Final

Integrated Natural Resources Management Plan (INRMP) 2020-2025

Fort Campbell, Kentucky

Prepared by:
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Directorate of Public Works
Environmental Division, Conservation Branch

August 2020

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Fort Campbell, Kentucky

Approval

This Integrated Natural Resources Management Plan meets the requirements of the Sikes Act (16 U.S.C. 670a *et. seq.*) as amended. The plan has been prepared in accordance with the procedures of the Department of Defense and the U.S. Army in cooperation with the U.S. Fish and Wildlife Service, the Kentucky Department of Fish and Wildlife Resources, and the Tennessee Wildlife Resources Agency. The signatures below indicate mutual agreement of the parties concerning the conservation, protection, and management of natural resources presented in this Plan.

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Fort Campbell, Kentucky

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EXECUTIVE SUMMARY

Fort Campbell is located on 104,664 acres in Montgomery and Stewart counties, Tennessee, and Trigg and Christian counties, Kentucky. About 14 percent of the installation is developed, while about 86 percent is undeveloped rear area maintained for military training. In the rear area, forests, streams, fields, and other natural settings are maintained to provide a realistic context for training activities. Fort Campbell is home of the 101st Airborne Division (Air Assault) and several tenant units. The primary peacetime mission of Fort Campbell is to support training, mobilization, and deployment of mission-ready forces, by providing services, facilities, and a safe and secure environment for soldiers, civilians, retirees, veterans, and their families, while transforming for the future.

This Integrated Natural Resources Management Plan (INRMP) is the principle guidance document for management of natural resources on Fort Campbell Military Reservation, Kentucky and Tennessee (Fort Campbell). The INRMP describes natural resource management activities between the years 2020 and 2025 and provides a foundation from which to build the program beyond the year 2025. This Plan implements the Army Strategy for the Environment, which is to integrate environmental values into the military mission to sustain readiness, improve the soldier's quality of life, strengthen community relationships, and provide sound stewardship of resources. This INRMP has been developed in accordance with the Sikes Act, Department of Defense and Army Regulations (ARs) and guidance, other Federal laws, and Fort Campbell regulations. This Plan was prepared cooperatively with the U.S. Fish and Wildlife Service, the Tennessee Wildlife Resources Agency, and the Kentucky Department of Fish and Wildlife Resources.

The goals of natural resources on Fort Campbell are consistent with the Army's Strategy for the Environment, DoDI 4715.03, and the Army Regulations described above. The goals of natural resources management are:

- Ensure the long-term sustainability of the lands to support the military mission.
- Maximize integration among natural resources programs, and integration of those resource management strategies with military operations.
- Ensure that all Fort Campbell activities, including natural resources management activities, comply with federal and state laws, DoD Instructions, Army Regulations, and Fort Campbell policy related to natural resources.
- Manage natural resources according to an ecosystem management approach to maintain a healthy natural environment.
- Maintain or increase the abundance and diversity of native species.
- Maintain effective reimbursable programs.
- Provide ample recreational opportunities.
- Accommodate multiple uses of the land.

Using these goals, natural resources managers have developed objectives for natural resources management to support training mission requirements as well as conserving natural systems. Resource media area goals and objectives are described in Section 5.0. Supporting plans and actions are found in the appendices.

Section 2.0 of the INRMP describes the existing condition and management of natural resources on Fort Campbell, including soils, surface and groundwater, wetlands, terrestrial and aquatic habitat, fish and wildlife including federally and state listed species, agricultural leases, and outdoor recreation. The Plan addresses management of natural resources to avoid constraints to the military mission, and measures for avoiding impacts to natural resources. Section 7.0 describes natural resources conservation standards, which are protective measures to be implemented during all Fort Campbell activities.

Section 3.0 describes Fort Campbell's mission driven environmental strategy and details the installation's environmental review process. The section discusses natural resource impacts to the training mission as well as training impacts on natural resources. Section 8.0 lists, by reference, the best management practices Fort Campbell utilizes to mitigate or minimize impacts to the human and natural environment.

Section 4.0 describes the programs responsible for natural resources management on Fort Campbell and identifies the interactions among the programs. This section describes natural resources management initiatives, such as the grassland, watershed, and fire management plans, which are integrated into the INRMP. Section 6.0 describes the role of the INRMP Coordinator, who is responsible for annual review and update of the INRMP, coordination with federal and state regulatory agencies, and coordination of INRMP objectives among programs.

Fort Campbell developed this INRMP in coordination with the U.S. Fish and Wildlife Service, the Kentucky Department of Fish and Wildlife Resources, and the Tennessee Wildlife Resources Agency. Coordination with those agencies is found in Appendix C. The INRMP was also submitted to the public for review and comment.

The INRMP is a working document in which adaptive management principles are used to ensure goals, objectives, and projects are realistic and effective. INRMP objectives and projects may be adjusted based upon changes to the military mission, monitoring, or surveys results, new data, or regulatory changes. Based upon the annual review of INRMP projects, the INRMP Coordinator may recommend modifications to the INRMP. The INRMP will be kept current on an annual basis, and will be reviewed and updated if necessary, at least every 5 years.

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1.0 INRMP OVERVIEW

1.1 Purpose

This INRMP is a practical guide for the management and stewardship of all natural resources on Fort Campbell, while ensuring the successful accomplishment of the military mission. The INRMP was developed using an interdisciplinary approach in which information was gathered from a variety of organizations. Guidance was also solicited from a variety of Federal, State, and local agencies and groups. These varying perspectives allowed for an accurate portrayal of the status and management needs of local ecosystems balanced against the requirement for Fort Campbell to accomplish its readiness mission at the highest possible level of efficiency.

This INRMP integrates the following separate component natural resources management plans for Fort Campbell:

- Range Complex Master Plan (RCMP, 2019);
- Forest Management Plan (FMP, 2015);
- Integrated Wildland Fire Management Plan (IWFMP, 2007);
- Integrated Pest Management Plan (IPMP, 2017);
- Endangered Species Management Component (ESMC, 2017);
- Bald Eagle Management Plan (BEMP, 2018);
- Watershed Management Plan (WMP, 2017);
- Grassland Management Plan (GMP, 2017);
- Migratory Bird Management Strategy (MBMS, 2017);
- Fish and Wildlife Management Plan (FWMP, 2017);
- Integrated Training Area Management 5-year Work Plan (ITAMWP, 2019);
- Fort Campbell Stormwater Management Plan Development/Construction Deliverables and Requirements Checklist (2016); and
- Urban Forest Management Plan (UFMP, 2008).

The INRMP is the primary tool for the management of natural resources on the installation in accordance with Fort Campbell regulations, Army Regulations (ARs) and guidance, and Federal laws.

1.2 Scope

Fort Campbell is an Army installation located on approximately 105,000 acres in Montgomery and Stewart counties, Tennessee, and Trigg and Christian counties, Kentucky (Figure 1). About 14 percent of the installation is developed, while about 86 percent is undeveloped rear area maintained for military training. In the rear area, forests, streams, fields, and other natural settings are maintained to provide a realistic context for training activities. The training area of Fort Campbell consists of approximately 93,000 acres consisting of 27,000 acres of ranges and impact areas and 65,000 acres of light maneuver areas. Except for roads, cleared areas, and structures associated with training and support facilities, most of the rear training areas consist of natural habitat including forests, old fields, fields leased for agriculture, streams, lakes, and wetlands. This plan primarily addresses the 93,000 acres of mostly undeveloped land in the rear area.

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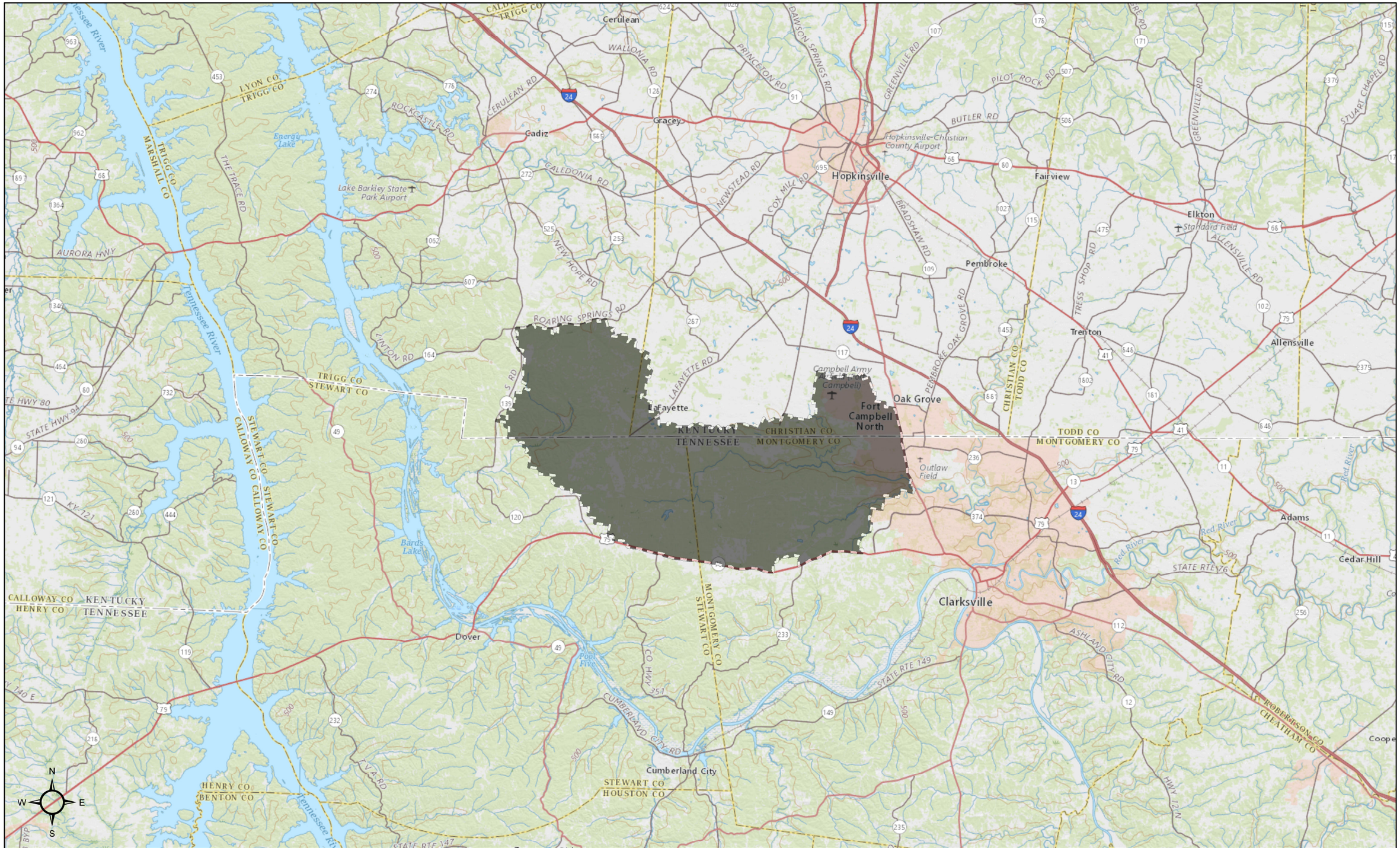

Figure 1. Location of Fort Campbell (gray area) in southwestern Kentucky and northwestern Tennessee.

Approximately 15,000 acres of the installation is cantonment area, which includes the main post/urban portion of the installation containing infrastructure for the residential, commercial, administrative, maintenance, recreational, and educational systems that support the installation, as well as Campbell Army Airfield (CAAF) and Sabre Army Airfield (SAA).

Vegetation in the cantonment area is primarily ornamental lawns, shrubs, and trees cultivated for aesthetic purposes. It is not within the scope of this document to develop comprehensive management measures for the cantonment area, golf course, or airfields. Installation departments other than the Conservation Branch address management of buildings and infrastructure, grounds maintenance/landscaping, and turf management. Therefore, only limited natural resources management activities, such as pest management and urban forestry conducted in the cantonment area are addressed herein.

The large Impact Area (22,000 acres) and Small Arms Impact Area (5,000 acres) are off-limits to natural resource management. While wildlife and natural habitat exist within the impact areas, they are off-limits to all personnel due to hazards associated with unexploded ordnance. Aerial photography is used to evaluate habitat conditions within the impact areas. However, those areas cannot be actively inventoried, managed, or monitored using surveys in the field. Management activities and objectives described in this Plan do not involve the impact areas.

1.3 General Natural Resources Goals and Objectives

The Army's commitment to natural resources management is reflected in the U.S. Army Environmental Strategy into the 21st Century. The Army environmental strategy is depicted as a building established on a solid foundation with four pillars supporting the environmental stewardship vision and the Army mission. The four pillars symbolize the Army environmental program and represent the four major activity areas, which include conservation. The conservation pillar focuses on responsibly managing Army lands to ensure long-term natural resource productivity so the Army can achieve its mission. This Army commitment to natural resources management is emphasized in Army Regulation 200-1 *Environmental Protection and Enhancement*, which requires that Integrated Natural Resources Management Plans be developed and maintained for all Army installations.

The command and staff of Fort Campbell are committed to environmental stewardship as an integral part of the mission at Fort Campbell. This commitment is evidenced by support of past environmental programs and their full support of this INRMP.

Fort Campbell natural resources goals and objectives are consistent with Department of Defense Instruction (DoDI) 4715.03, the Army's Strategy for the Environment, and Army Regulation 200-1. The main goal of this INRMP is to support Fort Campbell's military and nonmilitary activities while maintaining a functional, healthy ecosystem. Over the next five years this document and the programs outlined here will be refined as the situation warrants. Ecosystem management is an evolving management scheme. As new information and ideas are gleaned from current research, Fort Campbell's resource management will change to reflect the best information available.

The following general goals and objectives are Fort Campbell's commitment to manage natural resources. All six goals not only support management of natural resources but also support the overall military mission. Statements listed below represent general objectives for attaining those goals. These statements

will serve as a checklist for monitoring the plan's success. More specific objectives and tasks are proposed for each resource area in Section 5.

1.3.1 Goal 1: Provide quality natural resources as a critical training asset for accomplishing the military mission.

a) Objective 1: Ensure no net loss in the capability of installation lands to support existing and projected military training and operations.

b) Objective 2: Maintain quality training lands through range monitoring and damage minimization, mitigation, and rehabilitation.

c) Objective 3: Assess and mitigate long-term cumulative effects of training on natural resources.

1.3.2 Goal 2: Manage natural resources on Fort Campbell to assure good stewardship of public lands entrusted to the Army.

a) Objective 1: Use adaptive ecosystem management strategies to protect, conserve, and enhance native fauna and flora with an emphasis on priority species and biodiversity enhancement.

b) Objective 2: Monitor and manage soils, water, vegetation, and wildlife with consideration for all biological communities and human values associated with these resources.

c) Objective 3: Provide economic and other human-valued products of renewable natural resources when such products can be produced in a sustainable fashion without significant negative impacts on the military training mission or other natural resources.

d) Objective 4: Provide professional enforcement of natural resources-related laws.

e) Objective 6: Ensure the natural resources program is coordinated with other agencies and conservation organizations with similar interests.

1.3.3 Goal 3: Improve the quality of life of the Fort Campbell community and general public through high quality natural resources-based recreational opportunities.

a) Objective 1: Provide high quality opportunities for consumptive and non-consumptive uses within biological and recreational carrying capacities of the resources.

b) Objective 2: Provide conservation education opportunities.

c) Objective 3: Establish and maintain an environmental setting conducive to a healthy and satisfying lifestyle for the military community.

1.3.4 Goal 4: Comply with laws and regulations that pertain to natural resources.

a) Objective 1: Manage natural resources within the spirit and letter of environmental laws.

b) Objective 2: Protect, restore, and manage sensitive species and wetlands.

c) Objective 3: Use procedures within the National Environmental Policy Act (NEPA) to make informed decisions that include natural resources considerations and mitigation.

d) Objective 4: Ensure the natural resources program is consistent with the protection of cultural and historic resources.

e) Objective 5: Implement this INRMP within the framework of Army policies and regulations.

1.3.5 Goal 5: Comply with laws and regulations concerning endangered species.

a) Objective 1: Protect and manage threatened and endangered species in accordance with the Endangered Species Act (ESA), the NEPA, AR 200-1, DoDI 4715.03, United States Fish and Wildlife Service (USFWS) regulations and agreements, and other applicable laws or guidance from higher headquarters.

b) Objective 2: Manage and protect listed species as a priority in natural resource management.

c) Objective 3: Manage species of concern, species proposed for listing, and Army species at risk to assist in species recovery and prevent future Federal listing.

1.3.6 Goal 6: Fully integrate elements of environmental and military training programs to support mission essential training requirements.

a) Objective 1: Ensure the integration of, and consistency among, the various activities identified within this INRMP.

b) Objective 2: Ensure that natural resources management is consistent with principles of integrated pest management.

c) Objective 3: Ensure the integration of new military infrastructure development with the principles and guidelines of this plan.

d) Objective 4: Coordinate the implementation of natural resources management with Fort Campbell's Master Plan.

e) Objective 5: Use the natural resources program to support and enhance other elements within Fort Campbell's environmental programs.

f) Objective 6: Provide the Command with information needed to make decisions, which include natural resources-related values.

1.4 Responsibilities

Responsibilities contained within the INRMP deal with natural resources-related responsibilities on Fort Campbell.

1.4.1 Installation Commander (IC)

The Installation Commander commands the 101st Airborne Division (Air Assault) and Fort Campbell, implementing policies and directives of the Department of the Army (DA) and FORSCOM. He bears ultimate responsibility for ensuring natural resource management actions support mission readiness actions. Acting through the Command Group, personal and special Staff, directors, and separate commanders, the Commanding General is responsible for:

- Detailing changes to mission readiness activities to ensure compliance with environmental laws and regulations;
- Ensuring all installation land users are aware of and comply with procedures and requirements necessary to accomplish objectives of this INRMP together with laws, regulations, and other measures designed to comply with environmental quality objectives; and
- Provide directives to the Garrison Commander to synchronize mission critical training activities with natural resource actions to ensure training events meet training standards.

1.4.2 Garrison Commander (GC)

The GC is responsible for organizing, directing, coordinating and controlling garrison support and service activities, including overall management of the garrison workforce. The command is composed of numerous directorates and organizations responsible for the day to day operation of the city that is Fort Campbell. The GC, a military position, directs and is responsible for all aspects of garrison operations at Fort Campbell, including natural resources management. The GC bears ultimate responsibility for management of natural resources on Fort Campbell, including its land, forests and wildlife. Acting through the personal and special staff, directors, and separate commanders, the GC is responsible for:

- Providing for funding and staffing of natural resources management professionals and other resources required to effectively manage natural resources on the installation;
- Planning land utilization to avoid or minimize adverse effects on environmental quality and provide for sustained accomplishment of the mission;
- Developing a training environment to support the Senior Commander's training requirements;
- Entering into appropriate cooperative plans (16 USC 670a) with state and federal conservation agencies for the conservation and development of fish and wildlife, soil, outdoor recreation, and other resources;
- Ensuring the functioning of an Installation Environmental Quality Control Committee;
- Ensuring ongoing and timely coordination of current and planned land uses between mission, natural resources, environmental, legal, and master planning;
- Inspecting and reviewing mitigation measures that have been implemented or recommended for the protection of natural resources as prescribed in environmental documentation in accordance with 32 CFR 651;
- Ensuring all installation land users are aware of and comply with procedures and requirements necessary to accomplish objectives of this INRMP together with laws, regulations, and other measures designed to comply with environmental quality objectives; and
- Appointing a natural resources management professional as the Installation Natural Resources Coordinator.

1.4.3 Directorate of Public Works (DPW)

DPW is the environmental executive agent for the Garrison Commander and is the principle driver in the formulation of policies and procedures related to environment, energy and natural resources. The Director, DPW will maintain an organization with the resources available to accomplish the INRMP and is responsible for the following:

- Developing and implementing programs to ensure the inventory, delineation, classification, and management of all applicable natural resources to include: wetlands, threatened and endangered species, sensitive and critical habitats, and other natural resource areas of special interest;
- Providing for the training of natural resources personnel;
- Implementing this INRMP;
- Reviewing all environmental documents (*e.g*. environmental impact assessments and statements and remedial action plans) and construction designs and proposals to ensure adequate protection of natural resources, ensuring that technical guidance as presented in this INRMP is adequately considered;

- Coordinating with local, state, and federal governmental and civilian conservation organizations relative to natural resources management for Fort Campbell;
- Establishing procedures and administering the sign-in/sign-out process for outdoor recreation activities supporting consumptive and non-consumptive recreation activities; and
- Managing all phases of the natural resources program for Fort Campbell with appropriate natural resources management personnel. The Conservation Branch is responsible for preparation and implementation of this INRMP. This is the direct "vehicle" for accomplishment of above responsibilities.

1.4.4 Directorate of Plans, Training, Mobilization and Security (DPTMS)

DPTMS, particularly its Range Division and Integrated Training Area Management (ITAM) program, is responsible for coordinating military training, releasing range areas for recreational use, and developing, repairing and maintaining the ranges and training areas to support the Senior Commander's Training Guidance. The Range Division provides access to ranges to accomplish provisions of this plan, assists in enforcing considerations within range regulations, and is directly responsible for implementation and/or support of portions of this INRMP, which directly affect or interact with training responsibilities including:

- Operating and maintaining Fort Campbell ranges, associated training facilities, field training sites, and range equipment;
- Preparing, maintaining, and enforcing installation regulations involving the ITAM program, environmental compliance during field training, and range operations;
- Implementing the ITAM program (*i.e*., conservation awareness, geographic information system, Range and Training Land Assessment, land rehabilitation actions);
- Supporting the Geographic Information System (GIS) database to ensure good customer service for all installation programs that rely on GIS data layers; and
- Coordinating with DPW, Environmental Division on training activities that may affect fish and wildlife, wetlands, or cultural resources.

1.4.5 Provost Marshal's Office (PMO)

The PMO is responsible for providing natural resources law enforcement on Fort Campbell, including enforcement of hunting and fishing laws and regulations, and for military, federal, state, and local police support in the training areas of Fort Campbell. The Provost Marshall oversees USFWS personnel on Fort Campbell that enforce laws associated with natural resources in the training areas and ranges.

1.4.6 Public Affairs Office

The Public Affairs Office is responsible for promoting an understanding of Fort Campbell operations among its various publics and providing professional public affairs advice and support to installation leaders and activities.

1.4.7 Staff Judge Advocate

The Staff Judge Advocate provides legal advice, counsel, and services to command, staff, and subordinate elements of Fort Campbell. Specific Staff Judge Advocate responsibilities with regard to integrated natural resources management include:

- Conducting legal research and preparing legal opinions pertaining to interpretation and application of laws, regulations, statutes, and other directives;
- Coordinating with the Department of Justice, Litigation Division of the Office of the Judge Advocate General, and other governmental agencies on matters pertaining to litigation for the federal government;
- Advising DPW, Environmental Division on compliance with environmental laws; and
- Advising DPTMS on laws and regulations that affect training land use, management, and compliance.

1.4.8 Other Installation Organizations

Implementation of this Plan will require assistance from other directorates and organizations. Such organizations include the directorates of Contracting (procurement), Logistics (supplies), Resource Management (budgets), commanders of major subordinate organizations, and commanders of tenant units and activities.

1.4.9 Other Defense Organizations

1.4.9.1 Installation Management Command Headquarters G4 (IMCOM-HQ G4)

IMCOM-HQ G4 coordinates the Army's environmental program with regulators on state and regional levels, and monitors and analyzes state environmental regulatory and legislative activity. IMCOM-HQ G4 reviews budget requests and disburses funding to Fort Campbell in order to administer and implement many of the projects and programs described in this INRMP. The Headquarters is responsible for providing command and technical guidance to the Fort Campbell natural resources program by:

- Assisting with program implementation and conducting staff visits to Fort Campbell;
- Reviewing outdoor recreation plans for compatibility with the installation Master Plan and natural resources management plans and programs;
- Ensuring that effective natural resources stewardship is an identifiable and accountable function of management; and
- Reviewing and approving this INRMP as the Final Approving Authority.

1.4.9.2 Army Environmental Command (AEC)

AEC provides oversight, centralized management, and execution of Army environmental programs and projects. It has support capabilities in the areas of NEPA, endangered species, cultural resources, environmental compliance, and related areas.

1.4.9.3 U.S. Army Corps of Engineers

U.S. Army Corps of Engineers laboratories and the district offices can provide research, technical, administrative, and logistical support to Fort Campbell. The Louisville District assists major construction management, agriculture outlease, timber sales and contracting. The Nashville District assists with wetland delineations and administers wetland permits in accordance with Section 404, Clean Water Act and minor construction projects.

1.4.10 Other Federal Agencies

1.4.10.1 U.S. Fish and Wildlife Service (USFWS)

The USFWS is the primary federal agency with which Fort Campbell cooperates on fish and wildlife management. The USFWS provides signatory agreement on the INRMP concerning conservation, protection, and management of the fish and wildlife resources. The USFWS is the principal federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats. It is the regulatory authority for the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (16 U.S.C. 703–711). The USFWS provides technical support upon request from Fort Campbell, for management of fish and wildlife, including threatened and endangered species, on the installation. Consultation with the USFWS is required by ESA Section 7 when a proposed activity on Fort Campbell may affect a federally listed species.

Fort Campbell has established a Cooperative Agreement with the USFWS under which the USFWS provides up to five full-time, trained conservation law enforcement officers. The USFWS officers enforce Federal and State laws protecting natural and cultural resources on Fort Campbell, as well as enforcing Fort Campbell hunting regulations and curtailing illegal taking of wildlife and plants outside established seasons. The agreement also provides for the USFWS to assist Fort Campbell with management of natural resources and public outreach.

1.4.10.2 U.S. Natural Resources Conservation Service (NRCS)

The NRCS provides technical support to Fort Campbell, particularly in association with the development of conservation plans for the Agricultural Lease Program. The NRCS assists Fort Campbell with protection and enhancement of military training areas by advising on activities to prevent soil erosion, restore eroded areas, maintain vegetative cover, and protect watersheds.

1.4.10.3 U.S. Forest Service (USFS)

Fort Campbell regularly receives USFS technical assistance in areas of forest protection and management. The USFS carries out the provisions of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. §2101) by providing technical assistance and funding to meet specific pest management objectives. The DoD has a written interagency agreement with the USFS for cooperative assistance for forest insect suppression, including population monitoring, surveys, biological evaluations, trends, and projected damage for the control of gypsy moths. The USFS conducts a Forest Health Monitoring Program in cooperation with other federal and state agencies, as well as some academic institutions. The Program's objective is to develop national monitoring and reporting procedures for the status and trends of forest ecosystem health.

1.4.11 State Agencies

1.4.11.1 Kentucky Department of Fish and Wildlife Resources (KDFWR)

KDFWR is the primary state agency in Kentucky for issues regarding fish and wildlife management, as well as the regulatory authority behind the rules and regulations for hunting, fishing, and trapping. KDFWR provides signatory agreement concerning conservation, protection, and management of fish and wildlife resources presented in the INRMP for portions of the installation in Kentucky.

1.4.11.2 Kentucky Department of Environmental Protection (KDEP)

KDEP is a department in the Kentucky Environmental and Public Protection Cabinet (KEPPC) and is responsible for monitoring and regulating ground and surface water, air, wetlands, and other natural resources (except game and non-game fish and wildlife) in the state.

1.4.11.3 Tennessee Wildlife Resources Agency (TWRA)

TWRA is the primary state agency in Tennessee for issues regarding game and non-game fish and wildlife management, as well as the regulatory authority behind the rules and regulations for hunting, fishing, and trapping. TWRA provides signatory agreement concerning conservation, protection, and management of fish and wildlife resources presented in the INRMP for portions of the installation in Tennessee. TWRA issues scientific collection permits required to capture and collect wildlife. Fort Campbell participates in the amphibian monitoring program sponsored by TWRA. There is ongoing coordination between TWRA offices and Fort Campbell NR managers.

1.4.11.4 Tennessee Department of Environment and Conservation (TDEC)

TDEC is responsible for monitoring and regulating ground and surface water, air, wetlands, and other natural resources (except game and non-game fish and wildlife) in the state. TDEC administers the Tennessee Natural Heritage Program. Fort Campbell submits permit applications to TDEC for activities that involve stream alterations.

1.4.11.5 Kentucky and Tennessee Department of Forestry

A mutual aid agreement for the suppression of wildland fires has been established between Fort Campbell and the Kentucky and Tennessee Departments of Forestry.

1.4.12 Universities

Various institutions of higher education either are or have been partners with Fort Campbell. Inter-governmental Service Agreements (IGSA) are utilized with universities to provide required services to Fort Campbell and provide educational opportunities to students in their field of study.

1.4.12.1 Austin Peay State University (APSU)

Fort Campbell has coordinated with APSU to conduct floral and faunal surveys on the installation. The installation provides APSU students and professors the opportunity to investigate state-listed and rare

species of plants and wildlife. Projects conducted by APSU have been funded primarily with DoD Legacy Resources through a contract with The Nature Conservancy (TNC). The installation has entered into Intergovernmental Support Agreements (IGSA) with the University for wildlife and wetlands surveys, as well as seasonal endangered species program support for endangered bat monitoring actions.

1.4.12.2 University of Tennessee at Knoxville (UTK)

Fort Campbell has a cooperative research agreement with UTK that facilitates research on habitat and land management techniques that support military training, benefit wildlife, and the maintenance and reestablishment of naturally occurring communities such as native grass barrens. Recent Legacy projects focused on grassland bird species at risk population studies.

1.4.13 Other Interested Parties

Fort Campbell participates in the national Partners in Flight (PIF) program, which involves monitoring the status and trends of neotropical migrants on the installation. The data collected are shared with TDEC, TWRA, and KDFWR. Fort Campbell natural resource managers are participants in the regional PIF working group.

Conservation-oriented national and local groups sponsor annual bird dog field trials within the training complex. These groups support several projects designed to manage or restore game bird habitat on Fort Campbell.

1.5 Authority

The INRMP is the primary mechanism for compliance with natural resources laws and regulations. Federal, state, and local laws and regulations may apply to proposed management actions in this plan.

1.5.1 The Sikes Act

Preparation and implementation of INRMPs on military installations is required by the Natural Resources Management on Military Lands Act of 1960 (Title 16 of the United States Code [U.S.C.], Section 670a and following), commonly known as the Sikes Act (as amended according to the Sikes Act Improvement Act [SAIA] of 1997 and Public Law 108-136, the National Defense Authorization Act of 2004). The Sikes Act requires that, "consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall…provide for the conservation and rehabilitation of natural resources on military installations; the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping, and non-consumptive uses; and, subject to safety requirements and military security, public access to military installations to facilitate the use." In accordance with the Sikes Act, this INRMP provides, to the extent appropriate and applicable, for the following:

- Management of fish and wildlife, land use, and recreational opportunities related to fish and wildlife;
- Enhancement of, or modifications to, fish and wildlife habitat;
- Protection, enhancement, and restoration of wetlands, where necessary to support fish, wildlife, or plants;
- Integration of, and consistency among, the various activities conducted under the INRMP;

- Establishment of specific natural resources management goals and objectives and time frames for those proposed actions;
- Sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources;
- Public access to the military installation that is necessary or appropriate for the use described above, subject to requirements necessary to ensure safety and military security;
- Enforcement of applicable natural resources laws/regulations;
- No net loss in the capability of military installation lands to support the military mission of the installation; and
- Other activities as the Secretary of the Army determines appropriate.

Additionally, Army guidance on implementing the SAIA indicates INRMPs must reflect mutual agreement of the USFWS and the appropriate state fish and wildlife agencies concerning conservation, protection, and management of fish and wildlife resources (DoA 2006). Fort Campbell worked in close coordination with the Kentucky and Tennessee Field Offices of the USFWS, the USFWS Region 4 Office, the TWRA, and the KDFWR to develop plans for management of fish and wildlife resources on Fort Campbell.

Army guidance requires that, as a 5-year plan, the INRMP should include natural resource projects supporting military readiness and ecosystem management. IMCOM Environmental Funding Guidance indicates Class 0 projects are "must fund" projects. Class 0 includes activities needed to cover the recurring administrative, personnel and other costs associated with managing environmental programs that are necessary to meet applicable compliance requirements (i.e. federal, state, and local laws, regulations, EOs, DoD policies, etc.). While Class 1 applies to projects and activities needed that are currently out of compliance or will be out of compliance within the current program year. Projects in Classes 2 and 3 address maintenance and enhancement activities.

Not all projects listed in the INRMP are "must fund," and, due to budget constraints, Fort Campbell may not receive funds to execute all INRMP projects. Lack of implementation of Class 2 and 3 projects due to funding restrictions does not constitute failure to implement the INRMP. Full implementation of the INRMP is defined as the execution of all "must fund" projects and activities in accordance with the timeframes specified in the INRMP as funds are available for such activities. An INRMP is fully implemented if an installation:

- Actively requests, receives, and uses funds for natural resources management projects, activities and other requirements in support of goals and objectives identified in the INRMP;
- Ensures that sufficient numbers of professionally trained natural resources management personnel are available to perform tasks required by the INRMP;
- Invites annual feedback from the appropriate USFWS and state fish and wildlife agency offices on the effectiveness of its INRMP;
- Documents specific INRMP action accomplishments undertaken each year; and
- Evaluates effectiveness of past and current management activities and adapts appropriately to implement future actions.

1.5.2 Army Environmental Policy

In January 2015, the Army published the Installations, Energy and Environment Strategy 2025 that will govern all Army actions from fiscal year 2017 through 2025. The strategy supports the Army's need of a contingency force that is globally responsive and regionally engaged. To meet these sustainable readiness needs installations have been designated as the platforms of readiness, providing the mission and training areas, facilities, and infrastructure that prepare our Army for its ultimate challenges. They provide essential services for Soldiers, Civilians and Family members in a safe environment. The strategy is built upon three key business drivers supporting sustainable readiness:

- Driver 1 Installation - Readiness Platforms: Installations will be efficient, sustainable, and adaptive to the changing environment and needs of the Army.
- Driver 2 Energy and Sustainability: A ready and resilient Army, strengthened by secure access to energy, water and land resources.
- Driver 3 Environment, Safety, and Occupational Health: An effective environmental stewardship program and safety based culture for Soldiers, Families and Civilians

These key business drivers encompass the processes, initiatives, information, and talent that enable our communities to accomplish their missions. These drivers are the guiding force in executing this strategy and are the key factors and influences that propel our organization's success.

The Army has long made it a priority to protect the environment on installations, not only to preserve valuable resources for future generations, but to also ensure that we have the land, water and airspace needed to sustain military readiness. Army force readiness depends on the availability of both realistic and accessible training and testing areas and on continued operation of our industrial base for war-fighting materiel production. In order to maintain access to training and testing lands, Army environmental quality programs ensure conservation of natural resources including threatened and endangered species, and compliance with federal and state air, water and waste requirements in support of garrison operations and our industrial base. The Army's objective is to reduce enforcement actions and our metric is to keep our enforcement action rate at 10% or less. The Army's current low rate of environmental enforcement actions in the context of declining program resources demonstrates the effectiveness of our environmental professionals.

Other DoD and DA regulations and guidance that direct management of natural resources, and preparation of this INRMP include:

Department of Defense Instruction 4715.03 (DoDI; 2011). Sets forth policy for integrating natural resource management on DoD lands. The policy requires adaptive management to ensure the continued access to land and water resources for realistic military training and testing and to sustain long-term ecological integrity of natural systems for all lands managed by the DoD. The instruction establishes principles and guidelines on the scope, approach, implementation, programming and budgeting priorities, and evaluating the effectiveness of natural resource management on DoD lands. Guidance on preparation of INRMPs and Conservation Metrics are found in the instruction.

AR 200-1, Environmental Protection and Enhancement (2007). Provides a brief overview of environmental laws and requirements, sets forth guidelines to support Federal, State, and local environmental laws and

regulations, and integrates pollution prevention, natural and cultural resources protection, and the NEPA requirements into the Army Environmental Program. Department of the Army Pamphlet (DA PAM) 200-1 provides guidance on implementing the regulations in AR 200-1. The AR sets forth the policy, procedures, and responsibilities for the conservation, management, and restoration of land and the natural resources thereon consistent with the military mission and in consonance with national policies. It prescribes Army policy on cultural resources management and gives guidance for the treatment of historic properties, including any significant prehistoric or historic district, site, building, structure, or object on Army-controlled property. It also defines requirements for development of an Integrated Cultural Resources Management Plan (ICRMP) that details installation procedures for integrating cultural resources management with mission requirements. It provides policies and procedures for DA Pest Management Programs that implement DoD Instruction 4150.07, comply with national regulations and policies, and support the military mission. The regulation also identifies oversight responsibilities of HQDA, Assistance Chief of Staff for Installation Management, and reflects program emphasis for the protection of the environment through integrated pest management techniques.

AR 350-19, *The Army Sustainable Range Program (2005)*. AR 350-19 defines ITAM program objectives as achieving optimal sustained use of lands for training and testing, integrating Army training and other mission requirements for land use with sound natural resources management, and advocating proactive conservation and land management priorities. It provides guidance for the integration of military mission requirements into INRMPs.

The purpose of the ITAM program is to achieve optimum, sustainable use of training lands by implementing a land management program that includes inventorying and monitoring land condition, integrating training requirements with land carrying capacity, educating users to minimize adverse impacts to the land, and rehabilitating/maintaining training lands. ITAM Program goals and objectives are provided to define the scope of ITAM and serve as the basis for ITAM functions.

Goal 1: Provide maneuver land capability to support installations' training mission requirements. Objectives supporting this goal are:

- Ensure no net loss in the capability of military installation land to support the military mission of the installation;
- Ensure sustained accessibility, capability and capacity of maneuver training land on home station training installations;
- Quantify training land capabilities and capacity to support maneuver training;
- Monitor training land conditions to identify land maintenance and repair requirements;
- Improve existing training land capabilities by conducting land reconfiguration projects to support validated mission requirements; and
- Improve existing training land capacity by conducting land maintenance and repair projects to support existing and future mission needs.

Goal 2: A decision support capability based on the integration of training requirements, land conditions, maneuver ranges, and land management requirements. Objectives supporting this goal are:

- Provide geospatial capability to support range operations, range modernization, and the ITAM program, and long term planning in the range complex;

- Promote awareness of mission land capabilities and management issues to avoid unnecessary maneuver damage and environmental impacts;
- Acquire and assess data and information about the impacts from land management activities, mission activities, and land conditions to support range and training land management and scheduling decisions, and range modernization planning; and
- Ensure mission needs are considered in environmental (e.g., INRMP, ICRMP, agricultural leases, annual burn plan, timber harvest plan) and facilities planning, and training land capabilities constraints are considered in mission planning.

32 CFR Part 651, Environmental Analysis of Army Actions (2002). 32 CFR 651 sets forth policy, responsibilities, and procedures for integrating environmental considerations into Army planning and decision-making. It is the Army's regulation for implementing NEPA. The policy establishes criteria for determining what Army actions are categorically excluded from requirements to prepare an Environmental Impact Statement and lists applicable Categorical Exclusions.

Department of the Army, Assistant Chief of Staff for Installation Management, Memorandum entitled "Guidance for Implementation of the Sikes Act Improvement Act" (25 May 2006). Establishes HQDA guidance that implements existing guidance related to INRMPs. Specifically, the Memo addresses procedures for coordinating development and reviews of INRMPs with regulatory agencies and the public, how INRMPs will address Army lands leased by others, which installations require INRMPs, the definition of a completed INRMP, deadlines and formats for reporting DoD metrics, implementation requirements associated with the Sikes Act, Endangered Species Act consultation, accommodating public access, and supporting mission requirements.

1.5.4 List of Laws and Regulatory Instruments

Appendix B lists the most significant federal and state laws and regulations and other regulatory instruments that govern implementation of this INRMP.

1.6 Stewardship versus Compliance

Wise management of natural resources on Fort Campbell involves balancing present training needs and long-term training site sustainability within the requirements of environmental law and regulations. Stewardship embodies the responsible planning, use, and management of resources while compliance is driven by federal, state and local laws and guided by Army Regulations. Environmental stewardship includes both passive and proactive management to sustain healthy ecosystems, biodiversity, and conserve natural resources so that natural resources are available to serve the needs of present and future generations. Fort Campbell's environmental stewardship is implemented in accordance with the INRMP and consists of the following program objectives: (1) manage natural resources in accordance with ecosystem management principles, to ensure their continued availability, (2) ensure realistic and sustainable training environment for current and future training missions, and (3) provide a safe and healthful environment for the Fort Campbell and surrounding communities. Conforming to environmental laws, regulations, standards, and other requirements is a basic tenant of the Army's Environmental Program. Environmental laws regulate stewardship actions to a degree and ensure dialogue with other resource stakeholders in the best interest of the Army. Ultimately, it these two actions that assists Fort Campbell in conserving its resources in support of current and future training missions.

1.7 Army Land Management Principles

1.7.1 Sustainability

The Army Strategy for the Environment is based upon the principles of sustainability. The emphasis of sustainability is upon long-term planning and management, to ensure the Army can meet future mission requirements. Mission sustainability requires that land, air, and water resources are maintained for the long-term in a state conducive to realistic training. Ongoing stewardship of natural resources is important to minimize restrictions on use of training lands. The Army Strategy emphasizes planning and sensible use of resources (e.g., pollution prevention) to minimize costs, including costs of restoring or rehabilitating training lands.

In 2003, Fort Campbell issued a Memorandum regarding Installation Environmental Policy, which states, "Fort Campbell is committed to total integration of environmental management and stewardship into all operations to project its vision of being the benchmark for the Army in people, readiness, and transformation, and in support of its mission to train, mobilize, and deploy mission-ready forces through:

- Conservation of natural and cultural resources;
- Compliance with environmental regulations and policies;
- Prevention of pollution with increasing efficiencies;
- Execution of systems based on continual improvement of environmental management through; and coordinated planning, operating, checking, correcting, and reviewing efforts."

Fort Campbell implements the Sustainable Installation Management System (SIMS), which provides a blueprint for sustainability on the installation. Fort Campbell's sustainability program identifies five major initiatives to achieve sustainability on the installation:

- Provide sustainable infrastructure;
- Implement sustainable procurement;
- Promote sustainable regional development;
- Provide sustainable training support; and
- Promote sustainable transportation.

Fort Campbell has identified activities necessary to successfully complete the initiatives. The INRMP is a primary planning and decision-making tool that supports the sustainability initiative. Maintaining and implementing the INRMP is critical to achieving sustainable training support. Coordinating the INRMP with the Range and Training Land Program Development Plan (RTLP-DP) is essential to ensuring adequate and suitable training lands while managing natural resources in a sustainable manner. This INRMP incorporates sustainability activities that pertain to natural resources management:

- Manage native grasslands for maximum allowable training use while preserving unique habitat characteristics;
- Reallocate and reshape open fields to support modifications to training areas indicated in the RTLP-DP;
- Survey fields and forest for suitability of training needs considering erodiblity, vehicle access, dust, noise, fire, etc. Revise and execute INRMP and RTLP-DP in accordance with survey findings;

- Maintain drop zones (DZs) through appropriate management systems;
- Execute forest management to establish desired future conditions (DFCs) that conform to requirements of RTLP-DP;
- Execute wetland banking actions in anticipation of potential impacts under new RTLP-DP and Installation Master Plan (IMP);
- Assess stream and surface water quality and devise a water quality rating scheme;
- Develop and begin implementation of a plan that includes all Fort Campbell subwatersheds to eliminate pollutant impacts to surface and ground water; and
- Identify mechanisms for buffer development such as agricultural outlease expansion, and other compatible land acquisition and use options to protect Fort Campbell operations including airfield and training missions. The Environmental Division will assist the Plans Analysis and Integration Office for this task.

1.7.2 Ecosystem Management

The DoD defines ecosystem management as "a goal driven approach" to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is on a scale compatible with natural processes; is cognizant of nature's time frames; recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements; and is realized through effective partnerships among private, local, state, tribal, and federal interests (DoDI 4715.03). The Army utilizes an adaptive management approach to ensure sustainability ecosystems that support training mission requirements.

DoD's overall goal regarding ecosystem management is "…to preserve, improve, and enhance ecosystem integrity. Over the long term, this approach will maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies and communities." The specific principles and guidelines that DoD has identified to achieve this goal are listed below. They are reflected in the management goals and objectives set forth in Section 5 of this Plan.

- Maintain and improve the sustainability and native biodiversity of ecosystems;
- Administer with consideration of ecological units and time frames;
- Support sustainable human activities;
- Develop a vision of ecosystem health;
- Develop priorities and reconcile conflicts;
- Develop coordinated approaches to work toward ecosystem health;
- Rely on the best science and data available;
- Use benchmarks to monitor and evaluate outcomes;
- Use adaptive management; and
- Implement through installation plans and programs.

Ecosystem management recognizes that humans are ecosystem components and that sustainable human activity does not mutually exclude the preservation and enhancement of ecological integrity. Therefore, it is ecosystem management that provides Fort Campbell the means to both protect biodiversity and continue to provide high-quality military readiness.

New to this approach is the inclusion of climate change in natural resource management planning efforts. Inclusion of climate change helps protect the integrity and diversity of natural systems while ensuring that any use of natural resources is ecologically sustainable. Of most importance is addressing the potential vulnerabilities that are derived from climate change and their impacts on the training mission. Potential vulnerabilities to water, soils, and imperiled communities need to be addressed early in the planning process to ensure sustainable systems.

For example, impacts to water sources from mismanagement of natural resources (high pesticide use, erosion, etc) on Fort Campbell can greatly impact local and regional water supplies during extreme weather conditions. Resource management components evaluate, develop program adaptations and mitigations to offset potential effects to climate change through resource management actions. This approach provides a planned versus reactive approach to climate change.

Management objectives and projects described in this INRMP are designed with consideration for the interrelationships between the individual components of the ecosystem, the requirements of the military mission, and other land use activities. The focus is on maintaining the structure, diversity, and integrity of the biological communities, while recognizing that the soldiers and military mission are a vital component of the ecosystem. An adaptive management strategy has been incorporated into this INRMP to monitor resources and to adjust the management objectives based upon the effects of management activities. Monitoring programs indicate whether management measures and strategies are effective in achieving intended objectives. This adaptive management approach will preserve and enhance natural resources while providing the optimum environmental conditions required to sustain the military mission and realistic training conditions.

1.7.3 Conservation of Biodiversity

Biodiversity is the variety of living organisms at all levels of organization, from genetic to taxonomic, and the interactions of living organisms in the communities and ecosystems in which they live. The Army deems conservation of biodiversity important to natural resources management because it:

- Helps maintain natural landscapes for realistic military training, now and in the future;
- Helps keep DoD in compliance with the Endangered Species Act (ESA) and other environmental laws;
- Contributes to national security by helping maintain the natural resources upon which this country's strength depends;
- Provides a public relations benefit because Americans want good stewardship of their natural resources; and
- Enhances quality of life for military personnel (Leslie et al. 1996).

The DUSD-ES Memorandum articulates the biodiversity conservation policy embraced by the DoD and the military departments. The goal of this policy is to "Maintain and improve the sustainability and native biological diversity of terrestrial and aquatic, including marine, ecosystems while supporting human needs, including the DoD mission (Leslie et al. 1996)." The DoD has developed a Biodiversity Management Strategy (The Keystone Center 1996), which identifies the INRMP as the primary vehicle to implement biodiversity protection on military installations. This INRMP implements the biodiversity model by implementing the following principles:

- Support the military mission;
- Use joint planning between natural resources managers and military operations personnel;
- Integrate biodiversity conservation and planning into the INRMP, the ITAM Program, and other planning efforts;
- Involve internal and external stakeholders up front;
- Emphasize the regional (ecosystem) context; and
- Evaluate results and apply adaptive management when appropriate.

The Sikes Act (as amended) requires an integrated natural resources management plan be prepared and implemented for each military installation, unless the absence of significant natural resources makes preparation of a plan inappropriate. The Sikes Act requires that INRMPs include:

- Fish and wildlife management, land management, forest management, and wildlife-oriented recreation;
- Fish and wildlife habitat enhancement or modifications;
- Wetland protection, enhancement, and restoration where necessary for support of fish, wildlife, or plants;
- Integration of, and consistency among, the various activities conducted under the Plan;
- Establishment of specific natural resources management goals and objectives and time frames for proposed actions;
- Sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources;
- Public access to the military installation that is necessary or appropriate for sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources, subject to requirements necessary to ensure safety and military security;
- Enforcement of applicable natural resource laws;
- No net loss in the capability of military installation lands to support the military mission of the installation;
- Regular review of this INRMP and its effects, not less often than every five years;
- Provisions for spending hunting and fishing permit fees exclusively for the protection, conservation, and management of fish and wildlife, including habitat improvement, and related activities in accordance with the INRMP;
- Exemption from procurement of services under Office of Management and Budget Circular A-76 and any of its successor circulars; and
- Priority for contracts involving implementation of this INRMP to state and federal agencies having responsibility for conservation of fish and wildlife.

1.8 Review and Revision Process

Per DoDI 4715.03, Fort Campbell will review the INRMP annually in cooperation with the USFWS, KDFWR, TWRA and installation stakeholders. Annual reviews are utilized to ensure the INRMP meets its targeted goals and objectives, as well as include any state or regional regulatory changes. Seven focus areas area assessed annually on INRMP implementation; annual reviews shall verify that:

- INRMP project implementation;

- Federally listed species and critical habitat;
- Partnership effectiveness;
- Fish and wildlife management and public use;
- Team adequacy;
- Ecosystem integrity; and
- INRMP impact on the installation mission.

Executive Order (EO) 13423 Strengthening Federal Environmental, Energy, and Transportation Management was signed in January 2007, which sets federal goals in the areas of energy efficiency, acquisition, renewable energy, toxics reductions, recycling, renewable energy, sustainable buildings, electronics stewardship, fleets, and water conservation. The order requires the use of Environmental Management Systems (EMS) as the primary management approach for addressing environmental aspects of internal agency operations and activities. Developing and implementing an EMS is required at all Army installations.

The EMS is part of an installation's overall management system and includes organizational structure, planning, responsibilities, practices, procedures and processes, and resource allocation for developing, implementing, achieving, reviewing, and maintaining environmental commitments. The International Standards Organization (ISO)-14001 EMS model leads to continual improvement based upon a cycle of "plan, do, check, act." The Fort Campbell Sustainable Installation Management System (SIMS) process can be summarized into four phases:

- Planning, including identifying environmental aspects and establishing goals [plan];
- Implementing, including training and operational controls [do];
- Checking, including monitoring and corrective action [check]; and
- Reviewing, including progress reviews and acting to make needed changes to the EMS [act].

The EMS is continually updated through this cycle, fine-tuning its management of operations that may harm the environment. This continual improvement cycle is a fundamental attribute of the EMS that allows the system to adapt to the dynamic nature of the organization's operations. This INRMP is used to provide a sustainable natural and human environment for Fort Campbell. Fort Campbell is required to complete an annual review and update of the document to ensure compliance with SIMS.

1.9 Management Strategy

This INRMP has been developed in an interdisciplinary approach by gathering information from the DPW Environmental Division, DPTMS Range Control, TWRA, Tennessee Department of Environment and Conservation (TDEC), and KDFWR personnel, other federal, state, tribal and local agencies, and special interest groups with an interest in the management of natural resources at Fort Campbell. The draft INRMP and draft Environmental Assessment (EA) and Finding of No Significant Impact (FNSI) were made available for public comment. A distribution list for the draft INRMP, as well as initial agency and tribal coordination and response letters are included in Appendix C.

An INRMP describes the baseline conditions of natural resources at a military installation and provides management programs and guidance allowing for the performance of successful military training, while

providing for the conservation of renewable natural resources, preservation of rare and unique resources, and long-term resource sustainability. Specific plan expectations include the following:

- Provide a comprehensive plan for Fort Campbell to carry out its mission while promoting ecosystem health and biodiversity found on the installation and in the surrounding region;
- Document goals, objectives, guidelines, and future direction for natural resources management;
- Establish a framework for implementing natural resources programs and ecosystem management;
- Provide centralized information on the natural resources program status;
- Identify environmental constraints to land use so that military training can be matched with the ecosystem carrying capacity;
- Identify mission-related impacts and options for conflict resolution;
- Serve as a baseline of existing environmental conditions for defensible future EAs and Environmental Impact Statements (EIS);
- Ensure that the installation complies with environmental regulations; and
- Identify, prioritize, and schedule long-term budget requirements.

The typical management programs addressed in an INRMP include training area management, land management, forest management, aquatic and terrestrial habitat management, special natural area management, fish and wildlife management, rare and endangered species management, pest management, fire management, recreational resource and activity management, and agricultural program management. The overall policies and philosophy of natural resource management at Fort Campbell are derived from AR 200-1 and the Sikes Act (16 USC 670). These policies, regulations, and programs are based on the concept that natural resources management is an integral component of the primary mission of military use. The 101st Airborne Division and associated units must train; therefore, Fort Campbell will strive to conserve valuable training resources, including the natural environment. Management of natural resources on an ecosystem basis ensures the sustainable use of training lands while considering the effects on the surrounding environment and public concern.

An ecosystem is the "sum of the plant community, animal community, and environment in a particular region or habitat" (Barbour 1987). Ecosystem management may be defined as management "to restore and maintain the health, sustainability, and biological diversity of ecosystems while supporting sustainable economies and communities" (U.S. Environmental Protection Agency [USEPA] 1994). The goal of ecosystem management is "to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity" (DoDI 4715.03). Natural resources at Fort Campbell will be managed with an ecosystem management approach.

Principles and guidelines of ecosystem management, per DoDI 4715.03, are as follows:

- Guarantee continued access to land, air and water for realistic military training;
- Maintain and improve the sustainability of native biodiversity of ecosystems;
- Administer with consideration of ecological units and timeframes;
- Support sustainable human activities;
- Develop vision of ecosystem health;
- Develop priorities and reconcile conflicts;
- Develop coordinated approaches to work toward ecosystem health;
- Rely on the best science and data available;

- Use benchmarks to monitor and evaluate outcomes;
- Use adaptive management; and
- Implement through installation plans and programs.

Biological diversity or biodiversity may be defined as "the variety of living organisms considered at all levels of organization, from genetics through species, to higher taxonomic levels, and including the variety of habitats and ecosystems, as well as the processes occurring therein" (Meffe 1994). Biodiversity refers to the variety and variability among living organisms and the environment in which they occur. Biodiversity has meaning at various levels, including ecosystem diversity, species diversity, and genetic diversity. The DoD has developed a Biodiversity Management Strategy (Keystone 1996). Five reasons to conserve biodiversity on military lands are:

- Sustain natural landscapes required for the training and testing necessary to maintain military readiness;
- Provide the greatest return on the DoD investment to conserve and protect the environment.
- Expedite the compliance process and help avoid conflicts;
- Engender public support for the military mission; and
- Improve the quality of life for military personnel.

The Keystone Center report notes that the challenge is, "to manage for biodiversity in a way that supports the military mission." This strategy identifies the INRMP as the primary vehicle to implement biodiversity conservation on military installations. The model process developed within the strategy includes the following principles:

- Support the military mission;
- Use joint planning between natural resources managers and military operations personnel;
- Integrate biodiversity conservation into the INRMP and other planning protocols;
- Involve internal and external stakeholders up front;
- Emphasize the regional (ecosystem) context; and
- Concentrate on results.

Specific management practices identified in this INRMP have been developed to enhance and maintain biological diversity within the ecosystems at Fort Campbell.

1.10 INRMP Integration

Natural resources integration is accomplished through an annual review and a comprehensive revision or update at least every five years. This INRMP is prepared in coordination with the Installation Master Plan; Range Complex Master Plan; Integrated Cultural Resources Management Plan; Installation Pest Management Plan; and numerous other resource specific plans. It is a compilation of natural resource related plans that can potentially influence other Installation activities.

Due to the complexity of multiple natural resource management objectives and the intensity of the military training requirement, Fort Campbell natural resources management often requires an extensive planning effort. Fort Campbell resource managers and military trainers have had great success with the use of integrated discussion groups, specifically the Land Manager's Forum. The forum is composed of inter-

organizational and inter-disciplinary personnel that are consensus-based when considering actions that have a potential to impact natural resources. Fort Campbell natural resource staff members also participate in various regional conservation working groups or organizations.

2.0 CURRENT CONDITIONS

2.1 Location

Fort Campbell is 14 miles south of Hopkinsville, Kentucky, and 13 miles north of Clarksville, Tennessee. The closest major urban area (greater than 500,000 residents) to the installation is Nashville, Tennessee, located 60 miles to the southeast. Louisville, Kentucky; Memphis, Tennessee; and St. Louis, Missouri are within 200 miles of the installation. Approximately 70,000 acres, or two thirds of the total area of the installation, is in Tennessee; however, the official postal address for Fort Campbell is Kentucky.

2.2 Installation History

On 6 July 1941, the initial 101,755-acre site was selected for the installation then named Camp Campbell. Construction of facilities began on 4 February 1942 (Robert and Company 1994). Camp Campbell was officially designated a major armor training and mobilization center for the World War II effort on 6 March 1942.

The first troops arrived for training and ultimate deployment overseas in September 1943. Following the end of World War II, Camp Campbell was transformed into an assembly and redeployment center for returning troops. Camp Campbell transformed from an armored post into an airborne post with the arrival of the 11th Airborne Division from Japan in May 1949. A number of new facilities were established during the seven-year tenure of the 11th Airborne Division, including a jump school, cleared DZs, and an expanded airbase.

On 14 April 1950, Camp Campbell was re-designated Fort Campbell and became a permanent post (Robert and Company 1994). In January 1956, the 11th Airborne Division joined the North Atlantic Treaty Organization (NATO) forces and was replaced by the 101st Airborne Division, commonly known as the Screaming Eagles. On 1 January 1959, Campbell Army Airfield was transferred from the U.S. Air Force Division to the Army, becoming the Army's largest airfield. In December 1967, the last of the 101st Airborne Division were airlifted to Vietnam and replaced by the 6th Infantry Division, which occupied Fort Campbell until July 1968. In December 1971, the 101st Airborne Division returned to Fort Campbell as a reorganized, all-volunteer unit to establish a permanent headquarters. The 101st Airborne Division became an Air Assault unit in April 1974 after losing its parachute jump status and therefore its airborne capability. In October 1974, the parenthetical identifier "Air Assault" was adopted by the 101st Airborne Division as part of the official title (Robert and Company 1994).

Fort Campbell military reservation has served as home to two airborne divisions, four armored divisions, four infantry divisions, an Army training center, and headquarters for three Corps units. Training both men and women, Fort Campbell has provided the support needed to successfully prepare combat units for World War II, Korea, Vietnam, and Desert Storm. Beginning in 2003, Fort Campbell provided significant support in conflicts occurring in Afghanistan and Iraq.

2.3 Installation Mission

The primary mission at Fort Campbell is the training, housing, and support of military forces for deployment in support of contingency operations. The post provides training, readiness, and deployment support for active component units, mobilizes and deploys active and reserve component units, and provides effective support for soldiers and their families during peacetime and war. The general mission of Fort Campbell as described in AR 10-42 includes the following:

- Organize, train, and equip all assigned units and individuals to perform assigned missions;
- Provide for the operations, safety, security, administration, education and training, procurement support, service, maintenance, and supply of all individuals, units, activities assigned, attached, or under the command of the installation;
- Provide base operations and other support to DA, Department of Defense (DoD), and other government activities which are tenants of, supported by, or satellited on the installation;
- Plan, program, allocate, and supervise the use of resources and facilities for accomplishing FORSCOM basic support missions, functions, and responsibilities, and program budgets;
- Exercise command of all FORSCOM units, Special Mission, and General Support Force (GSF) units other than designated tenant units/activities; and
- Support within capability the Commanding General, Fifth U.S. Army for planning and supervising all the Reserve Component units' activities to include their support.

According to Campbell Regulation 10-8, *Fort Campbell Organization and Functions Manual,* the mission of the 101st Airborne Division (Air Assault) is to deploy more rapidly than heavy divisions anywhere in the world to protect the U.S. national interests. Specific roles and missions for the division are:

- Seize and hold via vertical envelopment vital objectives behind enemy lines until linkup with supporting forces;
- Exploit the effects of nuclear or chemical weapons;
- Rescue U.S. nationals besieged overseas;
- Reinforce forward-deployed forces (if augmented with ground transportation);
- Serve as a strategic or theater reserve;
- Conduct large-scale tactical raids; and
- Occupy areas or reinforce friendly or allied units beyond the immediate reach of other ground forces.

Accomplishing these missions requires the use of modern, specifically designed training areas (TA) and ranges. Proper natural resource management provides realistic training opportunities to ensure mission success when deployed to theater.

2.4 Acreage and Land Use

Fort Campbell is encompasses 104,664 acres. The installation consists of training and maneuver areas (approximately 63,049 acres), range and impact areas (26,638 acres), and built-up areas (Table 1; Figure 2). Covering approximately 15,000 acres, the built-up area consists of the cantonment area (Administrative Area (9,371 acres), (Sabre Heliport (2,280 acres), the former Clarksville Base (2,600 acres), CAAF AB03 Green space (726 acres) and various solid waste management units (SWMUs).

Table 1. General land use on Fort Campbell.

Category	Description	Acreage	Sum
Built-up Area	Cantonment Area (including CAAF)	9,371	
	Old Clarksville Base	2,600	
	Sabre Heliport	2,280	
	CAAF AB03 Green Space	726	
			14,977
Ranges and Impact Area	Small Arms Impact Area	4,494	
	Impact Area	22,144	
			26,638
Training Area	Non-duded Maneuver Land	63,049	
			63,049
		Total	**104,664**

A variety of small land uses are located in the built-up areas including administration, operational training and maintenance, landing strips for fixed-wing aircraft and helicopters, motor pools, supply and storage, maintenance, commercial and medical services, industrial, community facilities, troop and family housing, recreation (e.g. golf course), open space, and two small lakes. Natural resource management activities in the cantonment area and around airfields are limited to pest control and management of the "urban" forest by the Forestry Program.

Areas designated for training include maneuver areas, ranges (including demolition areas) and impact areas (Figure 2). Fort Campbell has 53 light maneuver areas (training areas [TA]) that cover approximately 64,491 acres. Three DZs, totaling 2,038 acres, are located in the maneuver space. Drop zones range from 251 acres to 1,429 acres. 112 designated ranges are available on the installation that include:

- 61 Soldier & Basic Marksmanship Ranges
- 4 Modified Qualification Training Ranges
- 24 Live Fire Maneuver Ranges, supporting fire teams to battalion operations
- 1 Multi-Purpose Range Complex (RG 28)
- 1 Multi-Purpose Training Range (RG 46)
- 7 Shoot Houses
- 2 USASOC Training Complexes
- 1 Urban Assault Course & Breach Facility (RG 44)
- 1 Engineer Training Site & Demolitions Training Range (Demo 39)
- 2 Convoy Live Fire Range (RG28, RG42)
- 3 Live Fire Maneuver Ranges have MATCH protective structures installed
- 1 UAS training facility & 3 UAS runways
- 2 Deliberate Attack Trench Scout/Recon Range (RG 55, RG42)
- 20 Urban Combat Training Sites w/ 122 major building structures and one 350m sewer complex supporting fire team to battalion operations. Also supports Counter-Improvised Explosive Device (Counter-IED) training site and Search Facility.
- 8 Afghan Villages & 3 Cave Complexes

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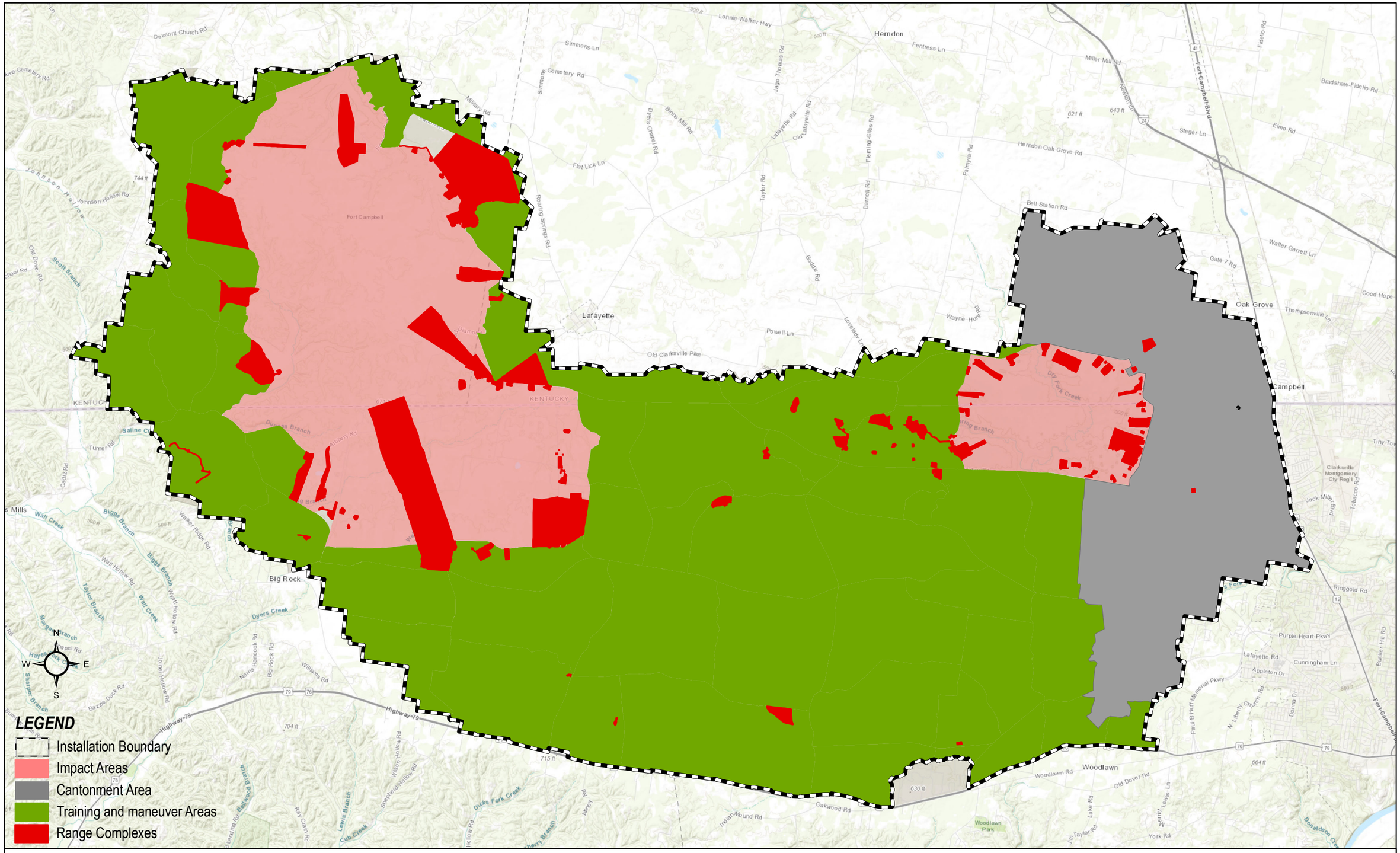

Figure 2. Fort Campbell land use map depicting administrative (cantonment area), training and maneuver areas, range complexes, and impact areas (prohibited areas).

- 10 Specialty ranges (2 Advanced Driving Courses, FARPs, UAS, Demo, Mines, Indoor Firing Range – 5th SFG)
- 7 Mortar Firing Points
- 93 Artillery firing points
- 3 Drop Zones & 6 named Landing Zones
- 1 Medical Simulation Treatment Center
- 1 C130 Flight Landing Strip (Golden Eagle FLS)

Live fire ranges typically are located within the impact areas, with the majority located in the Small Arms Impact Area. Detailed descriptions of ranges are provided in the Range Complex Master Plan (DPTMS, 2017). Ranges typically are cleared, or vegetated only with short herbaceous species, to facilitate training. Therefore, natural resource management on ranges generally involves maintenance and monitoring of soil stability and management of vegetation primarily through use of prescribed fire, aerial herbicide application, and mowing.

Impact areas include the Small Arms Impact Area and the North/South Impact Areas. Surrounding impact areas are artillery FPs where troops, vehicles, and equipment are located when firing into the impact areas. Demolition training and ordnance disposal takes place in Range 39, which is classified as a Special Live Fire Range. Access to impact and demolition areas is restricted due to hazards associated with training and unexploded ordnance, therefore, no natural resource management activities are conducted within impact and demolition areas, except for use of prescribed fire and aerial herbicide application to manage vegetation. However, habitat within impact and demolition areas is evaluated remotely using aerial photographs, and is included in land management objectives.

Tactical Operation Centers/Logistic Sites (TOC/LOG sites) are unsheltered temporary encampments where units camp for the night during extended field maneuvers. Some established TOC/LOG sites are maintained and used repeatedly. However, TOC/LOG sites may be established anywhere throughout the TAs, as needed by the unit(s) conducting training. The size and location of the site varies depending upon the unit and the purpose of the exercise. To the maximum extent practicable, TOC/LOG sites are located at least 300 feet from surface waters. These encampments may be in forested or non-forested settings; herbaceous and short woody vegetation may be flattened or altered to conceal the site. Due to the intensity and duration of foot traffic within TOC/LOG areas, soil compaction and loss of ground cover vegetation are potential problems.

Within training and maneuver areas are a variety of land cover types (Figure 3). When originally obtained by the federal government, most of the land that is Fort Campbell had been cleared for cultivation, but natural tree growth and tree planting have created tree cover on nearly half of the installation. Approximately 37,478 acres are hardwood timber; 11,734 acres are pine plantations, for a total of 49,812 acres of forest. Approximately 19,253 acres are open lands, with 6,185 acres in agricultural leases and 13,068 acres managed as native grass barrens or old fields.

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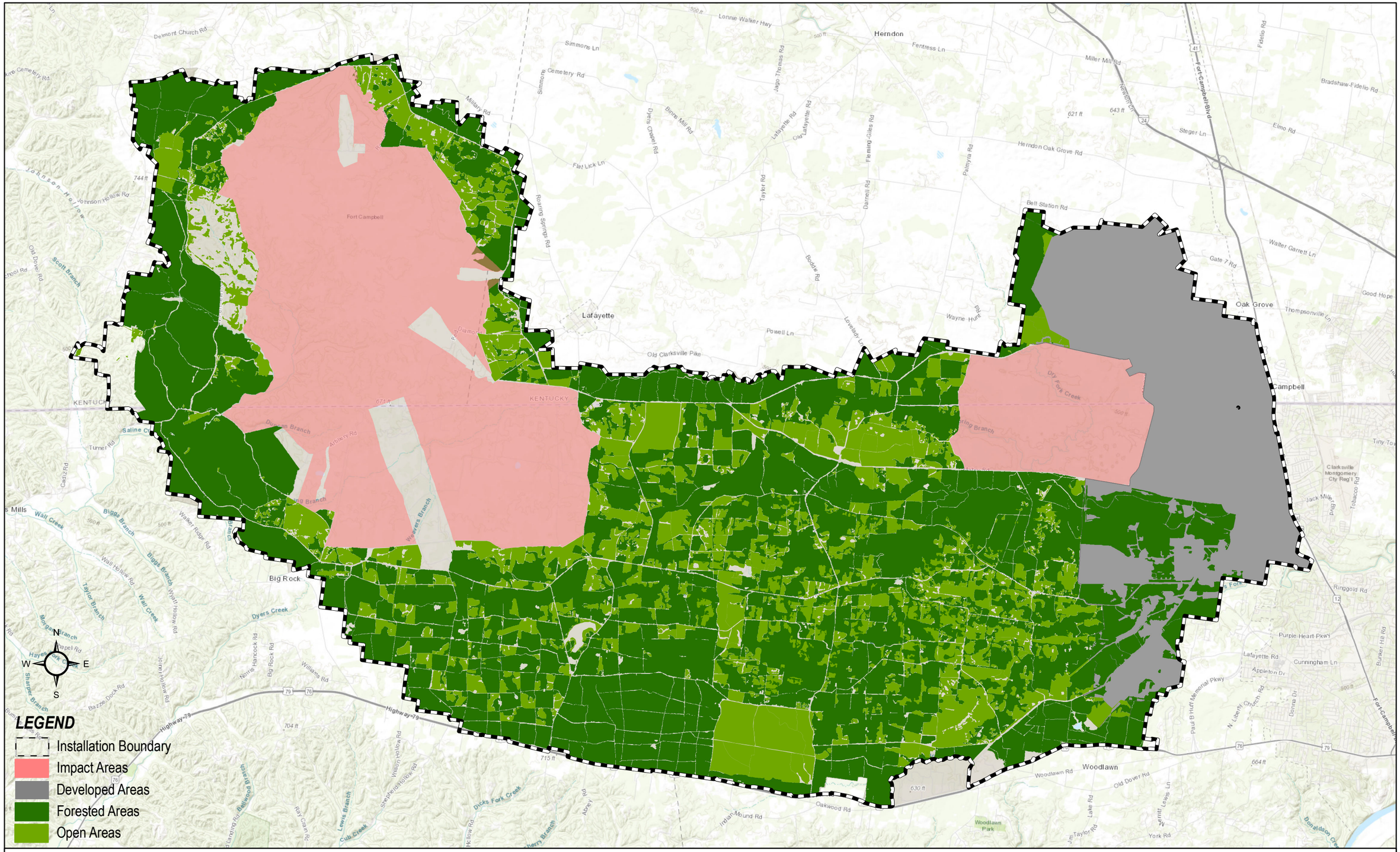

Figure 3. Fort Campbell general landscape covertypes.

2.5 Operational Activities and the Natural Environment

Fort Campbell provides training support to units training for airborne, mounted and dismounted infantry, and air assault operations. The primary training objective is to ensure all individuals and units are fully prepared to perform their assigned missions in a contingency situation. Training emphasis is on crew, squad, platoon, company, and battalion collective training, individual mission essential tasks skills, and live fire exercises. The mix of forested and open areas makes the installation favorable for infantry and aviation maneuvers. Impacts associated with training events vary in scope and size. Typical impacts associated with military training exercises are:

- Reduction of vegetative ground cover and the subsequent increase in bare ground;
- Potential for soil erosion and sediment transport into surface waterways;
- Duded areas caused by live fire exercises;
- Environmental noise and seismic vibrations caused by high explosive impacts in the impact areas;
- Munition constituents runoff;
- Petroleum product spills and improper clean-up;
- Wildfires from training activities;
- Loss or degradation of endangered species and/or Species At Risk habitat; and
- Change of land use due to construction of range complexes or training sites.

Generally, impacts to natural systems are localized and easily mitigated. Much of the training damage occurs within open areas where mounted infantry training and aviation support operations occur. Field rutting and loss of vegetative cover are the primary impacts from these action. The Fort Campbell DPTMS Range Branch, ITAM Program is responsible for managing maneuver area training conditions and remediating any training damage following training actions. Maintaining the integrity of natural systems within the maneuver lands is essential to ensure Fort Campbell can continue to provide high quality, realistic training to individuals and units that training on the post.

2.6 General Constraints and Opportunities

The 2018 Range Complex Master Plan (RCMP) addressed general environmental constraints and opportunities to the training mission at Fort Campbell. Many of the training constraints consisted of installation management controls set to reduce formal regulatory compliance requirements. The overall management objective for Fort Campbell is to seek compliance through informal means while allowing mission training activities to continue unencumbered.

Fort Campbell consults with the regulatory community when a training mission activity has the potential to not meet a compliance requirement. Fort Campbell Range Division periodically updates the RCMP to ensure the training environment meets mission training standards.

Goals of the Range Division in minimizing constraints and maximizing training opportunities are:

- Maximize the capability, availability and accessibility of ranges and training lands to support unit doctrinal training requirements under normal and surge mobilization conditions;

- Integrate facilities management, environmental program management, the Army Range Safety Program, and munitions management with the Sustainable Range Program to optimize mission sustainment of ranges and training lands;
- Ensure other installation plans support the installation Range Complex Master Plan.
- Implement a Sustainable Range Outreach Program with the local community;
- Manage the installation range and training lands for the integration of future force training requirements and support the Army Force Generation (ARFORGEN) requirements;
- Implement a program to preclude encroachment on the installation's training capability; and
- Manage the installation training lands from an ecosystem approach.

2.6.1 General Training Constraints

Constraints to the training mission can be categorized in to three general activities; dismounted, maneuver, and live fire training. Units are able to conduct dismounted type training on the majority of the installation with the following exceptions:

- Units are not authorized to train inside the impact area with the exception of walking across non-dudded small arms qualification ranges and selected live fire ranges; and
- Units are not authorized to conduct the full range of combat training exercises inside the cantonment area.

Units maneuvering throughout the training lands are able to train over limited portions of the installation. Installation lands that will not support heavy maneuver training are the following areas:

- Impact areas are not cleared for maneuver training;
- The cantonment area is not available for unit maneuver training;
- Units are not authorized to drive vehicles through or excavate in wetlands;
- Cemeteries are off limits to vehicular traffic;
- The forest area is too dense and will not support maneuver training;
- Units are not authorized to conduct maneuver training involving berming or mechanically assisted digging in No Dig Areas within the training areas;
- Units must use established low water crossings to cross streams on Fort Campbell; and
- Units are not authorized to clean or "decontaminate" their vehicles in the streams.

Live fire exercises occur within established range complexes adjacent to the impact areas. Two general restrictions apply to live fire exercises on Fort Campbell:

- Units are not authorized to conduct live fire training exercises in the cantonment area (with the exception of the Indoor Shooting Facility); and
- Units are not authorized to fire from inside the fenced cemetery areas into the impact area (i.e. artillery and mortars).

The use of smoke grenades, smoke pots, smoke generators, and Riot Control (CS) grenades are limited to areas that will not interfere with civilian and military traffic. A biological assessment for the use of obscurants on Fort Campbell did not find any environmental constraints on their use within the training

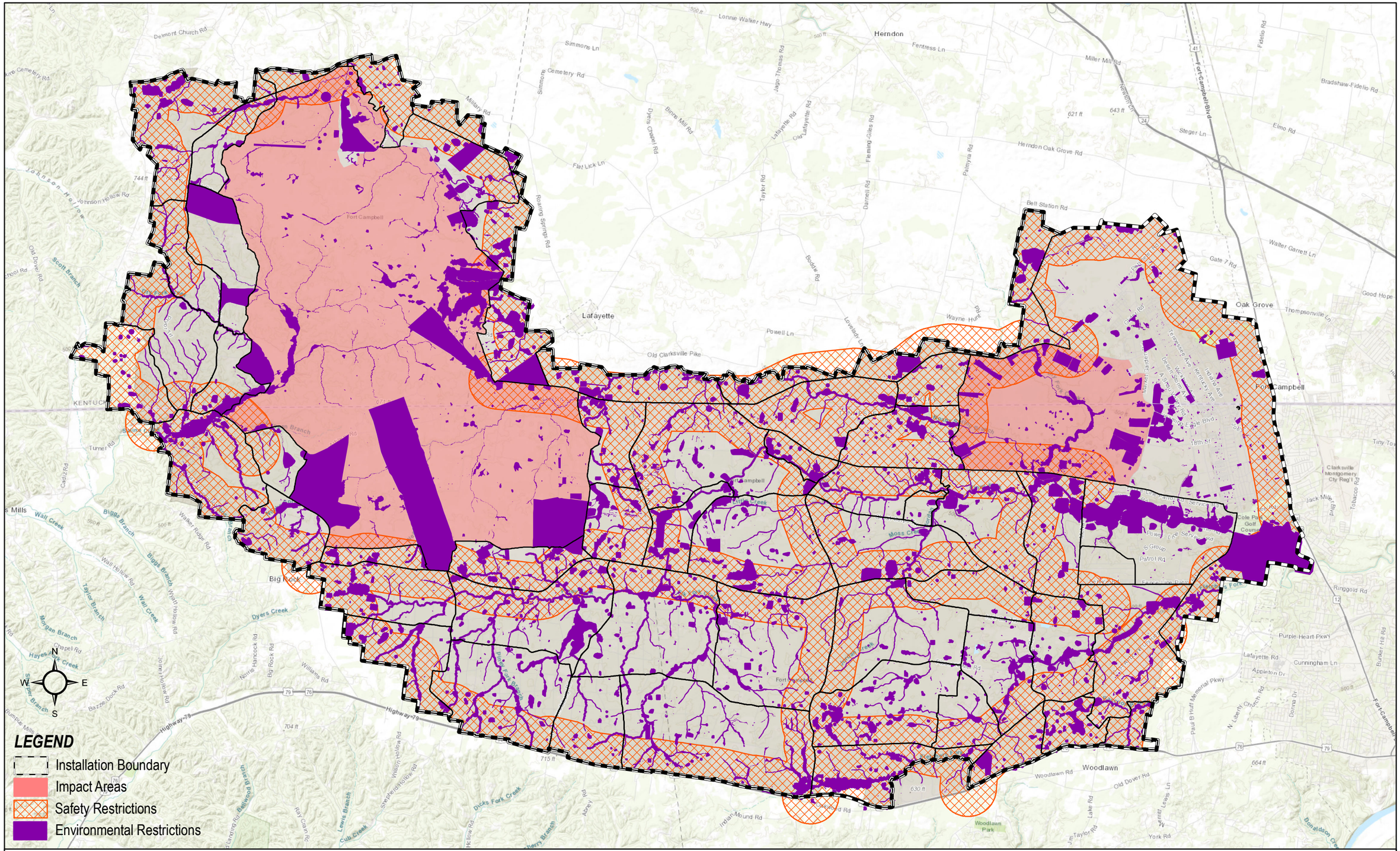

Figure 4. Fort Campbell training mission constraints.

areas. Figure 4 indicates those areas where units are not authorized to use Smoke for training. This training limitation for safety reasons is defined in the Ft Campbell Range Regulation 350-19.

2.6.2 Environmental Constraints

Two endangered species, the Indiana and gray bat, and one threatened species, northern long-eared bat, have been identified at Fort Campbell. Training actions are restricted from inside caves and limited in and around foraging areas. Units are authorized to conduct dismounted training throughout the Installation's riparian zones; however, vehicular traffic is restricted to use of established low water crossings. Tree removal activities are seasonally restricted to ensure that no "take" of an endangered species occurs.

Executive Order (EO) 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, and the DoD MOU for promoting the conservation of migratory bird populations require installations to review the impact of mission related activities on bird species. Fort Campbell supports 23 Birds of Conservation Concern. Most species of concern are associated with the grasslands and shrub habitat on the installation. Training mission activities that have a measureable negative effect on a population of a migratory bird species of concern are required to confer and cooperate with the USFWS to develop reasonable conservation measures to minimize or mitigate effects. Non-military readiness activities are not exempt from the Migratory Bird Treaty Act (MBTA) or EO13186 and pose significant challenges in meeting landscape level natural resource conditions required for many training activities.

Fort Campbell leases many of its open fields to area farmers. Farmers are authorized to grow hay and row crops (primarily beans and corn). Some DZs and routinely used named landing zones (LZ) are leased to local farmers for hay production. Other fields outside the DZs and LZs are leased for both hay and row crop production. Fields in agricultural outlease production are not off-limits to training. However, farmers are not compensated for any training damage to their fields. The DZ and named landing zones that are in hay production are open for all types of training (with the exception of berming and force protection) since the hay will recover with minimal effort by the farmer. Berming and Force Protection on the DZ are restricted because unrecovered holes create an obstacle for airborne and airdrop training. Farmers maintain a mowed area adjacent to their row crop fields as an alternative location for training. The majority of these mowed fields coincide with firing points in the vicinity of the row-crop fields.

Cultural Resources and their management provide constraints in three areas; cemeteries, cultural surveys, and no dig areas. It is important to note that although these areas are listed as a constraint, they can be mitigated to reduce the impact on the training mission. There are 131 cemeteries located within the ranges and training areas. The majority of these cemeteries have been fenced and the locations are available to training units. Most cemeteries are fenced to ensure grave sites are not disturbed. Not all the areas on the installation have been surveyed. Range and training facility construction in unsurveyed areas will not proceed without either a full survey of the large area (such as a range complex) or localized surveys (such as construction of a building). Areas determined to have potential cultural significance are not restricted to training just excavation activities within their boundaries.

Wildlife activities on Campbell Army Airfield and Sabre Army Airfield are monitored by airfield staff to ensure minimal impacts to airfield operations. Fort Campbell began monitoring wildlife activities in 2001 to determine wildlife presence. Birds and whitetail deer were the most common threat to air field operations. A formal wildlife aircraft strike hazard (WASH) program and plan has been established and are incorporated into the Integrated Pest Management Plan. However, wildlife occurrences on the airfields are

considered constraints on the installation's mission from a safety perspective. Management options include the enhancement of grassed areas away from the airfields to pull wildlife away from the airfield.

2.6.3 Climate Change

Over the past 30-years there has been a dramatic increase in the scientific understanding of how our climate is changing and the risks that these changes pose to the natural and built environment (USEPA 2016). The DoD recognizes that this change will play a significant role in its ability to fulfill its mission and potentially undermine the capability of our military installations to support mission critical training activities. To address this risk, the DoD implemented a policy for installations to address climate considerations within the Integrated Natural Resources Management Plan (Stein et al. 2019). Potential climate change impacts to Fort Campbell are rising temperatures, changes in precipitation patterns, increases in storm frequency and intensity, increased frequency and severity of wildfires, and soil loss due to drought conditions. Comprehensive vulnerability assessments are needed to determine what adaptive responses are the most appropriate at Fort Campbell.

2.6.3.1 Temperature

Temperature change has been increasing throughout the region over the last century. Region-wide average temperatures rose about 2.0 degrees Fahrenheit (°F) or 0.4 degrees Fahrenheit (°F) per decade since 1970 and are forecasted to continue to rise significantly during this century (Climate Central 2019a, 2019b). Forecasted changes in temperature are not even throughout the year, with greater warming occurring in summer and early fall than in winter and spring. Heat waves are predicted to become more frequent as climate changes (EPA 1998, 1999). Currently, Tennessee averages 10 dangerous heat days a year. By 2050, Tennessee is projected to see 55 such days annually (a more than 5-fold increase)(Climate Central 2019b).

Environmental impacts of rising temperatures are likely to include shifts in vegetation communities including any rare, threatened, or endangered species they support; increased invasive species; increased vector-borne and zoonotic (animal to human) diseases; increases in wildfire risk; and soil warming and drying. Potential impacts to the Fort Campbell mission from increases in average yearly temperature and more frequent heat waves include increased occurrence of training limitations due to high heat days and wildfires; degrading infrastructure and increased maintenance costs for roads, utilities, and runways; reduced live-fire training, and increased energy costs for building and industrial operations; and increased operational health surveillance and risks.

2.6.3.2 Precipitation

Annual precipitation for the region has increased approximately 5 percent since the first half of the 20th century. Although rainfall is likely to continue to increase during the next 40 to 50 years, the total amount of water running off into rivers or recharging ground water each year is likely to decline 2.5 to 5 percent, as increased evaporation from increased temperatures offset the greater rainfall. Over the past 50 years the amount of precipitation falling during heavy rainstorms has increased by 27 percent in the region, and the trend toward increasingly heavy rainstorms is likely to continue. Increased flooding is becoming more severe in the region (USEPA 1998b, 1999).

Changes in precipitation amounts and patterns are likely to result in increased wildfire risk and altered burn regimes; impacts to air quality; increases in storm frequency and intensity; stream bank erosion and gullying; impacted soil function; soil loss; water supply constraints; impacted groundwater quality; increased dust; protected species stress and potential for more species placed at risk; and spread of invasive species; and increased vector-borne and zoonotic (animal to human) diseases;.

Potential impact to the Fort Campbell mission from changes in precipitation include reduced land carrying capacity for vehicle maneuvers; increased maintenance costs for roads, utilities, and runways; reduced live-fire training; reduced water availability and greater competition for limited water resources; reduced training land access; reduced training carrying capacity; operational health surveillance and risks; and increased flood control/erosion prevention measures. Other impacts include military personnel safety; temporary or prolonged disruption of military operations or test and training activities due to intense storms and resulting storm damage; inundation of and damage to infrastructure; reduced access to military water crossings and river operations; reduced off-road maneuver capacity; increased maintenance costs; increased flood control/erosion prevention measures; and transportation infrastructure damage.

2.6.3.3 Wildland Fire

Climate changes projected for the Kentucky and Tennessee region in the next 20-years imply dramatic alteration of fire frequency from what has been experienced in the recent past. Higher temperatures and longer dry periods will create a longer fire season, more intense fires, and directly increase wildfire risk (Liu 2013). Indirectly, wildfire risk will also be influenced by potential climate-related changes in vegetation and ignition potential from natural (lightning) and man-made sources. Human activities will continue to be the biggest factor in ignition risk.

Potential impacts to the Fort Campbell mission from more frequent wildfires include increased occurrence of training limitations; reduced military readiness activities; loss of infrastructure and increased maintenance costs; reduced live-fire training due to high fire risk days; increased invasive species; loss of critical species habitat; and increased operational health surveillance and risks.

2.6.3.4 Erosion

Long-term changes in temperature and precipitation patterns directly affect soil stability and tend to increase soil loss vulnerabilities. Droughts are likely to be more severe, because periods without rain will be longer and very hot days will be more frequent. Increased drought conditions reduce water infiltration into the soil and increase surface runoff. These changes exacerbate soil loss impacts caused by increased precipitation intensity. While there is no apparent change in drought duration for the region as a whole over the past 50-years, the average number of days without precipitation is projected to increase in the future. Tennessee is projected to see an increase in severity of widespread summer drought of approximately 65 percent by 2050 (USEPA 1999). These changes to the region's temperature and precipitation patterns as well as changes in land use and land cover will serve to amplify the effects of climate change on regional ecosystems.

Potential impact to the Fort Campbell mission from increased erosion include reduced land carrying capacity for vehicle maneuvers; reduced training land access; reduced training carrying capacity; and increased cost to repair training lands. Environmental impacts are expected from increased sedimentation

of aquatic systems; indirect impacts on endangered species; loss of habitat; and increased environmental regulation and restrictions.

2.6.2.5 Vulnerability Assessments

Climate change vulnerability assessments are a means of preparing for and coping with the effects of climate change. A vulnerability assessment is a key element in identifying which species or systems are likely to be most strongly affected by projected changes in climate and provides a framework for understanding why particular species or systems are likely to be vulnerable, often depending on factors such as exposure, sensitivity, and adaptive capacity (Stein et al. 2019). Vulnerability assessments inform conservation planning by identifying climate-related threats and resulting stresses, which then become part of the decision-making process undertaken to identify and prioritize conservation strategies. Fort Campbell natural resource personnel proactively identify the likely effects of climate change to adapt and maintain cost-effective programs and meet legal requirements to manage natural resources. Climate change and vulnerability assessments requirements for ecosystems and individual species is discussed further in Section 5.13 as it relates to Fort Campbell's natural resources management issues, goals, and objectives.

2.6.4 General Opportunities

Fort Campbell has partnered with local communities as part of the Joint Land Use Study (JLUS) to minimize impacts on both parties caused by development and training activities. This cooperative work has provided a mechanism to discuss local and regional issues relating to activities on and off the installation. Most importantly to Fort Campbell is the Army Compatible Use Buffers (ACUB) program which is detailed in Section 3.10. The program's intent is the secure development easements to reduce development encroachments on the post. The ACUB program has targeted land that surrounds the airfields to ensure to net loss of aviation capabilities on the installation. Fort Campbell has designated parcels south of the installation a potential partners as conservation easements. These parcels would support two SAR species, Henslow's and Bachman's sparrow, in habitat conservation; limiting impacts to training activities within the maneuver areas on Fort Campbell.

2.7 Facilities

2.7.1 Transportation Systems

Interstate 24 (I-24) is just north of the post and traverses the region in a northwest-southeast direction. U.S. Route 41 is a 4-lane highway that parallels I-24 in a northwest-southeast direction, is adjacent to the eastern boundary of the installation. Fort Campbell's Main Gate (Gate 4) is accessible from U.S. Route 41. State Highway 79 runs east and west along the southern border of the installation. Within the installation, numerous paved roads support the transportation system within the cantonment area. The rear area is accessed by a system of rural roads and firebreaks.

Fort Campbell has a rail spur and railhead connecting to Hopkinsville, Kentucky and the CSX Transportation rail system.

Fort Campbell has both fixed- and rotary-wing airfield facilities. Campbell Army Airfield (CAAF) is capable of handling all United States Air Force (USAF) airlift assets. Golden Eagle, a Forward Landing Strip located adjacent to Centerline Road in Training Area 8A, is also capable of handling both C-130 and C-17 cargo

aircraft. Rotary-wing aircraft use the CAAF, Destiny Heliport, Sabre Heliport, and numerous landing zones located throughout the training areas. These facilities allow Fort Campbell to meet operational deployments and mobilization in minimal time. Remote landing strips for rotary-wing aircraft are scattered throughout the western portion of the installation. With the exception of Indian Mound, which has an asphalt surface, all the remote landing strips are grass or bare ground.

2.7.2 Utilities

Potable Water. Potable water supplied to the cantonment area is provided exclusively by Fort Campbell. Water is drawn from the Boiling Springs aquifer, south of Mabry Road at Little West Fork Creek (Robert and Company 1996), with a potential yield of 24.65 million gallons per day, and treated in a rapid sand filter treatment plant (Harland Bartholomew & Associates, Inc. 1994). The Fort Campbell Water Plant has been rehabilitated over the last several years to update the treatment processes. Improvement of water distribution system and storage facilities throughout the installation is ongoing. In September 2003, the water system was privatized with ownership transferring from the U.S. Army to CH2M HILL Constructors Inc. The installation's potable water storage system consists of one 0.25-million-gallon, one 1.0-million-gallon, and three 0.5-million-gallon elevated steel storage tanks, all located within the cantonment area. Total water storage capacity at the installation is 2.75 million gallons (Lockwood Greene 1994). Current use of potable water ranges between 4 and 5 million gallons per day (Fort Campbell 1999).

Waste Water Management. Sewage collection and treatment is also provided exclusively by Fort Campbell through one system that serves the cantonment area, CAAF, and Sabre Heliport. Both domestic and industrial wastewater are collected and treated at a sewage treatment plant on the former Clarksville Base (Robert and Company 1996), which provides both primary and secondary treatment and has a capacity of 4.0 million gallons per day (Harland Bartholomew & Associates, Inc. 1994). Effluent is discharged to Little West Fork Creek, a tributary of Ringold Creek and the Red River. Water from the sewage treatment facility meets all applicable water quality standards (Lockwood Greene 1994).

Electricity. Electrical power is supplied by the Tennessee Valley Authority through two 69 kV transmission lines, each having a capacity of 83 KVA. Presently, one of these lines at a time has sufficient capacity to power Fort Campbell during peak demand periods. Fort Campbell is contractually limited with TVA to a peak demand of 62 MW. Additional power is available with peak shaving diesel generators. In the case of a loss of power, emergency power is available to operate the water treatment plant, Boiling Springs aquifer pumping station, sewage treatment plant, some of the sewage lift stations, and other major facilities.

Natural Gas. Installation natural gas is supplied by the Defense Logistics Agency (DLA). The natural gas distribution system is privatized at Fort Campbell and is owned by Clarksville Gas and Water Department. This system distributes natural gas throughout the cantonment area (Fort Campbell 1999).

2.7.2.1 Solid Waste Management

Nonhazardous waste generated at Fort Campbell is disposed of through a variety of means:

- All sanitary waste is collected by a refuse contractor and transported to a regional landfill for disposal;

- One convenience center is operated by the refuse contractor for disposal and separation of recyclable materials;
- A Recycle Center is available to process and sell recyclable materials; and
- A landfill is operated by Roads and Grounds for the disposal of construction/demolition debris.

The convenience centers and Recycle Center promote reduction of waste disposal and recycling. There are approximately 300 SWMUs located on Fort Campbell, nine of which are located in the rear area.

2.7.2.2 Storm Water Management

Storm water management and permitting is handled by the Fort Campbell Environmental Division, Compliance Branch. Storm water is managed using natural limestone sinkholes and man-made collection basins to direct runoff into storm sewers and open ditches. Storm water runoff from the cantonment area drains into Little West Fork Creek and one of its primary tributaries, Dry Creek.

Initial stormwater management controls were implemented through the *Fort Campbell Policy for Storm Water Erosion and Sediment Control at Construction Projects* (2005). Subsequent revisions to the plan supporting installation initiatives to reduce runoff and improve the quality and quantity of runoff from construction sites led to the development of an installation-wide comprehensive plan (Fort Campbell Stormwater Management Plan Development/Construction Deliverables and Requirements Checklist). The new stormwater plan was implemented in 2016 and is annually reviewed and monitored for effectiveness in meeting Federal and State water quality mandates. The Storm Water Policy establishes requirements to ensure compliance with pollution prevention requirements of permits issued by the states of Kentucky and Tennessee, as well as Fort Campbell's commitment to sustaining water quality. The Policy requires management of storm water, prevention of erosion, and control of sediment for construction or land clearing activities on the installation. The Policy establishes detailed procedures for notification, preparation of project-specific Storm Water Pollution Prevention Plans (SWP3s), and frequent inspection of erosion control measures. The Storm Water Policy applies to all DoD contracted construction activities, ground disturbance to create fire breaks, and construction of new structures/facilities in training areas.

Fort Campbell implements SWP3s at industrial sites on the installation in accordance with the Clean Water Act and permit requirements of the states of Kentucky and Tennessee. The SWP3s identify potential sources of pollution including drainage, exposed materials, spills and leaks. Each Plan describes site-specific storm water management controls including good housekeeping, preventative maintenance, spill prevention and response, inspection, employee training, record keeping, non-storm water discharges, sediment and erosion control, and management of runoff. State permits require that effluent from permitted facilities be monitored twice per year for chemical oxygen demand, presence of oil and grease, total suspended solids, pH, and other pollutants (depending upon the type of facility). Limestone sinkholes and man-made ponding areas are used to regulate the quantity and rate of runoff carried to storm sewers and open ditches.

Motor pools, also known as Tactical Equipment Maintenance Facilities (TEMFs) are monitored by the Fort Campbell Stormwater Program for implementation of best management practices (BMPs) that minimize discharge of sediment, petroleum products (POL), and other contaminants. In accordance with the Clean Water Act and Fort Campbell's National Pollution Discharge Elimination System (NPDES) permits, Fort Campbell eliminates contaminants to the extent practicable before water enters the collection and

treatment system. Central vehicle wash facilities (CVWF), equipped with oil/water separators, grease traps, and grit traps are provided to collect mud, grit, and petroleum products washed off equipment and vehicles returning from field exercises. High pressure water is used in the CVWF; soaps and detergents are prohibited. The CVWF is a closed-loop system in which contaminants are removed and wash water is recycled, so that nothing is discharged to the sewer system. Other routine cleaning of vehicles and equipment takes place in aircraft and vehicles maintenance and wash facilities, where oil/water separators are in place to remove oil and grease contaminants from surface water runoff. Grease traps are found at facilities where food is prepared.

Before being removed from service, fuel tankers and fuel containers must be purged to eliminate vapors and fuel residue. Protocol is rigorously followed to assure that no fuel reaches the wastewater system during the purging activity. Additionally, Fort Campbell has established water pollution prevention measures for activities that occur outside the cantonment area. There are guidelines for disposition of treated water and waste water generated during field exercises that minimize contamination of surface and ground water supplies. Unit personnel are briefed on site-specific spill prevention and control measures prior to each field exercise. Each unit includes a trained Environmental Quality Officer, who educates and instructs the unit about environmental guidelines, including water pollution prevention and spill prevention and response. The Compliance Branch monitors selected sites to ensure proper implementation of erosion control measures.

2.7.3 Projected Changes in Facilities

Future long-range land use plans for Fort Campbell are designed to support the mission in a sustainable manner. The 2018 Range Complex Master Plan (RCMP) identified existing training assets, determined current and future training facility requirements based upon Army doctrine, and provided a near- and long-term project plan for expanding training facilities to meet anticipated needs. The Fort Campbell Strategic Initiative, Sustainability Annex Implementation Plan describes actions to be taken to allow Fort Campbell to fully execute the current mission, without jeopardizing the ability to accept future missions. Actions proposed in the Range and Training Land Development Plan and Strategic Initiative include renovation of existing training facilities, construction of new training facilities, conversion of certain habitat types to support training, improving efficiency of described in conceptual terms and are not yet planned or budgeted in detail. An Environmental Impact Statement entitled “Training Mission and Mission Support Activities Final Programmatic Environmental Impact Statement” supporting current and future mission and mission support activities was developed, approved, and implemented in 2015.

The Base Realignment and Closure Act (BRAC) of 2005 included recommendations for realignment of certain functions at Fort Campbell. Implementing BRAC-directed recommendations involved relocating the 52nd Explosive Ordnance Disposal Group to Fort Campbell and an attack aviation battalion from Fort Campbell to Fort Riley, Kansas. The United States Army Reserve (USAR) Center in Clarksville, Tennessee was closed and relocated into a new Armed Forces Reserve Center (AFRC) and Organizational Maintenance Shop (OMS) on Fort Campbell. Beyond the BRAC directed recommendations, Army Modular Force, Integrated Global Presence and Basing Strategy and other Army actions have resulted in changes to the force structure and population of Fort Campbell (CH2MHill 2006). Effects to the environment from these BRAC activities have been evaluated in an EA and a FONSI was issued (CH2MHill 2006).

Whether for capital improvement or mission realignments, construction projects that disturb ground and alter land uses may affect natural resources. When specific projects are planned in sufficient detail, Fort

Campbell will initiate the NEPA Process to evaluate potential impacts of the proposed project. To initiate the process, a 16-point checklist is used to evaluate the potential environmental and socioeconomic impacts associated with a proposed activity at Fort Campbell. Potential impacts are evaluated to identify measures to avoid and/or sufficiently minimize effects. Based upon the checklist review, a determination will be made regarding the level of analysis and documentation [i.e., no action, Record of Environmental Consideration (REC), EA, or Environmental Impact Statement (EIS)] required to comply with NEPA.

2.8 Neighbors and Surrounding Land Use

The area surrounding Fort Campbell consists of natural woodlands, farmlands, and some urban development. Urban development is concentrated in Clarksville (abutting the eastern boundary), Oak Grove (adjacent to the northeast border of the installation), Hopkinsville (about 14 miles northeast), and along U.S. Route 41A (adjacent to the eastern boundary), which connects those communities. Primary land uses directly south of Fort Campbell in Montgomery County are agriculture and rural residential. The portion of Christian County immediately adjacent to the northeast of Fort Campbell is also primarily farmland. The areas east and south of Fort Campbell contain substantial urban commercial and residential development, which is concentrated along U.S. Route 41A and within the city limits of Clarksville. Land adjacent to the installation to the northwest, west, and southwest in Trigg and Stewart counties is mostly forested to the banks of the Cumberland River (Robert and Company 1994).

Land use planning and regulation for off-post areas in Tennessee is done by the Clarksville-Montgomery County Regional Planning Commission and for off-post areas in Kentucky by the Hopkinsville-Christian County Planning Commission. A Joint Land Use Study (JLUS) prepared in 2007 has been adopted by Fort Campbell and the surrounding counties in Tennessee and Kentucky. The document contains recommended off-post land use practices that will not limit on-post training activities while keeping the surrounding economies viable.

Land in the far western portion of Montgomery County adjacent to Fort Campbell is planned to remain forested or agricultural. The city of Clarksville has a zoning ordinance, and zoning in Montgomery County outside the city limits controls residential development. There is no zoning, however, outside city limits in Christian County, and this area could be developed in uses incompatible with the airfield in the future. Commercial activity is expected to increase and concentrate along U.S. Route 41A and at major intersections between U.S. Route 41A with primary roads (e.g., KY 911, I-24, KY 115). Commercial development has been proposed at the intersection of I-24 and KY 115, and an industrial park has been proposed to be located along I-24 (Lockwood Greene 1994).

2.9 Natural Resources

This section provides a description of the existing environmental conditions on Fort Campbell. Physical and biological characteristics of the environment are described in the sections below. Descriptions are based upon the best mapping, species inventories, and other data currently available. Detailed information is provided where it is pertinent to management objectives, and supporting studies, plans, and reports are identified should additional information be necessary.

2.9.1 Setting

Fort Campbell is located in southwestern Kentucky and northwestern Tennessee, within portions of four counties: Christian and Trigg counties in Kentucky, and Montgomery and Stewart counties in Tennessee. Fort Campbell lies within the Western Highland Rim physiographic province, which forms a transition area between Kentucky farmlands to the north, the steeply dissected and wooded rim of the Cumberland River to the south and west, and gently rolling hills of low to moderate relief to the east.

2.9.2 Climate

The climate of the region is characterized by hot humid summers and cool winters. The mean high temperature during July is 89 degrees Fahrenheit (°F), while the mean low is 68°F. The average maximum temperature during the month of January is 45°F, and the average minimum temperature is 28°F. A growing season of 190 to 200 days extends from mid-April to mid- to late October. Soils may freeze to a depth of several inches on several occasions each winter but rarely remain frozen for more than four days (Chester and Ellis 1989). Mean annual snowfall for Fort Campbell is 14 inches (NOAA-CIRES 1999).

Average annual precipitation is approximately 49 inches and is generally well distributed over the year. The winter months are the wettest, with precipitation averaging about 5 inches in January, February, and March. Winter precipitation usually comes from weather systems of low pressure and associated cold fronts, which produce widespread and uniform areas of precipitation. Summer rainfall is deposited mostly in the form of scattered convective showers. Prevailing winds are southerly throughout the year, with the exception of February and October when the direction turns northerly. Extremely strong winds are not common in the region, with average wind speeds ranging from 4 to 9 miles per hour (Fort Campbell 1999).

2.9.3 Topography

The topography at Fort Campbell is gently rolling, with the exception of a comparatively flat area along the eastern boundary, and approximately 5,000 acres of steep, highly dissected, hilly land along the western boundary. The western part of the installation encompasses an area of the escarpment along Saline Creek that leads to the Cumberland River valley. The areas drained by Saline Creek and its tributaries are heavily dissected by streams with moderate to steep gradients. These drainages have relatively high topographical relief (50 to 120 feet).

The rest of the reservation is a combination of barrens and sinkhole plains. Barrens are weakly dissected uplands with low relief and underlain by impure limestone, shale, or chert. They can occur on broad, well-drained ridgetops; on short valley side slopes; or in poorly drained valley bottoms with weakly incised, intermittently flowing channels. Sinkhole plains are areas of low to moderate relief, with numerous sinkholes, sinkhole ponds, springs, and sinking streams (Figure 5). Most of the sinkholes on Fort Campbell occur in the flat areas in the eastern and northwestern parts of the reservation.

Elevations range from 397 feet above sea level south of the cantonment area, where Little West Fork Creek leaves the installation, to 718 feet above sea level in the Saline Creek area in the western portion of the installation. Slopes generally range from two percent to as great as 70 percent in steeper stream valleys.

2.9.4 Geology

2.9.4.1 General Geology

Fort Campbell is located near the boundary of the Lexington Plain of southwestern Kentucky and the Highland Rim Plateau of northwestern Tennessee. Fort Campbell is within the Western Highland Rim, which surrounds the Pennyroyal Plateau. The Pennyroyal Plateau is underlain primarily by bedrock of the Mississippian age (320 to 345 million years ago). The bedrock dips uniformly and gently to the north-northeast at a slope of 15 feet per mile. The uppermost formation on Fort Campbell is St. Genevieve Limestone, which overlies St. Louis Limestone. eneath these formations are the older Warsaw Limestone, Fort Payne Chert, and Chattanooga Shale. These formations primarily consist of limestone that is fine- to very coarse-grained, medium- to thick-bedded, fossil-fragmental, partly crystalline, and commonly silty with local oolitic, dolomitic, argillaceous, or silicious zones (USACE 1994). Older units are exposed along some deeply incised streams. The depth to bedrock ranges from seven to 98 feet with the exception of outcrops along the escarpment-like slopes of the Little West Fork in the southeastern section of the installation (USACE 1994).

The limestone formations are subject to solution weathering, as evidenced by the occurrence of numerous sinkholes (Figure 5). A predominant set of joints parallel the dip, and a second joint set closely parallels the strike of the limestone strata. The intersecting joint sets and zones of fracture in the limestone promote solution weathering and the development of karst conditions. The north and northeastern sections of the installation, east of the Casey Creek Subwatershed and north of the Little West Fork Subwatershed, is located in a highly karstic area. This area is characterized by thin soil mantles, sinks, and fractured and solution-weathered limestone (USACE 1994).

2.9.4.2 Surficial Geology

At most locations, the limestone bedrock is overlain by a thick overburden consisting of residual soil developed in place by weathering of a cherty limestone parent material. The residuum consists of red clay with a high plasticity and lesser amounts of silt, fine chert, and limestone fragments. Soil test borings made in 1941 and 1978 indicate the clay residuum is between 26 and 33 feet thick in the cantonment area and 49 feet thick just west of the main cantonment area. The thickness of the residuum continues to increase toward the west and is greatest on the hills, where it is up to 98 feet thick. The Tuscaloosa Gravel of upper Cretaceous age caps some of the uplands and drapes hillsides in the extreme western section of the reservation. It consists of up to 49 feet of unconsolidated gravel, sand, silt, and multicolored kaolinite clay (USACE 1994).

Neither the Kentucky Geological Survey, nor the Tennessee Cave Survey (a non-governmental organization), have records of any caves on Fort Campbell (BHE 2002a). However, three caves were discovered Noah's Cave in Christian County, Kentucky and Morgamie Cave in Stewart County, Tennessee have been known on the installation for several years, and nine potential caves recently were discovered in spring 2005.

The entrance to Noah's Cave is mapped on the Herndon quadrangle of the USGS 7.5-minute series of topographic and geologic maps. It is located in a large sinkhole near the intersection of Angels and Palmyra roads, in Training Area 15. The cave entrance developed at the base of a steep slope, along the line of contact between St. Genevieve and St. Louis limestones. Noah's cave is a swallow hole for a sinking

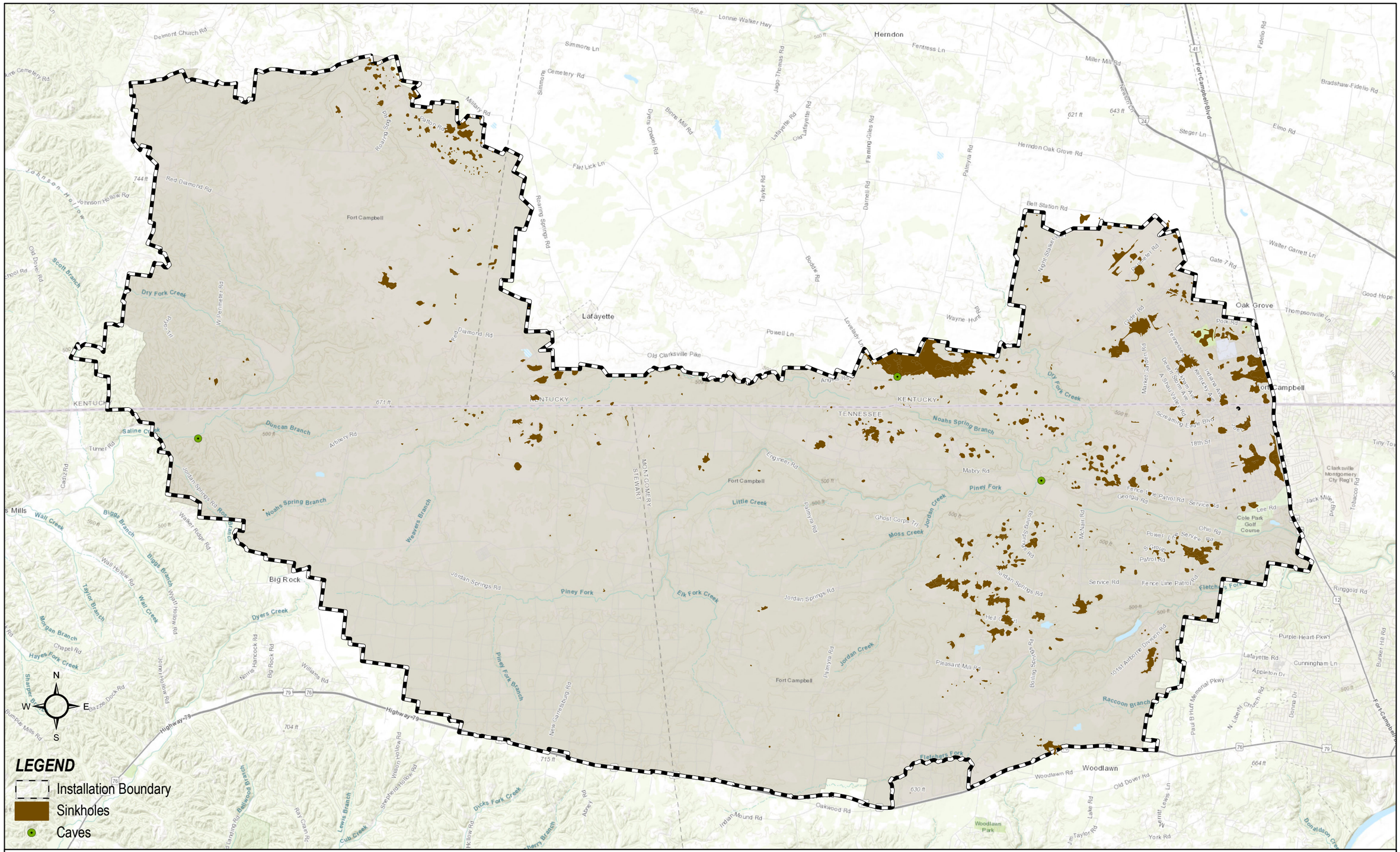

Figure 5. Known and potential sinkholes and caves on Fort Campbell.

stream and becomes flooded during heavy rain events. The creek that flows into Noah's Cave drains greater than 6,500 acres of farmland north of the installation and discharges 0.6 mile south at Noah's Spring.

The entrance to the second cave on Fort Campbell is not shown on USGS topographic maps. It is located in the far western part of the installation, along Saline Creek in Training Area 49. The cave is gated to protect natural and cultural resources inside. Geological features conducive to cave formation exist on some parts of the installation (BHE 2002a). In 2005, nine potential cave and/or open sinkholes were identified on Fort Campbell. The use by, and suitability of, these two caves by endangered bats is discussed in the ESMC.

2.9.4.3 Seismicity

Fort Campbell is in the seismically stable Nashville Dome tectonic province. The area experienced a few earthquakes in historic time and has had no major faulting since the early Cretaceous era (65 to 136 million years ago) and possibly the late Paleozoic era (approximately 240 to 560 million years ago) (Lockwood Greene 1994).

2.9.5 Soils

There are 23 soil mapping units that occur on Fort Campbell (Figure 6). Dickson silt loam is the most common soil on base and occurs on 29,228 acres. This soil is found throughout the upland training areas located in the middle and southern portions of the installation. The second most common soil occurring on post is Hammack (Bewleyville) silt loam. This soil is typical of the slopes found in the eastern and western portions of the base and covers 14,105 acres. The bottomland areas of the installation consist mainly of Sengtown gravelly silt loam. This soil is found exclusively around streams throughout the base and covers 10,391 acres. These three soil types cover 52 percent of the total acreage of Fort Campbell; all highly erodible. This is an area of concern due to the amount of training area that is covered by Dickson silt loam.

There is a moderate to severe potential for erosion for over half of the soils that occur on the installation (Table 2). Figure 7 shows the location of soils on Fort Campbell that have potential erosion problems. The potential for erosion varies with topographic conditions. Most problems associated with soil erosion on Fort Campbell result from the removal of vegetation on moderate to severe slopes or on long gradual slopes. Bare soil leads to erosion, creation of gullies and rills, and increased sediment load in streams. Erosion can render land unsuitable for training and impassable by vehicles. Sediment in streams may affect water flow and the survival of aquatic organisms.

Control of erosion and sedimentation in streams is one of the primary challenges faced by Fort Campbell NR managers. Primary source of erosion are the firebreak system and fields that are cleared of vegetation. Historically, firebreaks were built in a grid pattern that did not accommodate the varying slopes or soil types, and were graded twice annually. The firebreak system was re-designed in 1998, and the process of closing and restoring unnecessary firebreaks, and hardening necessary firebreaks is ongoing. To date, approximately 100 miles of firebreaks have been closed and restored to a vegetated condition, and 30 miles have been hardened to create Forest Access Roads.

Mapping units designated as hydric or having hydric inclusions are also indicated in Table 2 and Figure 7. Hydric soils are saturated, flooded, or ponded for sufficient periods during the growing season to develop

anaerobic (oxygen-deficient) conditions in their upper layers. Anaerobic conditions in hydric soils are conducive to establishment of vegetation adapted for growth under wet oxygen-deficient conditions (hydrophytic vegetation). Areas on Fort Campbell where hydric soils or soils with hydric inclusion have been mapped are typically associated with the general location of wetlands on the installation. Fifteen soil types found on Fort Campbell are classified by the USDA Natural Resources Conservation Service (NRCS) as prime farmland (NRCS 2007).

Table 2 lists all soil mapping units and provides a general description of the soil series or soil complexes. Soils of the same types with varying slopes are combined (e.g., Dickson silt loam 0-2% slope and Dickson silt loam 2-6% slope). More detailed information can be found in the soil surveys associated with the counties in which Fort Campbell is located.

2.9.6 Water Resources and Aquatic Habitat

The major uses of Fort Campbell's water resources are water supply, recreation, training, and aquatic habitat. The water resources of Fort Campbell can be divided into three categories: groundwater, surface water, and wetlands. Each has its own physical and chemical components, which in turn influence the aquatic flora and fauna that compose the biological communities. The following discussion describes water resources at Fort Campbell.

2.9.6.1 Groundwater

Dye traces performed on Fort Campbell have shown that two aquifers are present under the installation. One is a shallow aquifer that is recharged by sinkholes, and a deeper aquifer is associated with Boiling, Quarles, and Blue Springs. The bedrock aquifer at Fort Campbell consists of a zone of active groundwater flow in the shallow consolidated parts of limestone formations that underlie the installation. Typically, this zone is within the upper 150 feet of the bedrock. Much of the porosity in the aquifer results from solution weathering of minor structural features, such as fractures, joints, and bedding planes (USGS 1996). Groundwater in the bedrock aquifer flows through interconnected pores. Water enters the bedrock aquifer as regionally diffuse recharge from the unconsolidated overburden (regolith) or as locally concentrated, direct recharge from open sinkholes or sinking stream channels. In the aquifer, water flows down the potentiometric gradient. Groundwater discharges from the bedrock aquifer primarily to surface water at springs or as seepage along gaining reaches of streams. The groundwater that becomes surface water may return to the aquifer once again along the beds of losing reaches of streams and may discharge as groundwater downstream or even in an adjacent groundwater basin (USGS 1996).

Generally, water entering sinkholes and groundwater flows to springs within several drainage basins covering the installation (Figure 8). Springs are found just west of the installation adjacent to Training Area AB03, and in the cantonment area near Gate One, in the Small Arms Impact Area, and in Training Area 14 and Training Area 5. The USGS has conducted dye trace studies to determine patterns of groundwater flow, and associations of sinkholes and springs.

The primary source of drinking water used at Fort Campbell originates from Boiling Spring, which receives groundwater from the Boiling Spring groundwater basin. This basin covers 50 square miles on Fort Campbell, and underlies much of the surface drainage of Piney Fork. In addition to water that originates directly above its groundwater basin, Boiling Spring receives some stream flow from adjacent areas, including Noah Spring Branch and Dry Fork East Creek. Tracer studies indicate that Boiling Spring has no

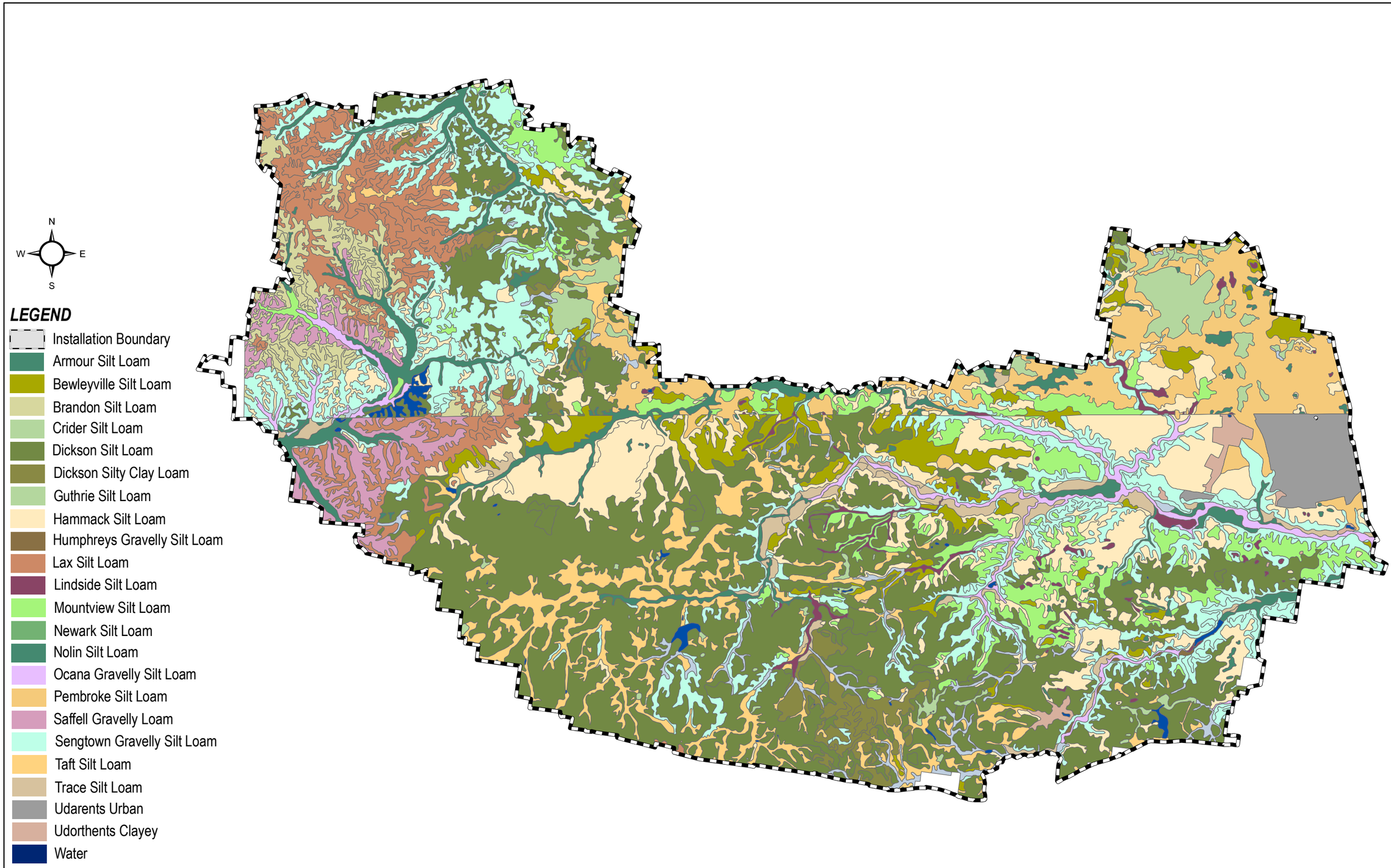

Figure 6. Fort Campbell soil mapping units.

Table 2. Land coverage and erodibility of soils found on Fort Campbell.

Soil Type and Percent Slope	Total Acres	Percent cover on Fort Campbell	Characteristic
Armour silt loam (5-12)	31	<1	Highly erodible
Brandon silt loam (5-12, 12-20)	2,733	3	Highly erodible, prime farmland (6-12% slopes)
Crider (Bewleyville) silt loam (2-5)	4,728	5	Non-erodible, prime farmland
Crider silt loam (0-2)	362	<1	Non-erodible, prime farmland
Dickson silt loam (0-2, 2-6)	29,228	28	Highly erodible, prime farmland
Dickson silty clay loam (2-6, 6-12)	1,627	2	Highly erodible
Guthrie silt loam (0)	1,152	1	Hydric
Hammack (Bewleyville) silt loam (2-5, 5-12)	14,106	14	Highly erodible
Hammack (Mountview) silt loam (2-5)	3,448	3	Highly erodible, prime farmland
Hammack silt loam (2-5)	19	<1	Highly erodible, prime farmland
Humphreys gravelly silt loam (2-5)	38	<1	Non-erodible, prime farmland
Lax silt loam (2-5, 5-12)	6,390	6	Highly erodible, prime farmland (1-4 % slopes)
Lindside silt loam (0)	831	<1	Non-hydric (prime farmland)
Newark silt loam (0)	1,344	1	Contains hydric inclusions, prime farmland
Nolin silt loam (0)	3,523	3	Non-hydric, prime farmland
Ocana gravelly silt loam (0)	1,624	2	Non-hydric, prime farmland
Pembroke silt loam (2-5)	3,768	4	Non-erodible, prime farmland
Saffell gravelly loam (20-60)	4,261	4	Highly erodible
Sengtown gravelly silt loam (5-12, 12-20, 20-60)	10,391	10	Highly erodible
Taft silt loam (0)	5,553	5	Contains hydric inclusions, prime farmland
Trace silt loam (0, 2-5)	2,088	2	Non-erodible
Udarents - Urban Land (0-6)	5,485	5	NA
Udorthents – clayey (0)	883	<1	NA

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W E

S

LEGEND

Installation Boundary

Highly Erodible Soils

Hydric and Hydric Inclusion Soils

0 2.5 5 10

Miles

Figure 7. Location of highly erodible, hydric, and hydric inclusion soils on Fort Campbell.

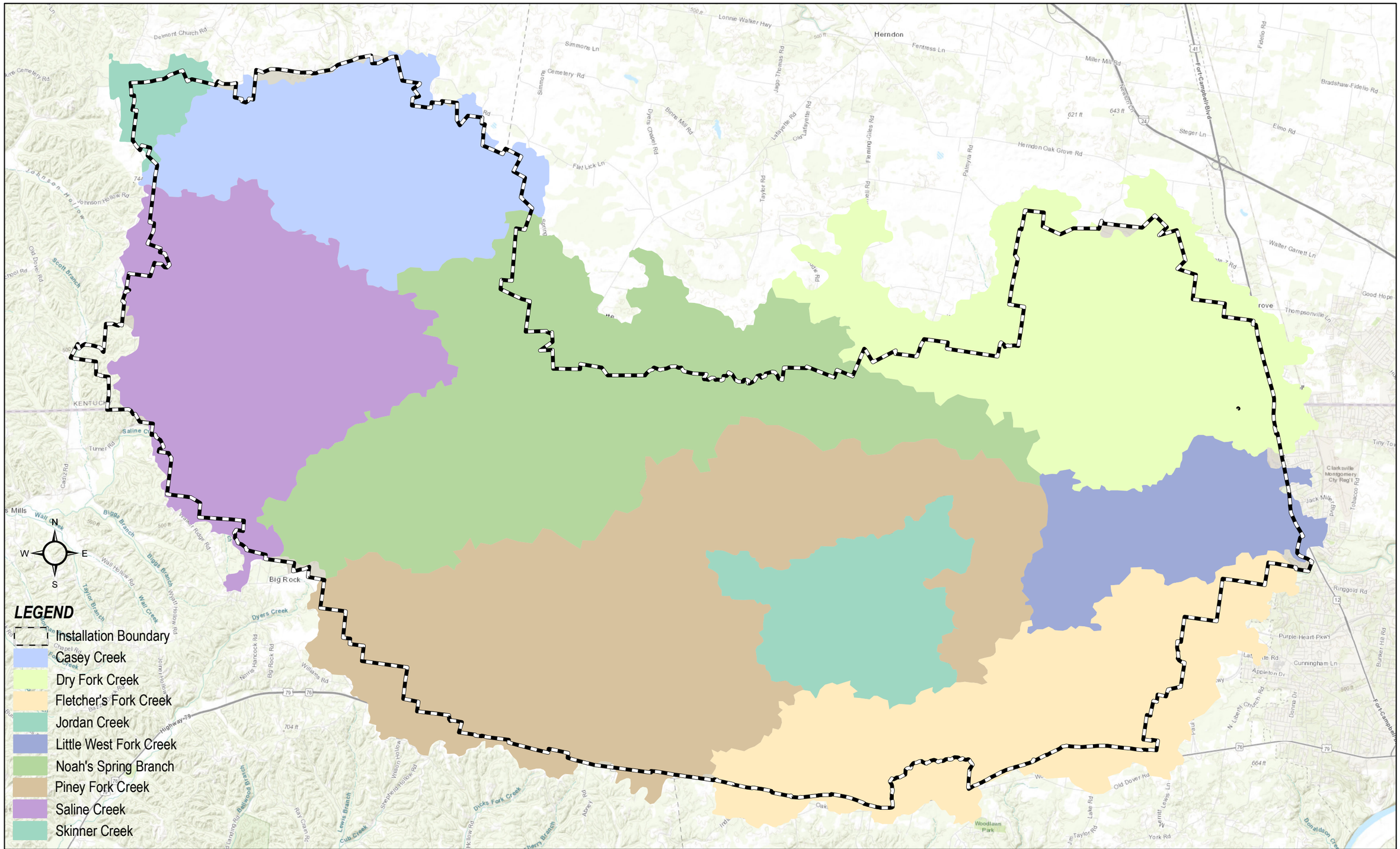

Figure 8. Fort Campbell sub-watersheds.

traditional recharge directly through sinkholes (USACE 1994). Regardless of origin, all the water that discharges from Boiling Spring flows down the potentiometric gradient through the bedrock aquifer in the Boiling Spring groundwater basin (USGS 1996).

To protect groundwater quality, Fort Campbell maintains 100-foot vegetated buffers around karst features to minimize run-off into groundwater via these features. Within the 100-foot buffers, Fort Campbell prohibits commercial timber harvest, development of skid trails, haul roads, and fire control lines, and creation of forest openings. If a cave entrance occurs within a prescribed burn area, the Fish and Wildlife Program must review proposed activities to determine the potential for effects to rare, threatened, or endangered species. In addition, application of pesticides, fertilizers, and other chemicals, as well as refueling and other potentially polluting activities are limited near karst features. Erosion control and spill prevention and control techniques in karst areas are developed in Fort Campbell's Compliance Program.

2.9.6.2 Surface Water

The surface water systems on Fort Campbell include approximately 700 watercourses, totaling about 453 stream miles (Figure 9)(BHE 2004a). Approximately 160 miles of streams are within impact areas, and 293 miles are outside impact areas. The installation is divided into nine subwatersheds, which are the primary management units in the Watershed Management Plan (Table 3). Dry Fork East, Piney Fork, Jordan, Fletcher's Fork, and Noah's Spring Branch creeks drain to the Little West Fork Creek, which drains to the Red River, a tributary to the Cumberland in Clarksville. Saline Creek drains to the Cumberland River, which flows approximately 9 miles south and 5 miles west of the installation. Casey Creek and its tributaries, including Skinner Creek, drain into the Little River in Kentucky, which then flows into Lake Barkley northwest of Fort Campbell. The Cumberland River flows into the Ohio and Mississippi Rivers and ultimately into the Gulf of Mexico. Surface water on the installation also drains into the groundwater system via sinkholes and disappearing streams.

In 2003, Fort Campbell conducted a comprehensive inspection of streams to characterize perennial and intermittent streams, and wet weather conveyances in the training and maneuver area (BHE 2004a). The nine subwatersheds and associated streams are described below. Four small man-made lakes also are present on Fort Campbell.

Generally, high water occurs during the months of December through April, gradually receding to the low water period, August through October. Disappearing streams are more likely to occur during drought conditions in late summer and early fall when the water table typically drops due to infrequent rain.

Little West Fork Creek Subwatershed

The Little West Fork Creek subwatershed covers approximately 9 square miles of training area and built-up area (including portions of the Clarksville Base, the cantonment area, and the golf course) about 50 percent of which currently is forested (Table 3). The GIS database indicates the Little West Fork Creek Subwatershed on Fort Campbell contains approximately 6 miles of perennial and 2 miles of intermittent streams. Little West Fork Creek has a mean annual discharge of about 24,235 gallons per minute (gpm).

The TDEC Division of Water Pollution Control designates uses for Little West Fork Creek, between Mile 0.0 to 10.4 as industrial water supply, fish and aquatic life, recreation, livestock and wildlife watering, and irrigation (TDEC 2004a). Little West Fork Creek appears on the 303(d) list for Tennessee (i.e., is non-

Table 3. Characteristics of nine sub-watersheds and associated streams on Fort Campbell.

Subwatershed	Watershed Area (acres)	Length of Stream on Fort Campbell (miles)				Designated Uses[a]	Fully Supporting of Designated Uses?[b]
		Perennial Stream	Intermittent Stream	Wet Weather Conveyance	Total		
Little West Fork Creek	6,124	6	2	8.5	16.5	IWS, FAL, REC, LWW, IRR	No
Dry Fork East Creek	12,158	6	3	6	15	FAL, IWW, REC, IRR	No
Piney Fork Creek	25,327	13	47	42	102	FAL, REC, LWW, IRR	No
Jordan Creek	6,263	2.5	12	13.5	28	FAL, REC, LWW, IRR	Yes
Fletchers Fork	10,718	9	15	14	38	FAL, REC, LWW, IRR	No
Noahs Spring Branch	18,734	9	14	46	69	FAL, REC, LWW, IRR	Yes
Saline Creek	13,944	7	27	44	78	IWW, FAL, REC, LWW, IRR	Yes
Casey Creek	10,380	0	11	33	44	CAH, PCR, SCR	No
Skinner Creek	748	0	2.5	0.5	3	CAH, PCR, SCR	No

[a] Source: TDEC 2004a and 401 KAR 5:026. IWS – Industrial Water Supply; FAL – Fish and Aquatic Life; REC-Recreation; LWW – Livestock and Wildlife Watering; IRR – Irrigation; CAH – Cold Water Aquatic Habitat; PCR – Primary Contact Recreation; SCR – Secondary Contact Recreation

[b] Source: TDEC 303(d) Year 2016 Final List (TDEC 2016), 2016 List of 303(d) Waters for Kentucky (KDOW 2016).

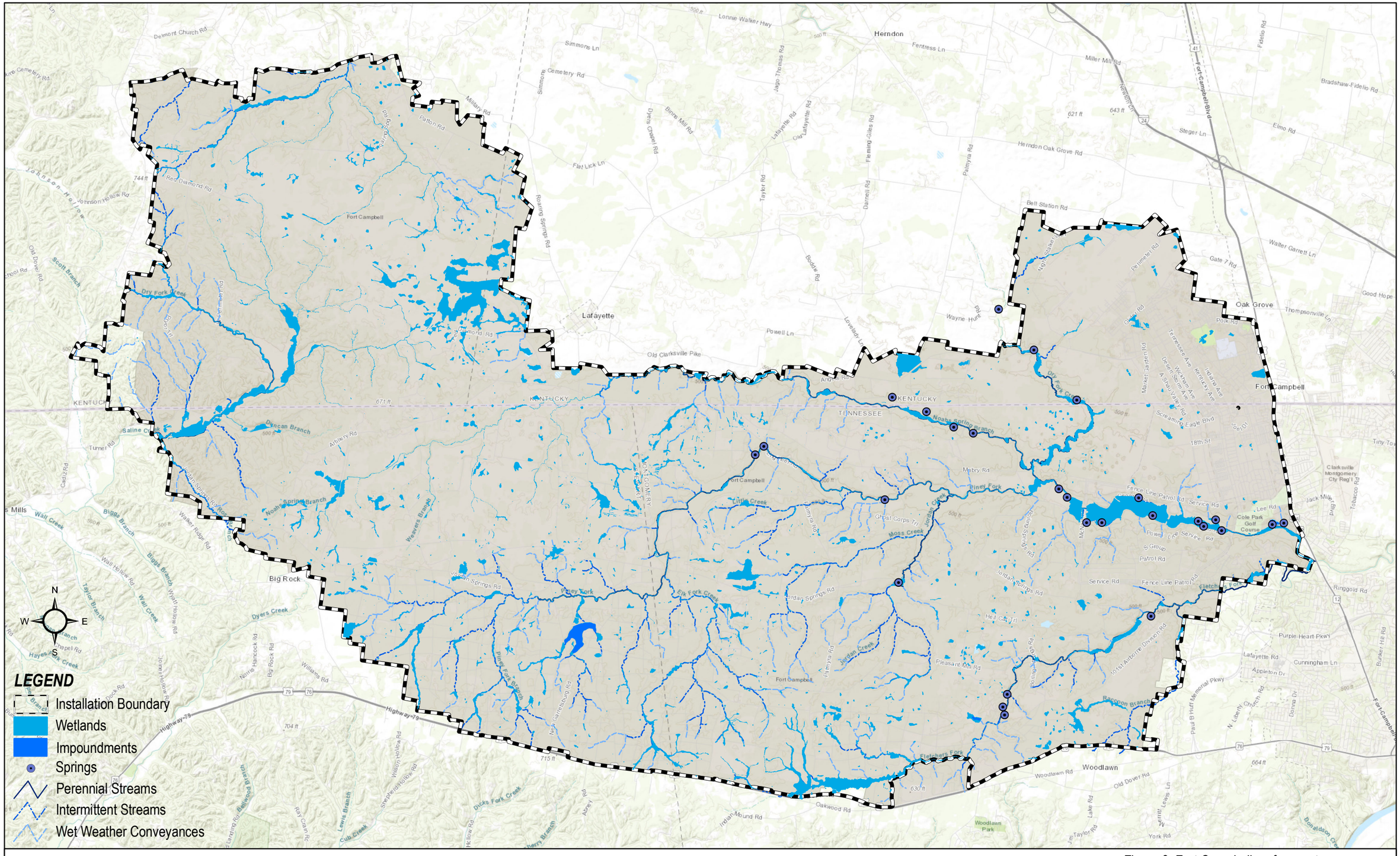

Figure 9. Fort Campbell surface water resources.

supporting of designated uses) due to phosphorous, siltation, organic enrichment, and low dissolved oxygen from a major municipal point source and habitat modification (TDEC 2016). However, the TDEC Division of Water GIS database indicates that the segment of Little West Fork Creek located on Fort Campbell is impaired due to sedimentation (TDEC 2018).

Dry Fork East Creek Subwatershed

The Dry Fork East Creek Subwatershed covers approximately 12,158 acres of training area, impact area, and built-up area (including the CAAF and portions of the cantonment area), about 10 percent of which is forested. The subwatershed boundary encompasses the land on the installation that drains into Dry Fork East Creek and its tributaries, up to the confluence of Dry Fork Creek with Noah's Spring Branch. On Fort Campbell, the Dry Fork East subwatershed contains approximately 6 miles of perennial streams, and 1 mile of intermittent stream. The headwaters of Dry Fork East Creek originate off the installation to the west of Training Area AB03, and extend to non-installation agricultural lands to the north and west. Designated uses for Dry Fork East Creek are fish and aquatic life, recreation, livestock and wildlife watering, and irrigation. Dry Fork East Creek appears on the 303(d) list for Kentucky, and is listed as non-supporting of aquatic life due to siltation from an unknown source (KDOW 2016). Sources of silt on Fort Campbell include firebreaks that are not covered with vegetation, mulch, or gravel.

Piney Fork Creek Subwatershed

The Piney Fork Creek Subwatershed is the largest on Fort Campbell. It drains approximately 25,326 acres of training area, about 72 percent of which is forested (Table 3). In 2003, 102 miles of streams were classified in the Piney Fork Creek Subwatershed: 13 miles are perennial, 47 miles are intermittent, and 42 miles are wet weather conveyance (BHE 2004a). Piney Fork Creek exhibits interstitial flow (no surface flow) from approximately 0.5-mile upstream of its confluence with Jordan Creek to its mouth at Little West Fork Creek, and also upstream of the mouth of Elk Fork Creek (BHE 2004a, USGS 1996). USGS topographic maps indicate up to 1 mile of some headwater streams in the Piney Fork Creek Subwatershed originate off the installation to the southwest. Designated uses for Piney Fork Creek are fish and aquatic life, recreation, livestock and wildlife watering, and irrigation. Vegetation removal along streambanks, presence of firebreaks across streams, and diversion of wet weather conveyances downstream are potential sources of sediment-laden run off into Piney Fork Creek.

Jordan Creek Subwatershed

The Jordan Creek Subwatershed is the only subwatershed located entirely on Fort Campbell. It drains approximately 6,263 acres of training area, about 79 percent of which is forested (Table 3). Of the 28 miles of streams classified in the Jordan Creek Subwatershed, 2.5 miles are perennial, 12 miles are intermittent, and 13.5 miles are wet weather conveyance (BHE 2004a). Jordan Creek exhibits interstitial flow (no surface flow) near its confluence with Piney Fork Creek. The mouth of Jordan Creek is dry or contains only pools during low flow conditions; flowing water is typically found approximately 0.75 stream miles upstream (BHE 2004a, USGS 1996). Designated uses for Jordan Creek are fish and aquatic life, recreation, livestock and wildlife watering, and irrigation. Jordan Creek does not appear on the 303(d) list for Tennessee (TDEC 2004b), however, in the past Jordan Creek has exhibited low dissolved oxygen, organic enrichment, and siltation from habitat modifications (Zirkle 2001a). Studies of Jordan Creek conducted in 2000 indicated that, while the physiochemical parameters met state water quality standards, and macroinvertebrate species diversity was similar to local reference streams, sediment loading was excessive (Zirkle 2001a).

The Jordan Creek Subwatershed contains about 87 miles of earthen firebreaks and receives moderate impacts from military and nonmilitary activities.

Fletcher's Fork Creek Subwatershed

Fletcher's Fork Creek Subwatershed is the second largest on Fort Campbell, draining approximately 10,718 acres of training area, 62 percent of which is forested. Of the 38 miles of streams classified in Fletcher's Fork Creek Subwatershed, 9 miles are perennial, 15 miles are intermittent, and 14 miles are wet weather conveyance (BHE 2004a). That total does not include one stream within the Sabre Heliport that was inaccessible during surveys. The waterway within Sabre Army Airfield flows into a sinkhole and does not have a surface connection to any other stream on the installation. Most headwater streams in the Fletcher's Fork Creek Subwatershed originate on the installation; the Woodlawn and New Providence USGS topographic quadrangles indicate some tributaries of Fletcher's Fork Creek, and several tributaries of Raccoon Branch originate off the installation to the south and southeast.

Designated uses for Fletcher's Fork and Raccoon Branch creeks are fish and aquatic life, recreation, livestock and wildlife watering, and irrigation (TDEC 2004a). The Fletcher's Fork Creek Subwatershed on Fort Campbell contains 86 miles of earthen firebreaks and receives heavy impacts from military and nonmilitary activities which may contribute to future impairment of the subwatershed (Zirkle 2001b).

Noah's Spring Branch Subwatershed

Noah's Spring Branch Subwatershed covers approximately 18,734 acres of training and impact area, about 27 percent of which is forested. The headwaters of Noah's Spring Branch originate entirely on Fort Campbell, in the southwest portion of the installation. Noah's Spring Branch flows through the Impact Area, and then along the north central installation boundary, where the stream receives input from several tributaries originating outside the installation. Noah's Spring Branch flows through the Small Arms Impact Area, and the eastern boundary of the subwatershed is where Noah's Spring Branch and Piney Fork Creek join to form Little West Fork Creek. Of 26 miles of stream classified downstream from the Impact Area, 9 miles are perennial, 3 miles are intermittent, and 14 miles are wet weather conveyance (BHE 2004a). Within the Impact Area is approximately 43 more miles of stream in the Noah's Spring Branch system, including about 11 miles of intermittent stream, and 52 miles of wet weather conveyance. While USGS topographic maps indicate intermittent streams located southwest (upstream) of the Impact Area (Training Areas 35, 47, and 48), field surveys indicated no water courses meeting the definition of wet weather conveyance, intermittent, or perennial stream were present (BHE 2004a). Portions of the main channel of Noah's Spring Branch upstream of the Small Arms Impact Area occasionally are dry (BHE 2004a, USGS 1996). Designated uses for Noah's Spring Branch are fish and aquatic life, recreation, livestock and wildlife watering, and irrigation. Noah's Spring Branch is listed on the 303(d) list for Tennessee due to sedimentation (TDEC 2016). The Noah's Spring Branch subwatershed contains extensive firebreaks and cultivated land, which may contribute to siltation of the waterways.

Saline Creek Subwatershed

Saline Creek Subwatershed drains approximately 13,944 acres (12 percent of total installation acreage) of the western portion of the installation in a southwesterly direction. Approximately 41 percent of the watershed is forested. Topography within the subwatershed contains rolling hills and steep bluffs, and the streambed gradient is 200 feet in approximately 6 miles. Stream banks in the subwatershed are steep, with

70 percent to nearly vertical slopes. Short periods of high water occur during December through February, with low water occurring August through November. During dry periods, flow is maintained by seeps and springs. Mean annual discharge is approximately 4,250 gpm.

Saline Creek originates on Fort Campbell, primarily in the Impact Area, and flows west directly into the impounded Cumberland River (Lake Barkley). Major tributaries on Fort Campbell include Dry Fork West Creek and Ross Branch. The majority of the Saline Creek Subwatershed exists west (downstream) of Fort Campbell. On Fort Campbell, outside the Impact Area, approximately 5 miles of perennial stream, 12 miles of intermittent stream, and 15 miles of wet weather conveyance are present in the Saline Creek Subwatershed (BHE 2004a). Within the Impact Area is 2 miles of perennial stream, 15 miles of intermittent stream, and 29 miles of wet weather conveyance. Between the origin of Saline Creek and the Fort Campbell boundary, designated uses include industrial water source, fish and aquatic life, recreation, livestock and wildlife watering, and irrigation (TDEC 2004a). None of the streams in this subwatershed appear on the 303(d) list for either state. Very little siltation or other pollutants were detected in this subwatershed during field surveys conducted in 2003 (BHE 2004a). However, installation training exercises and dredging for gravel occur within the subwatershed, and have potential to affect surface water quality.

Casey Creek Subwatershed

Casey Creek originates primarily in the Impact Area. The majority of the Casey Creek Subwatershed exists north (downstream) of Fort Campbell. On Fort Campbell, outside the Impact Area, approximately 5 miles of intermittent streams and 8 miles of wet weather conveyance are present in the subwatershed (Table 3). Within the Impact Area are 3 miles of intermittent streams and 25 miles of wet weather conveyance. Three storm water retention basins are located within Training Area 44 to control flash flooding during strong rain events. Designated uses for Casey Creek are cold water aquatic habitat and primary and secondary contact recreation (401 KAR 5:026). Casey Creek is listed on the Kentucky 303(d) list as partially supporting of aquatic life due to siltation from sources outside of state jurisdiction or borders; (KDOW 2016), which may include the Impact Area.

Skinner Creek Subwatershed

A very small portion (748 acres) of the Skinner Creek Subwatershed occurs in the northwest corner of Fort Campbell, while the majority of the subwatershed exists north (downstream) of the installation. Of the 3 miles of streams classified on Fort Campbell, 2.5 miles are intermittent, and 0.5 miles are wet weather conveyances. Skinner Creek appears on the 303(d) list for Kentucky due to an unknown pollutant from an unknown source (KDOW 2016).

Lakes

Four man-made impoundments lie within the installation boundaries and are used for recreational and training purposes. Lakes at Fort Campbell are generally small and shallow. Zooplankton and phytoplankton species are an important source of food for higher organisms in the lakes. Rooted plants are often found growing completely across the lakes. Lakes on Fort Campbell include:

- Lake Kyle is a 81-acre lake located in a maneuver area at the southwestern corner of the installation. The lake is often used for training activities (e.g., water purification training, helicopters lowering personnel into the lake, battalion-sized elements camping near the lake).

The lake was formed by construction of an earthen dam with concrete spillway. The lake depth is estimated at 10 feet (Byrnes 1992) and is considered to be well below its water height potential (KDFWR 1995). Sediment deposition is significant. In 1999, triploid grass carp were released into Lake Kyle to manage submerged aquatic vegetation including the southern naiad (*Najas guadalupensis*) and water willow (*Dianthera americana*). In 1992, four types of aquatic flora were identified in Lake Kyle: American pond weed (*Potamogeton nodosus*), water willow (*Dianthere americana*), cattail (*Typha latifolia*), and bushy pondweed (*Najas* spp.) (Byrnes 1992). Planktonic and filamentous algae also occur in Lake Kyle;

- Joe Swing Pool is an abandoned 6-acre quarry located near the golf course;
- An unnamed, 4-acre lake exists in the southeastern corner of the installation. The lake was formed by an earthen dam with an earthen spillway; and
- An unnamed, 3-acre pond exists within the southern boundary of Training Area 9B just north of US Highway 79. The pond was constructed during the Tennessee Department of Transportation widening of US Highway 79.

Wetlands

The legal definition of a wetland in the Clean Water Act (CWA) is "…those areas that are inundated or saturated by surface water at a frequency to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands typically include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(b)). Wetlands provide essential breeding, spawning, nesting, and wintering habitats for many fish and wildlife species. Wetlands also enhance the quality of surface waters by impeding erosive forces of moving water and trapping waterborne sediment and associated pollutants, maintaining base flow to surface waters through the gradual release of stored floodwaters and groundwater, and providing a natural means of flood control and storm damage protection through the absorption and storage of water during high-runoff periods.

Fort Campbell utilizes data from wetland surveys and the National Wetland Inventory (NWI) for National Environmental Policy Act (NEPA) reviews. The installation utilizes both GIS and web-based data from the USFWS. Current data indicates 1,463 wetlands encompassing 4,883 acres are located on the installation (Figure 9). Limited field surveys for wetlands have been conducted since the late 1990's but have not been continued due to the high cost. Funding requests for survey efforts are submitted annually.

From 1999 through 2009, Fort Campbell coordinated with the Natural Resources Conservation Service (NRCS) and the United States Army Corps of Engineers to conduct wetland delineations throughout the installation. The locations of potential wetlands were mapped using digital photographs, NRCS soil maps, and National Wetland Inventory (NWI) maps. Each potential wetland area was delineated using the "Routine Onsite Determination Method" described in the U. S. Army Corps of Engineers' *Wetlands Delineation Manual* (USACE 1987). All potential wetlands thought to be "jurisdictional" were submitted for a jurisdictional determination by the USACE, Nashville District. A total of 617 wetlands meeting jurisdictional requirements totaling 2,533 acres have been identified on Fort Campbell. All identified wetlands were mapped using Global Positioning System (GPS) technology, and the location of the wetland boundaries are maintained in a GIS database. Most wetlands on Fort Campbell are palustrine types (USInfrastructure 2000).

In addition to the wetland delineation, a hydrogeomorphic (HGM) assessment was conducted in 2000 to assess the physical, chemical, and biological functions of the wetlands identified on Fort Campbell. This functional assessment provided a baseline measurement of the quality and function of wetlands on the installation. The HGM assessment evaluated 43 of the wetlands identified on Fort Campbell, a representative sample. The wetland sample was divided into streamside, forested upland, and small pond wetlands, and each wetland was evaluated for eight functional indices: surface water storage, subsurface hydrology, nutrient cycling, removal and sequestering of elements and compounds, particle retention, exporting of organic carbon, plant community characteristics, and wildlife habitat. The wetlands were scored between 0 and 1, and the value ranked the wetland as to its relative quality based on function.

One wetland mitigation site has been developed on Fort Campbell in coordination with the USACE and U.S. Fish and Wildlife Service (USFWS). The mitigation site was developed on 36 acres in Training Area (TA) 19 to compensate for loss of 10 acres of wetlands affected by construction of the Sabre Heliport. Within the mitigation site, 26 acres of existing wetlands were enhanced and 10 acres of wetlands were restored. The requirements of the permit were satisfied in 2013 and the permit for the mitigation is closed. Since its establishment the mitigated wetland site has grown to 69 acres due to natural processes caused by beavers.

Vegetated buffers of 100 feet are maintained around all jurisdictional wetlands. The buffers are depicted in the GIS database. Where it is determined that a wetland has, or could have, significant habitat value, or where current activities adjacent to a wetland are causing noticeable adverse impacts on the habitat, buffers of greater than 100 feet may be established. Activities within buffer zones are limited to those which would cause little or no impact on, or disturbance to, the wetland.

2.9.6.3 Water Quality Summary

Fort Campbell monitors water quality to assess baseline conditions of streams, and to detect point/non-point source discharges into streams. Surveys for aquatic macroinvertebrates also are conducted to assess the relative condition of aquatic communities. As part of the Watershed Management Plan (Section 5.4), the F&W Program conducts water quality assessments in certain subwatersheds. A water quality monitoring work plan is developed annually. Water quality assessments include measurement of physiochemical parameters (dissolved oxygen, pH, temperature, total dissolved solids, turbidity, nitrates, ammonia, and conductivity). Additionally, the assessment includes a Bioreconnaissance (BR), which is similar to the EPA's Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (RBP; USEPA 1998a). The BR is a screening-level evaluation of the relative health of the biological community. The BR is used primarily for general subwatershed assessments and for determining where more intensive monitoring is needed. When more detailed data collection is warranted, a semi-quantitative single habitat survey is conducted using EPA RBP standards. Detailed description of site selection and assessment methods is provided in the Watershed Management Plan.

To date, in accordance with the Watershed Management Plan schedule, results of monitoring indicate the following for Jordan Creek and Fletcher's Fork Creek:

- physiochemical parameters met all state water quality standards for each designated use;
- turbidity increased following rain events but returned to normal levels in one week;
- macroinvertebrate community structures were similar to local reference streams; and
- moderately pollution tolerant species of macroinvertebrates are present.

Along both streams evidence of suboptimal habitat and excessive siltation were recorded, indicating impaired habitat quality. Continued management efforts to reduce sediment runoff into streams in Jordan Creek and Piney Fork Creek subwatersheds are warranted. Water quality assessments will be conducted in other subwatersheds on Fort Campbell through fiscal year 2018.

Endangered gray bats forage along streams in every subwatershed on Fort Campbell. Because they typically forage over water and in associated riparian areas, a significant portion of the gray bat diet is insects with aquatic life stages. Gray bats also drink water from streams and lakes. Maintenance of good water quality is critical to management and conservation of the gray bat on Fort Campbell. Chemical contaminants in water may be transferred to gray bats via drinking water or insects emerging from the water. Pollutants and silt may affect the survival of aquatic insects, which ultimately affects prey availability for gray bats. Fort Campbell regularly monitors the abundance and diversity of aquatic insect fauna in streams where gray bats forage. Annually, samples of aquatic insects are collected from 20 sites. Fort Campbell identifies insects in each sample and calculates the Index of Biological Integrity, the EPT (*Ephemeroptera, Plecoptera, Trichoptera*) ratio, and the percentage of emerging species to evaluate water quality and availability of prey for gray bats.

Another method for monitoring water quality in Fort Campbell streams is the State of Tennessee's water quality program. The Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control, and the Kentucky Division of Water (KDOW) evaluate water quality in streams throughout the state, including on Fort Campbell, in accordance with the Clean Water Act Section 303(d). Streams are classified as fully, partially, or non-supporting for uses designated by TDEC or KDOW. Five streams on Fort Campbell are classified as impaired for one or more designated uses (Table 3; TDEC 2004b, KDOW 2003). While Fort Campbell cannot manage water quality in the portion of a stream that flows off the installation, it can minimize input of pollutants contributing to impairment of the stream. Fort Campbell monitors the biennial revision of the 303(d) lists in each state, and identifies changes in status for streams on, or partially on, the installation.

A primary cause of impaired streams on Fort Campbell is siltation caused by habitat modification. Sediment deposition in streams ranges from moderate to severe and is the most serious water quality threat at Fort Campbell. From September 2002 to May 2003, water samples were collected following heavy rain events to determine total suspended solids in Fort Campbell streams. Sediment loading ranged from an average of 2728 tons per year to 59,130 tons per year. Presence of sediment is a result of stormwater runoff transporting highly eroded soil particles into nearby waterbodies. Sedimentation has also been observed in lakes on the installation.

The Range Training Land Assessment (RTLA) Program samples water quality and aquatic macroinvertebrates from a single site on six of the largest streams: Saline, Jordan, Dry Fork East, Little West Fork, Fletchers Fork, and Noah's Spring Branch creeks. Samples are taken from each of the six sites once per week throughout the year. Physiochemical parameters, including turbidity and dissolved oxygen are measured, and rapid bioassessment protocols (USEPA 1998a) are used to evaluate aquatic conditions.

In 2002 and 2004, water was collected from 22 sites along permanent streams and analyzed for presence of pesticides and other compounds used in agricultural production. Sample sites were selected near the installation boundaries, impact areas, and agricultural fields to facilitate identification of probable sources of contaminants in the streams. Samples were analyzed for pesticides (Triazines, Alachlor, Metolachlor, 2,4-D, Paraquat, Chlorpyrifos), orthophosphate, nitrate, chloride, sulfate, and bromide. Except for Paraquat and

bromide, each of the substances was identified in at least one stream on Fort Campbell during at least one sampling event (Schumacher 2002, and in prep.). Identification of compounds in streams flowing into the installation suggests the source is from outside Fort Campbell. Likewise, identification of compounds in streams originating on Fort Campbell suggests sources are located within Fort Campbell.

2.9.7 Terrestrial Habitat

Terrestrial habitat on Fort Campbell once consisted of woodlands and extensive native prairies sustained by fires set by Native Americans. During the pre-Civil War era, many of the open areas naturally converted to hardwood forests. Between the Civil War and World War II, most of the land was cleared and used for agricultural. At the inception of Fort Campbell in the 1940s, most of the land use was agricultural, with only remnants of native grass and woodland communities. When the agricultural activities were reduced, remnant native grass habitat spread throughout the installation into fallow fields that remained. Natural succession continued to convert much of the open habitat to forest. In addition, many non-forest areas were converted to loblolly pine plantations for commercial timber and to stabilize the soils, which further accelerated conversion of terrestrial habitat to forest cover.

Currently, 64,847 acres of undeveloped land on Fort Campbell are composed of several terrestrial habitat types. Terrestrial habitats are classified by their plant communities and include native grassland barrens, old fields, agricultural fields, and forest. A floristic inventory of Fort Campbell was conducted in 1992 (Johnson et al. 1992). Collections from the inventory included 89 plant families and 423 species (Appendix D). In the report, researchers speculated that as many as 100 additional species might be found on the installation with further inventorying. More recently, Fort Campbell has conducted plant inventories in grasslands to identify species associated with native barrens. Aerial photographs and forest inventory data are also used to classify habitat. To the extent possible, boundaries of terrestrial habitat types have been recorded using GPS and are maintained in the GIS database to facilitate land management.

2.9.7.1 Native Grassland Barrens and Old Fields

The grassland barrens and old field communities include all non-forested areas not developed (built-up) and not currently under agricultural outlease (Figure 10). These two non-forested habitat types are collectively called open areas. Approximately 19,253 acres on Fort Campbell are open areas. Except where sensitive species exist, open areas with woody growth no taller than 21 inches high are highly compatible with training. Open areas demonstrate varying degrees of succession and many are overgrown by thick woody brush, which limits accessibility for training. The majority of open areas are maintained with prescribed fire to limit woody growth. Mechanical and/or chemical methods may be used, when fire is ineffective in clearing woody vegetation.

Between 1999 and 2001, Fort Campbell developed a method of evaluating open areas to determine the value as training area, native grassland barrens community, or agricultural lease area. Native grassland barrens are classified with a tiered ranking system (Tiers 1-4) based upon presence of indicator floral species, and potential for restoration or cultivation. Tier 1 is composed of high quality sites with high priority for management and preservation. Tier 2 is characterized by medium quality sites with potential for restoring a high quality barrens community with moderate levels of effort. Tier 3 sites are low quality, degraded barrens communities in which restoration would require a significant effort and several prescriptions for treatment. Tier 4 is characterized by severely degraded fields not suitable for ecological restoration (Parsons 2004).

Of over 17,600 acres of open area evaluated between 2001 and 2003, 7,437 acres were identified as native grassland barrens, and the remainder was classified for use as agricultural lease areas or old fields. Open areas that are not barrens and not suitable for cultivation or training are allowed to naturally develop into forest.

High quality (Tier 1 and 2) native grassland barrens occupy 5,239 acres on Fort Campbell. They are typically composed of moderate to tall perennial native warm season grasses. Native warm season grasses grow primarily in summer. They also are called bunch grass because they tend to grow in deep-rooted clumps or bunches. Fescue and other introduced grasses growing in the spring are cool season grasses and have shallow root systems. Native warm season grasses typically found in barrens on Fort Campbell include big bluestem (*Andropogon gerardii*), broomsedge (*Andropogon virginicus*), two-edged panic grass (*Panicum anceps*), little bluestem (*Schizachyrium scoparium*), and Indian grass (*Sorghastrum nutans*). Forest surrounding native grassland barrens typically is dominated by oaks (*Quercus* spp.) and pines (*Pinus* spp.).

Native grassland barrens found on Fort Campbell are part of a historically extensive area referred to as the Big Barrens of Kentucky or Kentucky Meadows. The Big Barrens encompass a crescent-shaped area that extends from the Ohio River, west of Louisville, Kentucky, southward into Tennessee, and westward almost reaching the Cumberland River (Chester 1988). The southernmost part of the ecoregion extends into the northwestern Highland Rim section of Tennessee; barrens are found mostly in northern Montgomery and Robertson counties and northeastern Stewart County. Those barrens are closely associated with karst topography underlain by cavernous Mississippian limestone.

In eastern North America, native grassland barrens historically were characterized by high rates of endemism, endangered species, and species at or near the limit of their range (Chester 1988). Barrens in Tennessee are related by their dominant plants to prairies of the west and north, but are unique in that they have strong local and southern plant relationships. However, most of the barrens have now been destroyed or disturbed to such an extent that few representatives of the original flora remain. Major causes of the prairie loss include cultivation, a lack of fire, invasive species, or development. Fort Campbell may harbor the largest remaining remnant barrens east of the Mississippi River (Fort Campbell 2003). These grasslands are a high priority for protection by state and federal agencies as designated natural areas (Shea 2005). In 2001, Fort Campbell signed a Memorandum of Agreement with TWRA and KDFWR that establishes a cooperative means for reestablishing, enhancing, and protecting native warm season grasses on the installation, and allows the state agencies to harvest native warm season grass seeds from Fort Campbell. In return, Fort Campbell is provided native grass seed that contains the same genetic stock for maneuver land rehabilitation projects and habitat enhancement activities.

Open areas on Fort Campbell that do not contain plant species associated with native grassland barrens are classified as old fields. Vegetation in old fields is primarily grasses, although woody shrubs and trees typically are present, particularly if fire has been absent for several years. When possible, prescribed fire may be used to control growth of woody species to maintain conditions suitable for military training. In addition to training, old fields on Fort Campbell are used for hunting (e.g., bobwhite), and provide wildlife habitat. Old fields containing patches of low-growing woody vegetation are an important component of habitat for wildlife including the Henslow's sparrow.

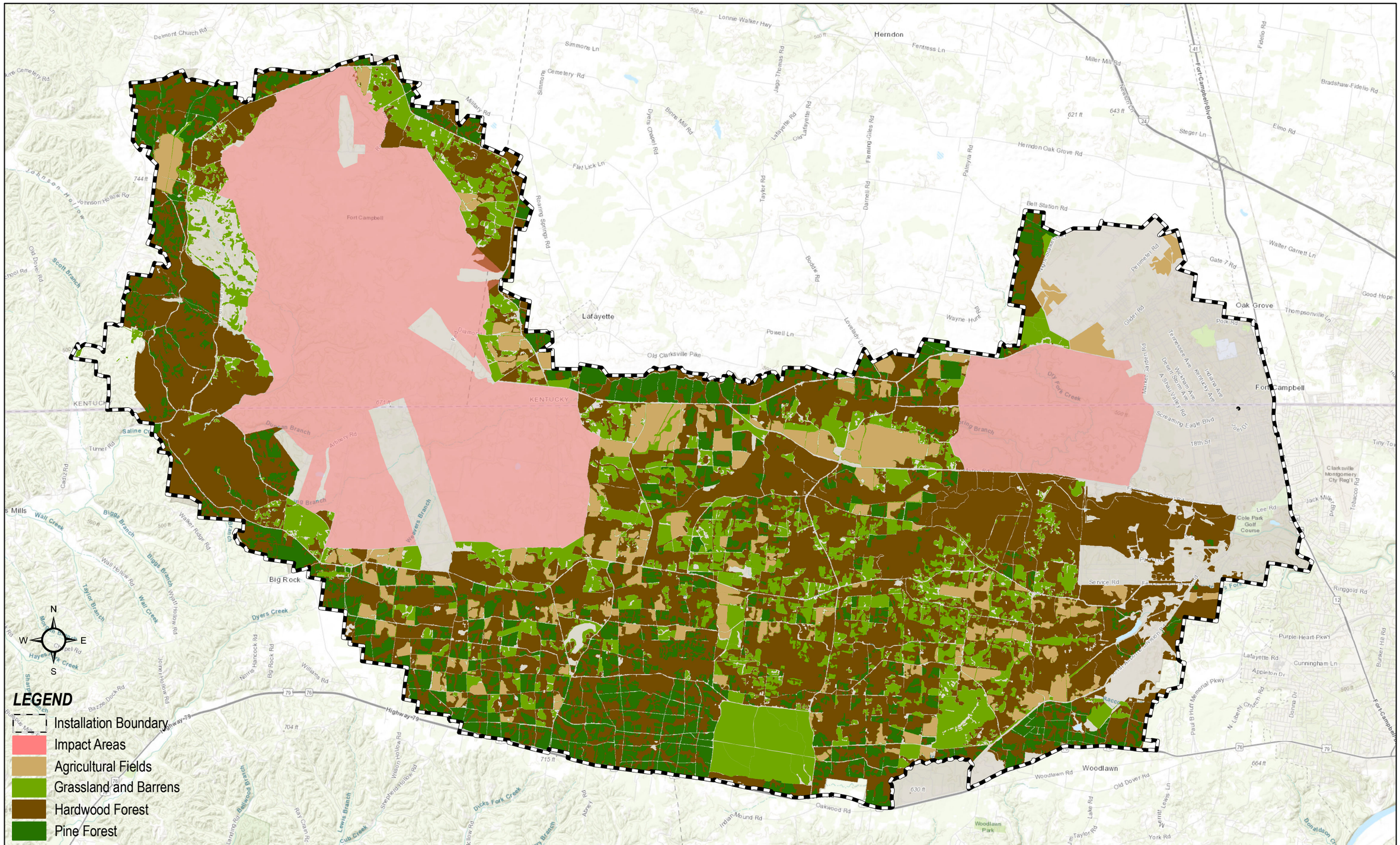

Figure 10. Location and types of forested and open areas on Fort Campbell.

2.9.7.2 Agricultural Fields

Fort Campbell operates an agricultural outlease program which includes 5,581 acres of fields leased to farmers in the local community (Figure 10). The program includes 3,736 acres of row crop (wheat, corn, grain sorghum, and soybean) production, 1,409 acres of hay and 436 acres of grassed areas supporting training mission requirements. Hay production includes varieties of tall fescue (e.g., *Festuca arundinacea*), bluegrass (*Poa* spp.), orchard grass (*Dactylis glomerata*), and timothy (*Phleum pratense*).

2.9.7.3 Forest

Woodlands currently occupy more than 45,145 acres on Fort Campbell, about 43 percent of the installation's total area. The forests consist primarily of deciduous (hardwood) communities, although pine plantations are predominant in the southwest part of the installation (Figure 10). Oak and oak-hickory associations occur most frequently, though more mesophytic community types occur on some slopes and ravines, including the western form of the mixed mesophytic forest in a few rare cases (Chester and Ellis 1989). The dominant forest types found on Fort Campbell are described in detail in the Forest Management Plan, and are summarized below.

Upland Hardwood Forest

Upland hardwood forests are the dominant forest type on Fort Campbell, though they vary considerably in composition depending on topography, soil, and land use history. Some of the dominant tree species in these forests are white oak (*Quercus alba*), black oak (*Q. velutina*), northern red oak (*Q. rubra*), yellow poplar (*Liriodendron tulipifera*) hackberry (*Celtis occidentalis*), sweetgum (*Liquidambar styraciflua*), sugar maple (*Acer saccharum*), red maple (*A. rubrum*), American elm (*Ulmus americana*), and ash (*Fraxinus sp.*).

Bottomland Hardwood Forest

Bottomland hardwood forests in Kentucky and Tennessee are concentrated on broad floodplains and other poorly drained areas and are associated with flooding regimes that range from periodic to permanent. Tree and shrub species characteristic of Fort Campbell's bottomland hardwood forests include sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), boxelder (*Acer negundo*), red maple (*A. rubrum*), river birch (*Betula nigra*), white ash (*Fraxinus americana*), Japanese honeysuckle (*Lonicera japonica*), blackgum (*Nyssa sylvatica*), black cherry (*Prunus serotina*), white oak, multiflora rose (*Rosa multiflora*), blackberry (*Rubus* spp.), sassafras (*Sassafras albidum*), and coralberry (*Symphoricarpos orbiculatus*).

Pine Plantation

Forests of planted pine trees cover approximately 10,500 acres of the installation. The forests consist primarily of loblolly pine (*Pinus taeda*) and other conifers including shortleaf pine (*P. echinata*), eastern white pine (*P. strobus*), and Virginia pine (*P. virginiana*). Of these, only *P. virginiana* and *P. echinata* are native to the region.

Fort Campbell monitors forest conditions using a Continuous Forest Inventory (CFI). Periodic sampling is conducted in permanent plots spaced randomly over the entire forest. Permanent plots were established in

1962 and provided an estimate of the total hardwood volume of timber. Subsequent assessments at 5-year intervals were compared to the earlier inventory to evaluate the change over time of the forest. Measurement of change is the principal value of CFI; because it is based on permanent plots, the precision of estimate (i.e., sampling error) is much better than would ordinarily be obtained from two independent inventories. Analyses show that the general forest health on Fort Campbell is comparable to that of forests of the surrounding region.

Riparian Zones

A riparian zone is the land adjacent to a body of water, and normally has soils and vegetation characteristic of floodplains or areas transitional to upland zones. Perennial streams, having surface flow throughout the year, generally support riparian zones distinct from the surrounding upland because the continually wet habitat allows development of riparian-dependant plant and animal communities. Plants in the riparian zone typically are tolerant of periodic flooding or saturated soils. Riparian areas may exhibit greater species diversity and productivity than upland sites because these area contain species from both aquatic and terrestrial communities.

Riparian zones serve useful functions in the ecosystem. Vegetation in the riparian zone protects water quality by reducing input of sediment, nutrients, and contaminants into surface water from activities in the subwatershed. Overland water flow is intercepted and filtered by riparian vegetation before it enters the water. Vegetation also provides stream bank/shoreline stabilization to the water body. Roots of riparian vegetation anchor shoreline soil and protect the shoreline from the erosive forces of water movement (USEPA 1993). Along streams, vegetated riparian zones help regulate temperature of the water by shading the water surface. Woody vegetation in riparian areas tends to have shallow roots due to the high water table, and is susceptible to wind throw, which supplies large organic debris (LOD) to the stream system. LOD influences the in-stream channel structure, such as the occurrence of pools and riffles. Streams with pools and riffles typically have less stream bank erosion, slower transport of organic detritus (the main food source for aquatic invertebrates), and greater habitat diversity than straight, even-gradient streams. LOD also provides suitable cover and spawning habitat for fish.

Riparian areas provide valuable flood control by attenuating floodwaters, storing the overflow, and conveying water slowly back to downstream areas, thereby easing flood peaks (USEPA 1993). Riparian habitats provide water, food, and shelter for many wildlife species (e.g., amphibians, beaver, muskrat, waterfowl). In addition, riparian areas form natural travel corridors for wildlife foraging, migration, and dispersal. When riparian areas are distinct from surrounding uplands, they can function as travel corridors and provide refuge for riparian-dependent species.

While the natural width of a riparian zone typically is determined by topography, the width of riparian zones in managed areas often is established by management practices. At Fort Campbell, 100-foot wide, vegetated buffers are maintained along each side of perennial streams (first-order and larger), lakes, and ponds. For first- and second-order streams, the buffer area is measured from the center of the stream. For larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from the stream bank. A 50-foot wide, vegetated buffer is maintained along each side of intermittent streams. With approximately 62 miles of perennial streams and 115 miles of intermittent streams, Fort Campbell has approximately 2,897 acres of riparian management areas. Stream classification and the associated riparian buffer are maintained within the GIS database.

Training and non-training activities that impact water quality and aquatic habitat are limited within riparian buffer zone. Within riparian buffer zones, timber harvest and creation of skid trails is prohibited. Prescribed fire is permitted in riparian areas only where recovery of habitat is needed due to natural or human-caused disturbance, or to enhance or maintain riparian species. Tree canopy is maintained to the extent practicable over streams.

Most of the riparian areas at Fort Campbell are vegetated with herbaceous species, shrubs, and/or trees, which helps trap sediment-laden runoff before it enters surface water, and helps stabilize the stream banks to avoid additional erosion problems. As part of the Watershed Management Plan, the Fish and Wildlife Program inspects the condition of streambanks and riparian zones. In some instances, riparian areas are severely eroding due to exposure of highly erodible soils on streambanks, or due to scour of streambanks during high volume flows. One cause of exposed soils in riparian zones is firebreaks that cross riparian zones and streams.

2.9.7.4 Fauna

Fort Campbell has conducted various surveys to inventory mammals, birds, fish, amphibians, reptiles, and insects on the installation. Fort Campbell wildlife biologists routinely survey game mammals, bird, and fish to monitor population trends. In 2004, Fort Campbell initiated a Biodiversity Initiative, designed to inventory the seldom sampled aquatic environments of the installation; surveys for adult aquatic insects and fish have been implemented, and surveys for crayfish, aquatic snails, and terrestrial insects are planned. Since 1992, the Wildlife and ITAM programs have conducted annual surveys to monitor population trends of certain taxa. Other project- or area-specific studies have also been conducted. Lists of wildlife identified on the installation are provided in Appendix D.

Mammals

Forty species of mammals have been recorded and/or documented on Fort Campbell. Mammals inhabiting the installation include species typically found in forest and grasslands in the region, including bats (e.g. *Myotis* spp., *Lasiurus* spp.), beaver (*Castor canadensis*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*) bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), and coyote (*Canis latrans*). Seven species of small mammals that are considered sensitive or in need of management in Kentucky and/or Tennessee are found on Fort Campbell (Table 4). Small game species on the installation include coyote, gray fox, groundhog (*Marmota monax*), opossum (*Dasypus novemcinctus*), eastern cotton tail (*Sylvilagus floridanus*), raccoon, gray squirrel (*Sciurus carolinensis*) and fox squirrel (*Sciurus niger*). The white-tailed deer (*Odocoileus virginianus*) is the only large game mammal hunted recreationally on the installation. Most mammals found on Fort Campbell are locally common and are not protected by federal or state law. However, two federally endangered species of bats, Indiana bat (*Myotis sodalis*) and gray bat (*M. grisescens*) and one threatened species, Northern long-eared bat (*M. septentrionalis*), are present on the installation; detailed information about these species is provided below.

Birds

Two hundred forty species of birds have been recorded on Fort Campbell. The installation supports diverse groups of songbirds, waterfowl, wading birds, and raptors. Certain species are present year-round, while others are present during limited seasons (e.g., nesting, wintering), or only occasionally during migration. Game birds found on Fort Campbell include the Wild Turkey (*Meleagris gallopavo*), American Crow

(*Corvus brachyrynchos*), Mourning Dove (*Zenaida macroura*), Northern Bobwhite (*Colinus virginianus*), and American Woodcock (*Philohela minor*); several species of waterfowl are also hunted. Great Blue Heron (*Ardea herodias*) rookeries are present, or have historical locations in Training Areas 1, 11, 19, and within the Small Arms Impact Area near the Dry Fork Creek and Noah's Spring branch confluence.

Bald Eagles (*Haliaeetus leucocephalus*) have been observed at the former Lake Taal site and Lake Kyle since the early 2000s. However, none were documented nesting at either site until February 2018 at Lake Kyle. The nesting pair are utilizing a loblolly pine approximately 500 meters north of the lake on the western edge of a permanent bivouac site. Management controls for compliance with the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) were implemented to ensure compliance with the regulation.

Several species of birds that inhabit Fort Campbell are listed by the Kentucky State Nature Preserves Commission (KSNPC) Natural Heritage Program and/or the TDEC Division of Natural Heritage, including Bachman's sparrow (*Aimophila aestivalis*; listed endangered in both states) and the Lark Sparrow (*Chondestes grammacus;* listed threatened in both states; Table 4). Henslow's Sparrow (*Ammodrammus henslowii*), which occupies most grasslands on Fort Campbell, is identified by the KSNPC as a species of special concern, and is tracked in Tennessee due to declining populations in the state. These rare and declining avian species warrant vigilant monitoring.

As a federal agency, the Department of Defense is required to comply with the Migratory Bird Treaty Act (MBTA) and Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds." The MBTA is an international treaty protecting migratory birds and their habitats. The MBTA prohibits take of migratory birds (and their nests, eggs, feathers, etc.) without a specific permit from the USFWS. Globally, 1048 species are currently protected under the MBTA. Executive Order 13186 states that federal agencies must identify adverse effects of their actions on migratory birds, and develop a Memorandum of Understanding (MOU) with the USFWS that promotes conservation of migratory bird populations and their habitats. Under the 2003 National Defense Authorization Act, the Secretary of the Interior was required to authorize incidental take of migratory birds during military readiness activities. The proposed exemption states that if the DoD determines that a proposed or ongoing military readiness activity will have a measurable negative effect on a population of a migratory bird species of concern, the DoD must confer and cooperate with the USFWS to develop reasonable conservation measures to minimize or mitigate effects. Non-military readiness activities are not exempt from the MBTA or EO1318. The DoD must obtain a Special Purpose Permit for non-military readiness actions involving take of migratory birds.

In 2005, Fort Campbell developed the *Migratory Bird Management Strategy: a conservation strategy for protecting and managing migratory birds on Fort Campbell, Kentucky* (MBMS) (Appendix I). The MBMS describes Fort Campbell's duties under the MBTA and EO13186, and provides management guidelines with respect to conservation planning, implementation and mitigation measures on the base. The MBMS focuses upon the 22 species of Birds of Conservation Concern (BCC) found on Fort Campbell (Table 4). BCC are a subset of the species protected under the MBTA, and are designated by the USFWS as species deserving special consideration due to populations that are declining, small, restricted, or dependent upon vulnerable habitats. Most of the 22 species of BCC on Fort Campbell depend upon open grassland habitat. The DoD has designated two species, Henslow's sparrow and Bachman's sparrow, as species at risk.

In accordance with Executive Order 13186 Fort Campbell conducts annual monitoring of migratory songbirds to assess trends in biodiversity on the installation. Annual surveys are conducted at approximately 120 sites using the point-count method. Point-counts are conducted in grassland, hardwood

Table 4. Animal species recorded on Fort Campbell that are federally listed, state-listed, and/or ranked as in need of management, special concern, imperiled, or declining by the states of Tennessee or Kentucky.

Scientific Name	Common Name	Status (Rank)			
		Fed	KY	TN	BCC
Myotis austroriparius	southeastern bat		E		
Myotis grisescens	gray bat	E	T	E	
Myotis leibii	eastern small-footed bat			D	
Myotis septentrionalis	Northern long-eared bat	T	E		
Myotis sodalis	Indiana bat	E	E	E	
Nycticieus humeralis	evening bat		S		
Sorex cinereus	masked shrew		S	D	
Sorex longirostris	southeastern shrew			D	
Synaptomys cooperi	southern bog lemming			D	
Zapus hudsonius	meadow jumping mouse			D	
Accipiter striatus	Sharp-shinned Hawk		S	D	
Actitis macularia	Spotted Sandpiper		E		
Aimophila aestivalis	Bachman's Sparrow		E	E	X
Ammodramus henslowii	Henslow's Sparrow		S	D	X
Ammodramus leconteii	Le Conte's Sparrow				X
Anas clypeata	Northern Shoveler		E		
Anas discors	Blue-winged Teal		T		
Aquila chrysaetos	Golden Eagle			T	
Ardea alba	Great Egret		T	D	
Asio flammeus	Short-eared Owl		E		X
Bartramia longicauda	Upland Sandpiper		H		
Botaurus lentiginosus	American Bittern		H		
Bubulcus ibis	Cattle Egret		S		
Calcarius pictus	Smith's Longspur				X
Caprimulgus vociferus	Whip-poor-will				X
Certhia americana	Brown Creeper		E		
Chondestes grammacus	Lark Sparrow		T	T	
Circus cyaneus	Northern Harrier		T	D	
Cistothorus platensis	Sedge Wren		S		X
Contopus cooperi	Olive-sided Flycatcher			D	
Dendroica cerulea	Cerulean Warbler			D	X
Dendroica discolor	Prairie Warbler				X
Dendroica fusca	Blackburnian Warbler		T		

Scientific Name	Common Name	Status (Rank)			
		Fed	KY	TN	BCC
Dolichonyx oryzivorus	Bobolink		S		
Egretta caerulea	Little Blue Heron		E	D	
Egretta thula	Snowy Egret		E	D	
Empidonax minimus	Least Flycatcher		E		
Euphagus carolinus	Rusty Blackbird				X
Falco peregrinus	Peregrine Falcon		E	E	
Fulica americana	American Coot		E		
Geothlypis formosa	Kentucky Warbler				X
Haliaeetus leucocephalus	Bald Eagle		T	D	X
Helmitheros vermivorus	Worm-eating Warbler				X
Hylocichla mustelina	Wood Thrush				X
Ictinia mississippiensis	Mississippi Kite		S	D	
Junco hyemalis	Dark-eyed Junco		S		
Lanius ludovicianus	Loggerhead Shrike			D	X
Lophodytes cucullatus	Hooded Merganser		T		
Melanerpes erythrocephalus	Red-headed Woodpecker				X
Nycticorax nycticorax	Black-crowned Night-heron		T		
Pandion haliaetus	Osprey		S		
Passerculus sandwichensis	Savannah Sparrow		S		
Peromyscus gossypinus	Cotton Mouse		T		
Phalacrocorax auritus	Double-crested Cormorant		T		
Pheucticus ludovicianus	Rose-breasted Grosbeak		S		
Podilymbus podiceps	Pied-billed Grebe		E		
Pooecetes gramineus	Vesper Sparrow		E	D	
Seiurus motacilla	Louisiana Waterthrush				X
Setophaga cerulea	Cerulean Warbler				
Setophaga discolor	Prairie Warbler				X
Sitta canadensis	Red-breasted Nuthatch		E		
Sphyrapicus varius	Yellow-bellied Sapsucker			D	
Thyromanes bewickii	Bewick's Wren		S	E	X
Tringa solitaria	Solitary Sandpiper				X
Tryngites subruficollis	Buff-breasted Sandpiper				X
Tyrannus forficatus	Scissor-tailed Flycatcher				
Tyto alba	Barn Owl		S	D	
Vermivora chrysoptera	Golden-winged Warbler			D	

Scientific Name	Common Name	Status (Rank)			
		Fed	KY	TN	BCC
Vermivora pinus	Blue-winged Warbler				X
Vireo bellii	Bell's Vireo		S		X
Hyla gratiosa	barking tree frog		S	D	
Cryptobranchus alleganiensis	eastern hellbender		E	D	
Eumeces inexpectatus	southeastern five-lined skink		S		
Thamnophis s. sauritus	eastern ribbon snake		S		
Esox niger	chain pickerel		S		
Noturus exilis	slender madtom		E		

Sources: KSNPC 2015; Tennessee Division of Natural Heritage 2016a, 2016b, Fort Campbell Migratory Bird Management Strategy (2017).

Status (Federal, State or Conservation Concern)
E – Endangered; T – Threatened S – Special Concern; H – Historic; D – "Deemed in Need of Management"; BCC – Birds of Conservation Concern

forest, and pine forest to monitor birds in a variety of habitats. Monitoring data are used to determine overall abundance and diversity of bird species, as well as to track the occurrence of rare species. Fort Campbell regularly coordinates with avian specialists in the Kentucky and Tennessee wildlife resource agencies, as well as the DoD PIF coordinator. Frequent contact with these groups allows Fort Campbell to monitor regional trends and participate in nationwide programs.

Fort Campbell examines the effect of land uses or management activities (e.g., training exercises, prescribed fire) within each habitat to identify effects to birds. Over 1,000 nests, representing several species of birds, have been monitored to investigate effects of training and management activities on productivity. Preliminary evidence suggests predation by snakes and mammals is the primary cause of nest failure. Training exercises appear to have a minor impact on nesting birds. The rate of nest predation on Fort Campbell is consistent with rates reported in other studies, and does not appear to be influenced by habitat suitability or activities specific to Fort Campbell.

Fort Campbell will continue avian monitoring to meet the goal of sustaining fish and wildlife resources and habitats. The avian monitoring program also facilitates compliance with Executive Order 13186, which states that federal agencies shall integrate bird conservation principles, measures, and practices into agency activities and avoid or minimize, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions. Additionally, approximately 150 bluebird boxes and greater than 90 wood duck boxes have been installed at Fort Campbell to provide nest sites for those species.

Reptiles and Amphibians

Baseline inventories for amphibians and reptiles were conducted beginning in 1993 (Zirkle 1997). The Range and Training Land Assessment (RTLA) Program conducted the most recent survey in 2002. Results of surveys identified five species of turtles, four species of lizards, 16 species of snakes (including

two venomous species), 13 species of salamander, and 13 species of frogs and toads (Appendix D). Generally, the species of reptiles and amphibians identified on Fort Campbell are relatively common and abundant in the region. The exception is the barking tree frog (*Hyla gratiosa*), which is deemed in need of management in Tennessee (Tennessee Division of Natural Heritage 2004a).

Fish

Surveys for fish conducted in Fort Campbell streams and lakes between 1994 and 2007 indicate approximately 60 fish species are present on the installation (Lockwood Greene 1994, Zirkle 1997, BHE 2007a). Some of the most common fishes identified to date include: stonerollers (*Campostoma oligolepis*), creek chubs (*Semotilus atromaculatus*), scarletfin shiners (*Lythrurus fasciolaris*), southern redbelly daces (*Phoxinus erythrogaster*), northern hogsuckers (*Hypentelium nigricans*), banded sculpins (*Cottus carolinae*), blackspotted topminnows (*Fundulus olivaceus*), bluegills (*Lepomus macrochirus*), longear sunfishes (*Lepomis megalotis*), fantail darters (*Etheostoma flabellare*), and Mamequit darters (*Etheostoma* sp. cf. *spectabile*). Appendix D provides a list of fish species identified on Fort Campbell. Surveys of streams on Fort Campbell are ongoing to evaluate the installation fish community. Electrofishing studies conducted between 1995 and 1998 indicate that the fish community in Lake Kyle continues to support a substantial population of small panfish (bluegill and redear), and small largemouth bass. Triploid grass carp were introduced into Lake Kyle in 1999.

Approximately 9,750 trout are stocked annually between March and August in Little West Fork Creek, Fletcher's Fork Creek, Noah's Spring Branch (TWRA only), and Kinser's Pond. Although the summer temperatures of the streams remain cool enough (i.e., high 50s to low 60s °F) to support rainbow trout during the hottest times of the summer, it is unlikely that overall habitat conditions are suitable for sustaining a population of trout year-round. Channel catfish are stocked in Fletcher's Fork Creek to support an annual fishing event for youth.

Invertebrates

Surveys for larval and/or pupal aquatic insects were conducted in 1996 (Zirkle 1997) and for adult aquatic insects in 2004 (BHE 2007b). Sampling was conducted in most major streams during both surveys. A diverse group of larval/pupal aquatic insects was collected in 1996. The survey of adult aquatic insects conducted in 2004 is one of the most comprehensive surveys of caddisflies from a single, large geographic area. Over 100 species of caddisflies have been identified from the survey, including several new state records for both Kentucky and Tennessee (Etnier, et. al. 2006). Surveys conducted in 2004 resulted in 27 taxa of mayflies (Ephemeroptera), 90 taxa of aquatic beetles (Coleoptera), and 9 species of aquatic snails (Gastropoda) identified on Fort Campbell (BHE 2007b). Studies conducted in 2007 recorded 10 species of crayfish, 26 stonefly (Plecoptera) taxa, and 23 species of dragonflies and damselflies. One crayfish, *Orconectes sp. cf. barrenesis*, is not known to occur within the Cumberland River drainage and the specimen is under taxonomic review (BHE 2008). Lists of recorded invertebrates are found in Appendix D.

A survey for freshwater mussels was conducted during September 1999 (USFWS 2000). Portions of Saline, Piney Fork, Little West Fork, and Fletcher's Fork creeks were surveyed. Seven taxa were recorded during the survey. Live specimens of six species were collected from Little West Fork and Piney Fork creeks and a single shell of the Flutedshell (*Lasmigona costata)* was collected in Little West Fork Creek. Many of the streams on Fort Campbell do not provide suitable habitat for mussel fauna due to factors including intermittent flows, unstable substrate, and sediment deposition. The reach of the Little West Fork

that occurs on Fort Campbell provides the most stable habitat characteristics observed during the survey. A large number of mussels were observed in Little West Fork Creek between the water intake facility and a small unnamed tributary entering from the north, near McNair Road. The report noted a decline in the number of mussels downstream of the tributary, and suggested sediment carried by the tributary may affect habitat suitability for mussels in Little West Fork Creek downstream of the tributary. Additionally, immediately downstream from the tributary, the Fort Campbell wastewater treatment facility discharges into Little West Fork Creek. No live mussels were observed downstream of the wastewater treatment plant. In the report, the USFWS recommended habitat suitability for mussels may be improved by improving the quality of wastewater discharged from the treatment facility, stabilizing the stream channel, and controlling runoff and erosion of soil into streams. Lists of recorded mussels are found in Appendix D.

A survey for butterflies was conducted in 2010. The survey sampled the eastern portion of the installation and resulted in 42 species. No rare taxa were recorded during the survey.

2.7.7.5 Rare, Threatened, and Endangered Species

A baseline inventory of rare, threatened, and endangered animal species was conducted on the installation from 1 July 1993 through 15 November 1994 (Scott et al. 1995). The survey included investigations of mammals, birds, reptiles, amphibians, fish, crustaceans, and mollusks listed by the USFWS, Tennessee, and Kentucky. Field work focused on species that could potentially occur on the installation based on data gleaned from published records and USFWS, Tennessee, and Kentucky county records. Survey results are found in Table 4. To facilitate management of rare, threatened, and endangered animal populations, Fort Campbell maintains locations of individuals or groups in the GIS database.

In 1998, Fort Campbell conducted a survey to inventory bat fauna and investigate presence of federally listed bats. The Indiana bat and the gray bat were identified in 1998, and annual surveys to determine the distribution and habitat use of both species were conducted between 1999 and 2004. Both species are federally listed as endangered. The bald eagle, which was formally a federally threatened species, was recorded nesting just north of Lake Kyle in 2018. No critical habitat for the gray bat, Indiana bat, or bald eagle exists on Fort Campbell. The Endangered Species Act of 1973 as amended (U.S.C. 1531 et seq.) provides legal protection for federally listed species.

Because of their protected status, Fort Campbell has established specific management objectives for the gray bat and Indiana bat. A brief description of the gray bat, Indiana bat, Northern long-eared bat, and the bald eagle, including their presence and management considerations on Fort Campbell, is provided below; detailed information is provided in the ESMC.

Fort Campbell also is home to 21 other wildlife species listed as threatened or endangered by Kentucky and/or Tennessee, and 23 species considered special concern, in need of management, rare, or declining by one or both states (Table 4; Figure 11). Throughout this Plan, the term rare species will be used to identify species that are state-listed or are considered in need of management, special concern, imperiled, or declining in one or both states. For species without specific legal protection, but considered rare by KDFWR or TDEC, Fort Campbell does not manage at the species level, but rather at the ecosystem level. Management objectives are established to sustain a variety of natural habitat types likely to support a diverse group of species, including rare species.

Gray Bat

Gray bats forage on Fort Campbell from approximately April through September. Nine hundred forty gray bats were captured on the installation during surveys conducted between 1999 and 2017 (BHE 2000, 2001, 2002b, 2002c, 2003a, 2004b, 2005; EcoTech 2009 and 2011; Fort Campbell 2013, 2014, 2015, 2016, 2017). Most perennial and some intermittent streams on Fort Campbell provide suitable foraging habitat for gray bats, and they have been identified in seven of the nine subwatersheds on Fort Campbell (primarily Fletcher's Fork, Piney Fork, Jordan, and Saline creeks watersheds). Gray bats have not been identified in the Dry Fork East Creek Subwatershed, and no surveys for bats have been conducted in the Skinner Creek Subwatershed. Gray bat captures have included numerous adult males and pregnant females, suggesting both bachelor and maternity colonies are located nearby. No Critical Habitat has been designated by the USFWS for the gray bat on Fort Campbell. Gray bats inhabit caves year-round, but the species is limited to few caves that provide a narrow range of climate conditions. Different caves are occupied by gray bats during the summer maternity season and winter hibernation. Gray bat hibernacula (winter caves) are generally deep, vertical caves that act as cold air traps. Gray bats hibernate in clusters of up to several thousand individuals. Gray bats migrate to summer caves that provide microclimate conditions different than those in hibernacula. Reproductive females form maternity colonies in caves with warm interiors that are typically within about 0.5 mile of a water body (lake, reservoir, stream) that provides foraging habitat.

No caves providing suitable summer or winter roost habitat for gray bats are known to exist on the installation. Past surveys of the two known caves on Fort Campbell have found no use by Indiana bats or gray bats (BHE 2001, BHE 2002a). Because gray bats occasionally roost in man-made structures that provide conditions similar to caves, 17 concrete bridges on the installation were inspected to determine presence of roosting bats (BHE 2002b). No gray bats were observed roosting under the bridges. Fort Campbell has also inspected and monitored temperatures inside concrete storage bunkers. No gray bats were identified in bunkers, and temperatures inside bunkers do not appear to provide suitable summer or winter habitat for roosting gray bats. Based upon results of extensive surveys, we conclude that gray bats do not roost on Fort Campbell. However, caves near the installation are occupied during summer and winter by gray bats, including Big Sulfur Spring Cave in Kentucky, and Tobaccoport and Bellamy caves in Tennessee (BHE 2001).

Gray bats typically forage over streams, reservoirs, and lakes, and through the adjacent riparian vegetation. Both large and small perennial streams provide suitable foraging habitat for gray bats (LaVal et al. 1977). Forested riparian zones may improve the suitability of a river or reservoir for foraging gray bats. Forested corridors between caves and foraging areas are important to the survival of gray bats; forest is thought to provide cover from predators. The Gray Bat Recovery Plan recommends maintaining forested shorelines and riparian zones near gray bat maternity colonies (USFWS 1982).

Gray bats primarily consume flying insects emerging from aquatic life stages (Clawson 1984, USFWS 1982). Terrestrial insects also are common prey (Clawson 1984). Studies comparing prey selection with prey availability have indicated gray bats are opportunistic feeders (Best et al. 1997). Water pollution and

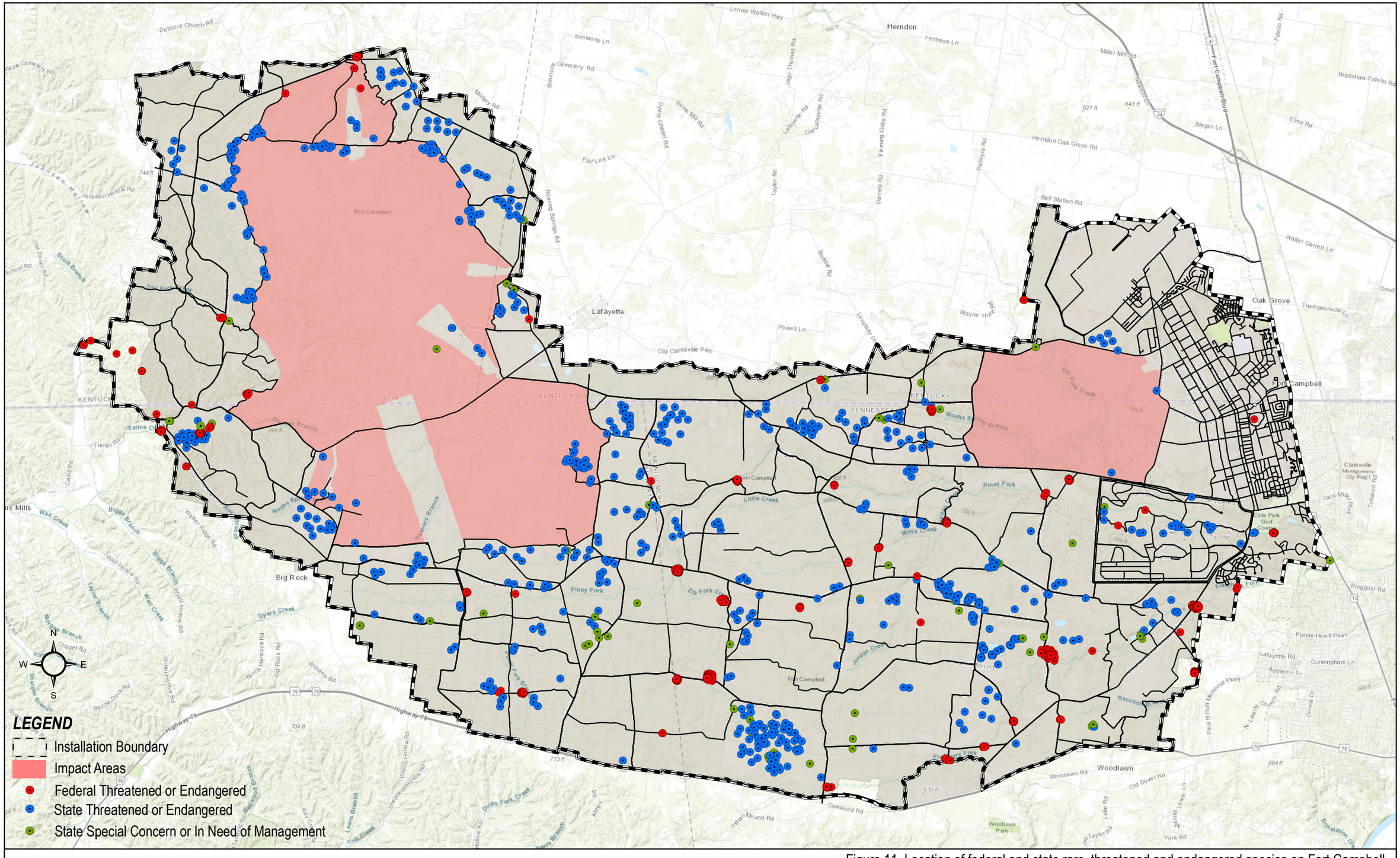

Figure 11. Location of federal and state rare, threatened and endangered species on Fort Campbell.

siltation that adversely affect aquatic insect larvae may, therefore, also affect the survival of gray bat colonies (USFWS 1982, Tuttle 1979).

Indiana Bat

The Indiana bat has been documented in very low numbers on Fort Campbell during summer and autumn (approximately mid-April through September). Between 1998 and 2017, eight adult males and one juvenile male were captured on the installation. No caves or mines providing suitable winter habitat for Indiana bats are known on the installation. However, caves used by Indiana bats are located within 5 miles. Results of several years of intensive, installation-wide mist net surveys suggest that small numbers of solitary male Indiana bats may occasionally inhabit Fort Campbell during summer and the spring/autumn migration periods. No female Indiana bats have been captured and no maternity colonies have been identified on the installation. No Critical Habitat for the Indiana bat has been designated by the USFWS on Fort Campbell.

For approximately six months (mid-October through mid-April) each year, Indiana bats hibernate in caves or mines. A small percentage of available caves and mines offer the narrow range of climatic conditions (temperature, humidity, and air flow) required by the species. The period when bats leave the hibernaculum and migrate to summer habitat, called spring staging, occurs from approximately mid-April through early May. During the summer maternity season (approximately mid-May through mid-August), Indiana bats occupy summer habitat. They forage at night in upland and riparian forests, along wooded edges between forests and croplands, and over fields. Indiana bats roost during daytime in upland or bottomland habitats under exfoliating bark or in crevices/hollows of live or dead trees, or occasionally in tree cavities (Harvey 1992). Female Indiana bats gather in maternity roosts in trees, where they give birth and raise a single young each year (Barbour and Davis 1969, Whitaker and Hamilton 1998). Male Indiana bats typically roost beneath bark or in cavities of trees, but tend to roost singly or in small groups (Thomson 1982). At the end of summer, from approximately mid-August through September, Indiana bats return to hibernacula and enter a period of activity near the hibernaculum, called swarming. Swarming is significant because most mating occurs during that period, and foraging during swarming helps individuals accumulate fat reserves necessary to survive winter in hibernation (Barbour and Davis 1969, Hall 1962, Thomson 1982).

Forest habitat is essential to the survival of the Indiana bat. Indiana bats utilize forested areas as roosting and foraging habitat in the spring, summer, and fall. Forested corridors between summer roosts and foraging habitat are important; Indiana bats may avoid open fields to travel along forested corridors, even if it increases commuting distance. Large-scale clear-cutting or other forms of extensive tree removal eliminate Indiana bat maternity and foraging habitat, and remove corridors between caves and foraging habitat, leaving the bats vulnerable to predation. Removal of riparian forest may also result in degradation of water quality and elimination of prey species (USFWS 1999).

Northern long-eared Bat

Northern long-eared bats were first documented on Fort Campbell in 1998. At present, no Critical Habitat has been designated for the bat on Fort Campbell. Current information indicates northern long-eared bats may be present on Fort Campbell during spring, summer and autumn while migrating between summer habitat and local winter hibernacula. Seventy-three bats have been recorded since 1998 from all four counties that comprise the installation. Although the majority of captures have been males (47), 16 females and 9 juveniles have been captured which suggests the installation supports maternity colonies or roosts. No maternity roosts have been recorded on the installation from roost surveys conducted from 2016-2017.

The northern long-eared bat shares similar habitat conditions as the Indiana bat and forests on Fort Campbell appear to provide suitable spring, summer, and fall roosting and foraging habitat. Woodlands currently occupy nearly 49,000 acres on Fort Campbell, about 50 percent of the installation's total area. The forests consist primarily of deciduous (hardwood) communities, although pine plantations are predominant in the southwest part of the installation. Oak and oak-hickory upland forest and bottomland hardwood forest types common on Fort Campbell are similar to forests where Indiana bats are typically found in other parts of the United States (Menzel et al. 2001). Suitable roost trees and foraging habitat on Fort Campbell may be used during summering bats and by spring migrants from local hibernacula.

Morgamie Cave, located in Stewart County, Tennessee has a wintering record of a northern long-eared bat. No other hibernacula existing within the boundaries of Fort Campbell. Morgamie Cave was gated by the Fort Campbell Cultural Resource Management Program in the early 2000's to protect Native American relics. Cave access is controlled by the Fort Campbell Fish and Wildlife Program due to the annual wintering bat counts, condition surveys, and WNS counts.

Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) were considered occasional visitors on Fort Campbell with most sightings near Lake Kyle. Multiple records have been documented of transient birds foraging at Lake Kyle and the former Lake Taal since 2001. Between one and three bald eagles were observed on each occasion. The majority of observations occurred between December and February, but in 2006, bald eagles were observed near Lake Kyle between February and May, and again in November. This record is significant since it was the first observation of an adult pair and a single juvenile. However, none were documented nesting at either site until February 2018 at Lake Kyle. The nesting pair are utilizing a loblolly pine approximately 500 meters north of the lake on the western edge of a permanent bivouac site. Management controls for compliance with the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) were implemented to ensure compliance with the regulation. In southeastern states, the period between November and May is when many resident bald eagles nest.

Potential habitat for nesting bald eagles on Fort Campbell is forest within about 0.25 mile of Lake Kyle. However, potential nesting habitat on Fort Campbell is marginal quality compared to the abundant, high quality nesting habitat available less than 5 miles away along the Cumberland River, and approximately 10 miles away at LBL. Two nest sites have been recorded on Fort Campbell, Lake Kyle and the Training Area 19 mitigated wetland site. Only the Lake Kyle site supports and active nesting pair. Foraging bald eagles can be observed anywhere on Fort Campbell.

Plants

A survey of rare, threatened, and endangered vascular plants was conducted on Fort Campbell in 1993 and 1994 (Chester et al. 1995). Field work focused on species that could potentially occur on the installation based on data gleaned from published records and USFWS, Tennessee, and Kentucky county records. Twenty state-listed species, and no federally listed species were recorded (Table 5). To facilitate management of rare plant populations, Fort Campbell maintains locations of individuals or groups in the GIS database.

Table 5. State-listed endangered, threatened, and special concern plants that occur on Fort Campbell.

Scientific Name	Common Name	Status		
		Global Rank[1]	KY[2]	TN[2]
Agalinis auriculata	earleaved false foxglove	G3	E	E
Carex alata	broadwing sedge	G5	T	
Eurybia hemispherica	Tennessee aster	G4	E	
Gymnopogon ambiguus	bearded skeleton-grass	G4	S	
Helianthus occidentalis	naked stem sunflower	G5		S
Hieracium longipilum	hairy hawkweed	G4/G5	T	S
Jugulans cinerea	white walnut or butternut	G4	S	T
Lespedeza capitata	roundhead lespedeza	G5	S	
Muhlenbergia glabriflora	smooth-flowered hair grass	G4	S	S
Oenothera linifolia	thread-leaf sundrop	G5	E	
Panax quinquefolius	American ginseng	G3/G4		S
Phacelia ranunculacea	blue scorpionweed	G3/G4	S	
Prenanthes aspera	rough rattlesnake root	G4	E	E
Prenanthes barbata	barbed or bearded rattlesnake root	G3	E	S
Rudbeckia subtomentosa	sweet coneflower	G5	E	T
Scleria ciliata	fringed nutrush	G5	E	
Silphium laciniatum	compass plant	G5	T	T
Silphium pinnatifidum	southern prairie-dock	G3Q	S	T

[1] G3 - Very rare and local throughout its range or found locally in a restricted range, vulnerable to extinction throughout its range; G4 - Apparently secure globally, though it may be quite rare in parts of its range especially at the periphery; G5 - Demonstrably secure globally, though it might be quite rare in parts of its range especially at the periphery; G#Q - Taxonomic status is questionable, numeric rank may change with taxonomy

[2] E - Endangered; T - Threatened; S - Special Concern.

2.9.7.6 Noxious, Invasive, and Pest Species

A noxious weed is any plant designated by a Federal, State, or local government as injurious to public health, agriculture, recreation, wildlife, or property. Noxious weeds are often defined as plants that are

growing out of place, that are competitive, persistent, and pernicious. An invasive species is an alien (non-native) species whose introduction does or is likely to cause economic or environmental harm, or harm to human health (Executive Order 13112). The U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS) defines a pest species as any biotic agent (any living agent capable of reproducing itself) that is known to cause damage or harm to agriculture or the environment. The Kentucky Exotic Pest Plant Council (KEPPC) and the Tennessee Exotic Pest Plant Council (TNEPPC) maintain lists of exotic invasive plants in each state (KEPPC 2000, TNEPPC 2001).

Executive Order 13112 requires coordination and enhancement of Federal activities to control and minimize the economic, ecological, and human health impacts caused by invasive species. The term non-native reflects only the origin of the plant and not its ecology. Therefore not all alien or non-native plants are invasive (in fact, only a small fraction of them are). Department of the Army Memo "Army Policy Guidance for Management and Control of Invasive Species" (26 June 2001) provides guidance on implementing the Executive Order.

A survey completed on Fort Campbell indicates several noxious plant species on the installation are listed as exotic invasive plants by the KEPPC and/or the TNEPPC (Table 6). Loblolly pine (*P. taeda*) growing outside pine plantations on Fort Campbell are managed as an aggressive species on Fort Campbell. An aggressive species is a species of any origin (including native) that has the potential to dominate under certain conditions within its preferred habitat. On Fort Campbell, vegetation control is needed primarily along railroad rights-of-way, in areas containing state-listed or rare plants, in graveled areas, along motor pool fences, and within the impact areas.

Selective control of noxious weeds is also practiced in agricultural fields, native grass barrens, and old fields. Animals considered pests on Fort Campbell are addressed in the Integrated Pest Management Plan.

2.10 Cultural Resources

Cultural resources at Fort Campbell date from the Paleoindian Period (ca. 10,000 B.C.) to the 20th century, and include archaeological sites, historic cemeteries, historic structures and objects, and historic districts. To date, 1,574 archaeological sites have been recorded within Fort Campbell. Of the known archaeological sites or components, 26 sites are considered eligible, 958 sites are not eligible, and 590 sites are considered potentially eligible for inclusion to the National Register of Historic Places (NRHP). In addition, there are 131 known historic cemeteries on post with many other unmarked cemeteries still unidentified. Work is ongoing to evaluate eligibility of archaeological sites and historic structures (e.g. buildings, statues), objects (e.g., state line marker), and districts (e.g., Clarksville Base).

Federal laws exist to preserve national history and encourage representation of diverse cultures and experiences inherent to the United States. Cultural resources on Fort Campbell are protected under several federal laws, including but not limited to:

- National Historic Preservation Act (NHPA) – federal agencies must avoid damage to properties listed, eligible for listing, or potentially eligible for listing on the NRHP;
- Archaeological Resources Protection Act (ARPA) – Prohibits excavation or damage of federal or Native American lands without a permit. Prohibits use of metal detectors to

Table 6. Exotic invasive plants on Fort Campbell that are listed as threats by the state exotic pest plant councils.

Scientific Name	Common Name	Type	State Rank[1]	
			KY	TN
Ailanthus altissima	tree of heaven	Tree	Severe	Severe
Agrostis stolonifera	creeping bentgrass	Grass		Alert
Albizia julibrissin	mimosa	Tree	Significant	Severe
Alliaria petiolata	garlic mustard	Forb/Herb	Significant	Significant
Allium vineale	field garlic	Forb/Herb		Significant
Broussonetia papyrifera	paper mulberry	Tree		Significant
Carduus acanthoides	Plumeless Thistle	Forb/Herb		Alert
Carduus nutans	nodding thistle	Forb/Herb	Severe	Significant
Celastrus orbiculatus	Asian bittersweet	Vine	Severe	Severe
Chrysanthemum leucanthemum	ox-eye daisy		Significant	
Cichorium intybus	chicory	Forb/Herb	Lesser	Lesser
Cirsium arvense	Canada thistle	Forb/Herb	Significant	Alert
Cirsium vulgare	bull thistle	Forb/Herb		Significant
Coronilla varia	crown vetch	Vine	Severe	Alert
Daucus carota	Queen Anne's lace	Forb/Herb	Significant	Alert
Dianthus armeria	deptford pink	Forb/Herb	Lesser	
Echinochloa crus-galli	barnyard grass	Grass	Lesser	
Eichhornia crassipes	water hyacinth	Aquatic		Alert
Elaeagnus angustifolia	Russian olive	Tree		Alert
Elaeagnus pungens	thorny olive	Shrub		Significant
Elaeagnus umbellata var. parviflora	autumn olive	Shrub	Severe	Severe
Eragrostis curvula	weeping love grass	Grass		Significant
Eleusine indica	goose grass	Grass	Significant	
Euonymus alatus	burning bush	Shrub	Severe	Lesser
Hemerocallis fulva	day lily	Forb/Herb	Lesser	
Kummerowia stipulacea	Korean clover	Forb/Herb		Severe
Lespedeza bicolor	bicolor lespedeza	Shrub	Significant	Severe
Lespedeza cuneata	Chinese lespedeza	Forb/Herb	Severe	Severe
Lespedeza stipulacea	Korean lespedeza	Forb/Herb	Significant	
Lespedeza striata	kobe lespedeza	Forb/Herb	Significant	
Leucanthemum vulgare	ox-eye daisy	Forb/Herb		Alert
Ligustrum japonicum	Japanese privet	Shrub		Alert
Ligustrum obtusifolium	border privet	Shrub		Alert
Ligustrum sinense	chinese privet	Shrub	Severe	Severe
Ligustrum vulgare	common privet	Shrub		Severe
Lolium arundinaceum	tall fescue	Grass	Severe	Significant

Scientific Name	Common Name	Type	State Rank[1]	
			KY	TN
Lonicera japonica	Japanese honeysuckle	Vine	Severe	Severe
Lythrum salicaria	purple loosestrife	Forb/Herb		
Maclura pomifera	osage orange	Tree		Significant
Melia azedarach	Chinaberry	Tree		Significant
Melilotus alba	white sweet clover	Forb/Herb	Severe	Alert
Melilotus officinalis	yellow sweet clover	Forb/Herb	Severe	Alert
Mentha spicata	spearmint	Forb/Herb		Lesser
Mentha x piperita	peppermint	Forb/Herb	Significant	Significant
Microstegium vimineum	Japanese stiltgrass	Grass		Severe
Morus alba	white mulberry	Tree	Significant	
Muscari neglectum	grape hyacinth	Forb/Herb		Lesser
Myriophyllum aquaticum	parrot feather	Aquatic		Significant
Oxalis stricta	yellow wood-sorrel	Forb/Herb	Lesser	
Paulownia tomentosa	princess tree	Tree	Severe	
Poa pratensis	bluegrass	Grass	Significant	
Populus alba	white poplar	Tree	Significant	Significant
Pueraria montana var. lobata	kudzu	Vine	Severe	Severe
Pyrus calleryana	Bradford pear	Tree		Alert
Rosa multiflora	multiflora rose	Shrub	Severe	Severe
Rumex acetosella	dock, sheep sorrel	Forb/Herb	Lesser	
Setaria italica	foxtail-millet	Grass		Significant
Setaria pumila	yellow foxtail	Grass		Alert
Setaria viridis	green foxtail	Grass	Significant	Significant
Solanum dulcamara	bitter nightshade	Forb/Herb	Lesser	
Sorghum halepense	Johnson grass	Grass	Severe	Severe
Spiraea japonica	Japanese spiraea	Shrub	Significant	Significant
Stellaria media	chickweed	Forb/Herb	Severe	
Verbascum thapsus	common mullein	Forb/Herb		Significant
Vinca minor	common periwinkle	Vine	Significant	Significant
Wisteria floribunda	Japanese wisteria	Vine		Lesser
Wisteria sinensis	Chinese wisteria	Vine		Alert

[1]State rankings are based upon if the species is non-native to the ecosystem under consideration and/or whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Species with a severe designation have the highest impact on native communities.

find, and selling of, artifacts from federal or Native American lands; and
- Native American Graves Protection and Repatriation Act (NAGPRA) – protects Native American burial grounds on federal and tribal lands. Native American human remains held by federal agencies must be returned, upon request, to Native Americans with a rightful claim.

Army Regulation 200-1 makes federally-mandated historic preservation requirements part of each installation's mission. Each Army installation must establish a cultural resources management program and appoint a qualified administrator. In accordance with AR 200-1, Fort Campbell has developed an Integrated Cultural Resources Management Plan (ICRMP; Fort Campbell 2012) which ensures conservation of cultural resources is addressed in installation-wide planning. Because cultural resources at Fort Campbell are so diverse and widespread, it is critical the Dig Permit process and other established procedures are observed to protect resources, including those not yet identified, are adequately conserved.

2.10.1 Precontact Period Resources

The prehistoric occupation of Kentucky and Tennessee is divided into four periods known as the Paleoindian Period (ca. 10,000 B.C.-8,000 B.C.), the Archaic Period (ca. 8,000 B.C.-1,000 B.C.), the Woodland Period (ca. 1,000 B.C.-A.D. 1,000), and the Mississippian period (A.D. 1,000-A.D. 1,650). Archaeological sites within Fort Campbell represent the full range of prehistoric occupation found in Kentucky and Tennessee.

2.10.1.1 The Paleoindian Period

Paleoindians are the earliest known cultural groups to occupy Kentucky and Tennessee. During this period, the much cooler climate supported a mixed mesophytic forest and megafauna such as mastodon, bison, and ground sloth. Small, highly mobile Paleoindian groups focused on hunting these larger game animals, but also utilized small terrestrial animals, aquatic resources, nuts, berries, and plant materials (Tankersley 1996). Due to their high mobility, Paleoindians moved their camps several times a year resulting in small sites scattered across the landscape.

Larger sites occur near high quality chert outcrops and places that attracted game (i.e. sinkholes) (Tankersley 1989).

By the end of the Paleoindian period, there was a shift in subsistence and a growth in human population. Megafauna were extinct, forcing Paleoindian groups to hunt smaller game such as whitetail deer, bear, and turkey (Tankersley 1996). With resources more evenly dispersed, later Paleoindian groups become less mobile occupying areas not previously inhabited (Tankersley 1996). There are 17 sites with Paleoindian components at Fort Campbell. Most are located in upland settings in Montgomery and Stewart counties, Tennessee. Many of these sites are Late Paleoindian (Dalton) components.

2.10.1.2 The Archaic Period

The Archaic period typically refers to the archaeological remains of post-Pleistocene hunter gatherers that did not make or use pottery (Stoltman 1978). This period is divided into three sub- periods: the Early Archaic ranges from 8,000 B.C.-6,000 B.C.; the Middle Archaic from 6,000 B.C.-3,000 B.C.; and the Late Archaic from 3,000 B.C.-1,000 B.C. During this period, the climate changes from cold and dry to a warmer,

wet environment. Deciduous forests are dominant and fauna includes white tail deer, turkey, bear, smaller mammals, and birds. By the Late Archaic, environmental conditions are similar to present day. This shift in climatic conditions led to increasing population, a growing technological sophistication, a broadening subsistence base, greater residential stability, establishment of trade networks, and burial ceremonialism. These changes occurred gradually throughout the Archaic period.

There are 172 Archaic sites or components of sites identified within Fort Campbell. These include 82 Early Archaic components, 29 Middle Archaic components, and 100 Late Archaic components (there are more individual components as some sites have more than one component). Most Archaic sites within Fort Campbell are open habitation sites located in upland settings.

2.10.1.3 The Woodland Period

The Woodland period is often divided into three general sub-periods known as the Early Woodland (1,000 B.C.-200 B.C.), the Middle Woodland (200 B.C.-A.D. 500), and the Late Woodland (A.D.500-A.D. 1,000). The major distinction between the Woodland and the Archaic periods is the development of ceramic technology and the daily use of ceramic vessels. In conjunction with this technology, is the development of complex, hierarchical societies. Such societies developed after the cultivation of native plants and towards the end of Woodland, the cultivation of squash, gourd, beans, and maize (Chomko and Crawford 1978, King 1985, Railey 1990). A reliance on these crops and the development of storage techniques enabled Woodland populations to inhabit more restricted territories than previous hunter gatherers. Other characteristics of the Woodland period include the construction of earthworks, elaboration of artistic expression, and burial rituals.

Within Fort Campbell, 132 Woodland sites or components of sites have been recorded. Of these 132 sites, 72 contain Early Woodland components, 50 contain Middle Woodland components, and 39 contain Late Woodland components. In general, Woodland components tend to be located in upland settings, but there are a growing number of sites located in alluvial settings and floodplains.

2.10.1.4 The Mississippian Period

Mississippian society is characterized by a hierarchical social organization and chiefdom based political economy. Within these settlement hierarchies, people lived in town centers with central plazas, cemeteries, and mounds. With emphasis on intensive agriculture, Mississippian sites are often located on floodplains consisting of large village sites sometimes with enclosed wooden palisade walls and mounds. Other characteristics of the Mississippian period include population increase, shell tempered ceramics, bow warfare, earthwork construction centered on celestial alignments, and stone box graves.

Thirty-eight Mississippian sites or components of sites have been found at Fort Campbell. These include 6 Early Mississippian components, and 1 Late Mississippian component. Most of these sites are open habitations, but a few also contain stone box cemeteries. In general, there are equal frequencies of Mississippian sites located in upland and alluvial settings.

2.10.1.5 Undated Precontact Sites

There are 1,012 prehistoric sites of indeterminate temporal association on Fort Campbell. These sites are not associated with upland landforms but are follow general settlement patterns.

2.10.2 Historic Period Resources

2.10.2.1 European Contact Period

The first Europeans to explore Kentucky and Tennessee were French and English explorers in the late 17th and early 18th centuries. Historical accounts from these expeditions documented historic Native American tribes such as the Cherokee, Delaware, Iroquois, Shawnee, and Chickasaw living in the region where Fort Campbell is located.

2.10.2.2 Historic Period

In 1756, both the French and English claimed Kentucky and Tennessee as their own territory starting the French and Indian War. France was defeated and signed the Treaty of Paris on 10 February 1763. At the onset of the Revolutionary War, the Cherokee sold most of north-central Tennessee to Britain during a meeting at Sycamore Shoals. At this time, most European settlements were concentrated in the eastern portion of Tennessee, the Central Basin, and the Mero District. After the Revolutionary War, Kentucky became a state in 1792 and Tennessee became a state in 1796.

During the 1820s, plantations and slave cabins existed within the area and tobacco was the dominant cash crop. By the Civil War, Confederate troops occupied several forts within the vicinity of Fort Campbell. The Fort Campbell area was especially conflicted, due to Kentucky remaining part of the Union and Tennessee joining the confederacy (Smith et al. 1990).

Although population and settlements steadily increased after the Civil War, the area remained primarily rural and agricultural until the establishment of Fort Campbell. In 1941, the Army began purchasing property from farmers for the installation. By 1942, all civilian families were moved, most pre-military structures were moved or demolished, and most historic cemeteries were moved as well. Named after William Bowen Campbell, Camp Campbell was established on 6 March 1942. During World War II, Camp Campbell was a major training center for combat units and members of the Women's Army Corps. Between 1943 and 1946, Camp Campbell also served as a Prison of War Camp detaining 4,000 German soldiers. At the end of World War II, the future of Camp Campbell was unclear and it changed from a training center to a mobilization center, to a redeployment center for returning troops. In 1950, Camp Campbell became a permanent installation and was renamed Fort Campbell. In 1956, the 101st Airborne Division moved to Fort Campbell where it resides today.

The Clarksville Base, now a part of Fort Campbell, was built in the late 1940s to store nuclear weapons. The base was one of 13 nationwide storage facilities used by the United States Navy (Gray et al. 1998). By 1965, activities at Clarksville Base transferred to a plant in Texas. Declared surplus property by the Defense Atomic Support Agency, the Clarksville Base was turned over to Fort Campbell.

To date, 871 historical archaeological sites or components of sites have been recorded within Fort Campbell. Table 7 lists the site temporal components of historical archaeological sites found on Fort Campbell.

Table 7. Site components for temporal historical periods.

Date range	Temporal Period Name	Number of Sites With Component
1570-1750	Protohistoric	0
1750-1795	Exploration	0
1795-1830	Early Settlement and Development	6
1830-1861	Antebellum	42
1861-1865	The Civil War	43
1865-1885	Reconstruction	83
1885-1929	Modernization and Diversification	166
1929-1941	Great Depression Era	88
Post 1941	Post Federal Acquisition	19

2.10.3 Historic Architectural Resources

Structures that are greater than 50 years old are historic structures that may be eligible for the NHRP if they meet certain criteria. The Childers House, Parrish House, and Durrett House predate the military installation and are considered eligible to the NHRP (BHE 2003b, 2003c, 2003d). In addition, the Enoch Tanner Wickham Memorial sculpture, the Kentucky/Tennessee State Marker No. 20, and the Clarksville Base Historic District are eligible for listing to the NRHP (BHE 2003e, 2003f). Historic architectural resources evaluated, but not considered eligible to the NHRP were the Pressler House, the remaining wings of the old Hospital Building, the Mann Theater, the old NCO Club, and Wilson Theater.

2.10.4 Cultural Resources Management Programmatic Agreement

Two active Programmatic Agreements (PA) for the management of historic properties have been executed among the U.S. Army, the Kentucky and Tennessee State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation, and Fort Campbell. These agreements are:

- *PA Between the United States Army, the SHPO of Kentucky and the SHPO of Tennessee Regarding the Operation, Maintenance, and Development of the Fort Campbell Army Installation at Fort Campbell, Kentucky (effective 15 January 2009 through 31 December 2013, and amended to January 2019):* The Ops PA identifies actions related to the operation, maintenance and development of Fort Campbell that are exempt from review under Section 106. Planned actions at properties considered eligible for listing in the NRHP may proceed with certification by the CRPM that the planned work stays entirely within the defined limitations; and
- *PA Between Fort Campbell and the Tennessee SHPO Regarding Development, Construction, and Operations at Clarksville Base Historic District (effective 15 January 2009 through 15 January 2014, and amended to January 2019):* The OCB PA supports the use of areas located within the

CBHD for the development of new buildings, structures and facilities in support of the Fort Campbell Installation Master Plan and its supported facility initiatives. This PA identifies a number of actions that will have no effect on historic properties. The OCB PA also notes that projects involving properties considered eligible for listing in the National Register of Historic Places may proceed with certification by the CRPM provided that the planned work stays entirely within defined limitations.

The purpose of the agreements is to stipulate measures that the U.S. Army will carry out to comply with the requirements of Section 106 of the National Historic Preservation Act (NHPA). These measures include staffing, planning, and project review. The installation commander is responsible for ensuring that all relevant offices at the installation are informed of the schedules and priorities, the potential of specific undertakings to affect historic properties, and the requirement to ensure an analysis of alternatives during the early stages of project planning. The PAs also requires that archeological and historic building inventories be conducted, that a context be developed for evaluation of archeological sites and other historic properties, and that historic structures be inventoried installation-wide, as funds are available. The PAs also lists projects that are exempt from review, as well as steps to take in the case of emergency discovery. The PA has been signed by the Garrison Commander and both of the State SHPOs. A new Programmatic Agreement incorporating base operations and management of Clarksville Base is being developed and is expected to be signed in 2018.

Regulations implementing Section 106 of the NHPA require any action that may affect historic properties to be coordinated with the SHPO and, in some cases, the Advisory Council on Historic Preservation. These agencies are afforded 30 days to review and comment on the effects of proposed installation activities and the necessity of conducting surveys to identify historic properties. The Fort Campbell PAs streamline the requirements of this act and allow many installation actions to be reviewed by the Fort Campbell Cultural Resources manager. The Pas benefit the installation by providing more timely project reviews.

3.0 ENVIRONMENTAL MANAGEMENT STRATEGY AND MISSION SUSTAINABILITY

3.1 Training Mission and Natural Resources Sustainability

3.1.1 Training Mission Requirements

The 101st Airborne Division and its tenant units require natural areas that replicate as many geographic conditions as possible to provide the most realistic training conditions. Natural resource conditions that support the military mission include forested areas allowing concealment of fixed locations and maneuver; open areas for firing, aviation operations and activities; and water resources for special operations, water purification, decontamination, and similar activities. Most land areas should have resilient ground cover or be otherwise developed to withstand vehicular traffic, helicopter rotor wash, excavations, or other activities which can lead to erosion, which can make areas unusable for training.

Forested Areas. Forested areas must be accessible, maneuverable, and support training mission activities. Units must be able to get into and out of areas quickly, deploy forces effectively within an area, and be able to identify targets and fire on approaching enemy forces.

Accessability: Fort Campbell has sufficient roads and combat trails to access most training areas. Once in the training areas, tactical vehicles are not restricted to roads; as a result, trails develop where vehicles repeatedly travel. Vehicles need roads and trails in training areas which are not gullied or washed out. On sloping trails and traveled hillsides, ground cover should be encouraged. Where erosion hazards are significant and traffic is too frequent to maintain adequate vegetative soil cover, other methods of covering the soil, such as gravel, should be considered. In addition, standard erosion control structures (*e.g.*, water bars, wing ditches, culverts) should be installed on permanent roads and trails where needed.

Maneuverability: Environmental variables that influence maneuverability include spacing and arrangement of trees, soil drainage characteristics, and terrain. Tree-free corridor width recommendations range from 10 to 15 feet; generally, corridors in the 20-30 feet range are preferred. Short spurs in assembly areas should be 20 feet to accommodate large vehicles moving in and out quickly. Main trails should be wide enough (30 feet) so that two vehicles could pass, if necessary, yet not so wide that they lose overhead concealment. Narrow trails (12 feet) work only where there are no sharp turns included in the trail. Dead ends should be avoided. Water crossings or bridges should support wheeled vehicles and track vehicles (up to 90 tons for military mine resistant vehicles).

Mission Support: Three crucial factors influence the value of assembly areas for military training: maneuverability, sustainability, and concealment. An area must provide adequate maneuverability for vehicles that use it, or it has very little value. Sustainability, or durability, indicates how well a site will tolerate traffic. Under long-term use, a site must be durable enough to continue to provide quality training experiences without suffering unacceptable environmental damage. All factors that affect maneuverability also affect sustainability. Level to gently sloping terrain, proximity to roads (although not visible from major roads), and dry soil are important for areas where units assemble. These sites should not be near or across streams. Positions intended for use by combat arms units should be located near an area which allows adequate fields of fire.

Tree canopy cover for overhead (vertical) concealment should be at least 50% and no more than 90% (optimum range of 60-80%), while allowing space for vehicles to maneuver between trees. The arrangement of overstory trees in an assembly area is a critical factor in the usefulness of the area to military trainers. Various unit types have different requirements and tolerances based on their missions and their types of vehicles. Combat Service Support, Combat Support, Command and Control, and dismounted units generally need heavier overhead concealment and are less concerned about maneuverability. Artillery units are more concerned with field of fire and maneuverability and are less concerned with concealment; they tend to use areas with wider corridors and less overhead concealment. Shrubs and small trees are important in training areas because they provide horizontal concealment. However, they also restrict maneuverability, fields of fire, and within-area visibility. Needs for horizontal concealment vary widely with the type of unit and the training scenario. For tactical assembly areas, most units select amounts of horizontal concealment between 20% and 60%, in clumps or patches. Lower amounts allow for greater fields of fire and visibility; higher amounts allow for greater concealment but also less visibility of advancing forces. Overall, high variability in shrub stem numbers and arrangement is probably desirable for training purposes. The preferred size of an assembly area varies widely.

Open areas. Primary uses for open areas are for aviation and combat support requirements, observation points, and firing locations for large weapons. Open areas are necessary for activities which require extensive mechanical excavations, such as artillery defensive berms, fuel points, or ammunition supply points. These areas need to be level or gently sloping, and low ground cover is desirable although popular

areas for excavations may have little time to revegetate. Open areas should be without obstructions, which could injure parachutists or make light vehicle access difficult, and have ground vegetation to reduce the dust from air operations. The optimum size of open areas varies with the activity's mission.

Open areas for aviation activities: Helicopter landing and pickup zones (LZ/PZs) require extremely durable surfaces to survive rotorwash. Durable vegetative cover reduces dust, which cause visibility problems as well as additional maintenance and repair to the aircraft. LZ/PZs vary in size, depending on the number and type of aircraft occupying the area. Drop zones must be kept free of woody vegetation that could lead to injury of parachutists. Drop zones vary in size and length to support different scenarios. Flight landing strips (FLS) require compacted, stable soils and low growing ground cover adjacent to the strip. Woody vegetation height at both ends of the FLS must not penetrate into the FLS flight path.

Open areas for large weapons firing: Large firing locations are needed away from well-beaten paths and drop zones. Artillery positions must be at distances appropriate to the weapon (2-15 km) and are most useful if the location allows firing into more than one impact area. Artillery positions should range in size from 200 x 200 m to 400 x 800 m. Mortars use smaller open areas at the edge of impact areas.

Water Resources. Installation lakes are important training sites for special operations, decontamination, water purification, and similar activities. The lakes provide sufficient quantity and depth of water to meet all training needs, although seasonal restrictions may be imposed during periods of limited precipitation. Major water resources need to be accessible by stable roads. Vehicles accessing water for decontamination training must have a network of roads which allow access by one route, egress by another, and a looping road or trail which allows convenient 'recycling' onto the access route. Potable water for field use is available in the cantonment area.

3.1.2 Training Land Requirements

Application of advanced technology to modern weaponry means that we are increasingly able to see, target, and hit the enemy at distances from which he cannot hit back. Longer ranges of weaponry require more range and impact area training space than in the past. More training space is also required for training combined arms formations that operate over larger areas of the battlefield and with less force density than in the past.

There is a significant shortfall in training land resources at Fort Campbell based on the 13-step Army Training Land Analysis Model (ATLAM) contained in Training Circular (TC) 25-1, *Training Land*. The maneuver acreage requirement, and the number and type of ranges needed to conduct individual and collective weapons training, range and training area requirements for Fort Campbell were computed as being 397,000 acres (Nakata Planning Group, 2004). The report identified a shortfall of 231,964 acres. Identified shortfalls in training land resources is primarily from requirements generated for unit missions rather than from natural resources. The sheer volume of training that must occur as compared to available resources necessitates almost constant use of resources, seven days a week, and innovative scheduling. In addition, Fort Campbell has maneuver and training agreements to utilize additional off-site lands to support training requirements. Although live-fire weapons training using ranges and impact areas generally cannot be conducted on off-site lands, reciprocal agreements have been made with other Army installations and with installations from other Services to alleviate the problem. Because of the varied and intensive use of installation lands and the lack of additional land to rest and allow timely restoration of damaged areas; some training activities have the potential to be environmentally significant.

3.1.3 Effects of the Military Mission on Natural Resources

Military training can have both negative effects on and positive benefits to natural resources. The two major types of training conducted are maneuvers and live-firing exercises. Impacts resulting from these activities include the destruction of terrestrial and aquatic habitat and soil, erosion. Maneuver damage is by far the most widespread negative effect on the natural resources at Fort Campbell. Maneuvering heavy wheeled vehicles across even the best-suited landscapes can cause damage to vegetation and soils. For this reason, soils require timely land rehabilitation efforts at appropriate intervals. Vegetation as well as soils can be damaged by regular use on areas such as trails, bivouac sites, and firing points. In addition, vehicles can be a source of invasive species when relocating from other training sites. Wildlife populations can also be harmed by field equipment training, small arms firing, or by mission-related wildfires.
The intensity, severity, and types of resulting environmental impacts will depend to a great extent upon the type units involved in training, where training activities are concentrated, and the duration of the action. The impact level of typical training activities is given in Table 8. Low impact activities are those which generally will not disturb the vegetation or soil and will require no rehabilitation. Medium impact activities may cause some disturbance or change which may require minor rehabilitation or which may recover over time without aid. High impact activities typically cause significant change to the soils or vegetation of the area which will require timely attention to avoid or minimize long-term alteration of existing conditions. Some training activities may be conducted at different levels of disturbance.

Five basic management techniques can be used to minimize military training effects to the soil and vegetation resources: (1) limit total use; (2) redistribute use; (3) modify kinds of uses; (4) alter the behavior of use; and (5) manipulate the natural resources for increased durability. These will be discussed throughout the management plan.

Vehicle maneuvers, tracked and wheeled, have the potential to cause the greatest military related impact to the Fort Campbell ecosystem. Vehicles used by the 101st Airborne Division and tenant units range from High Mobility Multipurpose Wheeled Vehicles (HMMWVs) to Mine Resistant Armored Vehicles (MRAP) vehicles. Military vehicle training may involve single vehicle maneuvers up to platoon or company-sized elements. Soil compaction and erosion are the most probable results of vehicle maneuvers. Appropriate planning (e.g., avoiding steep slopes, highly erodible soil types, and wet soils) and preparation (gravelling of tank trails, etc.) can mitigate much substrate damage. Immediate repair of any damaged areas after training maneuvers ensures no net loss of training area.

Bivouacking has impacts similar to civilian campgrounds. Soil compaction and trampling of vegetation increase runoff rates and may lead to higher erosion. There may also be a change in vegetation composition to more damage and disturbance tolerant species. During wet conditions, vehicles may create ruts if pulled off-road. Rotation of sites and careful site selection can minimize the damage caused by bivouacking.

The greatest benefit of the training mission is light to moderate military disturbance. Fort Campbell supports thousands of acres of barren/grassland habitat that requires periodic soil disturbances. Military training exercises provide soil disturbances that were once provided by the American bison (*Bison bison*). While other lands in the region have been converted to other uses, Fort Campbell has retained the natural character of the landscape, acting as a refuge for many rare plants and animals and threatened natural plant communities.

Table 8. Impact Levels of Typical Training at Fort Campbell.

	Level of Impact		
Training Activities	Low	Medium	High
Small Unit Infantry Tactics	x	x	
Reconnaissance	x		
Terrain/Map Analysis	x		
Infiltration	x		
Land Navigation	x		
Patrolling	x		
Nuclear, Biological, Chemical (NBC) Training	x	x	x
Tactical Bivouac Occupation/Displacement	x	x	
Cover and Concealment	x		
Construct Obstacles		x	
Establish Entrenchments		x	
Install/Clear Minefields	x	x	
Breaching and Clearing Operations	x	x	
Construct and Maintain Main Supply Routes		x	x
Demolition Training		x	x
Construct Tactical Bridges	x	x	
Fording Operations	x	x	x
Mobility and Countermobility		x	
Weapons qualifications/familiarization	x		
Mechanized maneuvers (tracked)			x
Mechanized maneuvers (wheeled)		x	x
Artillery training (setup and firing)		x	x
Direct fire			x
Aerial operations	x	x	x
Improvised Explosive Device (IED) Recognition/Destruction	x	x	x

Fort Campbell land managers have instituted good land use practices such as reducing erosion and negative impacts on stream crossings and wetlands. Landscape disturbances (for example, agricultural tillage, reduction of forest and wildlife habitat for development, and much recreational vehicle damage) are avoided so that natural communities are relatively undisturbed and are left to return to their natural compositions. After training, the land is evaluated by training site personnel for any damage. If repair is needed, it is initiated at that time to ensure minimal erosion or loss of training land is occurring. If impacts are substantial, training is rotated to another site until the first area has recovered and can be used again.

3.2 Effects of Natural Resources Management on the Military Mission

Natural resource management emphasizes the maintenance and enhancement of natural systems throughout the training areas. Resource management goals place a large emphasis on meeting compliance first and secondarily on developing desired training land conditions. This mindset drives annual project planning and requires resource managers to integrate compliance measures with mission support actions determined as critical for successful training missions. Many management actions support both compliance

and desired mission conditions. Integration ensures neither environmental compliance nor training land development take precedence but equally address both in a sustainable manner.

3.2.1 Land Management

Natural resources at Fort Campbell are generally benign to military training, rather than restrictive. The ecosystem provides a realistic environment for much of the unit training that is required at Fort Campbell. Management of landscape conditions are accomplished through coordinated efforts from the DPW Environmental Division and DPTMS Range Division. Range Division serves as the liaison between the training units and the Environmental Division. Monthly coordination meetings allow land managers to ensure environmental compliance and synchronize actions to accomplish desired conditions. Prescribed fire, timber stand improvements, open area management, water quality, and training land infrastructure improvements are evaluated and discussed to ensure no net loss of training or impairment of the training mission. Currently training activities are restricted from occurring with caves on the installations and limited to use of low water crossings when fording waterways. Non-military readiness activities are restricted from removing trees from 15 November to 15 March unless USFWS concurrence is provided for ESA Section 7 submittals.

3.2.2 Wildlife and Vegetation

3.2.2.1 Non-endangered Wildlife

Non-endangered wildlife resources have minimal impacts on maneuver training capabilities on the installation. Training requirements have priority over recreational activities. The planting of food fields, contractor data collection, and conducting wildlife research do not have impacts provided they are coordinated in advance with Range Control. When not coordinated with military activities, these activities can jeopardize individual safety or interfere with training activities.

3.2.2.2 Endangered or Species at Risk Wildlife

Gray, Indiana and Northern Long-eared Bats. The most critical natural resource program at Fort Campbell is management for federally protected species. Efforts to support the USFWS Recovery Plans dominate management practices and substantially affect how and where installation activities occur. The protection of foraging and roosting habitat for Indiana and Northern long-eared bats has led to the establishment of seasonal management restrictions to ensure installation actions do not directly or indirectly adversely affect either species. For example, tree removal supporting non-military readiness activities are restricted from 15 March to 15 November.

Bachman's Sparrow. The Bachman's Sparrow is a DoD Species at Risk bird that is seasonally present on the installation. The Bachman's Sparrow is one of only a few birds that are completely endemic to America. This species is associated with a wide variety of habitat types on Fort Campbell and has strict habitat requirements consisting of a high volume of grasses and forbs, and some scattered trees and shrubs with an open under-story on dry, upland sites. Installation populations occur within and adjacent to the Impact Area. Several live fire ranges have populations due to the frequent fires that simulate the habitat favored by the sparrow. Mowing during the breeding season may limit reproductive capacity through death of the adults or young. The installation has seasonal management restrictions to ensure installation actions do not directly or indirectly impact this species.

Henslow's Sparrow. The Henslow's Sparrow is a DoD Species at Risk and a potential candidate species under the ESA. The bird is one of the fastest declining songbirds in North America and is no longer considered common anywhere. This decline is apparently due to the loss of suitable grassland nesting habitat (Smith 1992). Fragmentation of suitable habitat into small widely scattered plots is another serious threat. The sparrow is rarely encountered on grassland fragments less than 250 acres. Fort Campbell actively monitors and manages habitat utilized by this species on Fort Campbell. Imposed seasonal mowing restrictions during the breeding season has the greatest chance to impact aviation or artillery activities.

Bald Eagle. The bald eagle was listed in 1978 by USFWS as endangered throughout most of its range. Factors contributing to the species decline include poisoning from pesticides and heavy metals in the environment, shooting, habitat loss, and human disturbance at nest sites. The USFWS changed the status of the bald eagle from endangered to threatened in the lower 48 states, effective 1 August 1995 (CFR 60 [50]) and fully delisted the species on 9 August 2007. The bald eagle is afforded protection under the Bald and Golden Eagle Protection Act 16 U.S.C. 668-668d which continues many of the restrictions contained within the USFWS species recovery plan. A nesting pair of eagles were recorded in February 2017 just north of Lake Kyle with two eaglets confirmed in April 2018. The Fish and Wildlife Program implemented management controls to reduce impacts to the nesting pair in accordance with the Army's bald eagle guidance. A species specific management plan for Fort Campbell is anticipated by the end of 2018.

3.2.2.3 Non-endangered Flora

Natural succession has the biggest impact to the training mission. Although Fort Campbell supports a robust prescribed fire program, woody encroachment into open areas has the potential to displace aviation or artillery training actions due to rotor strike or projectile strike hazards. Aviation and artillery activities can occur in any field located within the training areas. Areas determined to be mission critical for these activities are frequently mowed to reduce these hazards.

3.2.2.4 Endangered Flora

Fort Campbell does not support any federally-listed plant species; however, the installation does have 20 State-listed species. Locations of regionally rare State-listed plant species are buffered with signs noting the presence of rare species. These buffered locations vary in size, based on the size of the plant population and the presence of suitable habitat. With habitat improvement, plant numbers generally increase. These buffered locations have not created significant cumulative restrictions to land use. However endangered plants do, on occasion, require some effort to ensure that training events resulting in earth disturbance do not impact listed species and candidates. It is important to note, that while Fort Campbell has taken these measures to protect state-listed endangered species, as a Federal enclave, Fort Campbell is not subject to state enforcement of state endangered species laws.

3.2.3 Water

Protection of surface waters is important to Fort Campbell. Fort Campbell has imposed restrictions on activities that can occur around surface water sources. Water protection is achieved in part by the imposition of a 100-foot-wide buffer strip along the bank of each steam on Fort Campbell. Within the buffer area, hand-dug fighting positions are allowed, but no mechanical digging or earth moving is normally allowed. This restriction does not preclude training, but it limits the usefulness of areas adjoining streams.

Training actions that require the use of the four impoundments have seasonal restrictions to ensure water loss does not negatively impact aquatic systems. Water purification and decontamination actions are scheduled and approved prior to implementation. If the water source cannot support the requested mission, an alternate course of action is implemented to ensure the unit meets its training requirements.

3.3 Future Military Mission Impacts on Natural Resources

It is difficult to quantify effects of future military missions on natural resources at Fort Campbell. If mission, land area, and intensity of training remain unchanged, mission impacts on natural resources will remain similar to those today. Fort Campbell's mission is not likely to change and in this era of declining resources, nor is the size of its total land area. However, this may not be true for training intensity. Fort Campbell actively plans training area development within the Range Complex Master Plan. The plan is updated annually and includes planning for new range complexes or training land developments required to support mission training requirements. Actions within the plan are evaluated through the National Environmental Policy Act (NEPA) process in coordination with the Installation Environmental Division.

The intensity of training (operational tempo) at Fort Campbell has increased over the last decade. This was in part to global actions on the War on Terror and Army Transformation. Fort Campbell's troop strength increased with the implementation of Army Transformation with no increase in land area. Increases in training missions were highest at fixed training ranges and temporary IED training sites located along existing road and trails. Adequate conservation programs have ensured minimal impacts by the increased training tempo. Future changes beyond Army Transformation are unforeseeable at this time. Range modernization projects and new facilities to support mission needs will continue to occur at Fort Campbell. Fort Campbell will continue to support mission related changes utilizing the same management approach of the past to ensure no net loss of mission training actions from natural resources and to ensure desired natural resource conditions supporting training are met.

3.4 Mission Sustainability

The Army is being forced to make do with less in terms of both quantity and quality of training lands. Effective training resources must be managed so as to not exceed the optimum training carrying capacity of sites to ensure the long-term use of the resource can be guaranteed. The Range Complex Master Plan (RCMP) identifies training land requirements, both range facilities and maneuver land, necessary to support mission readiness activities. The plan outlines mitigations supported through the Sustainable Range Program (SRP) designed to support both near-term and long-term training. Sustainable range actions are included within this INRMP since separation of training actions and the training mission is impossible. The RCMP is reviewed annually and is considered a "living" document subject to modifications throughout the course of each year.

3.5 Natural Resources Consultations

Fort Campbell regularly consults with the United States Fish and Wildlife Service (USFWS), United States Army Corps of Engineers (USACE), Natural Resources Conservation Service (NRCS), Tennessee Department of Environment and Conservation (TDEC), Kentucky Division of Fish and Wildlife Resources (KDFWR), and the Tennessee Wildlife Resource Agency (TWRA) on matters that affect natural resources on the installation. The installation prefers to complete informal consultations and strives to work with regulators to ensure limited impacts on the military training mission. Specific resource area management

plans have incorporated a consultation procedure in which the installation must consult with regulatory agencies if a proposed action is deemed to have a negative effect to a species, population, habitat, or resource area. For example, Fort Campbell regularly consults with the USFWS on all projects that have the potential to impact endangered bat foraging habitat or will occur within the Indiana bat management zone.

Fort Campbell's consultation processes ensure transparency between the installation and its regulators. Consultations assist the installation in meeting its goal of environmental regulatory compliance. Fort Campbell plans on pursuing formal consultations with the USFWS on the INRMP and establishing a formal programmatic agreement for endangered species management on the installation. The goal is to negotiate a biological opinion that supports the long-term management of natural systems on the post.

3.6 Cultural Resources Consultations

The NHPA states that the preservation of cultural resources is "in the public interest so that it's vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Americans." Because cultural resources at Fort Campbell belong to the public, it is the responsibility of the caretakers of buildings or structures that may be historic properties to maintain contact with the public and interested parties, to disseminate information to them, and to provide them with avenues to interact and provide important input. Involving the public in Fort Campbell's Cultural Resource Management activities is also required under a variety of cultural resources laws and regulations, to include: Sections 106 & 110 of the NHPA and Army Regulation 200-1 6-4(b)(2).

Fort Campbell conducts consultations to interested parties in accordance with the procedures outlined within the Integrated Cultural Resources management Plan (ICRMP). Consultations with Federally Recognized Native American Tribes are conducted in a Government to Government manner since each tribe is a sovereign nation with the ability to make treaties and their own laws. The following tribes are regularly contacted during the consultation process:

- Absentee Shawnee Tribe of Oklahoma
- Cherokee Nation of Oklahoma
- Chickasaw Nation of Oklahoma
- Coushatta Tribe
- Eastern Shawnee Tribe of Oklahoma
- Eastern Band of Cherokee Indians
- Kialegee Tribal Town
- Muscogee Creek Nation of Oklahoma
- Poarch Band of Creek Indians
- Shawnee Tribe
- Thlopthlocco Tribal Town
- United Keetowah Band

The Cultural Resource Program Manager is responsible for managing the consultation processes, at the discretion of the GC.

3.7 National Environmental Policy Act Implementation

The National Environmental Policy Act (NEPA) requires Fort Campbell to consider all foreseeable environmental impacts before a commitment of funds. Under 32 CFR part 651, *Environmental Analysis of Army Actions* and Army Regulation 200-1 Fort Campbell must integrate NEPA early in the decision-making process to identify possible adverse environmental impacts and to avoid or minimize their consequences. The Directorate of Public Works, Environmental Division has one Department of the Army civilian and 1.0 Contracted Manpower Equivalents (CME) whose primary duties are NEPA. These positions not only ensure that NEPA documentation is provided for projects, training missions, and other installation actions, but it involves a considerable amount of time preparing NEPA documentation for organizations on Fort Campbell.

Fort Campbell's NEPA procedure is outlined within the Sustainable Installation Management System (SIMS). Fort Campbell uses the lowest level of environmental documentation that will have sufficient detail to support an informed decision. The most common NEPA document prepared for projects is a Record of Environmental Consideration (REC). A REC documents that a project falls within a category of actions excluded from further NEPA review because they do not individually or cumulatively significantly affect the environment or have been evaluated in an Environmental Assessment. These "categorical exclusions" (CX) are listed in Appendix B of 32 CFR 651. This simple documentation generally works well for routine projects, such as range and road maintenance, small digging projects, and similar projects where impact to natural and cultural resource are negligible.

When a project does not fall within a CX or has been evaluated by an environmental assessment (EA), the NEPA program will prepare an EA to determine whether an environmental impact statement (EIS) is necessary. If the EA determines that an EIS is not necessary, a finding of no significant impact (FNSI) will accompany it. After the Environmental Division Chief and Staff Judge Advocate review and approve the EA and FNSI, the NEPA program will publish the FNSI and solicit public comments for 30 days. If the EA determines that an EIS is necessary, Fort Campbell will notify the Army Environmental Command (AEC) that an EIS is required and AEC will draft a notice of intent (NOI) to prepare an EIS and staff it to the Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health for approval.

Requests for public comment advertisements are published in five local newspapers and are run for 7 days. Copies of the EA and supporting materials are placed in local libraries to facilitate comments prior to publication of the request for comment advertisement. Comments are accepted in written or digital format (email) sent to the Fort Campbell NEPA Program Manager. All public comments received are provided an acknowledgement of receipt, an official response, and are included within the NEPA document and administrative record.

3.7.1 Mitigation or Minimization

If a proposed action will adversely affect the environment, NEPA and 32 CFR 651 require Fort Campbell to consider less damaging options or otherwise offset the environmental damage. Below are five general mitigation tactics:

- **Avoidance:** Avoid adverse impacts on natural resources by not performing activities that would result in such impacts. Confine construction to areas where no significant impact would occur to natural resources;

- **Limitation of action:** Reduce the extent of an impact by limiting the degree or magnitude of the action. Minimize impacts of construction projects by arranging timing, location, and magnitude of actions so that they have the least impact on natural resources;
- **Restoration of the environment:** Restore the environment to its previous condition or better. This could involve reseeding and/or replanting an area with native plants after it has been damaged by construction projects;
- **Preservation and maintenance operations:** Design the action to reduce adverse environmental effects. This could involve actions, such as monitoring and controlling pollution, contamination, disturbance, or erosion caused by construction projects that would impact natural resources;
- **Replacement:** Replace the resource or environment when affected by a construction project. Replacement can occur in-kind or otherwise, on-site, or at another location. This could involve creation of the same type or better quality habitat for a particular impacted species or creation of habitat. Mitigation identified in a FONSI is a Class 1 "must fund" for environmental purposes. This provides a reliable mechanism to fund mitigation included in NEPA documents; and
- **Objective.** Classify mitigation as a "must fund" for budgetary purposes.

3.7.2 NEPA and This INRMP

The NEPA process ensures that managers properly plan, coordinate, and document all natural resources activities (as described in this INRMP) and identifies compliance requirements associated with proposed actions affecting natural resources. Fort Campbell has no NEPA documentation for the natural resources program as a whole. Fort Campbell will prepare an EA for this INRMP to ensure that it fully considers all foreseeable environmental impacts of implementing the INRMP. However, future natural resources projects will require NEPA documentation if they significantly exceed the scope of the EA for this INRMP. The EA is found in Appendix E.

3.8 Beneficial Partnerships and Collaborative Resource Planning

Stakeholders are those organizations or individuals who have a vested interest in natural resources management on the Installation. Over the past several years, Fort Campbell has developed partnerships and cooperative agreements for technical assistance with the stakeholders and other entities interested in participating in activities on the Installation. Fort Campbell believes that it is important to participate with the surrounding community and to open up communication between the Installation and the community. In addition, these efforts complement its overall philosophy of actively partnering with and sharing information and resources with other resources management agencies and organizations, including federal, state, and local governmental agencies, and other non-governmental organizations and groups.

Fort Campbell has a diversity of natural resources within its boundaries. Due to the need for a variety of expertise and assistance in developing and implementing sound management practices, Fort Campbell has developed partnerships and cooperative agreements for technical assistance in managing its natural resources. The development of partnerships with state and federal natural resources agencies, local conservation groups, and academic institutions makes expertise available to natural resources managers, and fosters good community relationships.

Stakeholders are those organizations or individuals who have a vested interest in land management on the installation. Stakeholders include the cities of Clarksville, Dover, Hopkinsville, Oak Grove; Montgomery and

Stewart counties in Tennessee; Christian and Trigg counties in Kentucky; regional planning councils, Central Hardwoods Council, Kentucky Prescribed Fire Council; Warioto Audubon Society; Red River Watershed Watch; state various wildlife societies and working groups; and local colleges. In addition, Fort Campbell may seek guidance from other agencies such as NRCS; the USFS; Tennessee and Kentucky Divisions of Forestry; Kentucky Division of Fish and Wildlife Resources; Tennessee Wildlife Resources Agency; state natural heritage groups; and the USFWS.
Partnerships, cooperative agreements, and community programs that affect natural resources management on Fort Campbell are discussed below.

- **Tree City USA Program** - This program is administered by the National Arbor Day Foundation in cooperation with the USFS and the National Association of State Foresters. The purpose of this program is to promote effective management of public urban forest resources. Fort Campbell has been recognized for the past 10 years by the Tree City USA Program for its effective forest management;
- **Audubon Christmas Bird Count** - The Warioto Audubon Society conducts an annual Christmas bird count through a partnership of cooperative agencies. This survey greatly adds to the database of natural resources information for Fort Campbell; and
- **Scouts** - Scouting programs are active on Fort Campbell. The Installation offers opportunities for scouts to participate in projects that could lead to rank advancements. Projects have included construction of a handicap fishing pier, bluebird boxes, wood duck boxes, and many others.

3.9 Public Access and Outreach

The Sikes Act requires that military installations provide public access for natural resource uses to the extent public access is appropriate and consistent with the military mission. Providing public access to the installation can serve to increase community awareness of the natural resources on the installation and the efforts put forth by Fort Campbell's natural resources program to protect, maintain, and enhance those resources. Fort Campbell Regulation 200-4, provides the guidelines for public access on the installation. Although Fort Campbell provides access, the access may be limited to certain locations that do not conflict with on-going training exercises.

The following are some of the activities, events, and environmental programs sponsored by Fort Campbell to improve the community's awareness of the natural resources on the installation:

- Hunting of deer, turkey, and small game is open to the licensed public in permitted areas on the base during the designated hunting seasons. Special youth-only deer and turkey hunts are held on Fort Campbell for hunters 15 years of age or younger several times during the year. For people with physical disabilities, a specific area on the base is reserved for use by only hunters who need mechanical aids to participate in hunting;
- Fishing is permitted year-round to the licensed public on the installation, provided areas are available for fishing. Fishing is not permitted in areas reserved for hunting. Both boat fishing and wade fishing in streams are authorized;
- Dog training is allowed on Fort Campbell. Clubs and organizations may sponsor dog field trials at the installation with permission from the Office of the Garrison Commander;
- Horseback riding and hiking are permitted year-round. Horse shows, rodeos, orienteering, and field trials can be hosted by Fort Campbell;

- Camping is permitted at Lake Kyle as scheduling permits;
- Fort Campbell's Agricultural Outlease Program provides local farmers access to fields on the installation for producing hay or row crops;
- To promote better relationships between officers, enlisted persons, and the community, Fort Campbell and the Chambers of Commerce from Christian and Montgomery Counties have formed Military Affairs Committees. An appointed liaison from Fort Campbell meets regularly with the organizations to discuss the needs and the role of the military in the community;
- Each year Fort Campbell participates in "Hopkinsville Salutes Fort Campbell Week," sponsored by the Hopkinsville Chamber of Commerce Military Affairs Division. The celebration includes a chili cook-off, a cross-country road race, and children's activities; and
- The Fort Campbell Environmental Division and Campbell Crossing LLC co-sponsor an Earth Day event each year, inviting local school groups to demonstrations about pollution prevention, recycling, and conservation of natural and cultural resources.

Access to the maneuver space is administered through the Fort Campbell iSportsman portal at www.ftcampbell.isportsman.net. Individuals wishing to utilize Fort Campbell for recreational activities must establish an iSportsman account, complete a background check and validation process prior to receiving access to the portal. Areas for recreational activities are available daily unless training mission requirements conflict with these activities.

Federally recognized tribes would be authorized access to the installation for collection of natural resources for inclusion in ceremonial activities. Access to the installation must be coordinated through the installation Tribal Liaison Officer.

3.10 Encroachment Partnering - Army Compatible Use Buffer (ACUB) Program

The Army Compatible Use Buffer (ACUB) Program creates land conservation partnerships between the Army and outside organizations to protect land from development that is incompatible with the military mission. Title 10, Section 2684a of the United States Code allows the Department of Defense to enter into agreements to establish buffer areas through a conservation easement around training and testing areas. This authority is implemented through the ACUB Program.

Funding is provided by the joint efforts of the Army and its partners. The Army's partners use these funds to acquire an interest (conservation easement) from willing landowners. This mutual effort preserves natural resources and limits land development that is incompatible with military training. The Fort Campbell ACUB Program was established in April 2006. The program was established to conserve open space (such as farmland) and promote compatible land use around the post's airfields and training facilities. To date, over 1,000 acres of farmland around Fort Campbell has been permanently preserved.

A conservation easement is a voluntary, legal agreement between willing parties for the purposes of conservation. It preserves the agricultural and/or natural character of the property by limiting development to a mutually agreed upon level. The property remains the private property of the landowner. Any easement obtained under the ACUB program will typically be held by ACUB partners not the Army. A conservation easement is the primary real estate interest pursued by Fort Campbell's Partners under the ACUB Program.

Some of the benefits of the ACUB Program include:

- Private landowners realize financial benefits and tax incentives while preserving land legacy and heritage for future generations;
- Partners get financial support for land conservation, such as working lands preservation and endangered species and key habitats protection;
- Fort Campbell realizes greater training flexibility and reduced incompatible use along its border;
- Supports local efforts to promote open space and preserve prime agricultural lands within the surrounding region; and
- The Partnership helps to preserve the long-term viability of Fort Campbell, which disburses over 4 billion annually to the region.

Fort Campbell has a partnership with two ACUB partners, Kentucky Department of Agriculture and the Land Trust for Tennessee. This partnership was established to pursue conservation opportunities on lands near Fort Campbell which contain prime agricultural soils and other natural habitat. The Partnership only works with willing sellers who may be interested in preserving their lands for future generations. Each ACUB partner has extensive experience in land preservation and achieving the long-term goals of landowners. Any easement obtained under the ACUB program will typically be held by ACUB partners not the Army. Fort Campbell's ACUB partners have been successful in region-wide conservation efforts:

- The Kentucky Department of Agriculture is a state government agency which has a core mission to preserve and enhance agricultural lands. The Department of Agriculture has been directly involved in farmland preservation through the State's Purchase of Agricultural Conservation Easement (PACE) Program since 1994 and has preserved over 122 farms comprising 29,877 acres; and
- The Land Trust for Tennessee is a private, nonprofit conservation organization dedicated to the preservation of natural and historic landscapes, regardless of Threatened and Endangered Species (TES) value. The Land Trust for Tennessee was established in 1999 and has preserved over 42,351 acres of working farms and scenic landscapes.

As of 30 April 2018, Fort Campbell ACUB partners have secured conservation easements on approximately 11,817 acres of farmland and open space. This includes 9,113 acres of ACUB easements in Kentucky and 2,704 acres in Tennessee. Fort Campbell ACUB partners have also obtained signed contracts (or verbal agreements) on approximately 1,000 acres in KY. The properties under contract are scheduled to close in calendar year 2018. These actions will establish permanent open space buffers on approximately 70% of the installation's highest ACUB Priority Zone around Campbell Army Airfield, and within substantial portions of the high noise zones surrounding Sabre Army Airfield and both installation Impact Areas. Figure 12 shows the Fort Campbell Partnership's current ACUB acquisitions to date

3.11 State Comprehensive Wildlife Plans

This INRMP includes goal and objectives from the Kentucky and Tennessee Comprehensive Wildlife Conservation Strategies (CWCS) for the conservation of non-game wildlife and their habitats. Each plan included the following eight elements:

- Information on the distribution and abundance of species of wildlife, including low and declining populations determined by each State's fish and wildlife agency that are indicative of the diversity

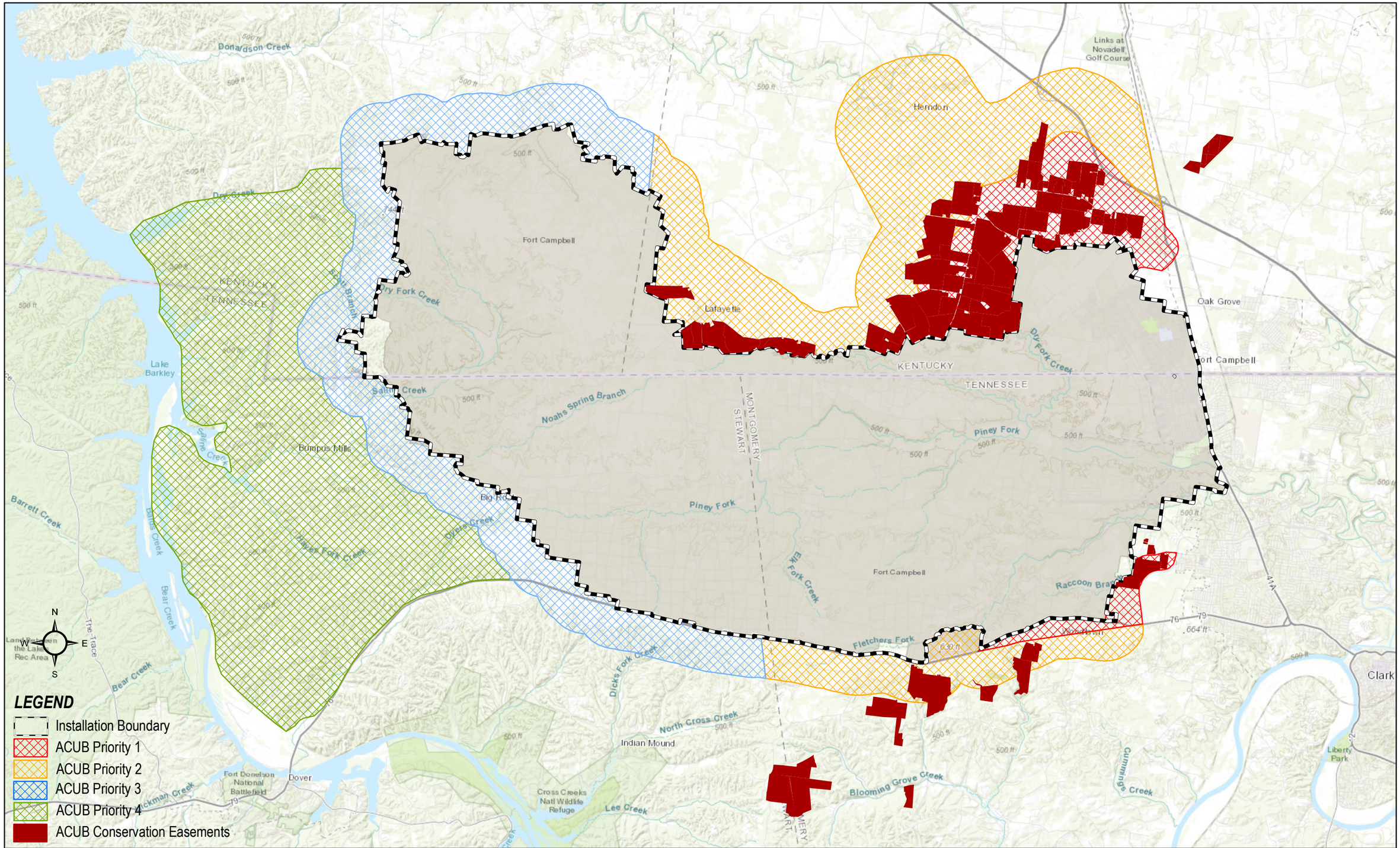

Figure 12. Fort Campbell Army Compatible Use Buffer (ACUB) program current and proposed conservation easement areas.

and health of the State's wildlife;

- Descriptions of locations and condition of key habitats and community types essential to concern and their habitats, for monitoring the effectiveness of conservation actions, and conservation of species of concern;
- Descriptions of problems which may adversely affect species of concern or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;
- Descriptions of conservation actions determined to be necessary to conserve species of concern, including their habitats and set priorities for implementing such actions;
- Descriptions of the proposed plans for monitoring species identified as species of for adapting these conservation actions to respond appropriately to new information or changing conditions;
- Descriptions of procedures to review the Strategy/Plan at intervals not to exceed ten years;
- Descriptions of the plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Plan-Strategy with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats; and
- Descriptions of the necessary public participation in the development, revision, and implementation of the Plan.

The purpose of the state plans is to provide management actions to species that have been determined to be “at risk” or “species of concern.” Fort Campbell includes many thousands of acres of near pristine native habitat that supports a high number of species of concern. The wildlife program on Fort Campbell has developed monitoring actions that collect data on many species listed from both states. These data are managed through the Fort Campbell Geographic Information System and are utilized to determine the effectiveness of conservation actions and objectives. Data sets are available to both states for their evaluations in the long term conservation and management of rare or species of concern, to include their habitats on Fort Campbell.

4.0 PROGRAM ELEMENTS

This chapter describes the Conservation Branch and Range Division programs responsible for designing, implementing, and monitoring natural resources management strategies, objectives, and actions. Responsibilities of each program and interactions among programs are addressed. Guidance documents used by each program (e.g., the Forest Management Plan, the Integrated Pest Management Plan) are summarized in this section but detailed descriptions of specific management activities found in guidance documents may be found in the Appendices of this document.

Inherent in the integration of natural resource management activities and the ecosystem management approach is management programs and objectives that involve multiple programs. While one program may lead the management of forest, threatened and endangered species, or agricultural outleases, other programs conduct activities that contribute to and affect those resources. Certain natural resources issues, such as soil conservation, protection of threatened and endangered species, and maintenance of riparian buffer zones require cooperation among several programs. The sections below describe the primary responsibilities of natural resource management programs, but are not inclusive of all responsibilities and objectives associated with each program.

4.1 Integrated Training Area Management (ITAM) Program

The Integrated Training Area Management (ITAM) Program is designed to integrate natural resource management with Army training and other mission requirements for land use. The purpose of the ITAM program is to achieve optimum, sustainable use of training lands by implementing a standardized methodology for inventorying and monitoring land condition, rehabilitating lands unsuitable for training, integrating training requirements with land capacity, and educating land users to minimize adverse impacts (U.S. Army Forces Command 1995, U.S. Department of the Army 1995).

The ITAM program at Fort Campbell is administered by the ITAM/Range Division of the G3/Directorate of Training, Plans, and Mobilization (G3/DPTM). The ITAM program consists of four components:

- Ranges and Training Lands Assessment (RTLA)
- Land Rehabilitation and Maintenance (LRAM)
- Training Requirements Integration (TRI)
- Sustainable Range Awareness (SRA)

Responsibilities of each component are described in detail below. Generally, one responsibility of the ITAM Program is to monitor the condition of physical and biological resources, and conduct restoration of degraded areas on ranges and training lands. At Fort Campbell ranges and training areas cover nearly all land in the rear area that is outside of Impact Areas. Therefore, the missions of the ITAM Program and the Conservation Branch are closely aligned, and must be fully integrated for maximum effectiveness.

To integrate land management activities, the G3/DPTM has established a partnering relationship with the Fort Campbell Environmental Division. The Land Management Forum is held quarterly to coordinate the integration of all ongoing activities in the training areas and ranges. The Forum is held to ensure that the needs of the training units are met, as well as to coordinate all ongoing activities. The forum is co-chaired by the Chiefs of the Range Division and Environmental Division.

The G3/DPTM prepares an ITAM Annual Work Plan describing specific activities to be implemented by each component during a five-year period; the plan is updated annually and is a component plan of the Range Complex Master Plan (RCMP). Activities in the ITAM Program Work Plan involving evaluation, monitoring, and management of natural resources have been incorporated into the goals and objectives of this INRMP. The ITAM Program will implement as many of the projects recommended in the Range and Training Land Program Development Plan (RDP) as possible. In the long-term, these proposed projects will distribute training activities more broadly across the landscape, thereby minimizing damage to natural resources due to overuse of certain areas. New construction and upgrades to training facilities will be coordinated with natural resource managers to minimize impacts to natural resources (e.g., wetlands, erodible soils, old-growth forest stands, riparian areas).

4.1.1 Range and Training Lands Assessment (RTLA)

RTLA is used to collect and analyze land condition information for the purpose of ensuring training and testing lands can support training loads. Information gathered through RTLA feeds TRI decision support and the LRAM project development process. RTLA does not conduct environmental baseline surveys. It is expected that some assessments entered into the ITAM Workplan are subject to modification depending on

evolving mission needs and changing LRAM project scopes. It is important that installations submit the maximum amount of assessment details as possible into the ITAM Plan/Workplan. Also, be sure to explain in the description and/or supporting documentation how the assessment directly supports TRI decision support and the LRAM project development process. Commands must remain aware of potential assessment scope changes when preparing contracts.

Planning and Coordination: Planning assessments can be iterative due to the complexities associated with planning and coordinating LRAM projects. When a scope change occurs for an LRAM project, that project's RTLA support is also subject to change. RTLA planning and coordination includes:

- Coordination with ITAM and Range staff to determine LRAM and TRI support priorities;
- Developing assessments that address the management of landscape conditions identified in the ITAM Plan;
- Entering assessments into the ITAM Workplan as activities and linking those assessments to land management objectives created to manage landscape conditions in support of training missions ;
- Developing assessments that address TRI decision support, entering those assessments into the ITAM Workplan as activities, and linking them to the TRI objective;
- Coordinating and conducting project planning fieldwork with ITAM staff and DPW personnel (Natural and Cultural Resources; Environmental Compliance; Real Property); and
- Acquiring and maintaining materials, equipment, and supplies.

Assessment Design: Assessments have to be adaptive to LRAM scope changes resulting from weather, training schedules, environmental compliance requirements, and evolving mission needs. Assessments and associated staffing actions have to be conducted in a manner that allows frequent and rapid revisions. All assessments shall be limited to the minimum number of locations, iterations, and time frame necessary to address the specific mission support management question from the ITAM plan for which the assessment is being executed. Each installation has unique training missions, landscape conditions, soil and vegetation types, weather events, and state prescribed environmental compliance requirements. Because each installation is distinctive, ITAM does not prescribe standard RTLA assessment designs. Assessments are developed by individual installations to ensure Army training lands are maintained in safe conditions, remain environmentally compliant, and support unit training tasks. The assessment design process includes:

- Delineating proposed assessment areas using GPS as appropriate and using GIS software to create maps as needed.

Management objectives (MO) and sampling objectives (SO) have been developed to establish desired future conditions for ranges, training areas, and other areas managed by the ITAM Program. Data collected under the RTLA Program is maintained in a GIS database administered by Range Division, which supports the ITAM Program and the Range Division Dig Permit process.

4.1.2 Land Rehabilitation and Management (LRAM)

The LRAM component mitigates the impacts that result from training and the mission. Based on the training requirements and priorities, LRAM develops land rehabilitation and maintenance projects. To successfully

rehabilitate, repair, and maintain natural resources, LRAM makes use of best management practices, training area redesign and reconfiguration, and long-term maintenance planning.

The focus of LRAM projects on Fort Campbell is on training area rehabilitation, maintenance of training areas and ranges, and training area damage prevention. Training areas that require rehabilitation are the priority ranges, logistics sites, and aviation assembly areas. Damage associated with these sites comes from heavy military training use. The most frequent symptom of this damage is soil erosion. As a result, most LRAM projects involve seeding, placement of gravel, construction of more permanent facilities and roads (hardening sites), and construction of storm water management structures. Maintenance of training areas involves reseeding operations, maintenance of storm water management structures, soil bioengineering, slope and soil stabilization, and re-contouring of damaged areas. Training area damage prevention includes proactive projects implemented to minimize damage and improve the durability of training areas and ranges, such as vegetation management and construction of combat trails, low water crossing sites, hardened TOCs, hardened artillery firing points, permanent berms, permanent battalion command post sites, and hardened forward landing strips.

4.1.3 Training Requirements Integration (TRI)

TRI integrates the installation's land use requirements for training, the range operations and training land management process, and the installation's readiness requirement with the natural resource conditions of the installation's lands. Training land and range requirements are derived from the Range and Training Land Program (RTLP), using the Mission Essential Task List (METL) and Combined Arms Training Strategy (CATS) of the installation's assigned units. Procedures for the day-to-day management of range and training lands are also outlined by the RTLP. Using RTLP information, TRI integrates the training requirements with the capabilities of the natural resources to support those requirements.

The G3/DPTM at Fort Campbell has fielded the Range Facility Management Support System (RFMSS) since 1987. RFMSS, which was developed by the USACE, is a collection of microcomputer-based software programs designed to automate the training facility management functions at an installation. RFMSS consists of components that provide for customization to a particular installation, scheduling of ranges and training areas, collection and analysis of range and training area usage data, and generation of various administrative reports.

The overall goal is to link GIS capabilities with scheduling and training information to more closely track multiple training activities. The linkage of these capabilities will be integrated with other ITAM program components (i.e., RTLA and LRAM) to provide a comprehensive management and decision-making program for integrating Army training and other mission requirements for land use with sound natural resource management of its lands.

4.1.4 Sustainable Range Awareness (SRA)

The objective of Sustainable Range Awareness (SRA) at Fort Campbell is to foster conservation awareness. Conservation awareness is instrumental in preserving the natural environment. The SRA component of ITAM applies to commanders, unit leaders, soldiers, and others using the Installation's training areas. This is accomplished by providing training and educational materials and by having the command emphasize the importance of environmental stewardship.

Objectives of the SRA Program include the following:

- Provide information to units, leaders, soldiers, civilian employees, and other installation users to improve their understanding of the impacts of their activities on the environment;
- Provide an understanding of the Fort Campbell natural resource program to the installation and surrounding communities;
- Provide decision makers with information needed to make judgments that affect the Fort Campbell natural resources program;
- Provide general conservation education to the Fort Campbell community;
- Establish and maintain good relations with the local media; and
- Inspect training areas for signs of natural resource degradation that have the potential to adversely affect training and the environment.

4.2 Natural Resources Management Programs

The Conservation Branch contains programs responsible for forestry, game and non-game fish and wildlife, pest management, agricultural leasing, and land management. The Conservation Branch coordinates with the ITAM Program to implement an integrated strategy of land management designed to support the military mission at Fort Campbell. Natural resources management programs under the Conservation Branch are described below.

4.2.1 Forestry Program

The Forestry Program manages approximately 45,145 acres of forest on the installation. Forest Program duties include prescribed burning, forest fire protection, firebreaks/forest access roads, forest product sales, forest improvements, forest monitoring, forest pest monitoring, planning, Environmental Quality Officer training, and environmental education.

The Forest Management Plan (FMP) is the primary guidance for the Forest Management Program on Fort Campbell. The FMP is developed in accordance with Army Regulation 200-1. The FMP is based upon the Ecosystem Management Approach. The FMP establishes Desired Future Conditions (DFC) for each forest stand type. The FMP describes each DFC, the processes used to assign a DFC to individual management units, and the expansion to a watershed and ecosystem levels. This approach allows forest managers to consider factors such as military training needs, wildlife and endangered species habitat, and cultural resources, and apply appropriate management strategies to reach the DFC.

The Forestry Program and the Fort Campbell Fire Department are responsible for fire prevention and suppression activities. The Fort Campbell Fire Department has an extensive fire prevention program and assists with fire suppression in the ranges and impact areas or when fires involve structures (e.g., military operations on urbanized terrain (MOUT) sites) or vehicles.

Nearly all wildfires at Fort Campbell are accidental and occur from the use of pyrotechnics during or following training activities. The complete prevention of wildfires is impossible without significantly restricting the military mission during the fire season, which generally runs from the beginning of October through mid-April. Weather conditions are monitored continuously during the fire season, and Range Division is notified when the fire danger is high so the necessary training restrictions can be imposed.

Measures taken to minimize the number, extent, and effects of wildfires include conducting an annual analysis of fires, providing fire education, reducing natural fire fuels, preparing adequately for fire suppression activities, restricting training during high fire risk periods, maintaining firebreaks, monitoring fire danger conditions, reporting fires immediately when they occur, and suppressing fires as soon as possible after they begin. The G3/DPTM develops and recommends munitions restriction measures to prevent initiation of wildfires, and is responsible for imposing those restrictions based on existing fire danger conditions.

When a wildfire occurs, the following procedures in CAM Regulation 385-5 are followed:

- Units are to report all fires in ranges and training areas to Range Division immediately upon knowledge of their occurrence;
- Commanders of the units using the range or training area where a wildfire occurs are to fight the fire to the best of their capabilities;
- Range Division is to notify the Fort Campbell Forester of the fire. The Forester and/or the installation Range Officer will decide whether to call the fire department. If the fire department is called, the Fire Marshall assumes responsibility for the firefighting effort;
- Officer in charge (OIC) of firing/training is to render all possible assistance; and
- The following information is to be reported whenever a fire occurs:
    - Location and type of fire
    - Name and telephone number of the person reporting the fire
    - How the fire started
    - Unit or person that started the fire
    - Direction that the fire is spreading.

Wildland fires that threaten life or property are extinguished as quickly as possible. The priorities of fire suppression are to protect human life and safety, minimize damage to real estate and natural resources, prevent interference with training, and minimize complaints of smoke from Fort Campbell neighbors.

When a wildfire is detected, the person(s) who first notices the fire attempts to control and extinguish it. If this is not feasible, the fire is contained to the extent possible. The Range Officer and/or the Forester determine whether to contact the fire department for assistance in fire suppression. Personnel out on the training areas should be adequately trained in fire prevention and reporting procedures. Procedures for fire prevention and suppression can be found in CAM Regulation 385-5, Range Safety Regulation.

Natural Resources management activities conducted by the Forestry Program are integrated with management of game and non-game fish and wildlife, threatened and endangered species, pest management, land management, and the ITAM Program. Fort Campbell foresters regularly coordinate with the USDA Forest Service and the IMCOM forester.

4.2.2 Fish and Wildlife Program

4.2.2.1 Game and Non-Game Species

The Fort Campbell Conservation Branch is responsible for maintaining healthy populations of game and non-game fauna on the installation, in a manner consistent with the military mission. As part of maintaining

a diverse, self-sustaining ecosystem, the Conservation Branch maintains populations of non-game mammals, birds, amphibians, reptiles, fish, and invertebrates, and habitat suitable for those species, on the installation. Conservation Branch wildlife biologists conduct species inventories, monitor population trends, and manage habitat for non-game species. Species that are rare, imperiled, or otherwise declining are monitored, and habitat is managed to support declining species to the extent practicable.
Conservation Branch wildlife biologists develop and implement species-specific management plans, monitor population trends, and manage habitat for fish, wildlife, and invertebrate species. Management of fish and wildlife is integrated with forestry, agricultural leasing, land management, and the ITAM Program. In accordance with DoD and U.S. Army policies, Fish and wildlife management on Fort Campbell is conducted in cooperation with the USFWS, KDFWR, and TWRA.

4.2.2.2 Threatened and Endangered Species

The Conservation Branch is responsible for conservation of federally listed threatened and endangered species (listed species). Conservation Branch biologists implement requirements, stated in the Endangered Species Act:

- "federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to utilize their authorities to further the purposes of the Act by carrying out conservation programs for listed species;" and
- "every federal agency, in consultation with and with the assistance of the Secretary, to insure that any action it authorizes, funds, or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of critical habitat."

Planning and diligent management of federally listed species and their habitat on Fort Campbell is critical to supporting the military mission. In addition to habitat management and species monitoring, the Conservation Branch manages coordination with the USFWS regarding listed species, and supports Fort Campbell tenants and installation staff compliance with Endangered Species Act compliance.

Army Regulation 200-1 requires an Endangered Species Management Component (ESMC) for each installation where federally listed species occur. The ESMC for Indiana bats and gray bats was prepared and authorized in 2001 (Fort Campbell 2001) and reauthorized in 2008 and 2013. The Component was updated in 2016 following the Northern long-eared bat listing. The purpose of the ESMC is to ensure compliance with the Endangered Species Act (ESA), while meeting the requirements of the military mission on the installation. The ESMC provides guidance for installation coordination between project proponents and the Endangered Species Program Manager to ensure proposed projects do not affect endangered bats. The ESMC also describes conservation goals and objectives developed to maintain or enhance suitable habitat for endangered bats on Fort Campbell. The ESMC covers a period of five years and is reviewed annually and updated as necessary.

Management of federally listed species is integrated with training and all other Conservation Branch programs.

4.2.3 Integrated Pest Management Program

The Fort Campbell Integrated Pest Management Program encompasses pest management in the rear area and built up areas of the installation, including residential areas, administrative facilities, food service facilities, the golf course, and installation schools. The Pest Management Program carries out the following responsibilities:

- Prepares and maintains the Fort Campbell Integrated Pest Management Plan (IPMP);
- Coordinates pest surveillance and control activities on the installation to ensure proper recordkeeping and reporting;
- Monitors the sale and distribution of pesticides on the installation;
- Serves as a point of contact for individuals who store and apply pesticides (e.g., public works, golf course, pest control contractors, tenant activities, agricultural lessees) and individuals who document or deal with pesticide use in their programs (e.g., Environmental Office, Safety Office, Fire Department, Industrial Hygienist). Provides information regarding pest management to the installation Commander, the Major Command, and Department of the Army (DA);
- Oversees the technical aspects of the Self-Help program with respect to pest control items and training of troop and family housing residents;
- Monitors certification and continuing pest management training for pesticide applicators on the installation;
- Coordinates and monitors contracts involving pesticide application; and
- Coordinates with local, State and Federal agencies as necessary to conduct the installation's pest management program.

The Fort Campbell IPMP is a framework through which pest management is defined and accomplished on the installation. The plan identifies elements of the program to include health and environmental safety, transportation, use and disposal. This plan is used as planning tool to reduce reliance on pesticides, to enhance environmental protections, and to maximize the use of integrated pest management techniques. The plan describes pest species, techniques for managing pests, resources necessary for surveillance and control, and legal requirements associated with pesticide operations on the installation. The IPMP provides guidance for operating and maintaining an effective pest management program using the principles of integrated pest management, which incorporates both chemical and non-chemical control techniques. Adherence to the IPMP ensures effective, economical, and environmentally acceptable pest management and maintains compliance with pertinent laws and regulations. The plan is updated annually, and annual updates are reviewed by the U.S. Army Environmental Command Pest Management Consultant.

The Pest Management Program employs Integrated Pest Management techniques (both chemical and nonchemical control) to eliminate, suppress, and/or control pests. Integrated Pest Management (IPM) is based on four basic principles of control: mechanical/physical, cultural, biological, and chemical. Detailed descriptions of these control measures can be found in the Fort Campbell Integrated Pest Management Plan. The IPM concept uses several approaches to accomplish long-term control in the most efficient and cost effective way.

The IPMP describes mechanisms for coordination of pest management activities with other Fort Campbell divisions and Army resources. Forestry, Fish and Wildlife, and Agricultural Lease Managers coordinate with the Pest Manager regarding pesticide applications used to manage forest, open areas, and agricultural leases.

4.2.4 Land Management Program

The Conservation Branch Land Management Program is responsible for monitoring and managing soil resources in areas not addressed by the ITAM Program. The Land Management Program carries out responsibilities regarding soil conservation stated in AR 200-1, CAM Reg 385-5, and the Public Law 74-46 Soil Conservation. The Land Management Program plans and implements soil rehabilitation projects along roads and streams, and installs soil erosion control structures (e.g. sediment basins).

The Land Management Program also delineates, manages, and evaluates potential impacts to wetlands on Fort Campbell. The Land Management Program Manager supports Fort Campbell tenants and installation staff with compliance with the Clean Water Act and state regulations regarding wetlands. The Land Management Program Manager coordinates with the USACE to obtain permits under the Clean Water Act Section 404 when permits are necessary for discharge of dredge or fill material into waters of the U.S. The Land Management Program Manager, along with the Compliance Branch, coordinates with state regulatory agencies to obtain water quality certifications under CWA Section 401 for necessary activities, which may include stream relocations, road crossings, stream bank protection, construction of boat ramps, ditching, mechanically clearing a wetland, and building in a wetland. Water quality certifications ensure that activities which may involve a discharge into waters of the State are consistent with the state's water quality standards.

Land Management Program Activities affect soil conservation and water quality. They are integrated with the ITAM, Agricultural Outlease, and Forestry Programs.

4.2.5 Agricultural Outlease Program

Fort Campbell implements an Agricultural Outlease (AO) Program that manages approximately 6,000 acres of non-forested land in the rear area (Figure 11). The Program began in 1965 and is an effective tool for enhancing and maintaining training lands with no Operations and Maintenance dollars. Revenue from leases is collected by the U.S. Army Corps of Engineers, Louisville District, and deposited to the Army account for redistribution to the Program for Outleasing for Grazing and Agriculture on Military Lands.

Non-forested areas that do not have characteristics of native grass barrens, and are located on soils conducive to cultivation, are managed by the AO Manager. Approximately 4,400 acres on Fort Campbell currently are leased to local residents who grow and harvest hay or row crops. The AO Program does not include grazing; livestock are not permitted on Fort Campbell leased lands. Lessees maintain fields cleared of woody vegetation, which fosters conditions suitable for training. Tracts are leased for a five year term with a five year option (recurring lease).

Agricultural fields are available for military training activities. Lessees are not reimbursed for damage to crops caused by training; soldiers are encouraged to avoid or minimize damage to crops and agricultural fields. For each contract, a tract management plan developed by the AO Manager. Lessees must comply with the tract management plans and Fort Campbell land use regulations. Provisions of the tract management plans and Fort Campbell land use regulations including farming in accordance with the crop rotation and soil conservation plans; conducting annual land preparation; leaving a 15-foot vegetated strip around the field; applying lime, fertilizer, and chemicals in accordance with the tract management plan; reporting pesticide usage in accordance with AR 200-1; and providing soil test analysis for the first and third

years of the lease. Lease conditions and the tract management plan are designed to maintain conditions suitable for military training, provide habitat for certain wildlife, minimize soil erosion and run-off of fertilizer and pesticides, and to support production of a viable crop.

Because agricultural fields are key elements to maintaining suitable training lands, the AO Program Manager coordinates annually with mission planners and frequently with range officers to minimize conflicts between training operations and agricultural production. The AO Program also is integrated with other Conservation Branch Programs responsible for managing the Fort Campbell landscape. AO Program activities must also be integrated with management of fish and wildlife, pests, and cultural resources.

4.2.6 Watershed Management

The watershed approach is an integrated, inclusive strategy for more effectively protecting and managing surface water and groundwater resources and achieving broader environmental conservation objectives using the naturally defined hydrologic unit (watershed). For a given unit, the management approach encompasses not only the stream or river, but all the land from which water drains to the stream or river. This approach encompasses physical (e.g., temperature, flow, mixing, habitat characteristics), chemical (pH, conductivity, dissolved oxygen), and biological (e.g., health and integrity of biotic communities, biodiversity) aspects of water quality.

Fort Campbell contains three watersheds of rivers and streams that are further divided into nine watersheds (Figure 9). Watershed boundaries are defined by topography, and certain watersheds extend outside the installation boundary. While Fort Campbell natural resource managers consider habitat conditions and land uses adjacent to the installation, Fort Campbell cannot conduct management activities outside installation boundaries.

Using the watershed management approach, rather than managing individual streams or reaches of streams, avoids the misperception that factors influencing water quality are restricted to the stream, its bed, and its banks. The watershed approach implements management on a scale that incorporates the ultimate factors influencing water quality. Fort Campbell's Watershed Management approach is based upon a five-year cycle of activities that allows for data collection/evaluation, design and prioritization of management measures, and monitoring of results. The Plan involves the following five phases:

- Phase 1: Scoping and Evaluation. This phase involves three basic activities: conducting outreach, identifying watershed issues, and planning for coordinated data collection. NR managers and other installation stakeholders communicate to raise awareness, identify concerns, prioritize watersheds, and establish management goals and objectives. Strategic plans are prepared to coordinate existing data and collection of additional data. Planning may also involve adaptive management based upon monitoring results.
- Phase 2: Data Collection. Watershed-based data (e.g., chemical, physical, biological, hydrologic, and land use data) are collected by natural resource managers. Monitoring plans incorporate three major aspects:
    - Baseline monitoring is conducted on every important water body in each watershed. Water quality data are collected by the Conservation Branch at six key sites on selected streams regardless of the watershed cycle. Data are collected using a monitoring network

to adequately characterize water quality trends and monitor progress in protecting or restoring water quality.
    - Status monitoring is also conducted on every important water body in each watershed. An intense one-year period of status monitoring commences in Phase 1 of the five-year management cycle and ends at the beginning of Year 2. These data are useful for trends analysis and assessing compliance with water quality standards.
    - Targeted monitoring commences at the beginning of Phase 2 of the five-year management cycle and ends at the beginning of Year 4. This monitoring will establish the geographic extent and degree of water quality impairment necessary to apply models for establishing total maximum daily loads (TMDLs), to determine sources of contamination, and to support specific wastewater permit limits.
- Phase 3: Assessment and Targeting. Quantitative and qualitative analyses of baseline and targeted watershed data are performed using GIS, statistical analysis methods, and models. Information gathered during Phases 1 and 2 is analyzed to determine habitat condition and to establish allowable sediment levels for point and non-point sources.
- Phase 4: Strategy Development. The Fort Campbell Environmental Division and technical experts from partner programs work to identify, evaluate, and select management strategies that will be effective at achieving pollutant (sediment) reduction goals for each watershed. Priorities and implementation strategies are documented in draft watershed action plans that outline specific methods and funding sources to serve as a guide for conservation programs and partners. Draft action plans are communicated to a broader audience and fine-tuned as necessary to strengthen support.
- Phase 5: Implementation. The Conservation Branch and other stakeholders carry out management actions in accordance with agreed-upon action plans.
- To accomplish all five phases in all watersheds while balancing annual workloads of resource programs, the nine watersheds are divided into the following groups:
    - Group A (Jordan Creek)
    - Group B (Piney Fork Creek)
    - Group C (Noah's Spring Branch)
    - Group D (Fletcher's Fork Creek)
    - Group E (Saline Creek, Casey Creek, Skinner Creek, Dry Fork Creek, Little West Fork Creek)

The first cycle was initiated in 2001 and completed in 2005 for the Jordan Creek Watershed. Each year the cycle was phased in for the next group, until all groups were initiated by 2006. The five phases were implemented sequentially in all groups, and the cycle is scheduled to repeat every five years. This schedule provides resource programs, partners, and other stakeholders with a basis for long-term work planning. Although under certain circumstances some flexibility in meeting schedules may be allowed, programs should adhere to the schedule to maintain continuity and integrity of the Watershed Management Plan.

Circumstances in each watershed differ in a given year. Factors such as weather may delay planned strategic monitoring, and the complexity of some groups may affect development of management strategies. If circumstances prevent collection of some desired information, the best available data will be used to formulate the most complete management strategies possible. Activities not completed in one iteration of the cycle will be addressed in the next five-year cycle.

4.2.7 Open Area Management

Approximately 19,000 acres on Fort Campbell are open areas vegetated primarily with grasses, crops or other herbaceous species. Open areas are essential to military training, including helicopter exercises and airborne training. Open areas on Fort Campbell are managed as agricultural outleases, native grass barrens, and old fields. Barrens are unique ecosystems that occur in the transition zone between forest and grassland. Barrens support rare native plants and endemic wildlife.

Evaluation and classification of open areas was conducted between 1999 and 2004 (see Section 3). The Fort Campbell Conservation Branch has developed an Open Area Management Plan that will guide the management of all types of open areas on the installation. The Plan coordinates requirements for the size and condition of non-forested areas required to support the military mission with goals for sustaining a natural ecosystem and associated plants and wildlife. The Plan also incorporates numerous management activities that affect open areas, and guide natural resources managers in implementing the barrens/open areas initiatives.

Due to natural succession, woody vegetation is steadily converting open areas to shrub or forest landscapes. Presence of woody vegetation reduces suitability of the open area for training, and may reduce suitability for native barrens species and rare plants. Active management is required to maintain open areas suitable for training and barrens species.

The Open Area Management Plan describes the basis for classifying each open area based upon factors such as slope, vegetation, presence of rare, threatened, or endangered species, and military training requirements. A management and use prescription for each open area has been developed, which may include prescribed burning, mechanical clearing, herbicide application or other techniques designed to maintain the parcel. The Plan describes routine monitoring of open areas designed to ensure desired physical characteristics and species are maintained. Incorporated into the Open Area Management Plan is a strategy for maintaining and expanding habitat for native warm season grasses (NWSG). The Plan contains goals and techniques from wildlife management plans (e.g., grassland birds, quail, rabbit) for selected open areas, and includes management prescriptions to maintain plant diversity and protection of rare plants found in open areas.

Implementing the Open Area Management Plan requires coordination among the Fish and Wildlife, Forestry, AO, Pest Management, and ITAM Programs. Several goals established for terrestrial habitat management (Section 5.4) are elements of the Open Area Management Plan.

4.2.8 Prescribed Fire

Prescribed fire is used as a management tool to prevent the buildup of fuel in pine stands, improve stand regeneration, control undesirable species, improve access, maintain areas in suitable troop training condition, improve wildlife habitat, and enhance appearance. Reducing the fuel load through controlled burning helps to prevent fires from starting, decreases the intensity of fires that do start, and inhibits the spread of wildfires. Prescribed fire is also used as a management tool in the grassland habitats to enhance their value for a variety of wildlife species and reduce the fuel load in these areas.

Training areas are to be burned on a 2 to 4-year cycle, depending on fuel accumulation and fire risk in the training area and surroundings. Impact areas are to be burned annually. Specific criteria for burning can be found in CAM Regulation 385-5, Range Safety Regulation.

Prescribed fire is to be conducted according to an annual plan prepared in advance of the burning season. All burning is to be coordinated with G3/Range Control, and under no circumstances is controlled burning to be conducted if it could threaten structures, vehicles, or bivouac or training activities in progress. Prescribed fire are exempt from air quality permits (Lockard pers. comm. 2012). However, controlled burns of vegetation may result in a temporary increase in particulates in the air. Fort Campbell notifies the surrounding communities prior to implementation of daily burn activities to reduce smoke impacts to the general populous.

Training conditions and hunting activities also determine suitability for controlled burning. Because days that meet these conditions are rare during the winter months, on days that these conditions are met controlled burning has precedence over other forestry activities for the area where the burn is planned to occur.

4.2.9 Outdoor Recreation

The Sikes Act and a Memorandum of Understanding between the Departments of the Interior and Defense requires all military installations to develop outdoor recreation plans where there are suitable resources for such a program consistent with installation mission and national security. Fort Campbell provides outdoor recreational opportunities to military personnel and the general public within the constraints of the military mission and the capability of installation's natural resources. Opportunities are provided in response to local interest and are available on a first come, first served basis through a web-based portal (www.ftcampbell.isportsman.net). The demand for outdoor recreational opportunities at the installation is steadily increasing. The level of enjoyment derived from outdoor activities is directly related to the condition and quality of Fort Campbell's natural resources. Maintaining a quality outdoor recreation program is dependent on proper management of the natural resources and efficient program administration and oversight.

Outdoor recreation programs generate funds that support administration and enhancement of outdoor recreation opportunities. Fees from special permits for outdoor recreational activities (hunting, fishing, hiking, cycling, camping, and horseback riding) are administered through the DPW iSportsman portal and support the protection, conservation, and management of fish and wildlife. The primary outdoor recreation programs offered by Fort Campbell, which include hunting, fishing, boating, dog training and field trials, horseback riding, camping, hiking, and archery, are described below.

4.2.9.1 Hunting and Fishing Programs

Hunting and fishing on Fort Campbell is available to military and civilian staff, retirees, and the general public. All hunting and fishing on Fort Campbell must comply with Fort Campbell Regulation 200-4 (Hunting, Fishing, and Outdoor Recreation Activities) and applicable federal and state laws. The areas of responsibility for administering these programs are outlined below:

- The DPW is responsible for the operation and administration of the recreational aspects installation hunting and fishing program under the delegated authority of the Commanding General;

- The Fish and Wildlife Manager provides administrative oversight of the outdoor recreation program and is the appeal authority for confiscated/revoked permits;
- The Fish and Wildlife Program performs the administrative functions necessary to assign hunters and fishermen to the rear area of Fort Campbell;
- G3, Range Division is responsible for overseeing the release of training areas for recreational use;
- The Fish and Wildlife Program has the authority and responsibility to plan, coordinate, and implement fish and wildlife management programs in accordance with AR 200-1 and the Army Fish and Wildlife Reimbursable Program Policy (OACSIM 2017); and
- The Directorate of Emergency Services (DES) is the Chief of the Game Wardens and is responsible for enforcement of hunting and fishing laws and regulations, and for the military, federal, state, and local police support in the rear area of Fort Campbell.

Eligibility to hunt or fish at Fort Campbell is determined by Army Regulation 200-1, the Army Hunting and Fishing Policy, and CAM Regulation 200-4. Trapping is prohibited at Fort Campbell.

The rear area of Fort Campbell offers more than 66,000 acres for hunting. Small game species include coyote, crow, dove, fox, frog, groundhog, opossum, quail, rabbit, raccoon, squirrel, waterfowl, and woodcock. White-tailed deer and turkey are large game species hunted on Fort Campbell. Permits for hunting are issued by the Fish and Wildlife Program. Hunting area assignments follow the system outlined in CAM Regulation 200-4. No hunting is allowed on Tuesdays or Wednesdays unless otherwise scheduled.

Fishing for both cold water and warm water species is permitted year-round on Fort Campbell. The installation has approximately 40 miles of stream suitable for fishing during a portion of the year and 19 miles are suitable for stocking trout. Streams on Fort Campbell cannot support year-round trout populations due to seasonal variation in stream flow, high water temperatures during summer, and excessive sediment deposition. Therefore, Fort Campbell employs a put-and-take strategy that entails stocking fish of harvestable size near popular fishing locations, where the fish are not expected to grow significantly before being caught.

Three streams and one pond are stocked with brown trout and rainbow trout on a monthly basis from March through August every year. The trout are supplied and stocked by the states of Kentucky (March, April, and May) and Tennessee (June, July, and August) at no charge to the installation. Trout are stocked in the following locations:

- Little West Fork Creek: East bridge next to McNair Road bridge, Mabry Road culverts (south end of Small Arms Impact Area), and 101st Airborne Division Road bridge;
- Fletcher's Fork Creek (accessed from Boiling Springs Road); and
- Kinser's Pond (inside former Clarksville Base)

In addition to providing the fish and personnel to conduct the stocking operations, the KDFWR and TWRA Fishery Divisions, also compile and evaluate the data collected from the trout fishing survey forms. The survey forms are used to obtain information for the Fort Campbell Trout Program, and every trout angler is required to complete a form, per CAM Regulation 200-4, at the end of each trout fishing trip.

Warmwater fishing opportunities for Fort Campbell anglers can be found at Lakes Kyle and Taal, as well as many of the streams, such as Saline Creek, Jordan Creek, Piney Fork Creek, Dry Fork Creek, and Elk Fort

Creek. The most popular and abundant game species available in these water bodies include bass, bream (sunfish), and channel catfish. In addition, Fort Campbell also sponsors special events such as an annual youth fishing tournament at Fletcher's Fork Creek. Channel catfish are stocked in this creek specifically for this event.

All anglers are required to have the appropriate Tennessee or Kentucky fishing licenses/permits and a valid Fort Campbell outdoor Recreation Permit. Approximately 1,200 to 1,300 fishing permits are sold each year and an additional 2,400 combination hunting and fishing permits are sold as well. Annual revenue from the sale of permits averages between $50,000 and $70,000.

4.2.9.2 Other Outdoor Recreation Activities

Boating opportunities are available at Lake Kyle. The lake is considered a no wake zone and the maximum speed is 5 miles per hour. Waterskiing, jet skiing, and wind surfing are prohibited on installation waters. Fort Campbell is open to bird dog field trials and training sponsored by various hunting clubs and organizations. Two major field trial events are held near the Outdoor Recreational Complex: the Tennessee Open Shooting Dog Trial and the American Quail Classic. The latter is recognized nationally, and points earned at this event are applied to qualification for the National Bird Dog Field Trial Championship. In addition to these major events, several local field trials are held on Fort Campbell each year. Fort Campbell has hosted field trials for nearly 50 years and has benefited from the positive national publicity that these field trials generate. Conservation-oriented groups that sponsor the field trials have been responsible for several of the natural resource programs benefiting wildlife habitat that have been conducted on Fort Campbell, such as providing food plots. These groups also mow lanes within the open areas prior to dog trials.

Horseback riding is permitted year-round in designated areas. There are approximately 70 miles of marked riding trails available at Fort Campbell. Hunting rabbits or quail from horseback is permitted.

Camping is permitted at Lake Kyle as scheduling permits. Prospective campers must obtain area assignments from the Fish and Wildlife Program and must specify the location of their intended campsite. Camping may occur for up to 3 days in the rear area. In addition to primitive camping in the rear area, there are two established campgrounds at Fort Campbell, which provide a minimum of 25 campsites (at Travel Camp) and 45 sites with utilities (near Wohali and Creekside pavilions).

Hiking is permitted on Fort Campbell year-round. It is permitted only within the boundaries of an assigned area and only when the area is not being used for hunting.

Archery is permitted year-round at the designated archery range, which is located adjacent to the Fish and Wildlife facility on Lafayette Road.

4.2.10 Safety and Security

Safety on Fort Campbell for outdoor recreational activities is regulated under Fort Campbell Regulation 200-4. Examples of safety precautions implemented at Fort Campbell include the following:

- Access to the impact zone and ranges is prohibited and controlled;

- It is unlawful to hunt or discharge any weapon from a vehicle, within 100 feet of a centerline of a road, or within 300 feet of a building, camping area, or military training;
- Hunters born after 1 January 1969 must have proof of completing a Certified Hunter's Safety Course;
- All firearms must remain on *safe* until ready to fire;
- All hunters (with the exception of dove, waterfowl, and turkey hunters, as well as archery hunters) must wear at least 500 square inches of fluorescent orange (hunter orange);
- Target practicing within a training area is prohibited; and
- Transported weapons are to be encased and firearms unloaded.

4.2.11 Off-Road Vehicles

Off-road vehicles (ORV) are operated within the designated 129-acre area formerly utilized as horseback riding trails along the uplands east of the Lake Taal basin located in Training Area 00 in Montgomery County, Tennessee. Use of the area is limited to ATV, UTV, and motorcycle traffic and operators must adhere to strict management controls to minimize safety concerns and environmental degradation. Management controls for this activity is found in Appendix V.

ORV are authorized for off road use throughout the maneuver space by installation land managers for official use only. The Director of Public Works may grant special permission to handicapped hunters to use ORVs. Public operation of ORVs for recreational purposes in the rear area is permitted in accordance with Fort Campbell Regulation 200-4 during hunting seasons only.

4.2.12 Protection of Cultural Resources

Protection of cultural resources is required during implementation of natural resources management activities. Fort Campbell natural resource managers must integrate cultural resources protection into natural resource management plans, in accordance with federal and state laws, AR-200-1, and the Programmatic Agreement executed between Fort Campbell, the Tennessee and Kentucky SHPOs, and the Advisory Council on Historic Preservation (Section 2.8).

Cultural resources at Fort Campbell are managed by the Cultural Resources Management (CRM) Program of the Conservation Branch. Fort Campbell contains numerous historic farmsteads and other structures, cemeteries, and prehistoric archaeological sites (Section 2.8).

Integration of cultural resources conservation with all natural resource management goals and objectives is critical to avoiding adverse effect to cultural resources. To facilitate regular coordination among the CRM, natural resource management, and INRMP Programs, the CRM Program Manager participates in the Land Management Forum. The CRM Program Manager also reviews NEPA documents (Records of Decision, NEPA checklist, Environmental Assessments) to identify potential effects to cultural resources. The Fort Campbell GIS database indicates the location of known prehistoric and historic resources; however, because surveys are not complete, cultural resources may occur in areas not documented in the GIS database. While the GIS database provides useful information, review of the GIS maps does not fulfill legal requirements to avoid effects to cultural resources. The CRM Program Manager must be notified of any proposed projects that may affect significant or potentially significant cultural resources on the installation. The CRM Program Manager will review the project in accordance with the Programmatic Agreement, and

coordinate with regulatory agencies and Native American tribes as necessary. Frequent and early coordination with the CRM Program is critical, because surveys for resources, and evaluation of eligibility for the National Register of Historic Places, if necessary, will take time.

Activities that potentially affect cultural resources include disturbance of soil (excavation, disking, creation of roads, firebreaks, bog lines, plowing, timbering), modification of historic structures, and modifications of the landscape or areas within view of historic structures. Cemeteries are generally off-limits for training and natural resource management activities.

If objects or sites that may be cultural resources are discovered during natural resource management activities, the activity should be stopped and the site not disturbed further. The location of the object/site must be reported to the CRM Program for investigation.

4.2.13 Natural and Cultural Law Enforcement

Effective enforcement of laws and regulations applicable to natural resources enhances the overall natural resources program, protects the natural and cultural resources, and provides public safety by enforcing off-limit areas and providing protection from criminal destruction of natural resources (i.e., activities such as trespassing and poaching).

4.2.13.1 Enforcement Authority

At Fort Campbell, the DES is the Chief of the Game Wardens and is responsible for law enforcement and for military, Federal, State, and local police support in the rear area. In the rear area, military police (MPs) check sportsmen and other non-military users for licenses, post permits, and area assignment; use radar to identify speeding vehicles; and inspect vehicles for loaded and/or uncased weapons.

Historically, natural resource and wildlife laws and regulations at Fort Campbell have been enforced by active duty military personnel (military police). In August 2001, Fort Campbell entered into a Cooperative Agreement with the USFWS to provide up to five full-time, trained law enforcement officers on the installation. The USFWS officers enforce Federal and State laws protecting natural and cultural resources on Fort Campbell. The officers will enforce Fort Campbell hunting regulations and curtail illegal take of wildlife and plants outside established seasons. The agreement also provides for the USFWS to assist Fort Campbell with management of natural resources and public outreach.

4.2.13.2 Penalties of Violating Natural Resource Laws and Regulations

The laws and regulations for hunting, fishing, and participating in other recreational activities in the rear area of Fort Campbell are provided in CAM Regulation 200-4. Violators of federal and state game and natural resource laws are subject to prosecution before a U.S. Magistrate. Violators subject to the Uniform Code of Military Justice (i.e., military personnel) are also subject to prosecution under that code for violation of CAM Regulation 200-4. Actions taken by the magistrate or commanders under the Uniform Code of Military Justice are in addition to the administrative suspension or revocation of outdoor recreation privileges.

Violators are subject to suspension or revocation of hunting, fishing, and other outdoor recreation activities privileges. The minimum penalty for listed violations is a 1-week suspension of hunting, fishing, or outdoor

recreation privileges. Longer suspensions or permanent revocation of privileges may be applied for violations. In addition, violations may involve criminal punishment and/or punishment under the Uniform Code of Military Justice. Multiple offenses may also result in permanent barring from participation in outdoor recreation activities on Fort Campbell.

5.0 NATURAL RESOURCE MANAGEMENT ISSUES, GOALS, AND OBJECTIVES

In accordance with DoD and U.S. Army Policy, Fort Campbell manages natural resources using an ecosystem management approach. That approach is based upon establishing objectives, implementing projects to reach objectives, and monitoring progress toward objectives. This section describes objectives collectively established by Fort Campbell natural resources managers. Objectives organized by resource and are designed to integrate the efforts of several programs in managing each resource. For example, the ITAM, Forestry, Fish and Wildlife, and Agricultural Outlease Programs each implement projects that affect soil conservation. Goals for natural resource management at Fort Campbell are described in Section 1.3. Based upon those goals, Fort Campbell natural resource managers have developed objectives to guide management and monitoring activities for the next five years. Specific projects designed to achieve each objective and, in some instances, measure ecosystem conditions and progress toward objectives maybe found in species resource area appendices. Objectives and projects are described in as much detail as practicable, to facilitate implementation and progress monitoring.

The natural resource management program must remain flexible to achieve long-term success. Fort Campbell natural resource managers employ adaptive management to ensure objectives and projects are realistic and effective. Monitoring activities provide data to evaluate progress toward management objectives. During the annual review of the INRMP, or more often as appropriate, natural resource managers evaluate the status of management objectives and progress toward objectives. Based upon results of monitoring and other new information (e.g., new scientific literature, updated water quality standards), natural resource managers may adjust management objectives to improve achievement of goals and continue support of the military mission. The natural resource management program may also be required to adapt to unforeseen changes in military mission and legal requirements.

5.1 Communication, Training, Education, and Outreach

5.1.1 Management Issues

A primary function of this INRMP is to integrate natural resources management programs with each other, and with the military mission of the installation. Communication among natural resource programs and with other Fort Campbell tenants/installation staff is essential to integrating the planning and implementation of activities. Regular interaction between these groups, as well as maintaining current goals for training and land management, natural resources databases, and status of management and monitoring activities is essential to keeping all natural resource programs working together.

The GIS database is a key component of communication among natural resource managers and among other Fort Campbell groups. The GIS database identifies sensitive areas such as riparian buffer zones, archaeological sites, rare plants, and wetlands. Maintaining an organized and current database is critical to effective communication. Spatial data must be available to natural resource managers, but manipulation of the database must be controlled to maintain data quality.

Training and education among natural resource managers facilitates understanding of the capabilities and limitations of each program, and of technical resources available for planning and management. Training supports the Sikes Act mandate that, to the extent practicable with existing resources, professionally trained natural resource management personnel are assigned to INRMP activities. Promoting awareness of natural resource program responsibilities and resources to other Fort Campbell trainers, tenants, soldiers, and citizens is a key component of the natural resource management mission. AR 200-1 and AR 350-19 each establish requirements for awareness training programs. The primary vehicles for education about natural resource programs are the Environmental Quality Officer (EQO) Course, the Environmental Handbook, the ITAM Program Sustainable Range Awareness (SRA) component, resource specific workshops, wildlife symposia and conferences.

Outreach beyond Fort Campbell boundaries is also an important mission for installation natural resource managers. The 2004 Army *Strategy for the Environment* emphasizes the benefits of partnering on global, federal, state, and local levels. Fort Campbell has developed effective relationships with federal and state regulatory agencies, local universities, and non-governmental conservation groups to exchange resources with the regional community, and enhance resources for natural resource management on the installation.

5.1.2 Goals and Objectives

This section contains goals and objectives for communication, training, education, and outreach that are broad in scope, and address multiple resources (e.g., GIS database, conservation of natural resources during training). These goals are designed to ensure Fort Campbell maintains effective communication among natural resource programs and other Fort Campbell staff, a professional natural resource staff trained and able to successfully apply technology and current science to natural resource management activities, and fosters a military/civilian community that is well-informed of natural resource initiatives at Fort Campbell.

Goal 1: *Maintain an INRMP that facilitates integration among conservation and training activities, and effectively communicates natural resource management plans to natural resource managers, Fort Campbell Command, and federal and state regulatory agencies.*

Objective 1: The INRMP will be reviewed annually by natural resource managers, DPTMS, and cooperating agencies. The DoD Conservation Metric Report form (Appendix F) will be completed annually. New data, results of monitoring actions, and changes in goals/objectives will be communicated to natural resource managers annually or more frequently. Natural resource managers will identify where revised information potentially creates conflict with other goals, objectives, or management actions, and will coordinate to resolve the issue.

Objective 2: The INRMP will be revised, if necessary, at least every five years. The document will be revised before five years if warranted by significant changes to mission requirements or natural resources (DoD 1998).

Objective 3: Prepare the INRMP and five-year updates in cooperation with the USFWS, KDFWR, and TWRA.

Objective 4: Promote Fort Campbell sustainability goals by providing professional and informative education to the installation military staff regarding positive relationship between natural resources and the

military mission, and instruction about how and why adverse effects to natural resources are to be avoided. Natural resource management briefings will be conducted each Quarter at the Environmental Quality Officer's training sessions.

Objective 5: Develop a pamphlet for distribution to units describing best practices for avoiding damage to natural resources during training in the rear area. The pamphlet should address how healthy natural resources sustain the military mission.

Objective 6: Develop material appropriate for the Fort Campbell Environmental Division website that informs Fort Campbell personnel and surrounding communities about natural resource management responsibilities and stewardship efforts.

Objective 7: Provide up to date, concise, and informative training lectures to the EQO class.

Objective 8: Prepare and deliver a program/educational materials about natural resource management responsibilities and stewardship during the annual Earth Day event. Materials and/or presentations will be designed to educate school children who participate in the event.

Goal 2: *Establish and implement procedures to improve communication among natural resource program managers and support staff.*

Objective 1: Designate a POC in the Conservation Branch who will lead development of a brief training program about the Conservation Branch ArcView GIS System. The program should be designed to provide a basic level of understanding of the GIS database, mapping capabilities, and application of the technology to typical natural resource management activities. The program should include some hands-on training with a test data subset. The training program will include protocols to be used by the Conservation Branch and ITAM Program to standardize data collection, nomenclature, user privileges, and modification/updating the database.

Objective 2: All natural resource managers and support staff will be trained in the use of GIS. Upon completion of training, digital spatial data will be made available to facilitate land use planning, management, and monitoring.

Goal 3: *Participate and support, to the extent possible, opportunities for information exchange, research, and partnerships with local, regional, or national agencies, academic institutions, and conservation organizations.*

Objective 1: Support efforts to author/coauthor papers in scientific journals presenting research conducted on Fort Campbell.

Objective 2: Participate in national or regional scientific meetings and training sessions to ensure Fort Campbell staff are trained to provide the best available scientific and technical knowledge for the management of natural resources.

Objective 3: Coordinate with state wildlife agencies, conservation organizations, and volunteers to obtain support with surveys and monitoring.

Objective 4: Support requests from local youth groups and schools to conduct projects or field trips that promote understanding of conservation, and the role of the U.S. Army as a steward of natural resources.

Objective 5: Encourage academic institutions to propose research projects on Fort Campbell that address the guiding principles and goals of natural resource management on the installation.

Objective 6: Participate in a regional monitoring partnership, composed of all affected parties, to develop and implement a White-nose Syndrome monitoring program.

Objective 7: Review and approve requests, when feasible, from research-oriented groups to use Fort Campbell for research, contingent on coordination with Range Division not to adversely impact military training.

Objective 8: Review, evaluate, and respond to unsolicited proposals for area designations, such as scenic rivers, important bird areas, registered natural areas, etc. Responses to these unsolicited proposals for area designations are contingent on coordination with all Fort Campbell organizations and are not to adversely impact military training.

Goal 4: *Provide an understanding of the Fort Campbell natural resources program to installation and surrounding communities.*

Objective 1: Provide decision makers with information to make sound decisions which affect the Fort Campbell natural resources program.

Objective 2: Provide information to the military community and general public on recreational opportunities on Fort Campbell, especially those related to hunting, fishing, and other natural resources-based activities.

Objective 3: Provide information to units, leaders, soldiers, civilian employees, and other installation users to improve their understanding of impacts of their activities on the environment.

Objective 4: Emphasize the importance of fire in the survivability and maintenance of the remnant tall grass prairie/barrens ecosystem.

Objective 5: Look for opportunities to host or sponsor conferences, such as the Deer Study Group meeting in 1999.

Objective 6: Participate in activities in observance of National Hunting and Fishing Day, Earth Day, Arbor Day, and the Red River Clean-up.

Objective 7: Continue to participate in local events with natural resources significance.

Objective 8: Continue to mentor and supervise scouts and other youth group projects.

Objective 9: Provide lectures and slide presentations on conservation careers, wildlife biology, and fish and wildlife management when requested, generally about 10 presentations annually. Provide training for teachers at local schools during staff development training.

Objective 10: Participate in the local "shadowing" career development program.

5.2 Soil

5.2.1 Management Issues

Soil erosion and associated deposition of sediment into aquatic habitat is one of the most significant environmental problems at Fort Campbell. Over half of the soil mapping units are considered to be highly susceptible to erosion (Figure 7). Steep slopes and non-vegetated areas are most susceptible to erosion. The extensive firebreak system historically has contributed significantly to the erosion problem; modification of the firebreak system to minimize erosion is on-going since 1998. The practice of systematically grading firebreaks ceased in 1997 and all firebreaks that were not needed were obliterated. Disturbance of soils and vegetation during training (e.g., digging force protection structures or frequent use of TOC/LOG sites) creates potential sources of erosion. Improper recovery after digging also contributes to soil degradation. Inversion of soil layers during digging (i.e., placement of fertile top soils beneath infertile sub-surface layers) impairs revegetation of the recovered area. Improper use of off-road vehicles may also damage soil.

Eroded soils may restrict use of land by hindering passage of soldiers on foot and vehicles, ultimately potentially leading to closure of training areas for rehabilitation. Erosion that results in run-off of sediment-laden water to streams potentially affects aquatic biota. The Endangered Species Management Plan identifies maintenance of healthy aquatic communities and clean water as primary goals for conservation of endangered bats, which feed on aquatic insects and drink from streams. Excessive input of sediment into aquatic systems may degrade habitat upon which the prey of endangered bats depend. Finally, sediment is a primary factor in streams that are categorized by the states of Tennessee and Kentucky as non-supporting of designated uses.

Soil conservation and management on Fort Campbell involves preventing/minimizing the development of bare and disturbed soil areas, identifying soil erosion, and restoring areas undergoing or susceptible to erosion. A layer of soil types is maintained in the GIS database and is used to identify highly erodible soils during project scoping and site selection. Soils and vegetation that are disturbed, by anthropogenic or natural causes, are stabilized and repaired as quickly as possible. Installation sources of erosion and sedimentation, runoff, and dust are controlled to the maximum extent practicable to prevent damage to land, water resources, equipment, and facilities.

5.2.2 Goals and Objectives

Soil management goals and objectives are designed to protect soil resources and prevent soil destabilization and erosion, which potentially affect the mission as well as quality of aquatic and terrestrial habitat leading to indirect impacts to endangered bats which utilize aquatic insects as forage.

Goal 1: *Prevent/minimize damage to soils by educating soldiers.*

Objective 1: Educate soldiers about the importance of avoiding damage to soil, about Fort Campbell Regulations (CAM-Regulation 385) that address protection of soil, and about procedures for minimizing damage to soils. Instruct the class, and provide information in the DPW Environmental Handbook. Review the EQO class and Handbook information annually to ensure it is up to date.

Objective 2: Develop a "how-to" video/multimedia presentation to teach the appropriate method(s) for revegetating disturbed areas.

Objective 3: Prepare a brochure to distribute to soldiers that outlines acceptable and unacceptable activities in the rear area, to improve awareness of actions that damage soil.

Objective 4: Encourage trainers to site intensive land-disturbing activities, when possible, on the least erodible lands (those requiring the least cover for erosion control). The potential erodibility of a site (as determined from existing soil types, slopes, and vegetative cover) and location of adjacent wetlands and other surface waters should be considered in order to minimize impacts on these resources.

Goal 2: *Reduce erosion by remediating existing areas with bare/damaged soil.*

Objective 1: Map areas of potential and known sites of erosion and input information into GIS. Reduce known areas of erosion by 20% within all watersheds on Fort Campbell by 2018.

Objective 2: Annually develop a list of projects necessary to stabilize, cover, or otherwise rehabilitate damaged soils. The list will be developed cooperatively by the Conservation Branch and ITAM. Projects will be discussed, prioritized, and assigned to a lead program during the Land Management Forum. Projects may include installation of erosion control structures appropriate for the site (e.g., check dams, wind breaks, diversions), seeding, application of mulch or gravel, streambank stabilization, or revegetation of riparian zones. The status and priority of listed projects will be evaluated at least quarterly at the Land Management Forum, and priorities adjusted as warranted.

Objective 3: Implement the LRAM program to address as many areas with bare/damaged soil as possible.

Monitoring Action 1: Using RTLA procedures, monitor TOC/LOG sites, special use plots and core plots in each watershed on a regular basis. Use the RUSLE to determine if soil loss is above acceptable tolerance levels set by natural resources. Evaluate vegetative cover. Allow no more than 30 percent decrease in vegetative cover annually. Add problem areas to the list of soil rehabilitation projects, and use results of inspections to prioritize listed projects.

Monitoring Action 2: The ITAM program must recover all excavated areas to natural contour following the completion of field training, per CAM Reg-385. The ITAM Program will monitor recovery efforts and enforce digging recovery requirements for training exercises occurring in training areas, particularly those adjacent to water bodies.

Objective 4: As funds allow, projects on the soil rehabilitation list that are not addressed by the LRAM program will be implemented by natural resource programs in the Conservation Branch.

Objective 5: Where firebreaks have crossed perennial and intermittent streams, use bioengineering techniques to restore stream banks and beds to natural condition. Repair at least five sites per year.

Objective 6: Support efforts by the Compliance Branch to enforce placement of erosion and sediment controls on all construction sites. Report to the Compliance Branch observations of sites where control measures are lacking or failing.

Monitoring Action 1: Where soil management measures have been applied, check them at least once per month to ensure proper function.

Objective 7: Reduce the cost for site repair and restoration through maximization of bioengineering techniques as an alternative to conventional "hard" design and construction methods.

Goal 3: *Maintain vegetated riparian zones to stabilize soil on streambanks and minimize run off of sediment- and pollutant-laden water into streams.*

Objective 1: The area within 100 feet along each side of perennial streams (first-order and larger), and within 50 feet of intermittent streams must be maintained in vegetative cover. To the extent practicable, trees should be maintained or encouraged to grow in these areas. For first- and second-order streams, the buffer area is measured from the center of the stream. For larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from each stream bank. Avoid removing vegetation in these areas during natural resource management activities.

Monitoring Action 1: Annually inspect riparian zones in accordance with the target list included in the Watershed Management Plan. Identify areas where the width and/or density of vegetative cover is not adequate. Add those areas to the list of soil management projects.

Goal 4: *Avoid/minimize disturbance to the ground that results in bare soil and potentially leads to erosion.*

Objective 1: For mission-essential training activities (i.e. excavation of force protection structures), the ITAM program will coordinate with trainers to integrate soil conservation best management practices into 100 percent of action plans.

Objective 2: For natural resources activities (e.g. timber harvest) that result in soil disturbance, integrate soil conservation best management practices into 100 percent of project plans and contracts. Application of best management practices will be determined on a site-specific basis, as necessary to control erosion, sedimentation, and dust. Protective vegetative cover will be left undisturbed to the maximum extent practicable, especially on slopes. When vegetative cover must be disturbed, apply gravel, fabrics, mulch, riprap, or other materials that are environmentally safe and compatible with the location to control erosion in problem areas.

Objective 3: Enforce restrictions described in the Forest Management Plan regarding timber harvest, installation of skid trails, and revegetation of fire control lines in riparian zones.

Monitoring Action 1: Annually survey the entire forest road access system to monitor effective erosion control at each ditch, culvert, and other engineered structure.

Objective 4: Stabilize firebreaks and identify/begin closure and reclamation of those not necessary, while providing and maintaining access to Fort Campbell training areas, using access trails as effective firebreaks.

Objective 5 Stabilize all road shoulders.

Goal 5: *Develop and Implement a comprehensive sedimentation control plan to prevent soil erosion on drop zones, ranges, roads, streams and firing positions.*

Objective 1: Complete hydrologic and hydraulic studies of major watersheds.

Objective 2: Complete an inventory of drop zones, large areas having inadequate vegetative cover or denuded, firebreaks, and tank trails. Evaluate for impacts/degradation and priority for corrective action.

Objective 3: Perform water quality studies on major watersheds. Evaluate for impacts/degradation and priority for corrective action.

Objective 4: Develop a soil management plan for the installation that includes a soil rating system and incorporates an inclusion/exclusion of mission support functions.

Objective 5: Have all priority erosion sites in each watershed in compliance by the end of FY 2025 and to move Fort Campbell's soil conservation focus from restoration to maintenance.

Objective 6: Review and update soil conservation portions of this INRMP annually.

Objective 7: Develop a formal Land Restoration Team, which will have access to project implementers and others as they are identified.

Objective 8: Experiment with native and high value wildlife plants in soil stabilization activities, as feasible and compatible with training needs and other considerations.

5.3 Water Resources and Aquatic Habitat

5.3.1 Management Issues

Water resources on Fort Campbell include surface water in streams, lakes, and ponds, as well as groundwater. Because Fort Campbell is situated on karst, there are numerous connections between the surface and groundwater (e.g., sinkholes, losing streams, and springs). Wetlands are part of the water resources, but because wetlands are subject to specific management activities and, in some instances, coordination with the USACE, wetlands are addressed separately.

Water resources on Fort Campbell are used for drinking (Boiling Springs Aquifer), training (primarily Lake Kyle) and recreation. Healthy aquatic systems contribute to a self-sustaining ecosystem by providing food, water, shelter, and breeding sites for insects, fish, amphibians, waterfowl, and a variety of other wildlife.

Maintaining healthy aquatic habitat and good quality water is important for conservation of the two federally endangered bat species that forage upon insects from aquatic habitat and drink from streams, lakes, and ponds. Water quality and the condition of in-stream habitat determine the types and quantities of aquatic macroinvertebrates inhabiting streams. Therefore, water quality also directly influences the availability of prey species for the bats.

Sediment is one of the primary water pollutants in Fort Campbell waterbodies. Sediment and other pollutants adversely affect aquatic biota, including macroinvertebrates and fish (clogging gills), and the physical habitat (increased embeddedness resulting in loss of shelter and spawning sites). Because of the numerous links between surface and groundwater systems, avoiding contamination of groundwater is an important component of maintaining high quality potable water. The primary goal of managing aquatic habitat and water quality is to minimize input of contaminants into surface and ground water.

The ecological and human health importance of maintaining high quality water resources at Fort Campbell is reinforced by several federal and state laws and regulations. Because the installation exists in two states, Fort Campbell must satisfy the TDEC Division of Water Resources and the Kentucky Division of Water (KDOW) regulatory agencies for waterway issues. Section 303(d) of the federal Clean Water Act (and related regulations) requires states to assess the condition of their waters to determine where water quality is impaired (does not fully meet standards) or threatened (is likely to violate standards in the near future). The result of this review is the “303(d) list,” which must be submitted to the EPA every other year. Section 303(d) also requires states to prioritize and target water bodies on their list for development of water quality improvement strategies (i.e., TMDLs), and to develop such strategies for impaired and threatened waters. Streams on the installation that occur on the Tennessee 303(d) list include Little West Fork Creek and Noah’s Spring Branch (TDEC 2016). Streams that occur on the Kentucky 303(d) list include Dry Fork East Creek, Skinner Creek, and Casey Creek (KDOW 2016).

The TDEC Division of Water Pollution Control developed procedures to identify the hydrologic classification of waterbodies regulated under Section 401 of the CWA. Under TDEC’s Section 401 regulations, wetlands, wet weather conveyances, intermittent streams, and perennial streams are regulated as waters of the state. Tennessee does not define ephemeral streams (Rules of TDEC Water Quality Control Board, Division of Water Pollution Control, Section 1200-4-7-03).

The KDOW regulates water quality, including stream conservation and restoration in "waters of the state" under Section 401 of the Clean Water Act (CWA). Coordination and application for a 401 permit are required in Kentucky for disturbances of 200 or more linear feet of blue-line stream (defined by Kentucky as a perennial stream, denoted by a continuous blue line appearing on USGS 7.5-minute topographic map). Intermittent streams and wet weather conveyances are not regulated as waters of the state in Kentucky.

In addition, AR 200-1 promotes the importance of maintaining healthy water resource systems on the installation.

5.3.2 Goals and Objectives

Goals and objectives established for management of aquatic habitat and water quality are designed to protect and enhance the water quality of Fort Campbell’s streams, lakes, and ponds.

Goal 1: *Prevent/minimize degradation of aquatic habitat and water pollution by educating soldiers, residents, employees, and contractors, and distributing accurate information about surface and groundwater resources in the GIS database.*

Objective 1: Educate soldiers about the importance of, and practices for, protecting aquatic resources and water quality. Instruct the Environmental Quality Officer's class, and provide information in the DPW Environmental Handbook. Review the EQO class and Handbook information annually to ensure it is up to date.

Objective 2: Develop an educational pamphlet to be distributed to Environmental Quality Officers, and in vehicle motor pools, on the effects of vehicle washing on the aquatic habitat.

Objective 3: Coordinate with the DPW to ensure maintenance contracts describe required measures for minimizing input of sediment, chemicals, and other contaminants into surface and ground water. If no such language exists in contracts, develop standards for specific maintenance activities, and include in future contracts.

Objective 4: The Agricultural Outlease Program will ensure that 100 percent of lease agreements and Tract Management Plans require site-specific measures (e.g. practices such as contour farming and no till cultivation, placement of vegetated buffer strips, maintenance of cover crops and vegetated riparian areas) for minimizing input of sediment, chemicals, and other contaminants into surface and ground water.

Monitoring Action 1: The AO program will inspect all leased tracts to identify sites of sediment migration to wet weather conveyances, intermittent and perennial streams. A corrective action plan must be developed for all identified sites.

Objective 5: The Forestry Program will ensure that 100 percent of timber sale contracts require Forestry Best Management Practices designed to minimize input of sediment, chemicals, and other contaminants into surface and ground water.

Monitoring Action 1: The Forestry program will inspect all timber sales to identify sites of sediment migration to wet weather conveyances, intermittent and perennial streams. A corrective action plan must be developed for all identified sites.

Objective 6: The Integrated Pest Management Program will ensure that 100 percent of pesticide applicators are properly certified and trained about pesticide applications in and near surface water, sinkholes, and wetlands.

Monitoring Action 1: The Pest Management program will inspect herbicide application sites to ensure no pesticide was applied in and near surface water, sinkholes, and wetlands. A corrective action plan must be developed for all identified sites.

Goal 2: *Minimize input of sediment and other contaminants in storm water run-off entering Fort Campbell surface water (streams, lakes, ponds) and groundwater (sinkholes).*

Objective 1: Vehicles must not cross streams except at bridges or designated, hardened fords. As part of stream inspections conducted under the Watershed Management Plan (WMP), and/or the RTLA

Program, identify vehicle crossings at undesignated areas. Stream inspections conducted as part of WMP implementation will follow the schedule and approach described in Section 4.2.6 of this document. Create a database in the GIS system to map "unauthorized stream crossings." Work with trainers to enforce crossing at appropriate locations. Alternatively, design a hardened stream crossing to provide stream crossing sites essential to the training mission.

Objective 2: Maintain vegetated riparian zones to minimize run off of sediment- and pollutant-laden water into streams. The area within 100 feet along each side of perennial streams (first-order and larger), and within 50 feet of intermittent streams must be maintained vegetated. For first- and second-order streams, the buffer area is measured from the center of the stream. For larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from the stream bank. Avoid removing vegetation in these areas during training and natural resource management activities. Presence of herbaceous vegetation is important to filter sediment and other contaminants from run-off. To the extent practicable, trees should be maintained or encouraged to grow in riparian buffer zones to promote stable streambanks, to reduce mean summer stream temperatures and to provide a source of organic matter for aquatic biota. Limit training activities within the buffer zone to foot travel; tracked and wheeled vehicles should be kept outside the buffer zone. Do not harvest timber within 100 feet of streams and lakes.

Objective 3: Establish and maintain vegetative cover on side slopes of sinkholes, and 100-foot vegetated buffers around sinkholes.

Objective 4: As funds are available, prepare and implement site-specific plans to minimize potentially polluted storm water run-off into sinkholes or karst features in the rear area.

Objective 5: Do not apply pesticides, fertilizers, and other chemicals into, or within 100 feet of perennial and intermittent streams, sinkholes, and other karst features.

Objective 6: Refuel vehicles and conduct other activities with potential for pollutant spills at least 100 feet from sinkholes. Ensure all training units maintain up-to-date spill prevention and control techniques to be implemented in karst areas.

Objective 7: Continue to coordinate with the local soil and water conservation district, state agricultural extension service, and Tennessee Department of Environment and Conservation and Kentucky Division of Water to improve management practices designed to reduce nonpoint sources of pollution.

Monitoring Action 1: As part of the Watershed Management Plan, according to the schedule and approach described in Section 4.2.6 of this plan, inspect streams within target watershed(s) to identify degraded streambanks, damaged riparian buffers, and other sources of erosion. Degraded areas identified during monitoring will be added to the list of water quality improvement projects.

Monitoring Action 2: During the course of routine natural resource management activities, inspect vegetated buffer zones along streams and around sinkholes. Identify locations in the rear area where potentially polluted storm water runoff is intentionally routed to sinkholes or other karst features. Record in the GIS database features that are non-vegetated and receiving potentially polluted runoff.

Goal 3: *Improve quality of water and aquatic habitat in streams that are currently not fully supporting of designated uses (Casey Creek, Dry Fork East Creek, and Skinner Creek watersheds). Maintain the quality*

of streams that are currently fully supporting such that reaches located on Fort Campbell do not become listed on the Tennessee or Kentucky 303(d) lists. Water quality in the stream reaches located on Fort Campbell should meet or exceed standards for the Inner Nashville Basin Region found in Habitat Quality of Least-Impacted Stream and, Regionally-Based pH, and diversity and abundance of invertebrates should be similar to Inner Nashville Basin reference streams as described in Regionally-Based Biological Integrity Criterion.

Objective 1: Annually develop a list of projects necessary to improve water quality in streams. The list will be developed cooperatively by the Conservation Branch and ITAM. Projects will be discussed, prioritized, and assigned to a lead program during the Land Management Forum. Projects may include installation of erosion control structures appropriate for the site (e.g., check dams, wind breaks, diversions), streambank stabilization, restoration of natural stream channels, or revegetation of riparian zones. The cost of each project should be estimated to assist project prioritization and scheduling. The status and priority of listed projects will be evaluated at least quarterly at the Land Management Forum, and priorities adjusted as warranted.

Objective 2: Implement the LRAM program to address as many sites as possible on the water quality improvement list**.**

Objective 3: As funds allow, projects on the water quality improvement list that are not addressed by the LRAM program will be implemented by natural resource programs in the Conservation Branch.

Objective 4: Annually assess Fort Campbell surface waters to ensure waters meet State designated uses criterion by implementing monitoring requirements included within the Tennessee Municipal Separate Storm Sewer System (MS4) Permit. Fort Campbell monitoring plan is located in Appendix S.

Monitoring Action 1: Sample aquatic macroinvertebrates at 20 sites in late spring each year. Calculate the following indices to evaluate the health of the stream including the Index of Biotic Integrity (IBI), EPT richness, EPT composition, species richness, biotic index (tolerance), the Shannon-Wiener diversity index, and the Pielou's Evenness index for taxa evenness. Compare results with baselines established for the Inner Nashville Basin in the State of Tennessee in *Habitat Quality of Least-Impacted Streams*, and *Regionally Based Biological Integrity Criterion*.

Monitoring Action 2: Using a Hydrolab, collect standard water quality measurements weekly from six designated sample sites. Standard quality measures should include pH, dissolved oxygen, temperature, nitrate, ammonia, total dissolved solids, conductivity, and turbidity. These levels will be compared to standards set by Tennessee and Kentucky state agencies and/or the EPA to determine if levels exceed those determined to be detrimental to aquatic life.

Monitoring Action 3: Evaluate turbidity at reference and test sites (downstream from ground disturbing activities) to identify new sources of sediment in streams. Where chronic turbidity indicates sediment input, identify the source. When possible, implement immediate erosion control measures. When long-term erosion control (e.g., stream bank revegetation or stabilization), add the area to the water quality improvement project list.

Monitoring Action 4: Annually conduct Visual Stream Surveys and Unavailable Parameter Inventories on each stream segment within the MS4 jurisdiction with unavailable parameters for siltation, habitat alteration, pathogens, and nutrients to identify and prioritize sources of these pollutants of concern. If a stream segment is identified as having unavailable parameters of concern, it is recommended that visual stream surveys be performed throughout the entire HUC-12 sub-watershed including that stream segment. At a minimum, a visual stream survey must be performed immediately upstream and downstream of each MS4 outfall that discharges into that stream segment utilizing approved State of Tennessee Habitat Assessment Protocol and related Stream Survey Field Sheets. All stream segments with unavailable parameters in the permitted jurisdiction must be surveyed in a five-year period.

Monitoring Action 5: For stream segments identified by TDEC as waters with unavailable parameters for pathogens, bacteriological stream sampling must be performed utilizing methods identified in the division's most current version of the Quality System Standard Operating Procedure for Chemical and Bacteriological Sampling of Surface Water. Monitoring shall include the collection of five samples within a thirty-day period (to establish a geometric mean), and be performed during the summer (March through November). Corresponding flow measurement is recommended but not required. At least one series of five samples per stream segment must be collected, with all segments within the MS4 jurisdiction sampled in a five-year period.

Monitoring Action 6: Analytical monitoring shall be conducted in streams with unavailable parameters for nutrients, pathogens, siltation, or other MS4 pollutants of concern specifically required by TDEC. For stream segments identified as waters with unavailable parameters for siltation, habitat alteration and/or nutrients, biological stream sampling and habitat assessment must be performed utilizing the Semi-Quantitative Single Habitat (SQSH) Method as identified in the division's most current version of the Quality System Standard Operating Procedure for Macroinvertebrate Stream Survey. At least one sample per stream segment must be collected, with all segments within the MS4 jurisdiction sampled in a five-year period.

Goal 4: *Maintain concentrations of chemicals/nutrients related to agricultural activities below minimum detection limits in streams with sources on Fort Campbell.*

Objective 1: Where concentrations of chemicals/nutrients related to agricultural activities exceed minimum detection limits, identify the probable source. For sources originating on Fort Campbell, the AO Program Manager will contact lessee with results to work out a solution for prevention of reoccurrence (e.g., frequency or formula of pesticide/fertilizer application), improve vegetated strips surrounding the field, or improve riparian vegetation to minimize run off.

Monitoring Action 1: Sample water from 22 locations in December, April, June, and September each year to identify presence of chemicals /nutrients associated with agricultural activities.

5.4 Native Grassland Barrens and Old Fields

5.4.1 Management Issues

Fort Campbell manages terrestrial habitat for the purpose of conserving and enhancing existing flora and fauna and to conserve, protect, and sustain biological diversity while supporting the military mission. Terrestrial habitat management activities are directed towards maintenance of healthy ecosystems and

restoration of degraded ecosystems to their historic functions and values. Primary management consideration is given to the management of indigenous listed, proposed, and candidate species habitats.

Native grassland barrens on Fort Campbell support multiple land uses and sustainability goals. Native barrens provide open areas suitable for multiple types of training, and typically require less maintenance/rehabilitation because native grass fields are less susceptible to drought, pests, and erosion. Presence of native grasses, rather than introduced species, supports natural ecosystem processes because native species help prevent soil erosion, improve soil quality, improve water quality, are drought tolerant, and do not require fertilizer. Native grasslands provide excellent habitat for game and non-game wildlife. Some native grass barrens on Fort Campbell support rare, threatened, or endangered species. Old fields also provide for multiple uses as they provide suitable training areas, help maintain soil condition and water quality, and provide habitat for certain game and non-game wildlife. Without the deliberate actions of the military to maintain open areas (i.e., mechanical clearing, burning), native grass barrens and old fields would naturally convert to forest.

5.4.2 Goals and Objectives

Open area management goals and objectives are designed to maintain adequate amounts of suitable training and maneuver lands, enhance biodiversity, conserve native habitat types and species, and sustain a mosaic of natural habitat types on the installation.

Goal 1: *Monitor resources that are important indicators of overall ecosystem integrity, wildlife habitat conditions, and the capability of lands to support military missions.*

Objective 1: Implement a three tiered approach to monitoring utilizing benchmark monitoring, restoration monitoring; and maintenance monitoring to determine success toward desired future conditions.

Objective 2: Develop and implement a method to evaluate prescribed burning results based on multiple burning objectives.

Objective 3: Develop computer database to track the prescription process and monitor its progress.

Goal 2: *Measure the response of stand structure, density and composition of woody vegetation, and herbaceous ground cover to ongoing management through the use of prescribed burns, as well as to natural (e.g., climate, light gaps) and human (e.g., training, silviculture) disturbance factors.*

Objective 1: Measure the following parameters to assess the response to treatments:

- Percent cover of all plant species, litter, bare ground, dead woody material (3 feet long, 3 inches in diameter), non-native species;
- Percent cover by cover class of all species;
- Density of all tree species < 4"dbh by 1" size classes;
- Percent canopy cover in different height categories;
- Burn severity and fuel bed depth; and
- Other site characteristics, such as elevation, slope, aspect, topography, and hydrology.

Goal 3: *Manage the landscape to achieve the amount of suitable training and maneuver area described in the Range Development Plan and Range Complex Master Plan.*

Objective 1: Throughout the 65,800 acres of training and maneuver area, implement Open Area Management Plan prescriptions to establish 40 percent (approximately 26,320 acres) of trainable area by 2020. Trainable areas are native grass barrens (those without restrictions related to rare species), agricultural fields, or old fields having no woody growth greater than 21 inches high. Management techniques will be described in the Open Area Management Plan (Appendix H) and may include clearing trees and brush mechanically, with prescribed fire, and/or with herbicides. The Forestry, Fish and Wildlife, AO Lease, and ITAM Programs will coordinate to identify old fields and native grass barrens that are currently unsuitable for training due to presence of woody growth. Management prescriptions necessary to establish conditions suitable for training will be prepared, prioritized, and implemented.

Goal 4: *Manage open areas on Fort Campbell on a landscape scale to support multiple uses of open areas, sustain native species, and maximize efficiency of management actions*.

Objective 1: Maintain a current record of the boundaries of native grass barrens and old fields in the GIS database. Database information will characterize parcels consistent with the barrens tiered ranks, and will indicate special use restrictions (e.g., presence of protected species), if any.

Monitoring Action 1: Annually review and update the location of old fields and native grass barrens in the GIS database.

Objective 2: Update the Open Area Management Plan. For each parcel of native grass barrens and old field, develop a description of the desired future condition, and prescriptions for achieving the desired future condition, including management of woody growth, noxious/invasive species, wildlife, and sensitive species of plants and animals. The Plan will be designed to meet goals for developing adequate training area and expansion of native barrens.

Monitoring Action 1: Annually visit each field to determine management prescriptions required to meet the designated use.

Objective 3: During the NEPA review of proposed infrastructure development projects, identify potential effects to native grass barrens, and designated barrens restoration areas. Site projects to avoid destruction of barrens and barrens restoration areas to the greatest extent possible.

Goal 5: *Expand the acreage of open areas space by approximately 10,000 acres to create a total of approximately 30,000 acres of native grass barrens on Fort Campbell by 2030.*

Objective 1: By the end of FY 2025, use GIS and field data to identify parcels that have vegetation, soil, and other characteristics conducive to restoration to native grass barrens. To the extent practicable, establish large patches, and/or maintain connectivity with other native grassland barrens to minimize fragmentation of grassland or forest, and maintain corridors for wildlife.

Objective 2: Implement activities prescribed by the Grassland Management Plan to create/restore Tier 1 and 2 barrens on an average of 500 acres per year through 2025.

Monitoring Action 1: Implement the monitoring methods to annually inspect at least 10 percent of the Tier 1 and 2 barrens. The purpose of monitoring is to verify presence of native species (especially barrens indicator species), identify presence of non-native species, evaluate growth of woody species, and identify impacts from training or over-use. For parcels in which problems with woody vegetation or exotic species are identified, review the Grassland Management Plan and adapt the parcel management prescription as appropriate.

Monitoring Action 2: Annually survey at least 10 percent of old fields (including drop zones and powerline ROWs) in which native grass barrens restoration activities have been conducted for at least two years. Compare results of vegetation survey to the baseline species composition to verify progress toward establishment of barrens indicator species. For parcels in which problems with woody vegetation or exotic species are identified, review the Grassland Management Plan and adapt the parcel management prescription as appropriate.

Objective 3: Convert power line rights-of-way (ROW) to native grass. Require newly developed ROWs to be revegetated with native grass. Develop guidelines for managing native grass ROWs that ensure long-term sustainability of those areas.

Objective 4: By FY 2025, develop a one-page pamphlet to distribute to agricultural lessees that will encourage them to plant drop zones with native grasses. The information will identify sources of seed, management of native species, and the benefits of native plants.

Objective 5: By the summer of 2025, develop an efficient, standard method for monitoring vegetative composition and restoration progress in native grass barrens.

Objective 6: The ITAM Program will plant native grasses/plants throughout all landing zones (LZ) and drop zones (DZ) in the rear area by 2025. Prescriptions for managing those areas will be incorporated into the Grassland Management Plan. Beginning in 2020, maintenance of native grasses in LZ/DZ will be implemented in accordance with the Grassland Management Plan.

Objective 7: Determine open space use by military readiness activities throughout the training areas. Conduct assessment to determine the best location for increasing open space in support of military readiness activities to reduce conflict with the Henslow's Sparrow. Develop an open space development plan in support of military readiness activities.

Goal 6: *Support regional planning efforts for grassland areas to restore native habitat types and enhance habitat for wildlife.*

Objective 1: Develop and maintain a MOA and periodic coordination with the USFWS, KDFWR, and TWRA to establish a regional initiative for native grass barrens restoration and protection. Support efforts to conserve native habitat near the Fort Campbell boundaries to reduce potential encroachment on training activities.

Objective 2: Provide high quality stocks of locally adapted native seed and plants to support revegetation projects on Fort Campbell and in the region. Coordinate with TWRA and KDFWR for seed collection.

Goal 7: *Support the Presidential Memorandum (Office of the President, 1994) on the use of native species on federal lands by revising the construction design guide to incorporate environmental and economic benefits of native plants.*

Goal 8: *Implement landscape level habitat management using strategies and goals outlined in resource specific management plans.*

Objective 1: Develop priorities for training area treatment schedules and selection of target species.

Objective 2: Develop and implement plans for experimentation and adaptive management to restore natural communities to reach habitat targets as outlined in this INRMP.

Objective 3: Develop treatment prescriptions in phases to allow for scoping, draft, and final input levels. Consider both broad based management objectives and specific area needs, such as soil erosion control, training impacts, or natural area management requirements. Treatment schedule may include up to several years for full implementation.

Objective 4: Establish post treatment evaluation schedules to assess treatment success and determine needs for follow-up prescriptions and management actions.

Objective 5: Apply experimental design, ecosystem and other monitoring, research, and habitat models to predict and measure the influence of management treatments, training, and other land uses on training area habitat values. Use target species abundance and ecosystem monitoring to measure prescription success. Adjust treatments as needed.

Objective 6: Manage natural communities within training areas on a stand-by-stand level.

Objective 7: Develop annual burn plans based on habitat conditions and plant community restoration requirements of training areas.

Goal 9: *Maximize work efficiency through coordination and utilization of shared labor and equipment resources.*

5.5 Agricultural Outleases

5.5.1 Management Issues

The Agricultural Outlease (AO) Program currently manages over 6,000 acres in active leases. The Program provides Fort Campbell a low-cost means to manage non-forested areas in a manner that is compatible with training. Fort Campbell strives to manage agricultural outleases consistently with management goals for soil, water quality, wildlife, and threatened and endangered species.

5.5.2 Goals and Objectives

Goals and objectives established for managing agricultural outleases are designed to support training activities and maintain an effective reimbursable program.

Goal 1: *Increase program acres to 10,000 by FY2025.*

Objective 1: Within the central area of the installation, maximize the agricultural leases planting hay, rather than row crops. Row crops are generally avoided during the growing season by units training, thus creating a voluntary restriction of available training area. Because hay is a perennial crop and is fairly resistant to unit maneuvers, hay fields can be utilized by training units with little damage. As leases expire, convert leases to hay fields to the maximum extent practicable.

Objective 2: Around fields containing row crops, maintain mowed areas/fields adjacent to each field for unit training, which provides alternative areas for training and minimizes damage to agricultural fields.

Objective 3: Encourage long-term leases to keep fields free of woody vegetation. The AO Program has modified the lease agreement to allow farmers to extend the five-year lease by an additional 5 years.

Objective 4: Maintain in the GIS system a database of locations of agricultural field boundaries and adjacent mowed areas that is not more than five years old, to allow identification of agricultural fields by trainers planning exercises.

Goal 2: *Maintain a reimbursable program that provides lease opportunities for local farmers, revenue for the U.S. Army, and promotes sustainable agricultural activities consistent with conservation of soil, water, and other natural resources.*

Objective 1: Develop Tract Management Plans (TMP) for each new field included in the AO Program. At a minimum, TMPs will include the following:

- Avoid driving vehicles in leased fields during wet conditions;
- Each tract must have a conservation plan developed by natural resource or the Montgomery County Soil Conservation District;
- Lessees must comply with the TMP and the conservation plan;
- No livestock are allowed on tracts;
- Leased tracts are to be cleared of woody vegetation, as necessary, and brought into arable condition;
- Adhere to crop restrictions imposed by the Army (e.g., no tobacco, crop height restrictions);
- Maintain vegetated strips along all perennial and intermittent waterways; and
- Applications of pesticides must be reported to the AO Program Manager by September 1 each year; only approved pesticides may be used, and must be used according to label directions.

The TMP may also include site specific prescriptions that consider soils, slope, groundwater, and other site-specific factors related to crop production.

Objective 2: Maintain 15-foot vegetated buffers around agricultural lease fields to minimize run-off of soil and pesticides, and to provide alternative areas for vehicle and foot travel that minimizes damage to crops.

Objective 3: Identify fields that are routinely disturbed by military activities and consider removing them from the AO Program at the end of the current lease, to minimize farmers leaving the program. Coordinate with the ITAM, Fish and Wildlife, and Forestry Program to identify alternative management strategies for fields removed from the AO Program.

Objective 4: Where noxious weeds are problematic in agricultural lease fields, develop site specific prescriptions for controlling weeds. Coordinate with the Integrated Pest Management Program Manager when necessary treatments include herbicides.

Monitoring Action 1: Complete annual inspections of each agricultural field to ensure 100 percent compliance with Tract Management Plans.

Monitoring Action 2: Review reports of pesticide use submitted by September 1 each year. Ensure 100 percent of lessees report pesticide use, and 100 percent use only approved pesticides in a manner consistent with label directions.

Objective 5: Identify acres of naturally occurring erosion and implement measures for construction of waterways within leased areas.

Objective 6: Identify areas of degradation for construction of graveled accesses to currently leased fields or grassed fields.

Objective 7: Identify areas, in conjunction with other Conservation programs for inventories, surveys or wildlife habitat improvement.

5.6 Forest

5.6.1 Management Issues

The Army Forestry Program supports and enhances the immediate and long-term military mission and meets natural resource stewardship requirements set forth in AR 200-1. Army policy stipulates that forest resources must be managed for multiple uses, using an ecosystem management approach to optimize the benefits to the installation's natural resources. U.S. Army technical guidance on implementing ecosystem management on FORSCOM installations states that "the overall goal for the command is to manage for natural ecosystems... and in forested areas, this is old growth ecosystems" (U.S. Army Forces Command 1997). The guidance continues by stating that "this is best achieved by establishing a mosaic of different [seral] stages leading to the desired final stage.

In 2015, a Forest Management Plan (FMP) was developed in accordance with Army Regulation 200-1. The FMP is designed to integrate military training support with habitat management, sustainable timber production, and threatened and endangered species protection. The FMP describes implementation of Forestry Program responsibilities: prescribed burning, forest fire protection, firebreaks/forest access roads,

forest product sales, forest improvements, forest monitoring, forest pest monitoring, planning, environmental quality officer training, and environmental education.

The FMP designates Desired Future Conditions (DFC) for each forested stand. A DFC describes the forest structure and ecosystem components that will characterize the final state of a forest stand or sub-watershed. The FMP describes each DFC, the processes used to assign a DFC to individual forest stands, and the expansion to the watershed scale. This approach allows forest managers to consider factors such as military training needs, wildlife and endangered species habitat, and cultural resources, and then apply appropriate management goals. Comparing a DFC to the present condition and structure of the forest allows selection of the silvicultural systems and timber stand improvements needed to attain the DFC. Some of the DFCs established in the FMP support goals for training and other resources, including:

- Conversion of selected pine plantations to grasslands, which will expand available training area and support the restoration of native grasslands;
- Development/maintenance of old-growth forest to promote biological diversity and encourage additional habitat for endangered bats and other wildlife;
- Maintenance of conditions within impact areas and tactical concealment areas that promote training;
- Maintenance of conditions and forest management practices within minimum use areas including riparian zones, wetlands, and caves/karst that protect the quality of those resources; and
- Maintenance of conditions in selected stands near the installation boundary that screen noise and military activity to minimize disturbance to residents outside the boundary.

The Forestry Program fully complies with all applicable federal laws, policies, and regulations pertaining to forest management as outlined in the FMP. The FMP establishes standards and guidelines that integrate forest management with other natural resource activities.

Implementation of the ESMC and ICRMP during forest management activities is required by the FMP. Use of DFCs assists to integrate forest management practices with other natural resource activities because DFCs consider requirements for military training, conservation of natural and cultural resources, and other land uses for each particular forest stand. Forest pest monitoring and control is coordinated with the Pest Management Program. Because there are several ecological applications of prescribed fire, planning, implementation, and training for prescribed burning is coordinated among the Forestry, Fish and Wildlife, and the ITAM programs. Coordination among these programs typically occurs during frequent meetings among program managers.

The Forestry Program also leads the Conservation Branch in management of fire. The Integrated Wildland Fire Management Plan (IWFMP) addresses fire management policy, prevention, the fire break system, wildfire suppression, and training/certification consistent with the Department of the Army Memorandum "Army Wildland Fire Policy Guidance" (September 2002). Fort Campbell Foresters are responsible for monitoring and suppression of wildfires, application of prescribed fire for habitat management, and training personnel to control fires.

The FMP outlines a 12-step forest management implementation process. Steps in the process include monitoring treatments, evaluating the effectiveness of treatments, and adjusting future treatments (adaptive management). Appropriate methods for monitoring and evaluating treatments are developed for each treatment, to ensure the scope and scale of monitoring activities address relevant issues. Monitoring

actions specific to each treatment are not discussed here. Monitoring actions described below address the CFI conducted to measure overall forest health, and monitoring of wild fires and prescribed burns.

5.6.2 Goals and Objectives

Goal 1: *Manage forest resources in the rear area to support planned military use of the land.*

Objective 1: Regularly coordinate with G3/DPTMS and other Conservation Branch programs to ensure DFCs established in the FMP are on track to achieve the size, location, and conditions of training areas needed. At least once per year, discuss the proposed forest management activities in the FMP during the Land Management Forum, to ensure forest management goals are consistent with the military mission and other natural resource management initiatives.

Objective 2: In TOC/LOG sites, decrease basal area of trees by 20 percent to improve military maneuverability.

Objective 3: In TOC sites, maintain the density of tactical concealment cover at no less than 60 percent of the density measured in 2003.

Objective 4: Thin pine stands to create open canopy conditions. If possible, maintain canopy cover at or below 55 percent and remove up to 50 percent of the basal area. Promote encourage additional sunlight penetration in ecotone areas.

Objective 5: Manage low density pine areas to increase stocking, as needed, through natural and artificial regeneration. Favor shortleaf pine for all natural and artificial regeneration. Apply environmentally accepted site preparation methods, where applicable, to encourage regeneration of loblolly pine.

Objective 6: Control hardwood mid-story in selected oak/hickory forest stands with growing season fire to increase plant diversity.

Objective 7: Create, retain, and/or maintain oak/hickory and scrub patches in an area coverage and patch configuration that encourages habitat values for hardwood and mixed habitat dependent priority species. Manage 30% of uplands as either dedicated hardwood stands or within-pine-stand or within-mixed-stand hardwood patches. Provide a diversity of age classes, shrub and tree species, fruit-bearing vines and shrubs, and habitat structure within each training area.

Goal 2: *Maintain a healthy, sustainable forest on Fort Campbell that provides for natural habitat, conservation of endangered species, revenue from timber sales, and recreational opportunities.*

Objective 1: Implement the FMP to achieve forest DFCs in each watershed.

Monitoring Action 1: Fort Campbell monitors for the presence of forest pests (e.g., gypsy moth and southern pine beetle) to ensure rapid detection and control if pests appear.

Objective 2: Review the FMP annually and update it every five years, or more frequently as appropriate to maintain current information about forest conditions, progress toward goals and objectives, and current goals that support the military mission.

Objective 3: Update installation-wide inventories every ten years or more frequently.

Monitoring Action 1: The Forestry Program monitors the condition of the Fort Campbell forest using the Continuous Forest Inventory (CFI). The CFI was first begun in 1962 and is carried out every five years. The U.S. Forest Service, Southern Research Station analyzes CFI data and provides estimates of forest growth, mortality, and volume. The analyses show that the general forest health on Fort Campbell is comparable to that of forests of the surrounding region. The Forestry Program will continue to implement the CFI as described in the FMP to monitor forest health.

Goal 3: *Manage fire in a manner that protects human life and safety, minimizes damage to property, natural and cultural resources, and contributes to ecosystem management goals.*

Objective 1: Implement fire prevention and suppression measures described in the IWFMP.

Monitoring Action 1: Prepare an annual analysis of wildfires to determine causes.

Monitoring Action 2: Continually monitor fire danger (i.e., potential for wildfire) on the installation, and report it to Range Control at least once daily.

Objective 2: Implement the objectives and prescribed burning projects established in the IWFMP.

Monitoring Action 1: Monitor the success of prescribed burns by conducting post-burn evaluations to determine if the burn was implemented according to the planned procedures, and achieved the intended results.

Objective 3: Update the Integrated Wildland Fire Management Plan, in accordance with Department of the Army guidance that is integrated with other natural resource management activities.

Objective 4: Each year, train and certify an all Conservation Branch staff and support personnel according to the guidelines of the National Wildfire Coordinating Group.

Goal 4: *Modify the system of firebreaks to create a system that is effective at controlling fires and providing access to forest, but minimizes soil disturbance, soil erosion and drainage problems.*

Goal 5: *Manage the forest applying Kentucky and Tennessee's Forest Practices Guidelines Related to Water Quality (cite), which include recommendations for streamside management zones, stream crossings, access roads, timber harvest, site preparation, reforestation, prescribed burning, wildfire suppression, chemical treatments, and wetland management.*

Objective 1: Incorporate BMPs into all forest product availabilities for inclusion in Corps of Engineers contracts for forest harvest on Fort Campbell.

Goal 6: *Maintain the health of natural communities and generate forest product income through silvicultural treatments used to manage Indiana bat habitat and other priority floral and faunal species.*

Objective 1: Identify and maintain functional flora and fauna corridors to minimize fragmentation and maintain genetic and demographic linkages.

Objective 2: Control or eradicate invasive species, which can compete with native species.

Objective 3: Emphasize tall grass prairie/barren restoration as the primary vegetative cover, recognizing that native warm season grasses are essential fuel for the fire regime necessary to maintain this ecologically imperiled ecosystem.

Objective 4: Perpetuate and enhance other vegetative ground cover to optimize wildlife values regarding food and cover.

Objective 5: Preserve and maintain the status of those species associated with each natural community. Status is evaluated by the species abundance and species richness within the community.

Objective 6: Determine the abundance and richness of understory species or indicator species in assessing the integrity (health) of managed natural communities.

Goal 7: *Provide firewood to the Fort Campbell and civilian communities.*

Objective 1: Sell firewood through minor forest product contracts (permits) at the Forestry office. Make permits available to military and civilian communities. Maintain a list of available harvest areas at the Outdoor Recreation Unit. Do not allow firewood harvesting from impact areas.

Goal 8: *Provide improved forest conditions to promote biological diversity and maintain viable populations of native species, while simultaneously enhancing Army training, in accordance with the Endangered Species Management Component for Indiana, gray, and Northern long-eared bats.*

Goal 9: *Prepare timber sales in compliance with regulatory requirements and integrated natural resources goals.*

Objective 1: Conduct timber sales using the following procedures:

- Determine approximate timber volumes to be harvested at the beginning of each fiscal year;
- Consider habitat needs for the Indiana bat to determine approximate volumes;
- Coordinate timber availability through the Fish and Wildlife program and Range Control to ensure no endangered species and training mission issues;
- Forward the availability, upon completion of coordination, to IMCOM and the Louisville District Corps of Engineers, for sale action. Include location maps indicating all known endangered species sites, wetlands, and archaeological sites in the availability. Include volumes and harvest specifications. Use the Louisville District to advertise, sell, and conduct field inspections during harvesting activities; and
- Conduct a post-harvest inspection prior to clearing the contract.

Objective 2: Conduct salvage and sanitation sales for small volumes of wood needing removal on construction projects, as well as areas involved in forest insect control and/or storm damage.

Goal 10: *Re-establish forests in areas appropriate with other management needs.*

Goal 11: *Minimize forest insect outbreaks on the installation.*

Objective 1: Monitor insect spots during the growing season. Request technical assistance from the U.S. Forest Service (USFS) forest entomologist to verify occurrence of southern pine beetle and make control recommendations. Use continuous ground surveillance by Natural Resources personnel and helicopter flights during the growing season to pinpoint insect activity on the reservation.

Objective 2: Use the most current control recommendations in accordance with regulatory guidelines.

Objective 3: Update forest insect activity reports and table of forest insect control activity at the end of each fiscal year.

Goal 12: *Minimize forest tree diseases.*

Objective 1: Monitor for forest tree disease throughout the growing season and make recommendation for control prescriptions.

Objective 2: Take appropriate control action if significant tree disease problems are discovered.

Goal 13: *Apply herbicides to control vegetation to target levels in areas where prescribed fire is ineffective.*

Objective 1: Evaluate growing season burns for undesirable hardwood control effectiveness at the beginning of each burning cycle.

Objective 2: Determine chemical control treatment areas for Fiscal Years 2018-2023.

Objective 3: Update annually a summary of hardwood control prescription on Fort Campbell.

Goal 14: *Use forest management to support military training throughout the training areas.*

Objective 1: Consider the need for special vegetative cover requirements, *i.e.* density, overstory, and understory, to support the military training mission and construction projects. Assess training actions which require tree removal for potential impacts on endangered species. If assessment determines a no effect; initiate treatment.

Objective 2: Coordinate forest management activities and contracts with Range Branch during planning stages.

Objective 3: Conduct all forest product harvesting to minimize impacts on training activities. If necessary, delay harvesting activity in certain areas until the completion of training activities. Coordinate the annual prescribed burning plan through Range Control. Notify Range Control each day that prescribed burning is planned. Use the Fire Management Officer and Range Control to resolve areas of conflict.

5.7.1 Management Issues

Fire is a natural disturbance in the native woodland and grass barren habitats that promote ecosystem health, species at risk habitat, fuel reduction, wildlife habitat and improved silvicultural conditions while reducing adverse impacts from fire intolerant woody invasive species. Many ecosystems are fire dependant for seed dispersion and nutrient fluxes caused by annual burning. The use of fire as a management tool provides this natural disturbance without the destructive nature of an intense wildland fire on the ecosystem while enhancing military training lands and protecting civilian populations.
Prescribed fire is used for a variety of applications, including reducing hazardous fuel banks, disposal of logging debris, preparing sites for planting and/or seeding, managing wildlife, vegetation control, insect and disease control, improving forage, and increasing access for hiking and/or military training. By reducing flashy fuels (grasses and small twigs) significant reductions in wildland fires occur while an increase of the effectiveness of future suppression efforts can be seen. In addition to the environmental and safety benefits, burned fields and forested stands provide the needed corridors and landing zones for military maneuvers and aviation support training.

Prescribed fire exposes mineral soils and controls competing vegetation, while helping remove small woody debris, unwanted species, poor quality, shade-tolerant species and preventing the spread of certain types of fungal infestations. Low-intensity burns increase the quantity, quality, and palatability of grasses and forbs while removing dead and low nutrient valued material. The mosaic of burned and unburned areas maximizes edge effects which promote a multitude of wildlife species, including deer, dove, quail and turkey. Prescribed fire is the management tool of choice due to its minimal cost, numerous beneficial factors and the natural occurrence of fire in the ecosystem.

5.7.2 Goals and Objectives

Goal 1: *Ensure that all fire management activities complement suppression and control by minimizing resource damage and rehabilitation costs, while protecting the safety of military personnel, civilians, equipment and property.*

Objective 1: Contain, suppress and/or control wildland fires through the use of existing natural and man-made firebreaks when feasible, practical and based on firefighter and public safety, with direct or indirect suppression techniques. The technique used will be determined by factors such wildfire intensity, fire weather forecast, spread component, threat to existing infrastructure and personnel in the vicinity, and projected benefits and consequences to Fort Campbell due to fire activity and suppression actions.

Objective 2: Develop defined burn plans that take into account current and desired future conditions, post-burn objectives, and control techniques for each burn unit. Prior to deploying resources to conduct the prescribed burn operation, check to ensure controls and objectives are still relevant.

Objective 3: Communicate frequently with DPTMS, DES, and DPW personnel to detect wildland fires on and adjacent to the installation. Use of the fire tower and military aircraft observations will be heightened during days of high severe fire behavior potential.

Objective 4: Ensure that firefighting equipment and PPE is readily available for use at all times. Personnel responsible for responding to wildfires will have their equipment on hand while at work sites

across the installation should they be contacted to respond to a wildland fire. If needed, additional equipment and personnel from DPTMS, DES and military tasked resources may be requested.

Objective 5: Annually maintain the impact and installation boundary roads used for wildland fire access in the event that a suppression operation is required. Maintained fire breaks and control lines for use during indirect suppression and prescribed burning operations are essential elements for effective fire management.

Goal 2: *Enhance and support the immediate and long-term military mission using valid and accurate fire management and policy.*

Objective 1: Daily distribute the Burn Index (per CAM-Reg. 385-5) and the National Fire Danger Rating and color code (per CAM-Reg. 420-24) for situational awareness and military live-fire guidance.

Objective 2: Annually burn the North/South Impact and Small Arms Impact areas through the use of prescribed burns and indirect attack of range and impact wildland fires. Prescribe burn ranges with increased potential for ignition from munitions for wildland fire prevention on an as needed basis.

Objective 3: Minimize smoke impacts from fire activity in order to regulate the amount of smoke in any general area, taking into account smoke dispersal and adjacent sensitive areas (towns, airfields, heavily traveled areas and active military training).

Objective 4: Restore and maintain the woodland and barren ecosystems, using prescribed burns to reduce and/or hold encroachment at levels that do not impact the training mission, while maintaining viable woodland communities throughout the installation.

Goal 3: *Continue restoring fire to its natural role to the maximum extent possible so that the natural ecosystems can operate essentially unimpaired by human influence.*

Objective 1: Use prescribed burning in the training areas (fields and pine / hardwood stands) as recommended by annual forest inventory and open area monitoring actions. Tier 1 areas will have highest priority, based on endangered species habitat, land use, desired future conditions, and wildland fire prevention.

Objective 2: Conduct dormant season (January through March) fuel reduction burns to maintain and/or reduce fuel loads to a manageable level to prevent catastrophic wildland fires.

Objective 3: Prohibit use of bog disks in endangered species sites except when life or property is being threatened. The use of earth disturbing devises within designated endangered species habitat must constitute an emergency.

Goal 4: *Restore and maintain the woodland and tall grass prairie barren ecosystems, using prescribed burns to reduce and/or hold woody encroachment at levels that do not impact the training mission and maintain viable woodland communities throughout the reservation.*

Objective 1: Use prescribed burning on a 2-year management cycle for field maintenance or as recommended by annual open area monitoring actions. Place priority on burning areas selected for

endangered species habitat improvement and wildland fire prevention, contingent upon smoke management considerations and other activities occurring in the general area of the burn unit.

Objective 2: Conduct pre-burn reconnaissance to assess restoration status and burning requirements of burn blocks. Assign burn blocks as either growing season or dormant season burn, restoration burn, fuel reduction burn, or no burn.

5.8 Wetlands

5.8.1 Management Issues

Waters of the U.S., including jurisdictional wetlands, are protected by the CWA under Sections 401 and 404. The USACE and USEPA jointly administer Section 404 of the CWA, and states implement Section 401. Activities that may require permits under the CWA include discharge of material into waters of the U.S., stream relocations, road crossings, stream bank protection, construction of boat ramps, certain ditching, mechanically clearing a wetland, and building in a wetland.

Executive Order 11990 requires federal agencies minimize any significant action that contributes to the loss or degradation of wetlands, and requires that proactive enhancement their natural value. Department of the Army policy is to avoid adverse impacts on existing aquatic resources and offset those adverse impacts which are unavoidable. Additionally, the Army strives to avoid net loss of the value and functions of existing wetlands, and permits no overall net loss of wetlands on Army-controlled lands. The Department of the Army takes a progressive approach toward protecting existing wetlands, rehabilitating degraded wetlands, restoring former wetlands, and creating wetlands in an effort to increase the quality and quantity of the Nation's wetland resources. DoD natural resources policy states that wetlands will be protected to the extent possible. All activities that affect wetlands require an environmental analysis in accordance with AR 200-1, 32 CFR 651 and applicable federal and state laws and regulations.

As a signatory member of the North American Waterfowl Management Plan Cooperative Agreement with USFWS, the Secretary of the Army underscores the importance of participating in the international effort to restore declining waterfowl populations, including species that utilize wetlands.

5.8.2 Goals and Objectives

Wetlands on Fort Campbell are managed in accordance with DoD natural resources policy, which indicates there should be no net loss of wetlands. Consistent with Executive Order 11990, goals and objectives for wetland management at Fort Campbell take a progressive approach toward avoiding effects to existing wetlands and rehabilitating degraded wetlands. Where impacts to wetlands are not avoidable, mitigation of the impacts will be implemented.

Goal 1: *Ensure compliance with the Clean Water Act Sections 401 and 404.*

Objective 1: The Wetland Manager will conduct timely reviews of proposed project plans; identify potential effects to wetlands; advise the project proponent of means to avoid or minimize effects; lead necessary permitting; and direct mitigation efforts for unavoidable impacts.

Objective 2: Maintain a database of the location of wetland boundaries that is not more than five years old, to facilitate identification of areas that should be avoided during construction, training, and land management activities.

Objective 3: Conduct wetland surveys and functional assessments as necessary to assess effects of proposed projects, and to maintain the database. The USACE typically accepts wetland delineations for up to five years. To maintain current documentation on jurisdictional wetlands, wetlands for which delineations are four years or older will be re-evaluated using USACE delineation methods. Priority will be given to wetlands that are located near frequent training and maneuver sites (e.g., firing points, TOC sites), and proposed project sites. An updated jurisdictional determination will be requested from the USACE if warranted.

Objective 4: To the maximum extent practicable, plan development and training to avoid impacts to wetlands. When impacts are unavoidable, prepare appropriate permit applications and mitigation plans in coordination with the USACE.

Monitoring Action 1: The Wetland Manager will review the GIS database annually to ensure data associated with wetlands is current and accurate with respect to the most recent wetland delineation reports.

Goal 2: *Protect wetlands to ensure "no net loss" per Executive Order 11990.*

Objective 1: Continue the environmental clearance review process to protect wetlands.

Objective 2: Provide certified jurisdictional wetland delineations (and permit application, if necessary) before construction occurs in a suspected wetland.

Objective 3: Work directly with troop units to ensure compliance with wetlands provisions within Range Regulation 350-5.

Objective 4. Develop wetland management plans for individual wetlands, including wetland inventory, evaluation of condition, determination of target conditions, management strategy, and a monitoring program.

Objective 5. Incorporate BMPs into all forest product availabilities for inclusion in Corps of Engineers contracts for forest harvest on Fort Campbell.

Objective 6. Investigate the development of a wetland mitigation bank.

Goal 3: *Prevent/minimize degradation of wetlands by educating soldiers, residents, and employees about wetlands.*

Objective 1: Continue to disseminate guidance about conservation of wetlands to DPTMS prior to training on Fort Campbell. Ensure that training units have proper spill containment equipment to mitigate potential problems in wetlands. Instruct the EQO class, and provide current information in the DPW Environmental Handbook. Review the EQO class and Handbook information annually to ensure it is up to date.

Objective 2: Coordinate with appropriate Directorates to encourage project managers to notify the Conservation Branch about potential projects early in the planning process to determine the potential for adverse impacts on wetlands and to avoid or mitigate expected impacts.

Goal 4: *Minimize damage to wetlands, and input of sediment and other contaminants to wetlands.*

Objective 1: Maintain vegetated buffers at least 100 feet wide around wetlands. Where it is determined that a wetland has, or could have, significant habitat value, or where current activities adjacent to a wetland are causing noticeable adverse impacts on the habitat, buffers of wider than 100 feet will be considered. Activities within buffer zones are limited to those that would cause little or no impact on or disturbance to the wetland. Unless required by the military mission, training activities within the buffer zone should be minimized; foot travel should be limited, and vehicles should be kept outside the buffer zone.

Objective 2: Review operations and maintenance programs that potentially affect wetlands (e.g., mowing), and develop procedures and guidelines to avoid the degradation of wetland functions.

Monitoring Action 1: Annually inspect vegetated buffer zones around wetlands on Fort Campbell.

Goal 5: *Restore degraded wetlands to support future mitigation requirements (i.e. mitigation bank), as resources are available.*

Objective 1: Identify areas on Fort Campbell where wetlands formerly existed, or wetlands that have degraded functions and values. The AO program manager will identify, in the GIS database, drained or tiled fields that could be restored to wetland.

Objective 2: As funds are available, prepare and implement restoration plans designed to improve the function and value of individual wetlands. Coordinate plans, implementation, monitoring, and funding with appropriate state and federal agencies.

Monitoring Action 1: Wetlands designated for mitigation typically must be monitored to ensure the required function and value is achieved. In coordination with USACE, Fort Campbell will prepare and implement monitoring plans for each wetland mitigation area.

5.9 Fish and Wildlife

5.9.1 Management Issues

Fort Campbell strives to maintain a diverse, self-sustaining ecosystem that includes populations of native game and non-game wildlife and fish. As stated in AR 200-1, installation commanders and Army natural resource managers are required to develop and implement strategies to maintain viable populations of native plants and animals, maintain natural genetic variability, maintain the full spectrum of functioning ecosystems and biological communities, and integrate human activities with the conservation of biological diversity.

Game and non-game species are managed primarily with an ecosystem-based approach, which emphasizes maintaining diversity and suitability of native habitat types so that native communities of fish

and wildlife become self-sustaining. Management of migratory birds is guided by the Migratory Bird Treaty Act (MBTA) and Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds."

Management of game wildlife (e.g., deer, waterfowl, quail) on Fort Campbell is also important in providing recreational opportunities (e.g., hunting and fishing) to employees, military personnel, residents, and visitors on the installation. The purpose of sport fisheries management at Fort Campbell is to provide quality recreational fishing opportunities for Fort Campbell anglers while maintaining a balanced and diverse aquatic ecosystem.

5.9.2 Goals and Objectives

Goal 1: *Manage habitat to promote a balance of natural ecological processes and trophic structure that sustain native wildlife and fish.*

Objective 1: Manage habitat to maintain a mosaic of natural habitat types (e.g. forest, old field, native grass barrens, riparian zone, streams) that support self-sustaining communities of native non-game and game wildlife and fish species.

Objective 2: Where monitoring shows significant changes in abundance of indicator wildlife/fish species relative to the baseline population, modify DFCs in the Open Area Management Plan or the Forest Management Plan to adjust the abundance or quality of available habitat, including restoration of certain habitat types.

Objective 3: Evaluate the abundance and diversity of aquatic and terrestrial invertebrates that provide the basic trophic levels of the ecosystem food web on Fort Campbell. Taxa to be surveyed include aquatic and terrestrial insects, moths, butterflies, and beetles. Surveys should establish baseline information about abundance and diversity of invertebrate communities.

Objective 4: Sample small mammals to monitor population trends that may affect sustainability of the ecosystem. Sample in a variety of habitat types. Develop baseline measures for abundance and species richness.

Monitoring Action 1: Sample small mammals every two years to identify population trends

Objective 5: Develop a work plan to survey population densities of coyote, bobcat, red fox and gray to evaluate function of predators in the ecosystem. Train a Fort Campbell biologist to handle, anesthetize and take tissue samples from study animals for population health studies.

Objective 6: Develop a management plan for grassland birds that characterizes the quantity and quality of habitat needed to support a self-sustaining grassland bird community, with emphasis on rare species. The plan will describe management and monitoring techniques.

Objective 7: Implement the Tennessee Amphibian Monitoring Program protocols (http://www.tn.gov/twra/tamp/tamp.shtml) to monitor populations of amphibians. Compare results of surveys on Fort Campbell to the regional survey to determine whether changes occurring locally reflect regional trends or local causes. Use the Amphibian Research and Monitoring Initiative Protocol (Appendix G) to monitor abundance of amphibians in vernal ponds. Monitoring will be conducted at least every two years.

Objective 8: Participate in regional efforts to sustain native game and non-game wildlife and fish. Coordinate with KDFWR and TWRA to stay informed about regional trends in wildlife population changes, and particularly the State Wildlife Action Plans.

Goal 2: *Identify and inventory important wildlife habitat features; determine habitat values for special management and natural areas; determine burning requirements for habitat restoration and maintenance; and identify potentially limiting factors to wildlife populations.*

Objective 1: Create and maintain an installation-wide wildlife habitat inventory for Fort Campbell. Incorporate forest inventory data, natural community maps, soils, hydrology, and land use maps. Develop and annually update prescribed fire map for habitat management needs within the annual fire plan.

Objective 2: Create and maintain habitat maps showing both existing and desired habitat conditions, commensurate with the rate of management treatment schedules. Incorporate maps into forest stand and natural community layers.

Objective 3: Create and maintain specialized wildlife habitat and management maps.

Objective 4: Incorporate wildlife habitat inventory into the training area prescription process and other natural resource management planning. Prioritize map development for management prescriptions.

Objective 5. Monitor naturally-occurring important food species, such as legumes.

Goal 3: *Enhance habitat to support abundant, self-sustaining populations of native game and non-game wildlife and fish.*

Objective 1: As resources and opportunities allow, continue to place nest boxes for cavity nesting birds throughout the installation (particularly bluebird boxes near the cantonment area for insect control measures). Nest boxes may be provided for bluebirds, kestrels, owls, and wood ducks. Record locations of nest boxes in the GIS database to facilitate monitoring and upkeep. Monitoring will be conducted as time and funds allow. Continue to foster involvement of local civic groups (such as the Boy Scouts and Girl Scouts) to install and monitor boxes.

Monitoring Action 1: Annually monitor and maintain wood duck boxes to evaluate habitat use, and trends in population levels and nesting behavior.

Objective 2: Every two years, establish at least five new pools in the rear area that provide drinking water for wildlife and breeding habitat for amphibians.

Objective 3: Establish food plots. Identify suitable locations, and plant annually. Install waterfowl-friendly food plots near wetland areas in coordination with the Wetland Program Manager.

Objective 4: Install recycled Christmas trees or broken concrete pipes in lakes/impoundments to enhance habitat for fish.

Goal 4: *Promote the goals of the MBTA and Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds."*

Objective 1: Monitor the status, health, and habitat use of migratory birds and raptors, emphasizing certain target or indicator species that are state-listed or ranked by the states as imperiled.

Monitoring Action 1: Conduct annual surveys of heron rookeries and nesting sites for species of migratory birds that are state-listed.

Objective 2: Integrate migratory bird habitat and population conservation principles, measures, and practices, into Fort Campbell land management plans.

Objective 3: Coordinate with other agencies and non-federal partners, especially Partners in Flight, in planning efforts related to migratory bird conservation.

Monitoring Action 1: Continue participating in the national Partners in Flight neotropical migratory bird monitoring program to determine nesting locations, population densities, species abundance of BCC species in various habitat types on the installation. Efforts should support a "sink" or "source" determination.

Objective 4: Ensure that Fort Campbell's environmental review process and NEPA documents evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern, species in need of management, and imperiled species.

Objective 5: Coordinate with the USFWS prior to identify potential risk factors for unintentional take of migratory birds, and minimize unintentional take to the maximum extent practicable.

Objective 6: Promote research and information exchange related to the conservation of migratory bird resources.

Objective 7: Provide training and information to appropriate employees on methods and means of avoiding or minimizing the take of migratory birds and conserving and restoring migratory bird habitat.

Goal 5: *Manage the hunting and fishing programs to provide adequate recreational opportunities consistent with requirements in the Sikes Act, and to establish self-sustaining populations of game wildlife that are an integral part of the ecosystem.*

Objective 1: Each year, set hunting bag limits at levels that promote diversity of game wildlife, avoid causing overpopulation of any one species, and, to the extent practicable, respond to public demand.

Monitoring Action 1: Annually monitor populations of deer, quail, turkeys, and rabbits and compare results to population goals and hunting bag limits established for each species. If population goals are not met, adjust hunting seasons and/or bag limits.

Monitoring Action 2: Annually review information collected from hunters to determine if the hunting program meets public demand. To the extent practicable, adjust bag limits, areas available for hunting, or other aspects of the hunting program to maximize public accessibility.

Objective 2: Implement the quail management plan to ensure populations are self-sustaining and of adequate size for the desired level of hunting, and that adequate suitable habitat is present on the installation.

Objective 3: Implement the current waterfowl management plan to ensure populations are self-sustaining and of adequate size for the desired level of hunting, and that adequate suitable habitat is present on the installation.

Monitoring Action 1: Initiate, in conjunction with TWRA or the USFWS, annual surveys to capture and band wood ducks and resident geese to monitor population densities and movements.

Monitoring Action 2: Conduct annual waterfowl surveys on impoundments and selected wetlands to assess the abundance and diversity of waterfowl present on Fort Campbell. Coordinate results with the Land Management Program Manager to support wetland functional assessments (Objective 23.3).

Objective 4: Stock sport fish at locations and levels that promotes recreational fishing on the installation. Stocked fish will be native species except where trout are stocked to support the recreational angling program.

Monitoring Action 1: Survey impoundments and conduct creel surveys to evaluate populations of sport fish. Creel surveys will be conducted annually. A survey using electroshocking equipment will be conducted in at least one impoundment each year. Results of the electroshocking survey will be used to determine necessity for subsequent surveys. Fort Campbell will coordinate with the KDFWR Western Fishery District regarding support for electroshocking study of Lake Kyle.

Monitoring Action 2: Conduct an electroshocking survey of the eight major streams, and Raccoon Branch, on Fort Campbell, to monitor abundance and diversity of fishes, and identify areas where habitat quality affects fish abundance or diversity.

Objective 5: Develop an angler reporting form to assist gathering information about fish populations to evaluate the fishing pressure, catch rates, and the number of anglers using each water body.

Monitoring Action 1: Review angler reporting forms and interview anglers to ensure ease of access to preferred fishing sites, and to assess the effectiveness of recreational fishing opportunities offered by Fort Campbell. Up to two major streams will be surveyed each year, in accordance with the Watershed Management Plan.

Goal 6: *Minimize conflict between aviation activities and wildlife at Campbell Army Airfield (CAAF) and Sabre Army Airfield (SAAF).*

Objective 1: Conduct surveys to systematically evaluate daily activity patterns of birds at CAAF and SAAF. Survey results will identify which species may pose hazards to aircraft at which times of day. Determine if conditions exist at the airfield attract birds, such as roosts or perches, or fields and wetlands that attract birds.

Objective 2: Standardize coordination between the airfield, flight safety, operations, fish and wildlife and pest management program managers to minimize wildlife hazards to aircraft, and to manage habitat near the air field to minimize presence of potentially hazardous wildlife.

Objective 3: The Integrated Pest Management Program and Fish and Wildlife Program manager will coordinate to develop and implement plans, based upon the U.S. Air Force BASH (bird-air strike hazard management) procedures, to manage and control potentially hazardous wildlife near CAAF.

Goal 7: *Educate the Fort Campbell community about wildlife management initiatives, associated recreational opportunities, and wildlife native to the installation.*

Objective 1: Develop a one-page hand-out designed to increase public awareness about how to respond to wildlife encounters, problems with pest animals (e.g., skunks or raccoons in residential areas), and conflicts with potentially dangerous wildlife (e.g., copperhead snakes). The hand-out will be available at the Hunting and Fishing Unit and the horseback riding stables, and posted on the Fort Campbell website.

Objective 2: Develop an educational brochure that can be handed out to anglers when they purchase a permit to fish on Fort Campbell. The brochure will include illustrations of the species common to the installation. The brochure will explain the importance of completing the angler reporting forms, what the data is to be used for and its importance, and how the data will be used to improve the quality of the fishing at Fort Campbell.

Objective 3: Facilitate public meetings and forums for hunter education and hunter involvement in wildlife management planning and projects. Include annual research briefings to quail hunters to provide information on the management and status of quail hunting on post.

Goal 8: *Work within integrated management planning teams to measure and maintain maximum abundance and distribution of important wildlife food plants.*

Objective 1: Incorporate production of native wildlife food plants into the training area prescription process.

Objective 2: Develop techniques and establish trials for the use of native plant species for both soil stabilization and wildlife habitat enhancement. Rigorously monitor planting trials to evaluate results. Sources of native plants are difficult to find, especially those which supply native stock with local genotypes.

Goal 9: *Provide supplemental feed, cover, and brood rearing wildlife habitat and enhance outdoor recreational opportunities.*

Objective 1: Annually map existing and proposed wildlife food plots using GIS and provide data to the GIS server.

Objective 2: Repair or replace wildlife opening signs by 2023.

Objective 3: Plant and maintain wildlife openings by providing supplemental food, cover, or habitat structures.

Objective 4: Manage log decks to supplement wildlife openings.

Objective 5: Evaluate the feasibility and management potential for enhancement of grassland habitat functions in multiple-use open areas. Experiment with soil stabilization, LRAM, and other land management programs to find win/win multiple objective strategies in permanently open areas.

Goal 10: *Maximize military training land value and wildlife habitat values for cover dependent priority wildlife species throughout Fort Campbell without compromising habitat requirements for those priority species that are cover intolerant.*

Objective 1: Complete projects to create and maintain coarse woody debris, brush piles, and/or cover plantings in conjunction with silviculture, troop training, soil stabilization, and other activities. Use byproducts from forest treatments, Christmas tree production, and other activities to economically create wildlife cover. Monitor wildlife use of these types of cover and adjust the program as required.

Objective 2: Protect scrub and oak/hickory patches, cedar plantations, coarse woody debris, and other cover features from fire. Experiment with fire protection techniques including, but not limited to, manipulation of patch canopy closure and species composition for fuel suppression, pre-burning patches within burn blocks using low intensity fire, suppressing fire within patches during intensive burning, combining wildlife opening and cover locations into fire suppression areas, development and use of burn maps showing target fire intensity within burn blocks, planting fire retardant woody vines in brush piles, and the testing and application of other innovations as conceived.

Objective 3: Develop and implement a strategy to inventory, monitor, and manage snags and natural cavities across forest stands. Initiate monitoring and research as needed to assess snag use and/or requirements for priority wildlife species.

Goal 11: *Monitor fisheries resources to assess and steer lake management to produce desired fish diversity and optimum sustained yield of fish for anglers.*

Objective 1: Develop and update management plans as required to utilize data collected.

Objective 2: Reshape Lake Kyle banks to a 3:1 slope to facilitate future management.

Objective 3: Maintain Lake Kyle dam integrity, water control structure, lake access, boat ramps, and fishing trails as needed.

Objective 4: Apply liquid fertilizer (0-34-0 or 10-34-0) annually to Lake Kyle in April to increase fish carrying capacity and production and reduction in aquatic weeds.

Objective 5: Stock grass carp in Lake Kyle at about 10 fish per acre of weed cover.

Objective 6: Use Rodeo® or other approved aquatic herbicides as needed to supplement grass carp as an aquatic control agent.

Objective 7: Regulate harvest to ensure that fish populations in each lake can support the fishing pressure they receive.

Objective 8: Regulate fish harvest to maintain optimum fish populations, establish harvest objectives in terms of fish taken per hour, and analyze creel data to determine effort, success, and harvest of individual species by lake.

Objective 9: Update fish population data annually using fisheries and/or creel surveys.

Objective 10: Designate fish harvest for each body of water by daily take, possession, and length limits for each recreational fish species.

Objective 11: Use rotenone or other approved chemicals if control of undesirable species is needed.

Objective 12: Stock sport fish annually in ponds and lakes on the installation to develop sustainable fisheries.

Objective 13: Annually, conduct fisheries surveys of intensively managed impoundments: Lake Kyle, Training Area 9B pond, and the un-named lake in Training Area 8A.

Objective 14: Conduct fisheries surveys in other accessible waterways every five years.

Objective 15: Monitor streams and native fish populations using the Index of Biotic Integrity. Develop a stream monitoring rotation to determine the ecological health of streams.

Goal 12: *Maintain wildlife populations at target levels in accordance with species priorities, population ecology, population health considerations, and habitat capacities.*

Objective 1: Implement sustainable harvest limits for game species to produce population surpluses on a sustained basis.

Objective 2: Ensure 60% of white-tailed deer harvested are females.

Objective 3: Implement and monitor a Quality Deer Management system to ensure adequate harvest of does and restraint on the harvest of young antlered bucks.

Objective 4: Relocate quail to newly created or enhanced habitat areas, as a lower priority project and monitor results.

Objective 5: Coordinate development and monitoring of quail hunting systems with regional biologists and quail management groups. Volunteer the post as a good location to evaluate effects of hunting systems on quail abundance.

Objective 6: Establish and manage blinds for waterfowl hunting in the Training Area 19 mitigated wetland site.

Objective 7: Continue to monitor deer population status during the plan period using check stations, spotlight counts, track counts, and if needed, disease/parasite evaluations. Techniques are not expected to change, but post biologists will use improved techniques if they appear to be cost effective.

Objective 8. Evaluate the turkey population utilizing an index to productivity in the form of adult:poult ratios. Augment these counts with observations by field personnel and hunters and with hen:poult ratios derived from late summer sightings.

Objective 9: Collect biological data associated with small game harvests to assess and monitor population health. Statistically analyze these data to determine population levels, trends, and required harvest strategies.

Objective 10: Monitor quail densities using spring and fall call counts per the Quail Management Plan.

Objective 11: Develop small game flush counts (walking surveys) and other monitoring to monitor and adjust adaptive management. Conduct these surveys in spring, early fall (pre-hunting season), and early winter (post-hunting season) to monitor population changes throughout the year. Calibrate survey techniques using small areas with relatively known population sizes.

Objective 12: Select skilled hunters who are willing to keep annual standardized journals of sightings of game species to monitor changes in game populations by areas.

Objective 13: Use track and pellet counts on routes between scent stations for predators as a rough index to small game species.

Objective 14: Monitor wood duck population productivity as part of the wood duck box management program.

Objective 15: Develop a strategy to evaluate effects of predation on wildlife.

Goal 13: *Monitor population trends and habitat preferences for nongame birds on Fort Campbell. Steer adaptive management activities for high priority nongame bird species during the training area prescription development process.*

Objective 1: Monitor breeding birds annually using breeding bird survey routes, which are also quail call routes. Conduct the census annually during June and very early July, to coincide with existing 20-year quail call count database.

Objective 2: Participate in the annual Christmas Bird Count.

Objective 3: Participate in the annual migration census during the first week of May.

Objective 4: Participate in the Mapping Avian Productivity and Survivorship (MAPS) program, operating a MAPS station as part of a nationwide study. Convert the MAPS program to a cooperative program involving in-house, contract, and volunteer personnel by 2020.

Objective 5: Assess habitat use and management potential for grassland and other specialized habitat bird species.

Objective 6: Conduct owl surveys to determine populations and distribution on Fort Campbell using hooting owl calls.

Goal 14: *Monitor population trends and habitat preferences for nongame wildlife, excluding birds, on Fort Campbell. Steer adaptive management activities for high priority nongame species during the training area prescription development process. Use nongame population monitoring to assess ecosystem health.*

Objective 1: Continue to maintain and distribute comprehensive wildlife checklists and occurrence records for all wildlife species occurring on the installation. Continue to update and share this information with the KDFWR, TWRA, USFWS, and any other state agency or education institution.

Objective 2: Monitor nongame in conjunction with land management activities to determine pre- and post-treatment populations in special management areas. Monitor appropriate nongame species as described above for neotropical migrant birds and threatened / endangered species.

Objective 3: Develop a combined track/pellet count/scent station system to primarily monitor furbearers and predators.

Objective 4: Investigate the need and techniques for monitoring predators, primarily coyotes, using calling surveys.

Objective 5: Develop monitoring strategies for nongame species as bio-indicators of land use and management. Apply priorities to species of concern and/or by natural community. Use suspected or known listed species, species of high conservation priority, and sensitive species as indicators of habitat or natural community condition. Select natural communities by those that are essential to priority species, important to military training, sensitive to land use impacts, and/or those most likely to show overall ecosystem health.

Objective 6: Conduct surveys for butterflies, moths, and other pollinators throughout the natural communities on Fort Campbell and develop habitat specific management plans support sustainable populations.

5.10 Endangered, Threatened, and Species At Risk

5.10.1 Management Issues

Animals and plants federally listed as threatened or endangered receive protection under the Endangered Species Act. All Army land uses, including military training and testing, timber harvesting, and recreation, are subject to ESA requirements for the protection of listed species and critical habitat. Management of federally listed species on Fort Campbell is conducted in accordance with the Endangered Species Act, Endangered Species Recovery Plans, and U.S. Army regulations and guidance. The ESA requires all federal agencies to conserve listed species. Conservation, as defined by the ESA, means the use of all methods and procedures necessary to bring any listed species to the point where protections pursuant to the ESA are no longer necessary. The act specifically requires agencies not to “take” or to “jeopardize” the

continued existence of any endangered or threatened species, or to destroy or adversely modify habitat critical to any endangered or threatened species.

A multi-agency Memorandum of Understanding (MOU; 28 September 1994) provides the U.S. Army with guidance for implementing the Endangered Species Act. It establishes a framework for cooperation and participation among the agencies exercising their responsibilities under the ESA. The MOU states that the DoD and Department of Interior will work together to achieve the common goals of (1) conserving listed species, (2) using existing Federal authorities and programs to further the purposes of the ESA, and (3) improving the efficiency and effectiveness of interagency consultations conducted pursuant to Section 7(a) of the ESA. Each signatory agreed to (1) use its authorities to further the purposes of the ESA by carrying out programs for the conservation of federally listed species, including implementing appropriate recovery actions that are identified in recovery plans; (2) identify opportunities to conserve federally listed species and the ecosystems upon which they depend within existing programs and authorities; (3) determine whether respective planning processes effectively help conserve threatened or endangered species; (4) establish programs to evaluate and reward the performance of personnel who are responsible for planning or implementing programs to conserve or recover listed species or the ecosystems on which they depend.

The policy of the U.S. Army strives to balance mission requirements with endangered species protection, cooperation with regulatory agencies, and conservation of biological diversity. In accordance with AR 200-1, Fort Campbell has prepared an ESMC that addresses federally listed species on the installation: the gray bat, the Indiana bat, and the northern long-eared bat. No Critical Habitat for these species exists on Fort Campbell. The ESMC establishes conservation goals and objectives for federally listed species on Fort Campbell. Because those goals and objectives, and associated monitoring efforts must be fully integrated with installation training and non-training activities, they are included in this section of the INRMP.

Species that are proposed or candidates for federal listing are not protected under the ESA. No species that are proposed or candidates for federal listing occur on Fort Campbell. Species that are state-listed as threatened, endangered, or of special concern are not protected under the ESA (unless the species is also federally listed). AR 200-1 indicates that U.S. Army installations must be sensitive to species that are not federally listed, but are listed by the State as endangered or threatened. Whenever feasible, installations should cooperate with State authorities in efforts to conserve state-listed species. State-listed and rare species on Fort Campbell are integral to the ecosystem and their management is important to maintaining biodiversity. Some state-listed and rare species of migratory birds are protected under the MBTA and their conservation on federal lands is prioritized by Executive Order 13186.

5.10.2 Goals and Objectives

These goals and objectives are established to maintain compliance with the ESA, the multi-agency MOU regarding listed species, and Army regulations, as well as to conserve listed species and their habitat on Fort Campbell. Goals and objectives established for state-listed and rare species are designed to promote conservation of those species and their habitat, where possible, using a landscape management approach.

Goal 1: *Ensure proposed projects are in compliance with the ESA.*

Objective 1: The Endangered Species Manager will support project planning and timely environmental reviews under NEPA to identify potential effects to listed or rare species. Biological Assessments supporting a Determination of Effect (DoE) are prepared for all proposed projects that may

affect a federally listed species. If a proposed project may affect federally listed species, the Fish and Wildlife Manager will coordinate with the USFWS.

Objective 2: The Endangered Species Manager will plan, develop, and conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities in accordance to published USFWS guidance.

Objective 3: The Endangered Species Manager will request notification when the USFWS is considering making a species in Kentucky or Tennessee a candidate for listing.

Goal 2: *Continue to provide suitable habitat on Fort Campbell for Gray, Indiana and Northern long-eared bats.*

Objective 1: To provide suitable roosting and foraging habitat for Indiana and Northern long-eared bats on the installation, allow 4000 acres of forest to achieve old growth conditions, characterized by numerous large-diameter trees with dominant trees between 100 and 200 years old, snags and dying trees of all sizes, and downed rotting trees. Detailed description of old growth forest conditions is provided in the FMP. At least 2830 acres in the Saline Creek and Casey Creek watersheds, where both species have been captured, will be allowed to achieve old growth status.

Monitoring Action 1: Every two years, inspect 500 acres of forest designated to become old growth. Using an established sampling protocol, evaluate forest habitat parameters identified in the Indiana Bat Summer Habitat Suitability Index Model (Rommé et al. 1996) to verify that habitat suitable for summer roosting and foraging Indiana and Northern long-eared bats are present in the Casey Creek and Saline Creek watersheds. If average habitat suitability in sampled areas is less than moderate, the Fish and Wildlife and Forestry program managers will coordinate and develop treatments to improve parameters that are contributing to low suitability. Potential improvements may include girdling certain trees to increase availability of potential roost trees, or thinning.

Objective 2: During forest management activities (including those under contract) evaluate all cavities on snags and trees on a case-by-case basis, except where they are hazardous to humans.

Objective 3: Restrict removal of trees to times of the year when the Indian bat is not present (15 November through 15 March) to avoid harm to roosting Indiana bats.

Monitoring Action 1: Annually compile a report of the number of acres, location, and timing of timber harvests to inform the USFWS of tree clearing activities.

Objective 4: Provide good quality water and aquatic habitat for foraging bats.

Monitoring Action 1: Measure the condition and quality of riparian zones, water, and aquatic habitat, by implementing monitoring actions to evaluate quality of foraging habitat for foraging bats.

Objective 5: Maintain forested riparian zones at least 100 feet wide along perennial and 50 feet wide along intermittent streams, which provide foraging habitat for gray bats and Indiana bats. In riparian zones that are not currently forested, encourage development of forest by planting trees, and/or avoiding actions that inhibit natural succession to forest. Minimize activities that remove forest in riparian zones,

including timber sales, and establishment of skid trails or firebreaks. Timber stand improvement and prescribed fire, when used in riparian zones, will be carefully planned to avoid removing canopy trees.

Objective 6: Develop and implement a snag creation and management program in conjunction with the HMA prescription process and other natural resource management activities.

Objective 7: Maintain concentrations of chemicals/nutrients related to agricultural activities below minimum detection limits in streams with sources on Fort Campbell.

Goal 3: *Improve understanding about the habitat use of gray, Indiana, and Northern long-eared bats on Fort Campbell, to support effective habitat management and recovery of these species.*

Objective 1: Assess the relative abundance of foraging bats on Fort Campbell compared to similar sites in the region.

- Review the results of regional mist net surveys to compare the capture rate of gray bats (number of gray bats captured per net-night);
- Coordinate with TWRA to obtain other reports of mist net surveys conducted in middle Tennessee and southwestern Kentucky, and determine capture rates of gray bats;
- Use ultrasound detectors to determine habitat selection of Indiana and Northern long-eared bats on Fort Campbell. Bat detectors will be deployed at all sites on the same nights, for at least ten nights, between May 15 and August 15; and
- Use mist nets to compare relative abundance of foraging Indiana, gray, and Northern long-eared bats on Fort Campbell to sites outside the installation. Sites selected will be as similar as possible in stream characteristics (channel width, stream flow, riparian vegetation type, canopy closure), distance from gray bat summer roost caves, and other factors (illumination from man-made sources, human disturbance).
- Review installation and regional capture results for little brown bats (*Myotis lucifugus*) and tricolor bats (*Perimyotis subflavis*) in an effort to determine causes for their substantial decline. Compare habitat suitability models with annual capture data.

Objective 2: Identify, locate, and map all Indiana and Northern long-eared bat roost trees on the installation.

Objective 3: Update the installation survey every five years to document distribution of gray, Indiana, and Northern long-eared bats on the installation.

Objective 4: Conduct annual inspections of all assigned Cold War Era below ground bunkers.

Objective 5: Design a scientifically valid population monitoring program to measure endangered bat population trends and correlations to training intensity.

Objective 6: Sample a minimum of 25 (50 net nights) sites per year to collect baseline data of the population on Fort Campbell.

Objective 7: Correlate endangered bat population data with training intensity.

Goal 4: *To the maximum extent practicable, contiguous tracts of forest will be maintained in the Casey, Saline, Fletcher's Fork, Jordan, and Piney Fork watersheds. These watersheds lie between foraging areas and roost caves (Tobaccoport, Big Sulfur Springs, and Bellamy caves used by Indiana bats and gray bats.*

Objective 1: The Fish and Wildlife Program will review proposed construction projects. To the maximum extent practicable, proposed tree clearing within the Casey, Saline, Fletcher's Fork, Jordan, and Piney Fork watersheds will be sited in previously disturbed, non-forested areas. The F&W Program Manager will advise project proponents to design and site projects such that forested corridors are maintained.

Goal 5: *Construct and maintain artificial roost habitat for Indiana and Northern long-eared bats.*

Objective 1: Construct artificial roost habitat within the Cold War Era bunkers for Indiana and Northern long-eared bats.

Objective 2: Construct bat boxes in suitable habitat within the cantonment (developed) area of Fort Campbell.

Objective 3: Construct bat boxes in suitable habitat adjacent to timber harvest areas to provide additional roost locations and minimize impacts to forest bats.

Goal 6: *Continue to participate in regional conservation planning efforts for the gray, Indiana, and Northern long-eared bats.*

Objective 1: Annually, or more frequently, the Endangered Species Manager will coordinate with the USFWS Tennessee and Kentucky Ecological Services Offices to discuss long-term conservation plans and regional trends associated with Indiana, gray, and Northern long-eared bats.

Objective 2: Annually, or more frequently, the Conservation Branch will contact the KDFWR and TWRA to obtain updated results of gray bat and Indiana bat monitoring (summer and winter) conducted by the states. In particular, Fort Campbell will obtain current data regarding population monitoring in Tobaccoport, Bellamy, Cooper Creek, and Big Sulfur Spring caves. Fort Campbell will coordinate with the state agencies to assist identification of regional population trends, changes in distribution, or regional management initiatives for these species.

Objective 3: At least one biologist from the Conservation Branch will participate in the Tennessee Bat Working Group and the National Military Fish and Wildlife Association Bat Working Group to stay informed about studies and management initiatives related to endangered bats that are occurring locally and on other DoD installations.

Objective 4: The Endangered Species Program will contact the Kentucky and Tennessee State Natural Heritage Divisions to obtain updated results of cave surveys conducted by the states to monitor summer and winter populations of gray bats and winter populations of Indiana bats. In particular, Fort Campbell will obtain current data regarding population monitoring in Tobaccoport, Bellamy, Cooper Creek, and Big Sulfur Spring caves.

Goal 7: *Maintain the ESMC up to date as required by AR 200-1.*

Objective 1: The Endangered Species Manager will annually evaluate the status of ESMC objectives, will identify where revised information potentially creates conflict with other INRMP goals/objectives, and will coordinate with appropriate natural resource managers to resolve the issue. Major revision of the ESMC will be accomplished at least every five years.

Goal 8: *Maintain self-sustaining populations of state-listed and rare species on Fort Campbell to the maximum extent practicable.*

Objective 1: Maintain current records in the GIS database of the location of state-listed species of wildlife and plants, and nesting sites of state-listed species of birds to facilitate avoidance of adverse effects to those species. Conduct surveys necessary to maintain current information in the database.

Objective 2: Use GIS to identify habitat types on Fort Campbell that may provide suitable habitat for the state-listed species of animals or plants listed in Tables 5 and 6 (Section 4.13 above). As funding allows, conduct surveys to investigate presence of state-listed species in those areas.

Objective 3: Restrict access and disturbance of nesting and breeding grounds of Species at Risk or state-listed birds during critical periods. Incorporate this restriction into proposed project plans as an impact avoidance measure.

Objective 4: Plan habitat management activities to avoid harm to state-listed plants and animals. Management prescriptions for barrens/old fields inhabited by rare plants will include techniques not likely to destroy existing plants. Prescriptions will include specific timing of activities designed to avoid harm to plants or animals (e.g., nesting birds). Management measures will include:

- Disturbance along training road, 0.3-mile south of range marker 31, will be minimized to avoid damage to *Carex alata*;
- Timber harvest will be restricted in two locations along Saline Creek, and natural barriers will be installed/maintained to discourage visitation to sites containing *Hydrastis canadensis*;
- Timber harvest and prescribed burning will be restricted near five *Juglans cinerea* trees along Saline Creek;
- Timber harvest and digging will be restricted, and natural barriers will be installed/maintained to discourage visitation near the three populations of *Panax quinquefolius*;
- Mowing and deep disking will be restricted in areas containing *Silphium pinnatifidum*; and
- Cultivation and early mowing will be restricted in areas containing *Tomanthera auriculata*, *Prenathes barbata*, and *Prenathes aspera*.

Objective 5: Plan and implement management activities that improve the availability and/or suitability of habitat for state-listed species of animals and plants. Management measures will include:

- In areas containing *Rudbeckia subtomentosa*, woody growth will be mechanically cleared to prevent encroachment on the state-listed plants;
- Implement prescribed burning in the portion of Range 46 containing *Scleria ciliatata*; and

- Implement prescribed burning near *Tomanthera auriculata*, *Prenathes barbata*, and *Prenathes aspera*.

Monitoring Action 1: Conduct stem counts or population estimates at least once per year to assess stability of state-listed plant populations. Implement adaptive management if populations are decreasing.

Objective 6: Conduct installation-wide planning level surveys to determine the presence and distribution of federal or state-listed rare, threatened, and endangered species.

Goal 9: *Continue investigating opportunities to lease or purchase additional land to reduce training density on land necessary for species at risk and threatened and endangered species.*

Objective 1: Support acquisition of additional tracts of land and evaluate cooperative agreement and conservation easement opportunities through the ACUB program.

Goal 10: *Maintain all federal and state banding permits necessary to conduct monitoring and management of bat populations, to include endangered species, and migratory birds.*

Objective 1: Establish a master station permit for Federal Bird Banding Marking and Salvage Permit with Authorization for Auxiliary Marking every two years. Continue to band in accordance with the North American Bird Banding Manual and coordinate color-band combinations with local researchers.

Objective 2: Obtain and Renew Endangered Species Recovery Permits every five years and issue Letters of Authorization to subpermittees.

Objective 3: Obtain and Renew State Collection Permits with KDFWR and TWRA annually and issue Letters of Authorization to subpermittees.

Objective 4: Submit annual reports of capture/banding to the USFWs, KDFWR, and TWRA as required.

Objective 5: Submit annual reports of nesting and habitat enhancement efforts, population trends, and management progress to USFWS and others as required.

Objective 6: Report endangered bat mortality to appropriate state and federal agencies by the next working day. Continue to report ESA violations through the Staff Judge Advocate.

Objective 7: Immediately notify USFWS and IMCOM in the event of any incidental take.

Goal 11: *Develop conservation strategies to protect and manage for species at risk in consultation with the USFWS, TWRA, and KDFWR.*

Objective 1: Consider DoD Species at Risk and Federal Species of Concern in all Army actions, per 32 CFR 651 and AR 200-1.

Objective 2: Utilize species prioritization, habitat modeling, and population monitoring projects to determine wildlife management needs, and measure management effectiveness and land use impacts for priority species. Develop and implement focused or specialized adaptive management plans for priority species or groups of species as needed.

Goal 12: *Develop conservation strategies to protect and manage for State-listed species in consultation with TWRA and KDFWR.*

Objective 1: Consider State-protected species in all Army actions, per 32 CFR 651 and AR 200-1.

Goal 13: *Provide focus for Fort Campbell natural resource management by identifying wildlife species at risk with the highest management priorities for species conservation.*

Objective 1: Develop and apply species priorities and habitat models to direct natural plant community management and habitat landscape design to meet life requisite needs of high priority species.

Objective 2: Apply species priorities as adaptive management targets in treatment monitoring and for alteration of management activities.

Objective 3: Submit Army Species At Risk determinations to IMCOM for funding considerations.

Goal 14: *Develop conservation strategy to protect the active Bald Eagle nest sites on Fort Campbell.*

Objective 1: Monitor nest status, bird health, and document nesting behavior as required during the presence of an active nest.

Monitoring Action 1: Conduct weekly site visits from January through July.

Objective 2: Integrate conservation principles, measures, and practices into Fort Campbell land management and training mission plans.

Monitoring Action 1: Provide annual maps of restrictions for each known active nest site to G3 and Range Branch.

Monitoring Action 2: Update Bald Eagle Management Plan if additional nest sites are found.

Objective 3: Coordinate with other installation Directorates on efforts related to bald eagle conservation.

Monitoring Action 1: Utilize social media outlets to provide updates on bald eagle nesting activity.

Monitoring Action 2: Provide internal status reports to Directorates throughout the nesting season.

5.11 Integrated Pest Management

5.11.1 Management Issues

The Pest Management Program is responsible for protecting human health and preventing or suppressing damage from pests to real estate and natural resources. The primary guidance document for the Pest Management Program is the Integrated Pest Management Plan (IPMP) which was developed and is maintained in accordance with DoD Instruction 4150.07, DoD Pest Management Program, and AR 200-1. The Pest Management Program addresses control of noxious and invasive species of plants, insects, and animals. Control of noxious plants is conducted in accordance with Department of the Army Memorandum, 26 June 2001, "Army Policy Guidance for Management and Control of Invasive Species" and Executive Order 13112.

Routine surveillance is a critical factor to successful integrated pest management. Surveillance methods include sampling and surveying pest populations and monitoring complaints from the Fort Campbell community. Monitoring and adaptive management are built into each pest management initiative. The IPMP provides detailed information about monitoring conducted as part of the pest management program. Appendix M of the IPMP describes thresholds that trigger management actions. This section summarizes selected monitoring actions that integrate with other natural resource management programs, such as control of nuisance wildlife and noxious plants.

5.11.2 Goals and Objectives

Goal 1: *Implement the IPMP in accordance with AR 200-1.*

Objective 1: The IPMP will be updated at least once per year and reviewed by AEC.

Objective 2: Appropriate certifications and training will be maintained for Fort Campbell Professional Pest Management Personnel, pesticide applicators, and others involved in implementing the pest management program. Provide required refresher training and certification training for any new personnel, using the Academy of Health Sciences, Fort Sam Houston, Texas or other approved sources for certification.

Objective 3: Ensure contract personnel are either Kentucky or Tennessee-certified applicators.

Objective 4: Detailed records of all pesticide usage, spills, and reportable human exposures for pest management activities (including those performed under contract, by tenant and supported activities, and by lessees per formal agreements) will be maintained and reported in formats per the DOD Instruction or on equivalent automated systems. The database will be developed and updated annually or more frequently as required. Applicators will be provided palm computers to efficiently record, transfer, and review data.

Objective 5: Maintain a GIS database of pesticide applications (location, purpose, formula) that is updated annually. At least once per year, query the database to identify trends in the locations, types, and amounts of pesticides used.

Objective 6: Pesticide procurement, handling, storage, and disposal will strictly adhere to guidelines established by Federal laws, and DoD and Army guidance, which are described in the IPMP.

Objective 7: Standards for safety and health described in AR 200-1 will be met for each pest management activity conducted by in-house staff or under contract.

Objective 8: Control the quality of pest management activities by conducting detailed inspections of in-house and contract pest control activities. Establish quality control measures to ensure pesticide application is according to label instructions, locations and frequencies of applications follow guidelines of the IPMP, and all pesticides used on the installation are approved and recorded in the IPMP.

Objective 9: Follow precautionary statements on labels regarding contamination of water when pesticides are sprayed near wetlands. Implement special requirements for the protection of recreation areas.

Objective 10: Take special precautions during pest management activities that could affect endangered species or species of concern.

Goal 2: *Reduce pesticide use as required by guidelines.*

Objective 1: Emphasize surveillance before chemical application.

Objective 2: Use more efficient equipment and techniques to reduce chemical volume and toxicity.

Goal 3: *Control disease vectors, medically important arthropods, and other insect pests that are harmful to human health.*

Objective 1: Implement IPMP the West Nile Virus Management Plan.

Goal 4: *Control arthropods, mammals, and turf diseases that may affect the golf course.*

Objective 1: Implement IPMP measures specific to the golf course.

Goal 5: *Control noxious and invasive plants in terrestrial and aquatic habitat. Plants listed as noxious and/or invasive by the US Department of Agriculture and/or the states of Kentucky and Tennessee will be included in the IPMP.*

Objective 1: Implement portions of IPMP that address undesirable vegetation (pre- and post-emergence), broadleaf and grass weeds in corn and soybeans, aggressive species in grasslands, and aquatic weeds in ponds and streams. Depending upon the area to be treated, the Integrated Pest Management, Fish and Wildlife, Forestry, and/or AO program managers will coordinate to develop site-specific prescriptions for controlling invasive plants. Methods may include application of herbicides listed in the IPMP, mechanical control (mowing, disking), or prescribed fire.

Objective 2: Evaluate requirements and conduct control activities for kudzu and other invasive plants as needed.

Goal 6: *Minimize damage caused by nuisance wildlife to real estate and natural resources.*

Objective 1: Implement portions of IPMP that address pigeons, rats, mice, moles, beaver, and deer.

Monitoring Action 1: Monitor deer populations in the cantonment area (night surveys and visual observations) and monitor the rate of vehicle collisions with deer. Implement control measures when data indicates a significant increase in conflicts with deer. Control measures may include: reducing nuisance deer populations around the cantonment area; increasing hunting pressure in training areas near the cantonment area; removing underbrush in the cantonment area; monitor deer/vehicular collisions and take necessary corrective action (e.g., erect deer crossing signs, increase harvesting in certain areas).

Monitoring Action 2: Monitor beaver activity (night survey and visual observation) to identify potential threats to training activities, infrastructure, or real estate. If threats are identified, the Integrated Pest Management Coordinator will plan control activities that minimize impacts to natural resources, such as wetlands, or heron rookeries.

Objective 2: Eliminate feral hogs that have been released on the installation and have established breeding populations. Most significant is the Range 46, and Training Areas 40 and 41 areas.

Objective 3: Provide WASH technical support and assistance as needed and as requested to air operations of Campbell Army Airfield and Sabre Army Airfield.

Objective 4: Monitor, assess, and take corrective or control action as needed for exotic and/or detrimental wildlife species. Problems with endemic wildlife species have mainly involved their use of buildings, such as housing, warehouses, and hangers, and problems with Canada geese on golf courses and airfields. Numbers of nuisance wildlife cases vary seasonally with migration and/or other seasonal wildlife habits. Case responses range from public education to active control activity, both in-house and by pest management contract.

Objective 5: Coordinate and obtain approval of the USFWS for bird control activity, except for unprotected species.

5.12 Outdoor Recreation

5.12.1 Management Issues

The Sikes Act and a Memorandum of Understanding between the Departments of the Interior and Defense requires all military installations to develop outdoor recreation plans where there are suitable resources for such a program consistent with installation mission and national security. Fort Campbell provides outdoor recreational opportunities to military personnel and the general public within the constraints of the military mission and the capability of installation's natural resources. Maintaining a quality outdoor recreation program is dependent on proper management of the natural resources and efficient program administration and oversight.

Outdoor recreation programs offered on Fort Campbell are dependent upon high quality natural resources. The DPW supports the management of natural resources and actively pursues projects that enhance outdoor recreation opportunities. DPW goals and objectives supporting this INRMP are described below.

5.12.2 Goals and Objectives

Goal 1: *Provide outdoor recreational opportunities to the Fort Campbell community and general public.*

Goal 2: *Manage outdoor recreation consistent with needs of the Fort Campbell military mission.*

Objective 1: Update CAM Regulation 200-4, as needed to disseminate changes in procedures.

Objective 2: Continue to evaluate and adjust permit fees. Coordinate any adjustments through affected organizations and the installation chain of command.

Objective 3: Maintain and administer the Fort Campbell iSportsman web portal system to improve processes for permit sales and hunter check in/out.

Goal 3: *Encourage the development of facilities that improve use and enjoyment of fishing, hunting, and other natural resources-based recreation.*

Objective 1: Develop primitive camp sites at Lake Kyle.

Objective 2: Develop a hiking trail within the former Lake Taal basin.

Objective 3: Develop a recreational trail system that supports hiking and biking activities.

Objective 4: Develop interpretative trails to allow Fort Campbell and the surrounding communities non-consumptive wildlife opportunities.

Objective 5: Construct a watchable wildlife site at the Training Area 19 wetland mitigation site.

Objective 6: Increase accessibility for physically impaired sportsman/women. Develop several handicap hunting areas that are wheelchair accessible.

5.13 Climate Change

5.13.1 Management Issues

Climate change is any significant change in measures of climate (such as temperature and precipitation) lasting for an extended period (decades or longer). DoD recognizes that climate change will play a significant role in its ability to fulfill its mission in the future as climate change will affect both built and natural infrastructure, which impact readiness and environmental stewardship responsibilities at installations across the nation. As part of its annual Strategic Sustainability Performance Plan (SSPP), DoD has released its Climate Change Adaptation Roadmap (CCAR) detailing its plan for managing the effects of climate change on its operations and infrastructure in the short and long term (DoD 2012). The CCAR identifies several potential high-level climate change impacts to the DoD mission and operations including rising temperatures; changes in precipitation patterns; increases in storm frequency and intensity; rising sea levels and associated storm surge; and changes in ocean temperature, circulation, salinity, and acidity. However, more comprehensive and region/installation-specific vulnerability assessments are needed to determine what adaptive responses are the most appropriate at individual installations.

5.13.2 Goals and Objectives

These goals and objectives are established to support the DoD climate change policy on Fort Campbell. Goals and objectives established were developed to provide decision makers on Fort Campbell with data to understand climate change-induced impacts to natural resources and their impacts on the training mission. DPW goals and objectives supporting this INRMP are described below.

Goal 1: *Prepare Vulnerability Assessments for natural systems, species and habitats.*

Objective 1: Conduct internal climate change vulnerability assessments with installation stakeholders to provide a framework for understanding why particular species, systems, or activities are likely to be vulnerable. Vulnerability assessments of natural systems are conducted at the biological levels of species, habitats, and ecosystems, and should consider the current context of existing stresses such as habitat fragmentation and invasive species in addition to climate projections.

Monitoring Action 1: Establish an installation climate change working group to conduct vulnerability assessments and develop action plans to ensure no net loss of the training mission by 2021.

Monitoring Action 2: Develop vulnerability assessments for each natural system, species and habitats that may be degraded by climate change and impose restrictions or negatively impact the training mission by 2025.

Objective 2: Develop a climate change appendices that identifies climate-related threats and resulting stresses to be utilized as part of the decision-making process undertaken to identify and prioritize conservation strategies.

Goal 2: *Collect climate informed data.*

Objective 1: Gather data related to the climate, information should be gathered from several sources. RAWS will be maintained every year to monitor the weather and fuel moisture. Wildfire mapping will also continue yearly.

Objective 2: Develop annual climate summary data for the installation and compare to regional trends. Data will be utilized during the annual vulnerability assessment action plan review.

Objective 3: Conduct yearly monitoring of insect functional guilds (e.g., decomposers, pollinators, herbivores, predators) per plant community to maintain awareness of any changes as a result of climate change. During insect monitoring on the installation, climate data will also be collected to inform the analysis of the potential impacts of climate change on species.

Objective 4: Conduct yearly monitoring of plant and animal communities to maintain awareness of any changes as a result of climate change.

Goal 3: *Adapt and mitigate the adverse impacts of climate change through long-term planning and annual goal setting based on science-based scenarios, targets, collaborative planning, and adaptive management.*

Objective 1: Identify data and research needs for ensuring an effective response to the impacts of climate change.

Monitoring Action 1: Identify species and communities resilient/vulnerable to climate change impacts by conducting climate change vulnerability assessments.

Monitoring Action 2: Improve the application of models through data collection and validation (as feasible and needed) and for using such science-based models in environmental and natural resources management planning.

Monitoring Action 3: Improve the graphical depiction of the potential impacts of climate change on species ranges and population abundances in climate change vulnerability assessments.

Objective 2: Adapt and mitigate the adverse impacts of climate change, including stresses on infrastructure, aquatic vegetation, erosion, and shifts in distributions of terrestrial endemic species ranges and population abundances, and plant communities.

Monitoring Action 1: Ensure that species/community conservation priorities and expenditures reflect climate change risks, such as those on the margins of their distribution patterns.

Monitoring Action 2: Identify restoration projects to provide habitat elements for specific species, which could be altered by climate change.

Monitoring Action 3: Provide for the management of threatened, endangered, and other special status species to avoid or minimize impacts from climate change.

Monitoring Action 4: Monitor plant community composition and productivity for changes in status, or condition attributed to climate change and implement management strategies to address these concerns.

Monitoring Action 5: Monitor aquatic environments for changes in status, or condition attributed to climate change and implement management strategies to address these concerns.

Objective 3: Address the impact of human use of resources by emphasizing preventative technologies.

Monitoring Action 1: Improve water conservation.

Monitoring Action 2: Improve storm water management through use of low impact development (LID) technologies.

Monitoring Action 3: Improve coordination between natural resources and development project proponents to ensure more energy-efficient design features.

Objective 4: Improve and strengthen coordination among internal and external stakeholders with respect to climate change.

Monitoring Action 1: Establish partnerships for collaboratively addressing climate change issues.

Monitoring Action 2: Analyze project impacts and cumulative effects through NEPA in a consistent way.

Monitoring Action 3: Incorporate climate change in Encroachment Action planning.

Monitoring Action 4: Develop science-based agency coordination to protect, maintain, and restore at-risk habitats.

Objective 5: Ensure that Fort Campbell personnel have access to climate change education and outreach in order to help minimize effects of climate change through modification of individual behavior and lifestyle consumption patterns that contribute to climate change.

Monitoring Action 1: Develop a pamphlet for distribution to units describing best practices for avoiding negative impacts from climate change.

Monitoring Action 2: Develop material appropriate for the Fort Campbell Environmental Division website that informs Fort Campbell personnel and surrounding communities about climate change and planned and/or on-going management actions and stewardship efforts.

Monitoring Action 3: Prepare and deliver a program/educational materials about climate change impacts to natural resources and management responsibilities and stewardship during the annual Earth Day event.

6.0 INRMP IMPLEMENTATION

Fort Campbell depends on natural resources for the sustainability of installation training programs and will manage natural resources to ensure sustainable use. This INRMP is not intended to impair the ability of Fort Campbell to perform its mission. However, the INRMP does identify usage restrictions on sensitive attributes such as wetlands, species at risk, as well as threatened and endangered species.

Implementation of this INRMP will be realized through the accomplishment of specific goals and objectives as measured by the completion of projects described within this INRMP. Because all INRMP projects may not be funded in accordance with levels of effort and schedules described in this plan, implementation of the INRMP is assessed based upon metrics established by the DoD. An INRMP is considered implemented if an installation:

- Actively requests, receives, and uses funds for “must fund” projects and activities;
- Ensures that sufficient numbers of professionally trained natural resources management staff are available to perform the tasks required by the INRMP; and
- Annually reviews the INRMP, documenting accomplishments undertaken each year and coordinating with public agencies as needed.

6.1 INRMP Coordinator

The Environmental Division chief shall assign a wildlife biologist to serve as the coordinator for INRMP implementation and updates. The INRMP coordinator fosters communication among Program Managers, and maintains a record of progress on INRMP projects. Duties of the INRMP coordinator include:

- Coordinates with Program Managers throughout the year to obtain updates on completed and scheduled INRMP projects;
- Leads a bi-annual INRMP coordination meeting;
- Leads the annual review of the INRMP by soliciting progress reports and updates from each Program Manager;
- Annually makes minor changes to the INRMP based upon feedback from Program Managers, and disseminates updates among Program Managers;
- Annually obtains budgets from Program Managers and develops a comprehensive budget for INRMP implementation; and
- Annually reports progress toward INRMP objectives by completing the Conservation Measures of Merit Checklist.

The Fort Campbell Conservation Branch holds a bi-annual INRMP coordination meeting. Individuals involved in natural resources management are required to attend. The purpose of the meeting is to review and discuss progress on INRMP projects and results of monitoring efforts, schedule upcoming projects, ensure no conflicts exist among planned activities, and determine if adaptive management is appropriate for INRMP objectives and projects.

6.2 INRMP Staffing Requirements

The management and conservation of natural resources under Army stewardship is an inherently governmental function. Therefore, the provisions of Army Regulation 5-20 (*Competitive Sourcing Program*) do not apply to the planning, implementation, enforcement, or management of Army natural resources management programs. This includes all positions that have been validated as a requirement to perform natural resources management. However, support to the natural resources program, where it is severable from management, planning, implementation or enforcement actions of natural resources, may be subject to the provisions of Army Regulation 5-20.

The Sikes Act requires that, to the extent practicable with existing resources, an adequate number of professionally trained natural resource personnel shall be available to perform the tasks requirement for successful INRMP implementation. The ideal situation would be for all positions to be full-time, permanent federal positions. Considering current Army personnel policies, the addition of permanent full-time federal positions is not likely in the foreseeable future. A blended workforce appears to be a necessity. Table 9 lists personnel considered critical to minimally and fully implement this INRMP. Natural resource positions are filled to ensure compliance with Federal and state laws and regulations and meet multiple use demands on natural resources at Fort Campbell. Support from contractors will be sought on a project-specific basis depending upon the work load and expertise of Fort Campbell biologists.

6.3 Natural Resource Staff Training

Training received by resource personnel and others participating in the management of natural resources at Fort Campbell will address practical job-oriented information, legal compliance requirements, applicable DoD/Department of Army (DA) regulations, pertinent State and local laws, and current scientific and professional standards as related to the conservation of natural resources. The following annual workshops, professional conferences, and classes are excellent means of obtaining interdisciplinary training for natural resources managers:

- Tennessee and Kentucky Bat Working Groups
- Migratory Bird Working Groups
- National and State Wildlife Conferences to include the National Military Fish and Wildlife Association Conference
- Sustainable Range Program Workshop
- U.S. Army Corps of Engineers Wetland Courses
- National Wildfire Coordinating Group (NWCG) courses which support wildland fire management

6.4 Achieving No Net Loss

This INRMP and the actions contained within this document support no net loss of training capabilities for current and future training and mission requirements. The effective integration of stewardship principles into training land and conservation management practices ensures that Fort Campbell's land remain viable to support future training and mission requirements. Achieving this goal will require understanding and balancing Army training requirements with land management practices. It also requires a sound management ideology that includes cumulative impact analysis and a partnership with outside Agency stakeholders to ensure current and future military activities do not adversely affect rare species or their habitats while completing the necessary training actions that support a lethal Army. Conservation actions and training mission requirements can occur in a synchronized manner where by both actions achieve desired end results.

6.5 Geographic Information System

The Geographic Information System (GIS) is a required base capability of natural resource management. The Fort Campbell system is utilized to analyze and model (manipulate, overlay, measure, compute, and retrieve) digital spatial data and display the new map products and tabular resources information showing the results of the spatial analysis. Management of digital data sets is an annual requirement that assists in natural resource management decisions and compliance related documentation. For example, data developed in support of endangered species management actions are provided to the USFWS and state agencies as part of the permit process. GIS is considered a critical part of natural resources management on Fort Campbell.

6.6 Annual Work Plans and Budgets

Generalized ecosystem management projects scheduled for implementation each year between FY 2014 and 2024 are listed in Appendix F. Projects listed within this INRMP were developed through inventories, monitoring actions, or resource assessments designed to determine existing conditions and their ability to support military training exercises. Much of the INRMP work plan is composed of projects that integrate training resource requirements with natural resource desired conditions that support sensitive nature areas. Program Managers develop and submit proposed actions through Army funding mechanisms.

The INRMP Coordinator will consolidate and coordinate installation work plans to ensure integration of resource management activities. Program Managers will prepare annual budgets to accomplish the annual work plans. Program budgets and a roll up sheet of the combined budget for NR management activities will be tracked for each year by the INRMP Coordinator.

Table 9. Organizational staffing levels required to implement the Fort Campbell INRMP.

	Minimal Implementation		Full Implementation	
Organization/Position	Current	Type	Proposed	Type
DPW/ENV/Conservation				
Agricultural Outlease				
Outlease Manager	1	GS	1	GS
Inventory Specialist	1	contract	1	contract
Forestry Section				
Supervisory Forester	1	GS	1	GS
Forester	0	--	2	GS
Forestry Technician	4	GS	3	GS
Fire Tower Operator	1	contract	1	contract
Silviculturist	0	--	1	GS
Inventory Specialist	1	contract	1	contract
Wildlife Section				
Wildlife Manager	1	GS	1	GS
Wildlife Biologist (habitat)	1	contract	1	GS
Wildlife Biologist (game)	1	GS	1	GS
Avian Ecologist	1	contract	1	GS
Endangered Species Biologist	2	contract	3	GS
Aquatic Ecologist	1	contract	1	GS
Wildlife Technician	4	contract	8	contract
iSportsman Administrator	1	contract	1	contract
iSportsman Support	2	contract	4	contract
Cultural Section				
Cultural Manager	1	GS	1	GS
Archaeologist	3	contract	2	contract
Archaeologist	0	--	1	GS
Curation Technician	0	--	1	contract
DPTMS/TRNG/Range				
ITAM Program Manager	1	GS	1	GS
RTLA Coordinator	1	contract	1	contract
LRAM Coordinator	1	GS	1	GS
LRAM Team	9	contract	12	contract
GIS Coordinator	2	GS	4	GS
TOTAL STAFFING	**34**		**45**	

6.7 Funding and Prioritizing INRMP Requirements

The Garrison Environmental Requirements Build (GERB) database will be used to validate projects and determine funding priority. Projects need to be funded consistent with timely execution to meet future deadlines. Projects are generally prioritized with respect to compliance at the installation level. Highest priority projects are projects related to recurring or current compliance, and these are generally scheduled earliest.

Recurring requirements include projects and activities needed to cover the recurring administrative, personnel and other costs that are necessary to meet applicable compliance requirements (federal and state laws, regulations, Presidential memoranda, EOs, and DoD policies) or which are in direct support of the military mission. Recurring costs include manpower, training and supplies; hazardous waste disposal; operating recycling activities; permits and fees; testing, monitoring, and/or sampling and analysis; reporting and record keeping; maintenance of environmental conservation tools and equipment; and compliance self-assessments.

Sources of funding for projects in this INRMP include:

- Department of the Army Operations and Maintenance (Environmental) Funds;
- Department of the Army Training Funds;
- Sikes Act Funds collected via sales of licenses to hunt or fish on the installation;
- Forestry Funds generated from sales of forest products; and
- Agricultural Funds generated from Agricultural Outleases.

Training funds are designated for ITAM Program activities only. The ITAM Program maintains a budgeting and funding process separate from other natural resource management activities. ITAM funding cannot be utilized to correct environmental statutory compliance requirements and perform Army conservation program requirements. The use of Sikes Act fees and reimbursable funds from the Forestry and Agricultural Lease programs is restricted by federal law. For example, funded reimbursements can be used only for timber management-related expenses, and user fees may be used only to fund projects related to hunting and fishing. Expenses not directly associated with timber or agricultural management or with hunting, fishing, trapping, and outdoor recreational activities must be funded from appropriated funds.

Because implementation of INRMP projects is dependent upon available funding, the following guidelines have been established to prioritize financial resources for the INRMP, and to assess implementation of INRMP requirements.

IMCOM Environmental Funding Guidance describes the following funding priorities:

Class 0: Activities needed to cover the recurring administrative, personnel and other costs associated with managing environmental programs that are necessary to meet applicable compliance requirements (federal, state, and local laws, regulations, Presidential Executive Orders [EOs], DoD policies) which are in direct support of the military mission.

Class 1: Projects and activities needed that are currently out of compliance (have received an enforcement action from a duly authorized federal, state, or local authority; have a signed compliance agreement or received a consent order; and/or have not met requirements based on applicable federal, state, and local laws, regulations, EOs, DoD policies, and FGS overseas or the OEBGD. This class also includes projects and activities needed that are not currently out of compliance (deadlines or requirements have been established by applicable requirements, but deadlines have not passed or requirements are not in force) but shall be if projects or activities are not implemented within the current program year.

Class 2: Projects and activities needed that are not currently out of compliance (deadlines or requirements have been established by applicable federal, state, and local laws, regulations, EOs, DoD policies and FGS overseas or the OEBGD, but deadlines have not passed or requirements are not in force) but shall be if projects or activities are not implemented in time to meet an established deadline beyond the current program year.

Class 3: Projects and activities that are not explicitly required by law but are needed to address overall environmental goals and objectives.

The guidance indicates that Class 0 projects are "must fund." Projects addressing legal requirements and the military mission are afforded first funding priority. "Must fund" elements include those actions required to meet USFWS requirements for T&E species, provide for qualified NR personnel, and prevent resource loss or degradation that may affect military readiness. Class 2 and 3 projects are those that enhance the installation's natural resources. Not all projects listed in the INRMP are "must fund," and, due to budget constraints, Fort Campbell may not receive funds to execute all INRMP projects.

Program budgets are established one year ahead of the implementation year. However, the level of funding may change frequently due to the federal budgeting process and DoD financial requirements. Funding requests are submitted to the Installation Management Command-HQ G4 for validation and approval. In July of each year, the INRMP Coordinator will collect budget information from each Program Manager and summarize budget requests for all NR management activities during one fiscal year. As budget requests are validated and approved, and executed the INRMP Coordinator will insert the fiscal year programmed budget into this INRMP. The INRMP Coordinator will adjust annual work plans, if necessary, according to availability of funds each year.

The Office of the Secretary of Defense considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act, a high priority. However, the level of funding varies annually with the federal budget and Department of Defense priorities requirements. Funding for actions contained within this INRMP are subject to the Anti-Deficiency Act (31 USC §§ 1341, 1517a) and expenditures for these actions will only occur upon approval from IMCOM-HQ G4 and the Garrison Resource Management Office. Thus, funding for some actions described in this INRMP may not be available. Projects that are not funded may be held temporarily until funding is available, the project scope may be adjusted to match available funding, or the project may be eliminated.

6.8 Cooperative Agreements

Cooperative agreements may be entered with states, local governments, non-governmental organizations, and individuals for the improvement of natural resources or to benefit natural and scientific research on

federally-owned training sites. Upon written concurrence of the Fort Campbell INRMP, the USFWS, Kentucky Department of Fish and Wildlife Resources, and the Tennessee Wildlife Resources Agency become signatory cooperators of this plan. Therefore, the potential for access to matching funds programs and services offered by these agencies will be available.
Program initiatives under the CWA provide funding through several sources. The USEPA's Office of Water sponsors those projects related to the CWA. Available funding may support programs such as cost-sharing for overall water-quality management (e.g., monitoring, permitting, and enforcement), lake water quality assessments and mitigation measures, and implementation of non-point source pollution control measures. Potential sources of funding may be available at the USEPA's Office of Water funding website (http://www.epa.gov/water/funding.html).

The Legacy Resource Management Program provides financial assistance to DoD efforts to conserve natural and cultural resources on federal lands. Legacy projects could include regional ecosystem management initiatives, habitat preservation efforts, archaeological investigations, invasive species control, and/or flora or fauna surveys. Legacy funds are awarded based on national visibility. Project proposals are submitted to the program.

6.9 Inter-government Service Agreements (IGSA)

IGSAs are executed between a federal government activity and a state or local government for the provision or receipt of services under the authority of 10 USC 2679. The IGSA is used to receive, provide, or share an installation support service with a state or local government, where the state or local government currently provides the service for its own residents or where the installation has excess capacity to provide the service off-post. The public-to-public support agreement may be established to share, provide or receive services to leverage efficiencies, cost savings and economies of scale. IGSAs are not required to use Davis-Bacon or service contract rates. IGSAs provide relief from the complexity of Federal Acquisition Regulations and offer opportunities for creativity and community partnership.

Fort Campbell is interested in a wide variety of partnerships with state, county and cities as well as creative opportunities with other federal governmental agencies.

6.10 Annual Review and Coordination Requirements

Per DoD policy, Fort Campbell will review the INRMP annually in cooperation with the USFWS, Kentucky Department of Fish and Wildlife Resources, and the Tennessee Wildlife Resources Agency. Fort Campbell will consult with the agencies annually to determine if changes to the Plan are required. According to the *Updated Guidance for Implementation of the SAIA,* dated 5 November 2004, annual reviews shall verify that:

- Current information on all conservation metrics is available;
- All "must fund" projects and activities have been budgeted for and implementation is on schedule;
- All required trained natural resources positions are filled or are in the process of being filled;
- Projects and activities for the upcoming year have been identified and included in the INRMP. An updated project list does not necessitate revising the INRMP;
- All required coordination has occurred; and
- All significant changes to the installation's mission requirements or its natural resources have been identified.

One source of information for these annual reviews is the Army's Environmental Quality Report (EQR) system. The EQR is the automated system used to collect installation environmental information for reporting to Department of Defense and Congress. The EQR system moved to the Army Environmental Reporting Online (AERO) portal in February 2005, creating a day-to-day management tool. The Army Environmental Database Environmental Quality module (AEDB-EQ) is a full update of the Web-based software EQR application used to convey the Army's environmental status to senior Army leadership, DoD, and Congress since 1997.

Established to fulfill a semi-annual requirement to report the status of DoD's Environmental Quality program to Congress, EQR collects detailed information on enforcement actions, inspections and other performance measures for high-level reports and quarterly reviews. EQR also helps the Army track fulfillment of DoD Measures of Merit requirements. The module is designed to coordinate information management for conservation, compliance, pollution prevention and other Army environmental reporting. It can adapt easily to future changes in command structure or measures of merit.

6.11 Monitoring INRMP Implementation

The INRMP is a working document in which adaptive management principles are used to ensure goals, objectives, and projects are realistic and effective. INRMP goals, objectives, and projects may be adjusted based upon changes to the military mission, monitoring or survey results, new data, or regulatory changes. Based upon the annual review of INRMP projects, Fort Campbell resource managers may recommend modifications to the INRMP. If modifications are limited to changes in projects, an interim update of the INRMP is not necessary. However, if changes are made to goals or objectives, the INRMP document should be updated in coordination with the USFWS, TWRA, and KDFWR.

The Office of the Deputy Undersecretary of Defense (DUSD) *Updated Guidance for Implementation of the SAIA* updated *Conservation Metrics for Preparing and Implementing INRMPs*. Progress toward meeting these measures of merit is reported in the annual EQR to Congress. Reporting requirements include:

- The installation name and state.
- The year the most recent INRMP was completed or revised.
- Date planned for the next revision.
- Was the INRMP coordinated with appropriate military trainers and operators?
- Were projects added to the INRMP because of comments from military trainers and operators?
- Were segments of the INRMP concerning the conservation, protection and management of fish and wildlife resources agreed to by the USFWS Regional Director? (USFWS coordination)
- Were projects added to the INRMP because of USFWS comments?
- Has annual feedback been requested from the USFWS?
- Has annual feedback been received from the USFWS?
- Were segments of the INRMP concerning the conservation, protection and management of fish and wildlife resources agreed to by the State fish and wildlife agency Director? (State coordination)
- Were projects added to the INRMP because of State comments?
- Has annual feedback been requested from the State fish and wildlife agency?

- Has annual feedback been received from the State fish and wildlife agency?
- Does the INRMP contain a list of projects necessary to meet plan goals and objectives, as well as timeframes for implementation of any such projects?
- What was the dollar amount spent in the reporting fiscal year to implement the INRMP?
- Did the installation seek public comment on the draft INRMP?
- Were projects added to the INRMP because of public comments?

7.0 NATURAL RESOURCE CONSERVATION STANDARDS

Many routine activities on Fort Campbell have potential to affect natural resources. To minimize adverse effects to natural resources, the following conservation standards have been established. Conservation standards are important to integrated natural resources management, and to meeting the ecosystem management goals established by Fort Campbell. Unlike management goals and objectives and/or projects contained within the specific management plans located in the Appendices, conservation standards are not project-specific, time-limited, or managed by a single manager or program. Conservation standards are requirements that apply to all activities, including training, testing, facility maintenance, recreation, and natural resources management, at Fort Campbell. Deviation from these standards requires prior coordination with the appropriate natural resources manager. Several of the goals and objectives described in Section 5.0 are designed to monitor adherence to conservation standards.

The following natural resources conservation standards are to be implemented unless otherwise specifically authorized by Fort Campbell natural resource managers.

- Encourage trainers to locate intensive land-disturbing activities, when possible, on the least erodible lands (those requiring the least cover for erosion control).
- During forest management activities (including those under contract), leave all snags and trees with active cavities, except where they are hazardous to humans.
- Throughout Fort Campbell restrict removal of trees to times of the year when the Indiana bat is not present (15 November through 15 March), to avoid harm to roosting Indiana bats.
- The Fish and Wildlife Program will evaluate tree removal activities proposed anywhere on the installation. Consultations are required for all timber removal activities determined as “may affect” actions.
- To the maximum extent practicable, projects proposed within the Casey Creek, Saline Creek, Fletcher’s Fork, Jordan, and Piney Fork Creek subwatersheds will be located in previously disturbed, non-forested areas.
- Vehicles must not cross streams except at bridges or designated, hardened fords.
- Maintain riparian zones to improve water quality and provide foraging habitat for gray bats and Indiana bats. The area within 100 feet along each side of perennial streams (first-order and larger) must be kept vegetated, with the 50 feet nearest the stream forested. The area within 50 feet of perennial and intermittent streams must be forested. For first- and second-order streams, the buffer area is measured from the center of the stream. For larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from the stream bank.
    - Avoid removing trees and other vegetation in these areas during training and natural resource management activities.

    - Encourage development of forest within 50-100 feet of streams by planting trees, and/or avoiding actions that inhibit natural succession to forest.
    - Limit training activities within the buffer zone to foot travel; tracked and wheeled vehicles should be kept outside the buffer zone.
    - No timber harvest will occur within 100 feet of perennial streams, ponds or lakes.
    - Skid trails for timber harvest will be established outside these zones.
    - Timber stand improvement and prescribed fire, when used in riparian zones, will be carefully planned to maintain overstory canopy cover at 70 percent or greater. Trees >9 inches dbh should be retained in riparian zones to the maximum extent practicable.
- Maintain vegetative cover on side slopes of sinkholes, and 100-foot vegetated buffers around sinkholes.
- Do not apply pesticides, fertilizers, and other chemicals into, or within 100 feet of perennial and intermittent streams, sinkholes, and other karst features.
- Refuel vehicles and conduct other activities with potential for pollutant spills at least 100 feet from sinkholes.
- Do not enter caves on Fort Campbell, unless the Fish and Wildlife Program has authorized the activity. All personnel entering caves must adhere to the USFWS WNS decontamination policy.
- Encourage long-term agricultural outleases to keep fields free of woody vegetation.
- Around the circumference of agricultural outlease fields maintain a 15-foot wide strip of mowed vegetation. Additionally, maintain mowed grass areas adjacent to each agricultural field during the growing season. The vegetated strip and adjacent area provide alternative areas for training and minimize damage to agricultural fields. Vegetated buffers also minimize run-off of soil and pesticides.
- Maintain vegetated buffers at least 100 feet wide around wetlands. Where it is determined that a wetland has, or could have, significant habitat value, or where current activities adjacent to a wetland are causing noticeable adverse impacts on the habitat, buffers of wider than 100 feet will be considered. Activities within buffer zones are limited to those that would cause little or no impact on or disturbance to the wetland. Unless required by the military mission, training activities within the buffer zone should be minimized; foot travel should be limited, and vehicles should be kept outside the buffer zone.
- To the maximum extent practicable, plan development and training to avoid impacts to wetlands.
- Access into, and disturbance of, nesting and breeding grounds of species at risk birds will be restricted during critical periods. A layer in the GIS system will identify the restricted areas and time periods of restrictions.
- Pesticide procurement, handling, storage, and disposal will strictly adhere to guidelines established by Federal laws, and DoD and Army guidance, which are described in the IPMP.
- Standards for safety and health described in AR 200-1 will be met for each pest management activity conducted by in-house staff or under contract, as described in the IPMP.

8.0 BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are a set of practices designed to maintain soil and water quality during land management activities. They are mandatory guidelines developed by state and local authorities and professionals responsible for managing natural resources. BMPs are designed to ensure, when applied correctly, environmental compliance. Fort Campbell utilizes the following list of BMPs, however, the installation will adapt new BMPs if and when they become available:

- Field Guide to Best Management Practices for Timber Harvesting in Kentucky (1990)
- Kentucky Forest Practice Guidelines for Water Quality Management (2001)
- Tennessee Forestry Best Management Practices (2003)
- Fort Campbell Stormwater Management Plan Development/Construction Deliverables and Requirements Checklist (2016)
- Fort Campbell Technical Design Guide (2012)

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Appendix A
ACRONYMS AND ABBREVIATIONS

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AEC	Army Environmental Center
AFRC	Armed Forces Reserve Center
AO	Agricultural Outlease
APHIS	Animal and Plant Health Inspection Service (USDA)
AR	Army Regulation
BCC	Birds of Conservation Concern
BR	Bioreconnaissance
BRAC	Base Realignment and Closure Act
CAAF	Campbell Army Airfield
CFI	Continuous Forest Inventory
CFR	Code of Federal Regulations
CR	Cultural Resources
CRM	Cultural Resources Management
CVWF	Central Vehicle Wash Facility
CWA	Clean Water Act
DA	Department of the Army
DFC	Desired Future Condition
DFCs	Desired Future Conditions
DFMWR	Directorate of Family, Morale, Welfare, and Recreation
DoD	Department of Defense
DODI	Department of Defense Instruction
DOI	Department of the Interior
DPTMS	Directorate of Plans, Training, Mobilization, and Security
DPW	Directorate of Public Works
DUSD-ES	Deputy Under-Secretary of Defense for Environmental Security
DZs	Drop Zones
EA	Environmental Assessment
EIS	Environmental Impact Statement
EQO	Environmental Quality Officer
EO	Executive Order
ESA	Endangered Species Act (USFWS)
ESMC	Endangered Species Management Component
F&W	Fish & Wildlife
FMP	Forest Management Plan
FONSI	Finding of No Significant Impact
FORSCOM	U.S. Army Forces Command
FPs	Firing Points
FY	Fiscal Year
GC	Garrison Commander
GIS	Geographic Information Systems
gpm	Gallons Per Minute
GPS	Global Positioning System
HGM	Hydrogeomorphic
HQDA	Headquarters, Department of the Army
I-24	Interstate 24
IC	Installation Commander
ICRMP	Integrated Cultural Resources Management Plan

IMCOM	Installation Management Command
IMP	Installation Master Plan
INRMP	Integrated Natural Resources Management Plan
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
ITAM	Integrated Training Area Management
IWFMP	Integrated Wildland Fire Management Plan
JLUS	Joint Land Use Study
KDEP	Kentucky Department of Environmental Protection
KDFWR	Kentucky Department of Fish and Wildlife Resources
KDOW	Kentucky Division of Water
KEPPC	Kentucky Exotic Pest Plant Council
KSNPC	Kentucky State Nature Preserves Commission
LBL	Land Between the Lakes
LOD	Large Organic Debris
LRAM	Land Rehabilitation and Area Maintenance
LZ	Landing Zone
MBMS	Migratory Bird Management Strategy
MBTA	Migratory Bird Treaty Act
METL	Mission Essential Task List
MO	Management Objectives
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NR	Natural Resources
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRM	Natural Resources Management
NWI	National Wetlands Inventory
NWSG	native warm season grasses
OMS	Organizational Maintenance Shop
ORV	Off-road Vehicles
PA	Programmatic Agreement
pers. comm.	Personal Communication
PIF	Partners in Flight
POC	Point of Contact
PZs	Pick-up Zones
RBP	Rapid Bioassessment Protocols
REC	Record of Environmental Consideration
RFMSS	Range Facility Management Support System
RTLA	Range and Training Land Assessment
RTLDP	Range and Training Land Program Development Plan
RTLP	Range and Training Land Program
SAIA	Sikes Act Improvement Act
SHPO	State Historic Preservation Office
SRA	Sustainable Range Awareness

SWMUs	Solid Waste Management Units
SWP3	Storm Water Pollution Prevention Plan
TA	Training Area
TDEC	Tennessee Department of Environmental Conservation
TMDL	Total Maximum Daily Load
TMP	Tract Management Plan
TNC	The Nature Conservancy
TNEPPC	Tennessee Exotic Pest Plant Council
TOC/LOG	Tactical Operations Centers/Logistics
TRI	Training Requirements Integration
TWRA	Tennessee Wildlife Resources Agency
USACE	U.S. Army Corps of Engineers
USACERL	U.S. Army Construction Engineering Research Laboratories
USAR	U.S. Army Reserve
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UT	University of Tennessee
WMP	Watershed Management Plan

Appendix B
ENVIRONMENTAL LAWS

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NEPA
National Environmental Policy Act (42 USC 4321-4347)
Council on Environmental Quality (40 CFR 1500-1508)

Wetlands
Rivers and Harbors Act of 1899 (33 USC 403)
Protection of Wetlands (EO 11990)
Clean Water Act, Sections 401 and 404 (33 USC 1344, 1341)
Wetlands Action Plan (NPI 99.01)
Emergency Wetlands Resources Act of 1986 (16 USC 3901-3932)

Migratory Birds
Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186)
Migratory Bird Treaty Act (16 U.S.C 703-711)
Wild and Game Bird Preservation (16 U.S.C. 701)
USFWS General Permit Procedures (50 CFR 13)
Migratory Bird Permits (50 CFR 21)

Rare, Species at Risk, Threatened and Endangered Species
Endangered Species Act (16 U.S.C. 35)
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)
Fish and Wildlife Coordination Act (16 U.S.C. 661-666c)
Implementing Regulations of Endangered Species Act (50 CFR 401-423)
Non-game and Endangered or Threatened Wildlife Species Conservation Act (TCA 70-8-101 thru 112)
Rare Plant Protection and Conservation Act (TCA 70-8-301 thru 314)
Endangered Species Protection (KRS 150.183 thru .990)
Rare Plant Recognition Act (KRS 146.600 thru .619)

Natural Resources
Sikes Act (16 U.S.C. 670a-670o)
Military Reservations and Facilities, Hunting, Fishing, and Trapping (10 U.S.C. 2671)
OSD Natural Resources Management Program (32 CFR 190)
Taking, Possession, Transportation, Sale, Purchase, and Barter, Exportation and Importation of Wildlife and Plants (50 CFR 10-16)
Aquatic Nuisance Prevention and Control (16 USC 4701–4751)
Invasive Species (EO 13112)
Environmental Security (DODD 4715.1)
Strengthening Federal Leadership in Environmental, Energy, and Economic Performance (EO 13514)
Federal Environmental Control Act (PL 92-516-1972)
Federal Pesticide Act (PL 95-396)
Clean Air Act (42 USC 7401-7642)
Clean Water Act (33 USC 1251-1387)
Conservation and Rehabilitation Program on Military and Public Lands Act (PL 93-452)
Federal Insecticide, Fungicide and Rodenticide Act (7 USC 136-136y)
Fish and Wildlife Conservation Act of 1980 (PL 96-366: 16 USC 2901)
Forest and Rangeland Renewable Resources Planning Act of 1974 (16 USC 1601 et. seq.)
Multiple-Use Sustained Yield Act of 1960 (16 USC 528-531)

National Historic Preservation Act of 1966 (PL 89-665; 16 USC 470 et seq.)
Timber Sales on Military Lands (10 USC 1001)
Watershed Protection and Flood Prevention Act (PL 92-419; 68 Stat 666 as amended and 86 Stat 667; 16 USC 1001)
Protection and Enhancement of Environmental Quality (EO 11991)
Environmental Effects in the United States of DoD Actions (DoD 6050.1)
Kentucky Water Quality (401 KAR 5:026, 5:029, 5:030, 5:031)
Kentucky Forest Conservation Act (KRS 149.330-149.355)
Guide to Forestry Best Management Practices in Tennessee (TN Department of Agriculture, Division of Forestry 2003, 00800-7-3)
National Wildfire Coordination Group Wildland and Prescribed Fire Qualification System Guide (PMS 310/NFES 1414)
National Fire Protection Association (NFPA Standards 295, 299, 1051)
1995 Federal Wildland Fire Management Policy
Material Management Regulation (DoD 4140.1-R)
Leases (Agricultural and Grazing Outleases) (10 USC 2667)

Appendix C
External Scoping/Review Correspondence

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DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

IMCB-PWE

31 May 2018

Mr. Lee Andrews
Field Supervisor
US Fish and Wildlife Service
Kentucky Field Office
3761 Georgetown Road
Frankfort, KY 40601

Dear Mr. Andrews:

The Fort Campbell Environmental Division, Conservation Branch has finalized the draft update of the Integrated Natural Resources Management Plan (INRMP) for the installation, and requests your review and comments on the document. This INRMP updates the current INRMP dated January 2014 and will guide natural resource management activities for the next five-year period of 2019-2023.

The INRMP meets requirements of the Sikes Act, and establishes goals and objectives for managing Fort Campbell's natural resources to support the military mission, integrate compliance requirements, provide for multiple uses of resources, and conserve biodiversity. The Plan is based upon the concepts of ecosystem management, and is designed to integrate management activities among multiple programs and resources. Management of forest; fish and wildlife; rare, threatened, and endangered species; aquatic, riparian, and terrestrial habitat; pests and invasive species; agricultural leases; wildfires; and outdoor recreation will be addressed.

It is the policy of the Department of Defense and Fort Campbell to work cooperatively with resource agencies and other interested parties. In accordance with the Sikes Act, Fort Campbell invites your participation in the review and development of the INRMP for 2019-2023. Please send your comments or questions to Gene A. Zirkle by e-mail at gene.a.zirkle.civ@mail.mil, or by U.S. mail at IMCB-PWE, DPW, Environmental Division, Bldg. 871, Fort Campbell, Kentucky 42223-5130. Please submit your comments or questions about the Fort Campbell INRMP by 15 July 2018. We appreciate your cooperation and support.

Sincerely,

Gene A. Zirkle
Fort Campbell INRMP Coordinator

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

IMCB-PWE

31 May 2018

Mr. Dave Pelren
United States Fish and Wildlife Service
Cookeville Ecological Services Field Office
446 Neal Street
Cookeville, Tennessee 38501

Dear Mr. Pelren:

The Fort Campbell Environmental Division, Conservation Branch has finalized the draft update of the Integrated Natural Resources Management Plan (INRMP) for the installation, and requests your review and comments on the document. This INRMP updates the current INRMP dated January 2014 and will guide natural resource management activities for the next five-year period of 2019-2023.

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Gene A. Zirkle
Fort Campbell INRMP Coordinator

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

IMCB-PWE

31 May 2018

Mr. Gregory Johnson
Commissioner
Kentucky Department of Fish and Wildlife Resources
1 Game Farm Road
Frankfort, KY 40601

Dear Mr. Johnson:

The Fort Campbell Environmental Division, Conservation Branch has finalized the draft update of the Integrated Natural Resources Management Plan (INRMP) for the installation, and requests your review and comments on the document. This INRMP updates the current INRMP dated January 2014 and will guide natural resource management activities for the next five-year period of 2019-2023.

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Fort Campbell INRMP Coordinator

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

IMCB-PWE

31 May 2018

Mr. Ed Carter
Executive Director
Tennessee Wildlife Resources Agency
P.O. Box 40747
Nashville, TN 37204

Dear Mr. Carter:

The Fort Campbell Environmental Division, Conservation Branch has finalized the draft update of the Integrated Natural Resources Management Plan (INRMP) for the installation, and requests your review and comments on the document. This INRMP updates the current INRMP dated January 2014 and will guide natural resource management activities for the next five-year period of 2019-2023.

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Sincerely,

Gene A. Zirkle
Fort Campbell INRMP Coordinator

Appendix D
DOCUMENTED SPECIES OCCURRING ON FORT CAMPBELL

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Invertebrates

Invertebrates recorded from Fort Campbell from 1992 through 2017.

Mollusca	
Bivalves	
ORDER UNIONOIDA	
Family Unionidae	
Alasmidonta viridis	Slippershell Mussel
Lampsilis teres	Yellow Sandshell
Lasmigona costata	Flutedshell
Pyganodon grandis	Giant Floater
Utterbackia imbecillis	Paper Pondshell
Villosa lienosa	Little Spectaclecase
Villosa vanuxemensis	Mountain Creekshell
ORDER VENEROIDA	
Family Corbiculidae	
Corbicula fluminea	Asiatic Clam
Snails	
ORDER BASOMMATOPHORA	
Family Ancylidae	
Ferrisia rivularis	Creeping Ancylid
Family Lymnaeidae	
Fossaria sp. cf. *obrussa*	Golden fossaria
Pseudosuccinea columella	Mimic lymnaea
Family Physidae	
Physella globosa	Globose physa
Physella gyrina	Tadpole snail
ORDER NEOTAENIOGLOSSA	
Family Pleuroceridae	
Elimia sp. cf. *acuta*	Acute elimia
Elimia e. ebenum	Ebony elimia
Elimia sp. cf. *edgariana*	Cumberland elimia
Elimia l. laqueata	Panel elimia
Elimia livescens	Liver elimia
Elimia sp.	
Mollusca Mollusca	
Pleurocera acuta	Sharp hornsnail
Pleurocera canaliculata (cf. *alabamense*?)	Silty hornsnail

Pleurocera canaliculata (cf. small form?)	Silty hornsnail
Pleurocera sp.	

Insects	
ORDER EPHEMEROPTERA	
Family Baetidae	
Acentrella turbida (McDunnough)	
Acentrella sp.	
Acerpenna pygmaea (Hagen)	
Baetis sp.	
Callibaetis sp. cf. *floridanus* Banks	
Plauditus sp. cf. *dubius* (Walsh)	
Plauditus sp.	
Family Caenidae	
Caenis amica Hagen	
Caenis latipennis Banks	
Caenis sp.	
Family Ephemeridae	
Hexagenia limbata (Serville)	
Family Heptageniidae	
Leucrocuta hebe (McDunnough)	
Maccaffertium modestum (Banks)	
Maccaffertium terminatum (Walsh)	
Maccaffertium sp.	
Macdunnoa persimplex (McDunnough)	
Nixe inconspicuus (McDunnough)	
Stenacron interpunctatum (Say)	
Stenonema femoratum (Say)	
Family Isonychiidae	
Isonychia bicolor (Walker)	
Isonychia sp.	
Family Leptohyphidae	

Insects	
Tricorythodes allectus (Needham)	
Family Leptophlebiidae	
Choroterpes basalis (Banks)	
Leptophlebia sp.	
Paraleptophlebia ontario (McDunnough)	
Paraleptophlebia praepedita (Eaton)	
Family Siphlonuridae	
Siphlonurus sp.	
Order Coleoptera	
Beetles	
Family Dryopidae	
Helichus lithophilus (Germar 1824)	
Family Dytiscidae	
Agabus gagetes Aube 1838	
Bidessonotus inconspicuus (LeConte 1855)	
Celina hubbelli-angustata? Aube 1838	
Celina imitatrix Young 1979	
Copelatus chevrolati Aube 1838	
Copelatus glyphicus (Say 1823)	
Coptotomus venustus (Say 1823)	
Desmopachria convexa (Aube 1838)	
Heterosternuta allegheniana? (Matta and Wolfe 1979)	
Heterosternuta jenniferae (Matta and Wolfe 1979)	
Heterosternuta ouachitus (Matta and Wolfe 1979)	
Heterosternuta pulcher (LeConte 1855)	
Heterosternuta wickami (Zaizev 1908)	
Hydaticus bimarginatus (Say 1831)	
Hydrocolus sp.	
Hygrotus nubilus (LeConte 1855)	
Ilybius biguttulus (Germar 1824)	
Laccophilus fasciatus rufus Melsheimer 1844	
Laccophilus proximus (Say 1823)	
Liodessus fuscatus (Crotch 1873)	
Neobidessus pullus (LeConte 1855)	

Insects	
Neoporus blanchardi (Sherman 1913)	
Neoporus clypealis (Sharp 1882)	
Neoporus psammodytes (Young 1978)	
Neoporus shermani (Fall 1917)	
Neoporus solitarius (Sharp 1882)	
Neoporus striatopunctatus (Melsheimer 1844)	
Neoporus undulatus (Say 1823)	
Neoporus vittatipennis Gemminger and Harold 1868	
Rhantus callidus (Fabricius 1792)	
Thermonectus basillaris (Harris 1829)	
Thermonectus nigrofasciatus ornaticollis (Aube 1838)	
Uvarus granarius (Aube 1823)	
Uvarus lacustris (Say 1823)	
Family Elmidae	
Optioservus sp.	
Stenelmis (sp. 1)	
Stenelmis (sp. 2)	
Stenelmis (sp. 3)	
Stenelmis (sp. 4)	
Stenelmis crenata (Say 1824)	
Stenelmis lateralis Sanderson 1938	
Stenelmis sexlineata Sanderson 1938	
Family Gyrinidae	
Dineutus americanus (Linnaeus 1767)	
Dineutus carolinus LeConte 1868	
Gyrinus analis Say 1823	
Family Haliplidae	
Haliplus triopsis Say 1825	
Peltodytes dunavani Young 1961	
Peltodytes duodecimpunctatus (Say 1825)	
Peltodytes lengi Roberts 1913	
Peltodytes litoralis Matheson 1912	
Peltodytes muticus (LeConte 1853)	
Peltodytes sexmaculatus Roberts 1913	

Insects	
Family Hydrophilidae	
Berosus aculeatus LeConte 1855	
Berosus corrinni Wooldridge 1964	
Berosus exiguus (Say 1825)	
Berosus infuscatus LeConte 1855	
Berosus pantherinus LeConte 1855	
Berosus peregrinus (Herbst 1797)	
Berosus pugnax LeConte 1863	
Chaetarthria atra (LeConte 1863)	
Chaetarthria pallida (LeConte 1861)	
Crenitulus suturalis (LeConte 1866)	
Cymbiodyta semistriatus (Zimmermann 1869)	
Cymbiodyta toddi Spangler 1966	
Cymbiodyta vindicata	
Enochrus cinctus (Say 1824)	
Enochrus consors (LeConte 1863)	
Enochrus consortus Green 1946	
Enochrus hamiltoni (Horn 1890)	
Enochrus ochraceus (Melsheimer 1846)	
Enochrus perplexus (LeConte 1855)	
Enochrus pygmaeus (Fabricius 1792)	
Enochrus sayi Gundersen 1977	
Helocombus bifidis (LeConte 1855)	
Helophorus sp.	
Hydrobius melaenus (Germar 1824)	
Hydrochara obtusata? Say 1823	
Hydrochara soror Smetana 1980	
Hydrochara spangleri Smetana 1980	
Paracymus sp. c.f. *confusus* Wooldridge 1966	
Paracymus sp.	
Paracymus sp. c.f. *subcupreus* (Say 1825)	
*Tropisternus blatchleyi blatchley*i D'Orchymont 1922	
Tropisternus collaris (Fabricius 1775)	
Tropisternus lateralis nimbatus (Say 1823)	

Insects	
Family Noteridae	
Hydrocanthus atripennis-iricolor? Say 1834	
Hydrocanthus iricolor Say 1823	
Suphisellus puncticollis (Crotch 1873)	
Family Psephenidae	
Ectopria nervosa (Melsheimer 1844)	
ORDER COLEOPTERA	
Family Dryopidae	
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Berosus corrinni Wooldridge 1964	

Insects	
Berosus exiguus (Say 1825)	
Berosus infuscatus LeConte 1855	
Berosus pantherinus LeConte 1855	
Berosus peregrinus (Herbst 1797)	
Berosus pugnax LeConte 1863	
Chaetarthria atra (LeConte 1863)	
Chaetarthria pallida (LeConte 1861)	
Crenitulus suturalis (LeConte 1866)	
Cymbiodyta semistriatus (Zimmermann 1869)	
Cymbiodyta toddi Spangler 1966	
Cymbiodyta vindicata	
Enochrus cinctus (Say 1824)	
Enochrus consors (LeConte 1863)	
Enochrus consortus Green 1946	
Enochrus hamiltoni (Horn 1890)	
Enochrus ochraceus (Melsheimer 1846)	
Enochrus perplexus (LeConte 1855)	
Enochrus pygmaeus (Fabricius 1792)	
Enochrus sayi Gundersen 1977	
Helocombus bifidis (LeConte 1855)	
Helophorus sp.	
Hydrobius melaenus (Germar 1824)	
Hydrochara obtusata? Say 1823	
Hydrochara soror Smetana 1980	
Hydrochara spangleri Smetana 1980	
Paracymus sp. c.f. *confusus* Wooldridge 1966	
Paracymus sp.	
Paracymus sp. c.f. *subcupreus* (Say 1825)	
*Tropisternus blatchleyi blatchley*i D'Orchymont 1922	
Tropisternus collaris (Fabricius 1775)	
Tropisternus lateralis nimbatus (Say 1823)	
Family Noteridae	
Hydrocanthus atripennis-iricolor? Say 1834	
Hydrocanthus iricolor Say 1823	

Insects	
Suphisellus puncticollis (Crotch 1873)	
Family Psephenidae	
Ectopria nervosa (Melsheimer 1844)	
ORDER PLECOPTERA	
Family Capniidae	
Allocapnia rickeri Frison (nymphs)	
Allocapnia sp. (nymphs)	
Paracapnia sp. (nymphs)	
Family Leuctridae	
Leuctra alta James (nymphs)	
Leuctra sibleyi Claassen	
Leuctra tenuis (Pictet)	
Leuctra sp.	
Leuctra sp. (nymphs)	
Zealeuctra claasseni Frison	
Family Nemouridae	
Amphinemura delosa (Ricker)	
Amphinemura sp. (nymphs)	
Family Chloroperlidae	
Alloperla petasata Surdick	
Alloperla sp. (nymphs)	
Haploperla brevis (Banks)	
Family Perlidae	
Acroneuria frisoni Stark and Brown	
Acroneuria sp. (nymphs)	
Perlinella drymno (Newman)	
Perlinella ephyre (Newman)	
Perlesta bolukta Stark?	
Perlesta teaysia Kirchner and Kondratieff	
Perlesta sp.	
Perlesta sp. (nymphs)	
Neoperla catharae Stark and Baumann	
Family Perlodidae	
Clioperla clio (Newman)	

Insects	
Isoperla decepta Frison (nymphs)	
Isoperla sp. (nymphs)	
Order Trichoptera	
Genus Species	
Phylocentropus placidus (Banks)	
Agapetus avitus Edwards	
Agapetus Illini Ross	
Glossosoma nigrior Banks	
Protoptila maculata (Hagen)	
Goera calcarata Banks	
Ceratopsyche slossonae (Banks)	
Ceratopsyche sparna (Ross)	
Cheumatopsyche analis (Banks)	
Cheumatopsyche burksi Ross	
Cheumatopsyche campyla Ross	
Cheumatopsyche oxa Ross	
Cheumatopsyche pasella Ross	
Diplectrona modesta Banks	
Hydropsyche betteni Ross	
Hydropsyche depravata Hagen	
Hydropsyche orris Ross	
Hydropsyche rossi Flint, Voshell, & Parker	
Potamyia flava (Hagen)	
Dibusa angata Ross	
Hydroptila amoena Ross	
Hydroptila angusta Ross	
Hydroptila armata Ross	
Hydroptila consimilis Morton	
Hydroptila gunda Milne	
Hydroptila hamata Morton	
Hydroptila jackmanni Blickle	
Hydroptila oneili Harris	
Hydroptila perdita Morton	
Hydroptila spatulata Morton	

Insects	
Hydroptila vala Ross	
Hydroptila waubesiana Betten	
Neotrichia vibrans Ross	
Ochrotrichia eliaga (Ross)	
Ochrotrichia shawnee (Ross)	
Ochrotrichia tarsalis (Hagen)	
Ochrotrichia xena (Ross)	
Orthotrichia aegerfasciella (Chambers)	
*Orthotrichia cristat*a Morton	
Oxyethira forcipata Mosely	
Oxyethira pallida (Banks)	
Oxyethira pescadori Harris & Keith	
Oxyethira zeronia Ross	
Stactobiella martynovi Blickle & Denning	
Lepidostoma pictile Banks	
Ceraclea cancellata (Betten)	
Ceraclea maculata (Banks)	
Ceraclea nepha (Ross)	
Ceraclea protonepha Morse & Ross	
Ceraclea tarsipunctata (Vorhies)	
Ceraclea transversa (Hagen)	
Leptocerus americanus (Banks)	
Mystacides sepulchralis (Walker)	
Nectopsyche candida (Hagen)	
Nectopsyche exquisita (Walker)	
Nectopsyche pavida (Hagen)	
Oecetis avara (Banks)	
Oecetis cinerascens (Hagen)	
Oecetis ditissa Ross	
Oecetis inconspicua (Walker)	
Oecetis nocturna Ross	
Oecetis persimilis (Banks)	
Setodes epicampes Edwards	
Triaenodes aba Milne	

Insects	
Triaenodes ignitus (Walker)	
Triaenodes injustus (Hagen)	
Triaenodes marginatus Sibley	
Triaenodes nox Ross	
Triaenodes perna Ross	
Triaenodes tardus Milne	
Ironoquia kaskaskia (Flint)	
Ironoquia lyrata (Ross)	
Ironoquia punctatissima (Walker)	
Pycnopsyche antica (Walker)	
Pycnopsyche gentilis (McLachlan)	
Pycnopsyche guttifer (Walker)	
*Pycnopsyche lepid*a (Hagen)	
Pycnopsyche virginica (Banks)	
Psilotreta labida Ross	
Chimarra feria Ross	
Chimarra obscura (Walker)	
Dolophilodes distinctus (Walker)	
Wormaldia shawnee (Ross)	
Agrypnia vestita Ross	
Phryganea sayi Milne	
Ptilostomis ocellifera (Walker)	
Ptilostomis postica (Walker)	
Cernotina spicata Ross	
Cyrnellus fraternus (Banks)	
Neureclipsis crepuscularis (Walker)	
Neureclipsis piersoni Lago & Harris	
Nyctiophylax affinis (Banks)	
Nyctiophylax serratus Lago & Harris	
Polycentropus centralis Banks	
Polycentropus chelatus Ross & Yamamoto	
Polycentropus cinereus Hagen	
Polycentropus confusus Hagen	
Polycentropus crassicornis Walker	

Insects	
Polycentropus elarus	
Lype diversa (Banks)	
Psychomyia flavida Hagen	
Rhyacophila fenestra Ross	
Rhyacophila glaberrima Ulmer	
Rhyacophila ledra Ross	
Rhyacophila lobifera Betten	
Neophylax concinnus McLachlan	
ORDER TRICHOPTERA	
Phylocentropus placidus (Banks)	
Agapetus avitus Edwards	
Agapetus Illini Ross	
Glossosoma nigrior Banks	
Protoptila maculata (Hagen)	
Goera calcarata Banks	
Ceratopsyche slossonae (Banks)	
Ceratopsyche sparna (Ross)	
Cheumatopsyche analis (Banks)	
Cheumatopsyche burksi Ross	
Cheumatopsyche campyla Ross	
Cheumatopsyche oxa Ross	
Cheumatopsyche pasella Ross	
Diplectrona modesta Banks	
Hydropsyche betteni Ross	
Hydropsyche depravata Hagen	
Hydropsyche orris Ross	
Hydropsyche rossi Flint, Voshell, & Parker	
Potamyia flava (Hagen)	
Dibusa angata Ross	
Hydroptila amoena Ross	
Hydroptila angusta Ross	
Hydroptila armata Ross	
Hydroptila consimilis Morton	

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Hydroptila hamata Morton	
Hydroptila jackmanni Blickle	
Hydroptila oneili Harris	
Hydroptila perdita Morton	
Hydroptila spatulata Morton	
Hydroptila vala Ross	
Hydroptila waubesiana Betten	
Neotrichia vibrans Ross	
Ochrotrichia eliaga (Ross)	
Ochrotrichia shawnee (Ross)	
Ochrotrichia tarsalis (Hagen)	
Ochrotrichia xena (Ross)	
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*Orthotrichia cristat*a Morton	
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Oxyethira pallida (Banks)	
Oxyethira pescadori Harris & Keith	
Oxyethira zeronia Ross	
Stactobiella martynovi Blickle & Denning	
Lepidostoma pictile Banks	
Ceraclea cancellata (Betten)	
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Ceraclea protonepha Morse & Ross	
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Nectopsyche pavida (Hagen)	
Oecetis avara (Banks)	
Oecetis cinerascens (Hagen)	

Insects	
Oecetis ditissa Ross	
Oecetis inconspicua (Walker)	
Oecetis nocturna Ross	
Oecetis persimilis (Banks)	
Setodes epicampes Edwards	
Triaenodes aba Milne	
Triaenodes ignitus (Walker)	
Triaenodes injustus (Hagen)	
Triaenodes marginatus Sibley	
Triaenodes nox Ross	
Triaenodes perna Ross	
Triaenodes tardus Milne	
Ironoquia kaskaskia (Flint)	
Ironoquia lyrata (Ross)	
Ironoquia punctatissima (Walker)	
Pycnopsyche antica (Walker)	
Pycnopsyche gentilis (McLachlan)	
Pycnopsyche guttifer (Walker)	
Pycnopsyche lepida (Hagen)	
Pycnopsyche virginica (Banks)	
Psilotreta labida Ross	
Chimarra feria Ross	
Chimarra obscura (Walker)	
Dolophilodes distinctus (Walker)	
Wormaldia shawnee (Ross)	
Agrypnia vestita Ross	
Phryganea sayi Milne	
Ptilostomis ocellifera (Walker)	
Ptilostomis postica (Walker)	
Cernotina spicata Ross	
Cyrnellus fraternus (Banks)	
Neureclipsis crepuscularis (Walker)	
Neureclipsis piersoni Lago & Harris	
Nyctiophylax affinis (Banks)	

Insects	
Nyctiophylax serratus Lago & Harris	
Polycentropus centralis Banks	
Polycentropus chelatus Ross & Yamamoto	
Polycentropus cinereus Hagen	
Polycentropus confusus Hagen	
Polycentropus crassicornis Walker	
Polycentropus elarus	
Lype diversa (Banks)	
Psychomyia flavida Hagen	
Rhyacophila fenestra Ross	
Rhyacophila glaberrima Ulmer	
Rhyacophila ledra Ross	
Rhyacophila lobifera Betten	
Neophylax concinnus McLachlan	
ORDER ODONATA	
Suborder Zygoptera - Damselflies	
Family Calopterygidae	
Calopteryx maculata (Beauvois)	Ebony Jewelwing
Family Coenagrionidae	
Argia apicalis (Say)	Blue-fronted Dancer
Argia moesta (Hagen)	Powdered Dancer
Argia tibialis (Rambur)	Blue-tipped Dancer
Argia fumipennis violacea (Burmeister)	Violet Dancer
Enallagma basidens Calvert	Double-striped Bluet
Heterina sp.	
Ischnura verticalis (Say)	Eastern Forktail
Suborder Anisoptera – Dragonflies	
Family Aeshnidae	
Aeshna sp.	
Basiaeschna janata (Say)	Springtime Darner
Boyeria sp.	
Epiaeschna heros (Fabricius)	Swamp Darner
Family Corduliidae	
Somatochlora sp.	Unknown Emerald

Insects	
Family Gomphidae	
Dromogomphus spinosus Selys	Black-shouldered Spineyleg
Gomphus sp.	
Stylogomphus sigmastylus Cook and Laudermilk	Interior Least Clubtail
Family Libellulidae	
Celithemis eponina (Drury)	Halloween Pennant
Epitheca princeps Hagen	Prince Baskettail
Erythemis simplicicollis (Say)	Eastern Pondhawk
Libellula cyanea Fabricius	Spangled Skimmer
Libellula flavida Rambur	Yellow-sided Skimmer
Libellula incesta Hagen	Slaty Skimmer
Libellula luctuosa Burmeister	Widow Skimmer
Pachydiplax longipennis (Burmeister)	Blue Dasher
Perithemis tenera (Say)	Eastern Amberwing
Plathemis lydia (Drury)	Common Whitetail
Tramea carolina (Linnaeus)	Carolina Saddlebags
Family Macromiidae	
Didymops sp.	
Macromia sp.	
ORDER HEMIPTERA	
Family Belostomatidae	
Belostoma sp.	
Family Corixidae	
Trichocorixa sp.	
Family Gelastocoridae	
Nertha sp.	
Family Gerridae	
Gerris sp.	
Neogerris sp.	
Family Hebridae	
Lipogomphus sp.	
Merragata sp.	
Family Notonectidae	
Buenoa sp.	

Insects	
Pleidae	
Paraplea sp.	
Family Veliidae	
Microvelia sp.	
Rhagovelia sp.	
ORDER MEGAOPTERA	
Family Corydalidae	
Corydalus cornutus	
Family Sialidae	
Sialis sp.	
ORDER DIPTERA	
Family Tipulidae	
Antocha sp.	
Hexatoma sp.	
ORDER LEPIDOPTERA	
Family Hesperiidae	
Epargyreus clarus (Cramer)	Silver-Spotted Skipper
Achalarus lyciades (Geyer)	Hoary Edge
Thorybes bathyllus (Smith)	Southern Cloudywing
Thorybes confusis Bell	Confused Cloudywing
Pholisora catullus (Fabricius)	Common Sootywing
Ancyloxypha numitor (Fabricius)	Least Skipper
Atalopedes campestris (Boisduval)	Sachem
Polites themistocles (Latreille)	Tawny-Edged Skipper
Wallengrenia egeremet (Scudder)	Northern Broken-Dash
Euphyes vestris (Boisduval)	Dun Skipper
Family Papilionidae	
Battus philenor (Linnaeus)	Pipevine Swallowtail
Eurytides marcellus (Cramer)	Zebra Swallowtail
Papilio polyxenes Fabricius	Black Swallowtail
Papilio glaucus (Linnaeus)	Eastern Tiger Swallowtail
Papilio troilus Linnaeus	Spicebush Swallowtail
Family Pieridae	
Colias eurytheme Boisduval	Orange Sulphur

Insects	
Phoebis sennae (Linnaeus)	Cloudless Sulphur
Pyrisitia lisa (Boisduval & Leconte)	Little Yellow
Pieris rapae (Linnaeus)	Cabbage White
Family Lycaenidae	
Strymon melinus (Hübner)	Gray Hairstreak
Satyrium titus (Fabricius)	Coral Hairstreak
Everes comyntas (Godart)	Eastern Tailed-Blue
Family Nymphalidae	
Asterocampa celtis (Boisduval & Leconte)	Hackberry Emperor
Danaus plexippus (Linnaeus)	Monarch
Agraulis vanillae (Linnaeus)	Gulf Fritillary
Euptoieta claudia (Cramer)	Variegated Fritillary
Speyeria cybele (Fabricius)	Great Spangled Fritillary
Limenitis archippus (Cramer)	Viceroy
Limenitis arthemis (Drury)	Red-Spotted Purple
Anaea andria Scudder	Goatweed Leafwing
Libytheana carinenta (Cramer)	American Snout
Chlosyne nycteis (Doubleday)	Silvery Checkerspot
Junonia coenia (Hübner)	Common Buckeye
Phyciodes tharos (Drury)	Pearl Crescent
Polygonia interrogationis (Fabricius)	Question Mark
Vanessa atalanta (Linnaeus)	Red Admiral
Vanessa cardui (Linnaeus)	Painted Lady
Vanessa virginiensis (Drury)	Amercan Lady
Cyllopsis gemma (Hübner)	Gemmed Satyr
Hermeuptychia sosybius (Fabricius)	Carolina Satyr
Enodia anthedon Clark	Northern Pearly Eye
Megisto cymela (Cramer)	Little Wood-Satyr

Crustaceans and Allies	
ORDER DECAPODA	
Family Cambaridae	
Cambarus friaufi Hobbs	
Cambarus graysoni Faxon	

Cambarus tenebrosus Hay	
Cambarus (Lacunicambarus/Tubericambarus) sp.?	
Cambarus sp. Juveniles, cannot determine species	
Fallicambarus fodiens (Cottle)	
Orconectes sp. cf. barrenensis	
Orconectes compressus (Faxon)	
Orconectes placidus (Hagen)	
Orconectes tricuspis Rhoades	
ORDER AMPHIPODA	
Family Gammaridae	
Gammarus minus sp.	
ORDER ISOPODA	
Family Asellidae	
Caecidotea laticaudatus	

Amphibians

Amphibians recorded from Fort Campbell from 1992 through 2017.

		State	
Scientific Name	Common Name	KY	TN
AMBYSTOMATIDAE - MOLE SALAMANDERS			
Ambystoma maculatum	spotted salamander	x	x
Ambystoma opacum	marbled salamander		x
Ambystoma talpoideum	mole salamander		x
Ambystoma texanum	small-mouthed salamander		x
Ambystoma tigrinum	tiger salamander		x
Desmognathus fuscus	dusky salamander	x	x
Eurycea cirrigera	southern two-lined salamander		x
Eurycea lucifuga	cave salamander	x	x
Eurycea l. longicauda	long-tailed salamander	x	x
Plethodon dorsalis	zigzag salamander	x	x
Plethodon glutinosus	northern slimy salamander	x	x
Pseudotriton ruber	red salamander		x
BUFONIDAE - TOADS			
Anaxyrus a. americanus	American toad	x	x

Anaxyrus fowleri	Fowler's toad	x	x
CRYPTOBRANCHIDAE - HELLBENDERS			
Cryptobranchus alleganiensis	hellbender		x
HYLIDAE - TREE FROGS AND ALLIES			
Acris crepitans	northern cricket frog	x	x
Hyla gratiosa	barking treefrog	x	
Hyla chrysoscelis	Cope's gray treefrog	x	x
Pseudacris triseriata feriarum	upland chorus frog	x	x
Pseudacris crucifer	spring peeper	x	x
MICROHYLIDAE - NARROW-MOUTHED TOADS			
Gastrophryne carolinensis	eastern narrow-mouthed toad	x	x
PELOBATIDAE - SPADEFOOT TOADS			
Scaphiopus holbrookii	eastern spadefoot		x
RANIDAE - TRUE FROGS			
Lithobates catesbeiana	bullfrog	x	x
Lithobates clamitans	green frog	x	x
Lithobates palustris	pickerel frog		x
Lithobates sphenocephalus	southern leopard frog	x	x
SALAMANDRIDAE - NEWTS			
Notophthalmus v. viridescens	eastern newt	x	x

Reptiles

Reptiles recorded from Fort Campbell from 1992 through 2017.

		State	
Scientific Name	Common Name	KY	TN
CHELYDRIDAE - SNAPPING TURTLES			
Cheldrya serpentina	snapping turtle	x	x
COLUBRIDAE - COLUBRIDS			
Coluber c. constrictor	northern black racer	x	x
Diadophis punctatus stictogenys	Mississippi ringneck snake	x	x
Diadophis punctatus edwardssi	northern ringneck snake	x	x
Elaphe spiloides	gray ratsnake	x	x
Heterodon platirhinos	eastern hog-nosed snake		x
Lampropeltis getula nigra	black kingsnake		x
Lampropeltis c. calligaster	prairie kingsnake	x	x

Lampropeltis t. triangulum	eastern milksnake		x
Nerodia s. sipedon	northern watersnake	x	x
Opheodrys aestivus	rough green snake	x	x
Storeria dekayi wrightorum	midland brown snake	x	x
Storeria o. occipitomaculata	northern red-bellied snake	x	x
Thamnophis s. sirtalis	eastern garter snake	x	x
EMYDIDAE - BOX AND WATER TURTLES			
Graptemys geographica	northern map turtle		x
Terrepene c. carolina	eastern box turtle	x	x
Trachemys scripta elegans	red-eared slider		x
KINOSTERNIDAE - MUSK AND MUD TURTLES			
Sternotherus odoratus	common musk turtle (stinkpot)		x
PHRYNOSOMATIDAE			
Sceloporus undulatus	eastern fence lizard	x	x
SCINCIDAE - SKINKS			
Eumeces fasciatus	common five-lined skink	x	x
Eumeces inexpectatus	southeastern five-lined skink	x	x
Eumeces laticeps	broad-headed skink	x	x
Scincella lateralis	little brown skink	x	x
TRIONYCHIDAE - SOFTSHELL TURTLES			
Apalone s. spinifera	spiny softshell		x
VIPERIDAE - VIPERS			
Agkistrodon c. contortrix	southern copperhead	x	x
Crotalus horridus	timber rattlesnake	x	x

Fish

Fish recorded on Fort Campbell from 1992 through 2017.

		Drainage System		
Scientific Name	Common Name	Casey Creek	Saline Creek	Little West Fork Creek
Ichthyomyzon castaneus	chestnut lamprey		?	
Ichthyomyzon sp.	lamprey			x
Lampetra aepyptera	least brook lamprey		x	x
Campostoma oligolepis	largescale stoneroller	x	x	x

		Drainage System		
Scientific Name	Common Name	Casey Creek	Saline Creek	Little West Fork Creek
Clinostomus funduloides	rosyside dace		?	
Cyprinella spiloptera	spotfin shiner		x	
Cyprinus carpio	carp		x	x
Hybopis amblops	bigeye chub			?
Luxilus chrysocephalus	striped shiner		x	x
Lythrurus fasciolaris	rosefin shiner		x	x
Notemigonus crysoleucas	golden shiner		x	x
Notropis boops	bigeye shiner			?
Notropis telescopus	telescope shiner			x
Chrosomus erythrogaster	southern redbelly dace		x	x
Pimephales notatus	bluntnose minnow			x
Pimephales promelas	fathead minnow			x
Rhinichthys obtusus	western blacknose dace		x	x
Semotilus atromaculatus	creek chub	x	x	x
Catostomus commersonii	white sucker			x
Erimyzon claviformis	western creek chubsucker	x	x	x
Hypentelium nigricans	northern hog sucker		x	x
Minytrema melanops	spotted sucker			x
Moxostoma carinatum	river redhorse			?
Moxostoma erythrurum	golden redhorse		x	x
Ameiurus melas	black bullhead			x
Ameiurus natalis	yellow bullhead			x
Ictalurus punctatus	channel catfish		x	
Noturus exilis	slender madtom			x
Esox americanus	grass pickerel			x
Esox niger	chain pickerel			?
Umbra limi	central mudminnow		x	
Aphredoderus sayanus	pirate perch		x	x
Forbesichthys agassizi	spring cavefish			x
Fundulus catenatus	northern studfish		x	x
Fundulus olivaceus	blackspotted topminnow		x	x
Gambusia affinis	western mosquitofish		x	x

		Drainage System		
Scientific Name	Common Name	Casey Creek	Saline Creek	Little West Fork Creek
Labidesthes sicculus	brook silverside			x
Cottus bairdii	mottled sculpin			x
Cottus carolinae	banded sculpin		x	x
Morone chrysops	white bass			x
Amblopites rupestris	rockbass			x
Lepomis cyanellus	green sunfish		x	x
Lepomis gulosus	warmouth			x
Lepomis macrochirus	bluegill		x	x
Lepomis megalotis	longear sunfish		x	x
Lepomis microlophus	redear sunfish			x
Micropterus punctulatus	spotted bass			x
Micropterus salmoides	largemouth bass		x	x
Pomoxis nigromaculatus	black crappie			x
Etheostoma atripinne	cumberland snubnose darter			x
Etheostoma caeruleum	rainbow darter		x	x
Etheostoma chlorosomum	bluntnose darter		?	?
Etheostoma crossopterum	fringed darter	x	x	x
Etheostoma derivativum	rock darter			x
Etheostoma flabellare	fantail darter		x	x
Etheostoma flavum	saffron darter		x	x
Etheostoma sp. cf. *spectabile*	mamequit darter	x	x	x
Etheostoma nigrum	johnny darter		?	?
Etheostoma zonale	banded darter		x	
Percina caprodes	log perch			x
Percina sciera	dusky darter		?	
Percina maculata	blackside darter			x
Aplodinotus grunniens	freshwater drum		x	
Oncorhynchus mykiss	rainbow trout			x
Salmo trutta	brown trout			x

? – questionable record without voucher specimens

Birds

Birds recorded on Fort Campbell from 1992 through 2017.

Scientific Name	Common Name	State	
		KY	TN
ANATIDAE – DUCKS, GEESE, SWANS			
Anser albifrons	Greater White-fronted Goose		x
Chen caerulescens	Snow Goose		x
Branta hutchinsii	Cackling Goose		x
Branta canadensis	Canada Goose	x	x
Aix sponsa	Wood Duck	x	x
Anas strepera	Gadwall		x
Anas americana	American Widgeon		x
Anas rubripes	American Black Duck		x
Anas platyrhynchos	Mallard		x
Anas discors	Blue-winged Teal		x
Anas clypeata	Northern Shoveler		x
Anas acuta	Northern Pintail		x
Anas crecca	Green-winged Teal		x
Aythya valisneria	Canvasback		x
Aythya americana	Redhead		x
Aythya collaris	Ring-necked Duck		x
Aythya marila	Greater Scaup		x
Aythya affinis	Lesser Scaup		x
Bucephala albeola	Bufflehead		x
Bucephala clangula	Common Goldeneye		x
Lophodytes cucullatus	Hooded Merganser		x
Mergus serrator	Red-breasted Merganser		x
Oxyura jamaicensis	Ruddy Duck		x
ODONTOPHORIDAE - QUAIL			
Colinus virginianus	Northern Bobwhite	x	x
PHASIANIDAE – TURKEY, GROUSE, PHEASANT			
Meleagris gallopavo	Wild Turkey	x	x
GAVIIDAE - LOONS			
Gavia immer	Common Loon		x

Scientific Name	Common Name	State	
		KY	TN
PODICIPEDIDAE - GREBES			
Podilymbus podiceps	Pied-billed Grebe		x
PHALACROCORACIDAE - CORMORANTS			
Phalacrocorax auritus	Double-crested Cormorant		x
PELECANIDAE - PELICANS			
Pelecanus erythrorhynchos	American White Pelican		x
ARDEIDAE – BITTERNS AND HERONS			
Botaurus lentiginosus	American Bittern		x
Ardea herodias	Great Blue Heron	x	x
Ardea alba	Great Egret	x	x
Egretta caerulea	Little Blue Heron		x
Bubulcus ibis	Cattle Egret		x
Butorides virescens	Green Heron	x	x
Nyctricorax nycticorax	Black-crowned Night-Heron		?
CATHARTIDAE – NEW WORLD VULTURES			
Coragyps atratus	Black Vulture	x	x
Cathartes aura	Turkey Vulture	x	x
PANDIONIDAE – OSPREYS			
Pandion haliaetus	Osprey		x
ACCIPITRIDAE – KITES, HAWKS, EAGLES			
Elanoides forficatus	Swallow-tailed Kite		x
Elanus leucurus	White-tailed Kite		x
Ictinia mississippiensis	Mississippi Kite		x
Haliaeetus leucocephalus	Bald Eagle	x	x
Circus cyaneus	Northern Harrier	x	x
Accipiter striatus	Sharp-shinned Hawk	x	x
Accipiter cooperii	Cooper's Hawk	x	x
Buteo lineatus	Red-shouldered Hawk	x	x
Buteo platypterus	Broad-winged Hawk	x	x
Buteo jamaicensis	Red-tailed Hawk	x	x
Buteo lagopus	Rough-legged Hawk		x
FALCONIDAE - FALCONS AND CARACARAS			
Falco sparverius	American Kestrel	x	x

Scientific Name	Common Name	State	
		KY	TN
Falco columbarius	Merlin		x
Falco peregrinus	Peregrine Falcon		x
RALLIDAE - RAILS AND COOTS			
Porzana carolina	Sora		x
Fulica americana	American Coot		x
GRUIDAE - CRANES			
Grus canadensis	Sandhill Crane	x	x
CHARADRIIDAE – PLOVERS			
Pluvialis dominica	American Golden-plover		x
Charadrius semipalmatus	Semipalmated Plover		?
Charadrius vociferus	Killdeer	x	x
SCOLOPACIDAE - SANDPIPERS			
Actitis macularius	Spotted Sandpiper		x
Tringa solitaria	Solitary Sandpiper	x	x
Tringa melanoleuca	Greater Yellowlegs		x
Bartramia longicauda	Upland Sandpiper		x
Tryngites subruficollis	Buff-breasted Sandpiper	x	
Gallinago delicata	Wilson's Snipe	x	x
Scolopax minor	American Woodcock		x
LARIDAE - GULLS AND TERNS			
Chroicocephalus philadelphia	Bonaparte's Gull	x	
Larus delawarensis	Ring-billed Gull		x
Larus argentatus	Herring Gull		x
Sterna forsteri	Forster's Tern		x
COLUMBIDAE - PIGEONS AND DOVES			
Columba livia	Rock Pigeon	x	x
Zenaida macroura	Mourning Dove	x	x
CUCULIDAE - CUCKOOS AND ANIS			
Coccyzus americanus	Yellow-billed Cuckoo	x	x
Coccyzus erythropthalmus	Black-billed Cuckoo	x	x
TYTONIDAE - BARN OWLS			
Tyto alba	Barn Owl		x
STRIGIDAE - TYPICAL OWLS			

Scientific Name	Common Name	State	
		KY	TN
Megascops asio	Eastern Screech-owl		x
Bubo virginianus	Great Horned Owl	x	x
Strix varia	Barred Owl		x
Asio otus	Long-eared Owl		x
Asio flammeus	Short-eared Owl	x	x
Aegolius acadicus	Northern Saw-whet Owl		x
CAPRIMULGIDAE - NIGHTJARS			
Chordeiles minor	Common Nighthawk	x	x
Caprimulgus carolinensis	Chuck-will's-widow		x
Caprimulgus vociferus	Eastern Whip-poor-will	x	x
APODIDAE - SWIFTS			
Chaetura pelagica	Chimney Swift	x	x
TROCHILIDAE - HUMMINGBIRDS			
Archilochus colubris	Ruby-throated Hummingbird	x	x
ALCEDINIDAE – KINGFISHERS			
Megaceryle alcyon	Belted Kingfisher	x	x
PICIDAE - WOODPECKERS			
Melanerpes erythrocephalus	Red-headed Woodpecker	x	x
Melanerpes carolinus	Red-bellied Woodpecker	x	x
Sphyrapicus varius	Yellow-bellied Sapsucker	x	x
Picoides pubsecens	Downy Woodpecker	x	x
Picoides villosus	Hairy Woodpecker	x	x
Colaptes auratus	Northern Flicker	x	x
Dryocopus pileatus	Pileated Woodpecker	x	x
TYRANNIDAE - TYRANT FLYCATCHERS			
Contopus cooperi	Olive-sided Flycatcher	x	x
Contopus virens	Eastern Wood-pewee	x	x
Empidonax flaviventris	Yellow-bellied Flycatcher	x	x
Empidonax virescens	Acadian Flycatcher	x	x
Empidonax alnorum	Alder Flycatcher		x
Empidonax traillii	Willow Flycatcher	x	x
Empidonax minimus	Least Flycatcher		x
Sayornis phoebe	Eastern Phoebe	x	x

Scientific Name	Common Name	State	
		KY	TN
Myiarchus crinitus	Great Crested Flycatcher	x	x
Tyrannus tyrannus	Eastern Kingbird	x	x
Tyrannus forficatus	Scissor-tailed Flycatcher	x	
LANIIDAE - SHRIKES			
Lanius ludovicianus	Loggerhead Shrike	x	x
VIREONIDAE - VIREOS			
Vireo griseus	White-eyed Vireo	x	x
Vireo bellii	Bell's Vireo	x	x
Vireo flavifrons	Yellow-throated Vireo	x	x
Vireo solitarius	Blue-headed Vireo		x
Vireo gilvus	Warbling Vireo		x
Vireo philadelphicus	Philadelphia Vireo		x
Vireo olivaceus	Red-eyed Vireo	x	x
CORVIDAE - JAYS, CROWS, MAGPIES			
Cyanocitta cristata	Blue Jay	x	x
Corvus brachyrhynchos	American Crow	x	x
ALAUDIDAE – LARKS			
Eremophila alpestris	Horned Lark	x	x
HIRUNDINIDAE - SWALLOWS			
Progne subis	Purple Martin	x	x
Tachycineta bicolor	Tree Swallow		x
Stelgidopteryx serripennis	Northern Rough-winged Swallow	x	x
Petrochelidon pyrrhonota	Cliff Swallow	x	x
Hirundo rustica	Barn Swallow	x	x
PARIDAE - TITMICE AND CHICKADEES			
Poecile carolinensis	Carolina Chickadee	x	x
Baeolophus bicolor	Tufted Titmouse	x	x
SITTIDAE - NUTHATCHES			
Sitta canadensis	Red-breasted Nuthatch		x
Sitta carolinensis	White-breasted Nuthatch	x	x
CERTHIIDAE - CREEPERS			
Certhia americana	Brown Creeper		x
TROGLODYTIDAE - WRENS			

Scientific Name	Common Name	State	
		KY	TN
Thryothorus ludovicianus	Carolina Wren	x	x
Thryomanes bewickii	Bewick's Wren	x	
Troglodytes aedon	House Wren	x	x
Troglodytes hiemalis	Winter Wren	x	x
Cistothorus platensis	Sedge Wren	x	x
Cistothorus palustris	Marsh Wren		x
POLIOPTILIDAE - GNATCATCHERS			
Polioptila caerulea	Blue-gray Gnatcatcher	x	x
REGULIDAE - KINGLETS			
Regulus satrapa	Golden-crowned Kinglet	x	x
Regulus calendula	Ruby-crowned Kinglet	x	x
TURDIDAE - THRUSHES			
Sialia sialis	Eastern Bluebird	x	x
Catharus fuscescens	Veery		x
Catharus minimus	Gray-cheeked Thrush		x
Catharus ustulatus	Swainson's Thrush	x	x
Catharus guttatus	Hermit Thrush	x	x
Hylocichla mustelina	Wood Thrush	x	x
Turdus migratorius	American Robin	x	x
MIMIDAE - MIMIC THRUSHES			
Dumetella carolinensis	Gray Catbird	x	x
Mimus polyglottos	Northern Mockingbird	x	x
Toxostoma rufum	Brown Thrasher	x	x
STURNIDAE - STARLINGS			
Sturnus vulgaris	European Starling	x	x
MOTACILLIDAE – PIPITS			
Anthus rubescens	American Pipit		x
BOMBYCILLIDAE - WAXWINGS			
Bombycilla cedrorum	Cedar Waxwing	x	x
CALCARIIDAE - LONGSPURS			
Calcarius pictus	Smith's Longspur		x
PARULIDAE - WARBLERS			
Seiurus aurocapillus	Ovenbird	x	x

Scientific Name	Common Name	State	
		KY	TN
Helmitheros vermivora	Worm-eating Warbler	x	x
Parkesia motacilla	Louisiana Waterthrush	x	x
Parkesia noveboracensis	Northern Waterthrush		x
Vermivora chrysoptera	Golden-winged Warbler		x
Vermivora cyanoptera	Blue-winged Warbler	x	x
Mniotilta varia	Black-and-white Warbler	x	x
Protonotaria citrea	Prothonotary Warbler	x	x
Oreothlypis peregrina	Tennessee Warbler		x
Oreothlypis celata	Orange-crowned Warbler		x
Oreothlypis ruficapilla	Nashville Warbler	x	x
Geothlypis philadelphia	Mourning Warbler		x
Geothlypis formosus	Kentucky Warbler	x	x
Geothlypis trichas	Common Yellowthroat	x	x
Setophaga citrina	Hooded Warbler	x	x
Setophaga ruticilla	American Redstart		x
Setophaga tigrina	Cape May Warbler		x
Setophaga cerulea	Cerulean Warbler		x
Setophaga americana	Northern Parula	x	x
Setophaga magnolia	Magnolia Warbler		x
Setophaga castanea	Bay-breasted Warbler		x
Setophaga fusca	Blackburnian Warbler		x
Setophaga petechia	Yellow Warbler	x	x
Setophaga pensylvanica	Chestnut-sided Warbler	x	x
Setophaga striata	Blackpoll Warbler		x
Setophaga palmarum	Palm Warbler	x	x
Setophaga pinus	Pine Warbler	x	x
Setophaga coronata	Yellow-rumped Warbler	x	x
Setophaga dominica	Yellow-throated Warbler	x	x
Setophaga discolor	Prairie Warbler	x	x
Setophaga virens	Black-throated Green Warbler	x	x
Cardellina pusilla	Wilson's Warbler		x
Icteria virens	Yellow-breasted Chat	x	x
EMBERIZIDAE - SPARROWS			

		State	
Scientific Name	Common Name	KY	TN
Pipilo erythrophthalmus	Eastern Towhee	x	x
Peucaea aestivalis	Bachman's Sparrow	x	x
Spizella arborea	American Tree Sparrow		x
Spizella passerina	Chipping Sparrow	x	x
Spizella pusilla	Field Sparrow	x	x
Pooecetes gramineus	Vesper Sparrow		x
Chondestes grammacus	Lark Sparrow	x	x
Passerculus sandwichensis	Savannah Sparrow	x	x
Ammodramus savannarum	Grasshopper Sparrow	x	x
Ammodramus henslowii	Henslow's Sparrow	x	x
Ammodramus leconteii	Le Conte's Sparrow		x
Passerella iliaca	Fox Sparrow	x	x
Melospiza melodia	Song Sparrow	x	x
Melospiza lincolnii	Lincoln's Sparrow	x	x
Melospiza georgiana	Swamp Sparrow	x	x
Zonotrichia albicollis	White-throated Sparrow	x	x
Zonotrichia leucophrys	White-crowned Sparrow	x	x
Junco hyemalis	Dark-eyed Junco	x	x
CARDINALIDAE - TANAGERS, CARDINALS, BUNTINGS			
Piranga rubra	Summer Tanager	x	x
Piranga olivacea	Scarlet Tanager	x	x
Cardinalis cardinalis	Northern Cardinal	x	x
Pheucticus ludovicianus	Rose-breasted Grosbeak	x	x
Passerina caerulea	Blue Grosbeak	x	x
Passerina cyanea	Indigo Bunting	x	x
Spiza americana	Dickcissel	x	x
ICTERIDAE – BLACKBIRDS AND ORIOLES			
Dolichonyx oryzivorus	Bobolink		x
Agelaius phoeniceus	Red-winged Blackbird	x	x
Sturnella magna	Eastern Meadowlark	x	x
Euphagus carolinus	Rusty Blackbird	x	x
Euphagus cyanocephalus	Brewer's Blackbird		x
Quiscalus quiscula	Common Grackle	x	x

Scientific Name	Common Name	State	
		KY	TN
Molothrus ater	Brown-headed Cowbird	x	x
Icterus spurius	Orchard Oriole	x	x
Icterus galbula	Baltimore Oriole	x	x
FRINGILLIDAE - FINCHES			
Carpodacus purpureus	Purple Finch	x	x
Carpodacus mexicanus	House Finch		x
Spinus pinus	Pine Siskin		x
Spinus tristis	American Goldfinch	x	x
PASSERIDAE - OLD WORLD SPARROWS			
Passer domesticus	House Sparrow		x

Mammals

Mammals recorded on Fort Campbell from 1992 through 2017.

Scientific Name	Common Name	State	
		KY	TN
CANIDAE - DOGS AND ALLIES			
Canis latrans	coyote	x	x
Urocyon cinereoargenteus	gray fox	x	x
Vulpes vulpes	red fox	x	x
CASTORIDAE - BEAVERS			
Castor canadensis	beaver	x	x
CERVIDAE - DEER, ELK, AND MOOSE			
Odocoileus virginianus	white-tailed deer	x	x
DIDELPHIDAE - OPOSSUMS			
Didelphis marsupialis	opossum	x	x
DASYPODIDAE - ARMADILLOS			
Dasypus novemcinctus	nine-banded armadillo	x	x
FELIDAE - CATS			
Lynx rufus	bobcat	x	x
LEPORIDAE - RABBITS AND HARES			
Sylvilagus floridanus	eastern cottontail rabbit	x	x
MEPHITIDAE -SKUNKS			

Scientific Name	Common Name	State	
		KY	TN
Mephitis mephitis	striped skunk	x	x
MURIDAE - RATS AND MICE			
Peromyscus maniculatus	deer mouse	x	x
Reithrodontomys humulis	eastern harvest mouse	x	x
Orchrotomys nuttalli	golden mouse	x	x
Mus musculus	house mouse	x	x
Zapus hudsonius	meadow jumping mouse		x
Ondatra zibethicus	muskrat	x	x
Microtus pinetorum	pine vole	x	x
Oryzomys palustris	rice rat	x	x
Synaptomys cooperi	southern bog lemming		x
Peromyscus leucopus	white-footed mouse	x	x
MUSTELIDAE - WEASELS AND ALLIES			
Lutra canadensis	river otter		x
PROCYONIDAE - RACCOONS			
Procyon lotor	raccoon	x	x
SCIURIDAE - SQUIRRELS			
Tamias striatus	eastern chipmunk	x	x
Sciurus niger	fox squirrel	x	x
Sciurus carolinensis	gray squirrel	x	x
Marmota monax	groundhog	x	x
Glaucomys volans	southern flying squirrel	x	x
SORICIDAE - SHREWS			
Sorex cinereus	masked shrew	x	x
Sorex hoyi	pigmy shrew		x
Blarina brevicauda	short-tail shrew	x	x
Sorex longirostris	southeastern shrew	x	x
TALPIDAE - MOLES			
Scalopus aquaticus	eastern mole	x	x
VESPERTILIONIDAE - MOUSE-EARED BATS			
Eptesicus fuscus	big brown bat	x	x
Lasionycteris noctivagans	silver-haired bat	x	x
Lasiurus borealis	red bat	x	x

Scientific Name	Common Name	State	
		KY	TN
Lasiurus cinereus	hoary bat	x	x
Lasiurus seminolus	seminole bat	x	
Myotis austroriparius	southeastern bat	x	x
Myotis grisescens	gray bat	x	x
Myotis lucifugus	little brown bat	x	x
Myotis septentrionalis	Northern long-eared bat	x	x
Myotis sodalis	Indiana bat	x	x
Nycticeius humeralis	evening bat	x	x
Peromyotis subflavus	tri colored bat	x	x

FLORAL LIST FOR FORT CAMPBELL, KENTUCKY
Flora species identified at Fort Campbell in 1992.

Botanical Name	Common Name
ACANTHACEAE	ACANTHUS FAMILY
Justicia americana	water willow
Ruellia strepens var *strepens*	smooth wild petunia
ACERACEAE	MAPLE FAMILY
Acer negundo spp *negundo* var *negundo*	box-elder
Acer rubrum spp *rubrum* var *rubra*	red maple
Acer saccharinum	silver maple
Acer saccharum spp *floridanum*	sugar maple
AGAVACEAE	CENTURY PLANT FAMILY
Yucca flaccida yucca,	Spanish bayonet
ALISMATACEAE	WATER-PLANTAIN FAMILY
Alisma subcordatum	water-plantain
AMARANTHACEAE	AMARANTH FAMILY
Amaranthus retroflexus var *retroflexus*	green amaranth, pigweed
AMARYLLIDACEAE	AMARYLLIS FAMILY
Manfreda virginica	false aloe
Narcissus poeticus	poet's narcissus
ANACARDIACEAE	CASHEW FAMILY
Rhus copallina var *copallina*	winged sumac
Rhus glabra	smooth sumac
Toxicodendron radicans	poison ivy
ANNONACEAE	ANNONA FAMILY
Asimina triloba	pawpaw
APOCYNACEAE	DOGBANE FAMILY
Apocynum cannabinum	Indian hemp

Vinca minor	periwinkle
ARACEAE	ARUM FAMIL Y
Arisaema dracontium	green dragon
Arisaema triphyllum var *triphyllum*	small Jack-in-the-pulpit
ARALIACEAE	GINSENG FAMILY
Aralia spinosa	devil's walking stick
Panax quinquefolius	wild ginseng
ARISTOLOCHIACEAE	BIRTHWORT FAMILY
Asarum canadense var *acuminatum*	wild ginger
ASCLEPIADACEAE	MILKWEED FAMILY
Asclepias incarnata var *incarnata*	swamp-milkweed
Asclepias tuberosa spp *interior*	butterfly-weed
Asclepias viridiflora var *lanceolata*	green milkweed
Asplenium platyneuron var *platyneuron*	ebony-spleenwort
ASCLEPIADACEAE	MILKWEED FAMILY
Asplenium rhizophyllum	walking fern
Woodsia obtuse	common woodsia
Athyrium filix-femina var *angustum*	lady fern
Polystichum acrostichoides	Christmas fern
BALSAMINACEAE	TOUCH-ME-NOT FAMILY
Impatiens capensis	spotted touch-me-not
Impatiens pallida	pale touch-me-not
BERBERIDACEAE	BARBERRY FAMILY
Podophyluum peltatum	mayapple
BETULACEAE	BIRCH FAMILY
Alnus serrulata	common alder
Betula nigra	river birch
Carpinus caroliniana	American hornbeam
Ostrya virginiana	hop-hornbeam
BIGNONIACEAE	BIGNONIA FAMILY
Bignonia capreolata	cross-vine
Campsis radicans	trumpet-creeper
BORAGINACEAE	BORAGE FAMILY
Cynoglossum virginianum	wild comfrey
Lithospermum arvense	corn gromwell
Lithospermum canescens	hoary puccoon
Mertensia virginica	bluebells
Myosotis macrosperma	large-seeded scorpion grass
CAMPANULACEAE	BELLFLOWER FAMILY
Campanula americana	American bellflower
Lobelia puberula var meneolaya	downy lobelia
Lobelia puberula var puberula	downy lobelia
Lobelia spicata var spicata	spiked lobelia
Triodanis perfoliata	Venus' looking glass
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY
Lonicera japonica	Japanese honeysuckle
Lonicera sempervirens var sempervirens	trumpet-honeysuckle

Sambucus canadensis var canadensis	common elder
Symphoricarpos orbiculatus	coralberry
CARYOPHYLLACEAE	PINK FAMILY
Cerastium viscosum	sticky mouse-ear chickweed
Dianthus armeria	Deptford pink
Silene stellata	starry campion
Silene virginica	fire-pink
Stellaria media	common chickweed
Stellaria pubera	great chickweed
CELASTRACEAE	BITTERSWEET FAMILY
Euonymus biautschovicus	wahoo
Euonymus americanus	strawberry-bush
Euonymus atropurpureus	burning bush
CHENOPODIACEAE	GOOSEFOOT FAMILY
Chenopodium album var *lanceolatum*	pigweed
CISTACEAE	ROCK-ROSE FAMILY
Lechea tenuifolia var *tenuifolia*	narrow-leaved pinweed
COMMELINACEAE	SPIDERWORT FAMILY
Commelina communis var *ludens*	dayflower
Tradescantia subaspera harsh	spiderwort
COMPOSITAE	COMPOSITE FAMILY
Achillea millefolium	common yarrow
Ambrosia artemisiifolia var *artemisiifolia*	common ragweed
Ambrosia bidentata	twice-toothed ragweed
Ambrosia trifida	giant ragweed
Antennaria plantaginifolia	pussytoes
Aster dumosus var *dumosus*	bushy aster
Aster pilosus	pilose aster
Aster simplex	panicled aster
Aster solidagineus	white -topped aster
Astranthium integrifolium spp *integrifolium*	western daisy
Bidens polylepis var *polylepis*	scaled sticktights
Boltonia asteroides var *latisguama*	boltonia
Carduus nutans	musk-thistle
Cichorium intybus	common chickory
Cirsium discolor	two-colored thistle
Conoclinum coelestinum	mistflower
Conyza canadensis var *canadensis*	horseweed
Coreopsis major	large tickseed
Coreopsis tinctoria var *tinctoria*	tickseed
Eclipta alba	yerba-de-tajo
Elephantopus carolinianus	Carolina elephant’s foot
Erechtites hieracifolia var *hieracifolia*	fireweed, pilewort
Erigeron annuus	daisy-fleabane
Erigeron philadelphicus	Philadephia fleabane
Erigeron strigosus var *beyrichii*	daisy fleabane
Eupatoriadelphus fistulosus	Joe-pye-weed

Eupatoriadelphus fistulosum	hollow Joe-pye-weed
Eupatorium hyssopifolium var *calcaratum*	hyssop-leaved thoroughwort
Eupatorium perfoliatium	perfoliate boneset
Eupatorium perfoliatium var *cuneatum*	perfoliate thoroughwort
Eupatorium rugosum	white snakeroot
Eupatorium serotinum var *serotinum*	large-flowering thoroughwort
Euthamia graminifolia	
Fleischmannia incarnata	
Gamochaeta purpurea	purple cudweed
Gnaphalium obtusifolium var *obtusifolium*	catfoot
Grindelia lanceolata	gumweed
Helenium amarum	slender-leaved sneezeweed
Helenium flexuosum	flexous sneezeweed
Helianthus hirsutus	hairy sunflower
Helianthus maximilianii	Maximilian's sunfloer
Helianthus microcephalus	small wood-sunflower
Helianthus mollis	soft sunflower
COMPOSITAE	COMPOSITE FAMILY
Helianthus occidentalis var *occidentalis*	western sunflower
Helianthus tuberosus	Jerusalem artichoke
Heterotheca camporum	camphorweed
Kringa biflora	two-flowered cynthia
Krigia virginica Virginia	dwarf dandelion
Lactuca floridana var *floridana*	Florida wild lettuce
Lactuca serriola var *serriola*	prickly lettuce
Leucanthemum vulgare	ox-eye daisy
Liatris squarrosa var *hirsuta*	spreading blazing star
Pyrrhopappus carolinianus	false dandelion
Rudbeckia hirta var *hirta*	black-eyed Susan
Rudbeckia triloba var *triloba*	lobed-leaved coneflower
Senecio glabellus	butterweed
Silphium laciniatum	compass plant
Silphium t. var *terebinthaceum*	prairie dock
Solidago altissima var *altissima*	tall goldenrod
Solidago caesia var *caesia*	blue-stem goldenrod
Solidago juncea	stiff goldenrod
Solidago nemoralis var *longipetiolata*	woodland goldenrod
Solidago ulmifolia var *ulmifolia*	elm-leaved goldenrod
Taraxacum officinale	common dandelion
Verbesina alternifolia	wing-stem
Verbesina virginica var *virginica*	tickweed
Vernonia altissim	ironweed
Vernonia gigantea spp *gigantean*	tall ironweed
Xanthium strumarium var *glabratum*	cocklebur
CONVOLVULACEAE	MORNING-GLORY FAMILY
Calystegia silvatica spp *fraterniflora*	bindweed
Cuscuta pentagona	prairie dodder

Ipomoea hederacea	ivy-like morning glory
Ipomea pandurata	morning glory
CORNACEAE	DOGWOOD FAMILY
Cornus florida	flowering dogwood
Nyssa sylvatica var *sylvatica*	black gum
CRASSULACEAE	STONECROP FAMILY
Penthorum sedoides	ditch-stonecrop
Sedum ternatum	stonecrop
CRUCIFERAE	MUSTARD FAMILY
Barbarea vulgaris	common winter-cress
Brassica napus	turnip
Capsella bursa-pastoris	shepherd's purse
Cardamine bulbosa	spring-cress
Cardamine concatenata	lacinate toothwort
Cardamine parviflora	small-flowered bitter cress
Iodanthus pinnatifidus	purple rocket
Lepidium virginicum var *robinsonii*	peppergrass
Lepidium virginicum var *virginicum*	peppergrass
Sisymbrium officinale	hedge mustard
Thlaspi arvense	field penny-cress
CYPERACEAE	SEDGE FAMILY
Carex albursina	sedge
Carex amphibola var *turgida*	ambiguous sedge
Carex annectens var *xanthocarpa*	connected sedge
Carex artitecta var *artitecta*	covered sedge
Carex blanda	charming sedge
Carex cephalophora	headed sedge
Carex flaccidula	sedge
Carex frankii	Frank's sedge
Carex hirsutella	sedge
Carex jamesii	James' sedge
Carex vulpinoidea	fox-tail sedge
Cyperus filiculmis	thread-like sedge
Cyperus lancastriensis	Lancaster's sedge
Cyperus pseudovegetus	green sedge
Eleocharis intermedia	spike-rush
Eleocharis obtusa var *obtusa*	blunt spike-rush
Eleocharis tenuis var *tenuis*	spike-rush
Rhynchospora coniculata var *coniculata*	horned-rush
CYPERACEAE	RUSH FAMILY
Scirpus atrovirens	dark-green bulrush
Scirpus cyperinus	red bulrush
Scirpus pendulus	line-scalled bulrush
DIOSCOREACEAE	YAM FAMILY
Dioscorea quaternata var *quaternata*	common yam
EBENACEAE	PERSIMMON FAMILY
Diospyros virginiana	common persimmon

ELAEGNACEAE	OLEASTER FAMILY
Elaeagnus umbellata	autumn olive
ERICACEAE	HEATH FAMILY
Chimaphila maculata var *maculata*	spotted wintergreen
Vaccinium arboretum	farkleberry
EUPHORBIACEAE	SPURGE FAMILY
Acalypha ostryifolia	three-seeded mercury
Croton monanthogynus	prairie-tea
Euphorbia corollata	flowering spurge
Euphorbia maculata	milk purslane
Euphorbia nutans	eyebane
FAGACEAE	BEECH FAMILY
Fagus grandifolia	American beech
Quercus alba	white oak
Quercus coccinea	scarlet oak
Quercus falcata var *falcata*	southern red oak
Quercus imbricaria	shingle oak
Quercus marilandica	black jack oak
Querucs muhlenbergii	chinkapin oak
Quercus palustris	pin oak
Quercus phellos	willow oak
Quercus shumardii var *shumardii*	Shumard's red oak
Quercus stellata var *stellata*	post oak
Quercus velutina	black oak
GENTIANACEAE	GENTIAN FAMILY
Sabatia angularis	rose-pink
GERANIACEAE	GERANIUM FAMILY
Geranium maculatum	wild geranium
GRAMINAE	GRASS FAMILY
Agrostis alba	red top
Alopecurus carolinianus	Carolina foxtail
Andropogon gerardii var *gerardii*	big bluestem
Andropogon virginicus	broomsedge
Aristida longispica var *longispica*	threeawn
Aristida oligantha	few-flowered needlegrass
Arundinaria gigantea	large cane
Bromus commutatus	racemose brome grass
Bromus purgens var *purgans*	woodland brome grass
Chasmanthium latifolium	wild oats, uniola
Cinna latifolia	wood reed-grass
Cynodon dactylon	Bermuda grass
Dichanthelium a. var *acuminatum*	panic grass
Dichanthelium boscii	Bosc's panic grass
Dichanthelium d. var *dichotomum*	small-fruited panic grass
Dichanthelium latifolium	panic grass
Dichanthelium laxiflorum	loose-flowered panic grass
Dichanthelium scoparium	broom-like panic grass

Dichanthelium s. var *isophyllum*	round-fruited panic grass
Dichanthelium s. var *sphaerocarpon*	round-fruited panic grass
Digitaria sanguinalis	hairy crab grass
Echinochloa crusgalli var *crusgalli*	barnyard grass
Eleusine indica	wiregrass
Elymus villosus var *villosus*	hairy wild rye
Eragrostis capillaris	lace grass
Eragrostis cilianensis	stink-love-grass
Eragrostis pectinacea	purple eragrostis
Eragrostis spectabilis	tumble grass
Erianthus alopecuroides	wooly beardgrass
Festuca arundinaceae	tall fescue
Festuca obtuse	fescue
Glyceria striata var *striata*	manna-grass
Hystrix patula	bottle-brush grass
Lolium perenne var *perenne*	common ryegrass
Panicum anceps var *anceps*	two-edged panic grass
Paspalum laeve var *circulare*	smooth knotgrass
Phleum pratense var *pratense*	common timothy
Poa annua var *annua*	low speargrass
Poa chapmaniana	bluegrass
Poa compressa	Canada bluegrass
Poa pratensis	Kentucky bluegrass
Poa sylvestris	bluegrass
Schizachyrium scoparium var *scoparium*	little bluestem
Setaria geniculata	bent bristly foxtail
Setaria glauca	foxtail
Setaria italica	German millet
Setaria viridis	green foxtail
Sorghastrum nutans	Indian grass
Sorghum halepense	Johnson grass
Sphenopholis nitida	shining wedge grass
Sphenopholis obtusata var *major*	blunt wedge grass
Tridens flavus var *flavus*	tall red-top
Tripsacum dactyloides var *occidentale*	gama grass
GUTTIFERAE	ST. JOHN'S WORT FAMILY
Hypericum gentianoides	orange-grass
Hypericum mutilum	slender St. John's-wort
Hypericum perforatum	common St. John's-wort
Hypericum prolificum	shrubby St. John's-wort
Hypericum punctatum	dotted St. John's-wort
HAMAMELIDACEAE	WITCH-HAZEL FAMILY
Liquidambar styraciflua	sweet gum
HIPPOCASTANACEAE	HORSE-CHESTNUT FAMILY
Aesculus glabra var *glabra*	Ohio buckeye
HYDROPHYLLACEAE	WATER-LEAF FAMILY
Phacelia bipinnatifida	scorpion weed

Phacelia ranunculacea	ranunculus-leaved phacelia
IRIDACEAE	IRIS FAMILY
Iris cristata	crested dwarf iris
Sisyrinchium angustifolium	narrow-leaf blue-eyed grass
JUGLANDACEAE	WALNUT FAMILY
Carya cordiformis	bitternut hickory
Carya ovata var *ovata*	shagbark hickory
Carya tomentosa	mockernut hickory
Juglans cinera	white walnut, butternut
Juglans nigra	black walnut
JUNCACEAE	RUSH FAMILY
Juncus biflorus	rush
Juncus debilis	weak rush
Juncus tenuis var *tenuis*	path rush
Luzula echinata	woodrush
LAMIACEAE	MINT FAMILY
Blephilia hirsuta	wood-mint
Collinsonia canadensis var *canadensis*	richweed
Cunila origanoides	dittany
Glecoma hederacea	gill-over-the-ground
Lamium purpureum	purple dead-nettle
Monarda fistulosa var *mollis*	wild bergamot
Prunella vulgaris ssp *vulgaris*	heal-all
Pycnanthemum incanum	mint
Pycanthemum pilosum	hairy mountain mint
Pycnanthemum tenuifolium	slender mountain mint
Scutellaria integrifolia var *integrifolia*	entire-leaved skullcap
Scutellaria ovata var *ovata*	heart-leaved skullcap
Scutellaria serrata	showy skullcap
Stachys tenuifolia	smooth hedge nettle
Teucrium canadense var *canadense*	American germander
LAURACEAE	LAUREL FAMILY
Lindera benzoin	spicebush
Sassafras albidum	white sassafras
LEGUMINOSAE	PEA FAMILY
Albizia julibrissin	mimosa
Amphicarpaea bracteata var *bracteata*	hog-peanut
Apios americana var *americana*	American potato bean
Cassia fasciculata var *puberula*	partridge-pea
Cassia nictitans	wild sensitive plant
Cercis canadensis var *canadensis*	redbud
Desmodium ciliare	ciliate tick clover
Desmodium glutinosum	glutinous tick clover
Desmodium pauciflorum	few-flowered tick seed
Desmodium rotundifolium	prostrate tick-trefoil
Gleditsia triacanthos	honey locust
Glycine max	soybean

Lespedeza cuneata	sericea lespedeza
Lespedeza hirta var *hirta*	hairy bush clover
Lespedeza procumbens	prostrate lespedeza
Lespedeza stipulacea	Korean clover
Lespedeza thunbergii	clover
Lespedeza virginica	Virginia lespedeza
Melilotus alba	white sweet-clover
Melilotus officinalis	yellow sweet-clover
Pueraria lobata	kudzu-vine
Robinia pseudoacacia var *pseudoacacia*	black locust
Stophostyles helvola	yellow wild bean
Stophostyles umbellata	pink wild bean
Tephrosia virginiana var *virginiana*	goat's-rue
Trifolium dubium	low hop clover
Trifolium pratense	red clover
LEGUMINOSAE	PEA FAMILY
Trofolium repens	white clover
Vicia cracca	tufted vetch
LILIACEAE	LILY FAMILY
Allium canadense var *canadense*	wild onion
Allium vineale	field-garlic
Camassia scilloides	eastern camas, wild hyacinth
Erythronium albidum var *albidum*	white dog's-tooth-violet
Hemerocallis fulva	common orange day-lily
Muscari botryoides	grape-hyacinth
Ornithogalum umbellatum	star-of-bethlehem
Polygonatum biflorum var *biflorum*	two-flowered Soloman's seal
Smilacina racemosa var *racemosa*	false spikenard
Smilax glauca	sawbrier
Smilax rotundifolia var *rotundifolia*	common greenbriar
Trillium grandiflorum	large-flowered trillium
Trillium recurvatum	prairie trillium
Trillium viride	trillium
Uvularia sessilifolia	wild-oats
LINACEAE	FLAX FAMILY
Linum virginianum	yellow-flax
LOGANIACEAE	LOGANIA FAMILY
Spigelia marilandica	Indian-pink
LYCOPODIACEAE	CLUBMOSS FAMILY
Lycopodium digitatum	ground cedar
MAGNOLIACEAE	MAGNOLIA FAMILY
Liridodendron tulipifera	yellow poplar
MALVACEAE	MALLOW FAMILY
Abutilon theophrasi	velvet-leaf
Hibiscus mocsheutos var *moscheutos*	swamp rose-mallow
MELASTOMATACEAE	MEADOW-BEAUTY FAMILY
Rhexia mariana var *mariana*	Maryland meadow beauty

Rhexia virginica	Virginia meadow beauty
MORACEAE	MULBERRY FAMILY
Maclura pomifera	osage orange
Morus rubra	red mulberry
OLEACEAE	OLIVE FAMILY
Fraxinus americana	white ash
Fraxinus pennsylvanica	green ash
ONAGRACEAE	EVENING-PRIMROSE FAMILY
Circaea lutetiana spp *canadensis*	enchanter's nightshade
Gaura biennis	biennal gaura
Ludwigia alternifolia	seedbox
Oenothera biennis	biennial evening primrose
Oenothera linifolia	evening primrose
OPHIOGLOSSACEAE	ADDER'S-TONGUE FAMILY
Botrychium dissectum	common grape fern
ORCHIDACEAE	ORCHID FAMILY
Corallorhiza wisteriana	Wister's coral-root
Cypripedium calceolus	yellow lady's slipper
Liparis lilifolia	wayblade
Platanthera peramoena	purple fingeless orchid
Spiranthes cernua	common ladies'-tresses
Tipularia discolor	cranefly orchis
OXALIDACEAE	WOOD-SORREL FAMILY
Oxalis corniculata var *corniculata*	creeping lady's-sorrel
Oxalis stricta	sourgrass
Oxalis violacea	violet wood-sorrel
PASSIFLORACEAE	PASSION-FLOWER FAMILY
Passiflora edulis	apricot-vine
PHRYMACEAE	LOPSEED FAMILY
Phryma leptostachya	lopseed
PHYTOLACCACEAE	POKEWEED FAMILY
Phytolacca americana	pokeweed
PINNACEAE	PINE FAMILY
Juniperus virginiana	red cedar
Pinus taeda	loblolly pine
Pinus virginiana	Virginia pine
PLANTAGINACEAE	PLANTAIN FAMILY
Plantago aristata	bracted plantain
Plantago lanceolata	ribgrass
Plantago rugelii	Rugel's plantain
Plantago virginica	hoary plantain
PLATANACEAE	SYCAMORE FAMILY
Platanus occidentalis	sycamore
POLEMONIACEAE	PHLOX FAMILY
Phlox divaricata var *divaricata*	blue phlox
Polemonium reptans var *reptans*	Greek valerian
POLYGALACEAE	MILKWORT FAMILY

Polygala incarnata	pink milkwort
Polygala sanguinea	field milkwort
Polygala verticillata var *verticillata*	whorled milkwort
POLYGONACEAE	BUCKWHEAT FAMILY
Fagopyrum sagittatum	buckwheat
Polygonum hydropiperoides	mild water-pepper
Polygonum punctatum var *leptostachyum*	water smartweed
Polygonum sagittatum	arrow-leaved tearthumb
Polygonum setaceum var *setaceum*	bristly smartweed
Polygonum virginianum	jumpseed
Rumex acetosella	sheep-sorrel
Rumex crispus	curly dock
Rumex obtusifolius var *obtusifolius*	bitter dock
POLYPODIACEAE	COMMON FERN FAMILY
Asplenium platyneuron var *platyneuron*	ebony-spleenwort
Asplenium rhizophyllum	walking fern
Athyrium filix-femina ssp *anugustum*	lady fern
Polystichium acrostichoides	Christmas fern
Woodsia obtusa	blunt-lobed woodsia
PORTULACEAE	PURSLANE FAMILY
Claytonia virginica	spring beauty
POTAMOGETONACEAE	PONDWEED FAMILY
Potamogeton nodosus	long-leaved pondweed
PRIMULACEAE	PRIMROSE FAMILY
Dodecatheon meadia var *meadia*	shooting-star
Lysimachia ciliata	fringed loosestrife
Samolus parviflorus	water-pimpernel
RANUNCULACEAE	BUTTERCUP FAMILY
Actaea pachypoda	white baneberry
Anemone virginiana	tall anemone
Clematis virginiana	virgin’s bower
Delphinium tricorne	dwarf larkspur
Ranunculus abortivus ssp *abortivus*	kidney leaf-buttercup
Ranunculus sardous	European crowfoot
Thalictrum thalictroides	rue-anemone
RHAMNACEAE	BUCKTHORN FAMILY
Ceanothus americanus var *pitcheri*	New Jersey tea
Rhamnus caroliniana	Carolina buckthorn
ROSACEAE	ROSE FAMILY
Agrimonia microcarpa	agrimony
Agrimonia rostellata	agrimony
Amelanchier arborea	serviceberry
Crataegus ssp.	hawthorn
Duchesnea indica	Indian strawberry
ROSACEAE	ROSE FAMILY
Frageria virginiana spp *virginiana*	wild strawberry
Geum canadense	Canada avens

Malus angustifolia	wild crab
Potentilla simplex var *argyrisma*	old field cinquefoil
Prunus americana	wild plum
Prunus hortulana	wild-goose plum
Prunus munsoniana	plum
Prunus serotina var *serotina*	black cherry
Rosa carolina	pasture rose
Rosa multiflora	multiflora rose
Rosa setigera var *setigera*	prairie rose
Rubus allegheniensis	blackberry
Rubus flagallaris	dewberry
Rubus occidentalis	raspberry
Rubus ostryifolius	MADDER FAMILY
Cephalanthus occidentalis	buttonbush
Diodia teres var *teres*	poor-Joe
Galium aparine	cleavers
Galium pilosum	hairy bedstraw
Houstonia caerulea var *caerulea*	bluets
Houstonia minima	star-violet
Houstonia purpurea var *purpurea*	purple bluets
SALICACEAE	WILLOW FAMILY
Populus alba	white poplar
Populus deltoides ssp *deltoides*	cottonwood
Salix caroliniana	Ward's willow
Salix nigra	black willow
SAXIFRAGACEAE	SAXIFRAGE FAMILY
Heuchera villosa	alumroot
Hydrangea arborescens ssp *discolor*	wild hydrangea
Saxifraga virginiensis var *virginiensis*	early saxifrage
SCROPHULARIACEAE	FIGWORT FAMILY
Agalinis gattingeri	figwort
Agalinis skinneriana	figwort
Agalinis viridis	figwort
Aurelolaria virginica	downy false foxglove
Buchnera americana	American blue-hearts
Lindernia dubia var *dubia*	false pimpernel
Mecardonia acuminata var *acuminata*	figwort
Mimulus alatus	winged monkey-flower
SCROPHULARIACEAE	FIGWORT FAMILY
Penstemon digitalis	foxglove beardtongue
Scrophularia marilandica	carpenter's square
Verbascum thapsus	common mullein
Veronica arvensis	common speedwell
Veronica peregrina	neckweed
SIMAROUBACEAE	QUASSIA FAMILY
Ailanthus altissima	tree-of-heaven
SOLANACEAE	NIGHTSHADE FAMILY

Physalis heterophylla var *heterophylla*	variable-leaved ground cherry
Solanum carolinense var *carolinense*	horse-nettle
TYPHACEAE	CAT-TAIL FAMILY
Typha latifolia	common cat-tail
ULMACEAE	ELM FAMILY
Celtis occidentalis	hackberry
Ulmus alata	winged elm
Ulmus americana	American elm
Ulmus rubra	slippery elm
UMBELLIFERAE	CARROT FAMILY
Chaerophyllum p. var *procumbens*	chervil
Chaerophyllum tainturieri var *tainturieri*	rough chervil
Cicuta maculata	water hemlock
Cryptotaenia canadensis	honewort
Daucus carota	wild carrot
Osmorhiza longistylis	anise-root
Sanicula canadensis	Canada black snakeroot
Zizia aurea	parsnip
URTICACEAE	NETTLE FAMILY
Boehmeria cylindrica var *cylindrica*	false nettle
Laportea canadensis	wood-nettle
Pilea pumila	clearweed
Urtica dioica	stinging nettle
VALERIANACEAE	VALERIAN FAMILY
Valeriana pauciflora	valerian
Valerianella radiata	corn-salad
Verbena hastata var *hastata*	blue vervain
Verbena simplex	narrow-leaved vervain
Verbena urticifolia var *urticifolia*	white vervain
VIOLACEAE	VIOLET FAMILY
Viola bicolor	violet
Viola papilionacea var *papilionacea*	meadow violet
Viola pensylvanica	smooth yellow violet
Viola sororia	meadow violet
Viola striata	cream violet
Viola triloba var *dilatata*	dilated three-lobed violet
VITACEAE	GRAPE FAMILY
Parthenocissus quinquefolia	Virginia creeper
Vitus aestivalis	summer grape
Vitus rotundifolia	muscadine grape
Vitis vulpina	winter grape

FLORAL LIST FOR BARRENS OCCURRING ON FORT CAMPBELL, KENTUCKY.
Plant species identified by E.W. Chester from 22 different barrens in 1993. Species are listed based on the number of sites they were recorded from in the 22 barrens.

Botanical Name	Common Name
Occurrence in 22 Barrens	
Acer rubrum	red maple
Achillea millefolium	yarrow
Agalinis tenuifolia	narrow-leaved foxglove
Allium vineale	wild garlic
Andropogon gyrans	Elliott's broom sedge
Andropogon ternarius	silver broom sedge
Apocynun cannabinun	indian hemp
Asclepias amplexicaulis	clasping-leaved milkweed
Asclepias tuberosa	butterfly weed
Aster dumosus	bushy aster
Aster pilosus	pilose aster
Carex complanata	sedge
Chamaecrista fasciculata	partridge pea
**Chrysanthemum leucanthemum*	ox-eye daisy
Coreopsis major	tickseed
Cornus florida	flowering dogwood
**Daucus carota*	wild carrot
Desmodium ciliare	ciliate tick-clover/beggars lice
Desmodium sessilifolium	sessile-leaved tick-clover
Diospyros virginiana	persimmon
Elymus virginicus	Virginia wild rye
Eragrostis spectabilis	tumble grass
Erianthus alopecuroides	plume grass
Erigeron strigosus	fleabane daisy
Eupatorium altissimum	tall thoroughwort
Eupatorium hyssopifolium	narrow-leaved thoroughwort
Eupatorium rotundifolium	round-leaved thoroughwort
Euphorbia corollata	flowering spurge
Fragaria virginiana	wild strawberry
Galium pilosum	hairy bedstraw
Gaura biennis	gaura
Gnaphalium obtusifolium	catfoot
Hedyotis purpurea	purple bluets
Helianthus hirsutus	hairy sunflower
Helianthus mollis	soft sunflower
Helianthus occidentalis	western sunflower
Lespedeza procumbens	trailing bush clover
Lespedeza virginica	Virginia/slender bush clover
Linum striatum	flax
**Lonicera japonica*	Japanese honeysuckle

Nyssa sylvatica	blackgum
Oxalis stricta	sourgrass
Potentilla simplex	five-finger
Prunus serotina	black cherry
Pycnanthemum pilosum	hairy mountain mint
Pycnanthemum tenuifolium	narrow-leaved mountain mint
Quercus falcata	southern red oak
Rhus copallina	winged sumac
Rosa carolina	Carolina rose
Rubus argutus	common blackberry
Rubus flagellaris	dewberry
Rudbeckia hirta	black-eyed Susan
Sassafras albidum	sassafras
Schizachyrium scoparium	little bluestem
Sericocarpus linifolius	white-topped aster
Setaria parviflora	bristly foxtail
Smilax glauca	sawbrier
Solidago juncea	early goldenrod
Solidago nemoralis	gray goldendrod
Sorghastrum nutans	Indian grass
Strophostyles umbellata	wild bean
Stylosanthes biflora	pencil flower
Tridens flavus	red top

Occurrence in 21 Barrens

Ambrosia bidentata	toothed ragweed
Diodia teres	poojoe
Lobelia puberula	downy lobelia
Sabatia angularis	meadow pink

Occurrence in 20 Barrens

Cirsium discolor	two-colored thistle
Desmodium paniculatum	panicled tick-clover/beggars lice
Euthamia graminifolia	grass-leaved goldenrod

Occurrence in 19 Barrens

Ambrosia artemisiifolia	common ragweed
Hypericum dummondii	nits-and-lice
Hypericum punctatum	dotted St. John's-wort
**Kummerowia stipulacea*	Korean lespedeza
Panicum anceps	panic grass
Polygala sanguinea	milkwort
**Prunella vulgaris*	heal-all
Solidago canadensis	Canada/tall goldenrod

Occurrence in 18 Barrens

Agalinis fasciculata	fascicled-leaved foxglove

Desmodium canescens	hoary tick-clover/beggars lice
Hypericum gentianoides	narrow-leaved
Prunus angustifolia	Chickasaw plum
Bidens polylepis	sticktights
Buchnera americana	American blue-hearts
Eragrostis capillaris	lace grass
Juncus biflorus	rush
**Melilotus alba*	white sweet clover
Panicum acuminatum	panic grass
Panicum dichotomum	panic grass
Plantago virginica	Virginia/hoary plantain
Polygala incarnata	pink milkwort

Occurrence in 17 Barrens

Scleria pauciflora	nutrush
Spiranthes lacera var. *gracilis*	Luer, ladies'-tresses
Triodanis perfoliata	Venus' looking glass
Verbena simplex	vervain
Vitis aestivalis	summer grape

Occurrence in 16 Barrens

Eupatorium serotinum	late-flowering thoroughwort
Helianthus angustifolius	narrow-leaved sunflower
Juncus brachycarpus	rush
**Lespedeza cuneata*	sericea lespedeza
Liatris spicata	spicate blazing star
Liatris squarrosa	spreading blazing star
Liatris squarrulosa	rough blazing star
Valerianella radiate	corn salad

Occurrence in 15 Barrens

Chamaecrista nictitans	small partridge pea
Hieracium gronovii	hawkweed
Juniperus virginiana	red cedar
Polygala verticillata var. *ambigua*	milkwort
Rosa setigera	prairie rose
Senacio anonymus	Small's groundsel
Sphenopholis obtusata	wedge grass

Occurrence in 14 Barrens

Oenothera biennis	evening primrose
Ulmus alata	winged elm

Occurrence in 13 Barrens

Antennaria plantaginifolia	pussy toes
Boltonia diffusa	boltonia
Toxicodendron radicans	poison ivy

Trichostema dichotomum	blue curls

Occurrence in 12 Barrens

Gnaphalium purpureum	purple catfoot
Juncus tenuis	path rush
**Lespedeza bicolor*	bicolor/bush lespedeza
Lespedeza hirta	hairy bush clover
Liquidambar styraciflua	sweetgum
Panicun depauperatum	panic grass
**Pinus taeda*	loblolly pine
**Plantago lanceolata*	lance-leaved plantain
Platanthera lacera	lacerate orchid

Occurrence in 11 Barrens

Anemone virginiana	thimbleweed
Lespedeza repens	creeping bush clover
Oenothera linifolia	narrow-leaved evening primrose
Scirpus atrovirens	bulrush
Scirpus pendulous	bulrush

Occurrence in 10 Barrens

Andropogon gerardii	big bluestem
Ipomoea pandurata	wild potato/morning-glory
Lobelia spicata	spicate lobelia
Ludwigia alternifolia	rattlebox
Myosotis verna	forget-me-not
Quercus velutina	black oak
Rhus glabra	smooth sumac
Vernonia gigantea	ironweed

Occurrence in 9 Barrens

Asclepias viridiflora	green milkweed
Coreopsis tripteris	tall tickseed
Eleocharis tenuis	spike rush
Lespedeza capitata	headed bush clover
Passiflora incarnate	maypops
Plantago aristata	aristate plaintain
Prenanthes barbata	white rattlesnake root
Pyrrhopappus carolinianus	false dandelion
Quercus imbricaria	shingle oak
Scleria triglomerata	nutrush
Ulmus rubra	red elm
Vitis vulpina	frost grape

Occurrence in 8 Barrens

Aristida longespica	needlegrass
Aristida oligantha	needlegrass

**Dianthus armeria*	Deptford pink
**Melilotus officinalis*	Yellow sweet clover
Monarda fistulosa	bee-balm
Physalis heterophylla	ground cherry
Scutellaria parvula	small skullcap
*Symphoricarpos or*biculatus	coralberry
Tomanthera auriculata	auriculate-leave false foxglove

Occurrence in 7 Barrens

Ambrosia trifida	giant ragweed
Campsis radicans	trumpet creeper
Chasmanthium latifolium	wild oats
Danthonia spicata	poverty grass
*Helenium flex*osum	sneezeweed
Quercus stellata	post oak
Silphium integrifolium	rosinweed
Tephrosia virginiana	goat's rue

Occurrence in 6 Barrens

Corylus americana	hazelnut
Geranium carolinianum	crane's bill
Gymnopogon ambiguous	beardgrass
Hypericum denticulatum	coppery St. John's wort
**Kummerowia striata*	Japanese lespedeza
Panicum scoparium	panic grass
Vulpia octoflora	eight-flowered fescue

Occurrence in 5 Barrens

Agrimonia parviflora	agrimony
Agrostis perennans	upland bent grass
Carya tomentosa	mockernut hickory
**Cerastium fontanum*	chickweed
Cuscuta campestris	dodder
Gleditsia triacanthos	honey locust
Krigia biflora	false dandelion
Kuhnia eupatorioides	boneset
Ornithogalum umbellatum	star-of-Bethlehem
Panicum capillare	panic grass
**Rosa multiflora*	multiflora rose
Salix humilis	prairie willow
Teucrium canadense	germander

Occurrence in 4 Barrens

Acalypha virginica	three-seeded mercury
Allium canadense	wild onion
Carex muhlenbergii	sedge
Carex vulpinoidea	sedge

Crataegus viridis	hawthorn
Erianthus giganteus	plume grass
Galactia volubilis	downy milk pea
Hypericum stragalum	St. Andrew's Cross
Krigia dandelion	potato dandelion
Manfreda virginica	agave
Oxalis violacea	violet wood sorrel
Paspalum laeve	smooth knotgrass
Quercus coccinea	scarlet oak
Salvia lyrata	lyre-leaved sage
Scutellaria incana	skullcap
Spiranthes vernalis	ladies' tresses
Viola sagittata	lobed violet

Occurrence in 3 Barrens

Acer saccharum	sugar maple
**Agrostis gigantea*	redtop
Andropogon virginicus	common broomsedge
Asclepias syriaca	common milkweed
Aster novae-angliae	New England aster
**Bromus commutatus*	brome grass
Ceanothus americanus	New Jersey tea
Clematis virginiana	virgin's bower
Conoclinum coelestinum	mist flower
Croton capitatus	wooly croton
Eupatorium fistulosum	Joe Pye weed
Fraxinus americana	American ash
Geum canadensis	avens
Helianthus microcephalus	small-flowered sunflower
Heliopsis helianthoides	sweet oxeye
Hieracium longipilum	lang-haired hawkweed
Lactuca canadensis	Canada lettuce
Leucospora multifida	conobea
Muhlenbergia glabriflora	smooth-flowered muhly
Penstemon hirsutus	beard-tongue
Platanus occidentalis	sycamore
**Poa pratensis*	bluegrass
Pycanthemum incanum	mountain mint
Quercus phellos	willow oak
Sisyrinchium albidum	blue-eyed grass
Smilax bona-nox	catbrier
Solidago ulmifolia	elm-leaved goldenrod
Spiraea tomentosa	hardhack
Trifolium compestre	hop clover
Tripsacum dactyloides	gama grass
Vaccinium arboretum	deerberry
Verbesina virginica	crownbeard

Occurrence in 2 Barrens

Aristida purpurascens	needlegrass
**Asparagus officinalis*	common asparagus
Callitriche terrestris	starwort
Cephalanthus occidentalis	buttonbush
Cercis canadensis	redbud
Croton monanthogynus	Mexican tea
Dioscorea villosa	wild yam
Eupatorium perfoliatum	perfoliate boneset
Hedyotis caerulea	bluets
Heuchera villosa	spider lily
Liriodendron tulipifera	tulip tree
Lysimachia lanceolata	loosestrife
Oenothera fruiticosa	sundrops
Panicum laxiflorum	panic grass
Passiflora lutea	small maypops
Phyllanthus caroliniense	phyllanthus
Platanthera peramoena	purple fringeless orchid
Porteranthus stipulatus	Indian physic
Quercus marilandica	blackjack oak
Quercus palustris	pin oak
Rhamnus caroliniana	Carolina buckthorn
Rhexia mariana	meadow beauty
Rhynchospora capitellata	headed rush
Rudbeckia triloba	trilobed black-eyed susan
Ruellia strepens	wild petunia
Silphium pinnatifidum	prairie dock
Solanum carolinense	Carolina nightshade
Sporobolus asper	dropseed
Strophostyles helvula	wild bean
Viola sororio	meadow violet

Occurrence in 1 Barren

Ageratina altissima	tall thoroughwort
Asclepias variegata	variegated milkweed
Aster paludosus spp. *hemisphericus*	aster
Aureolaria flava	foxglove
Baptisia alba	false indigo
Blephilia hirsuta	wood-mint
**Cardamine hirsuta*	bitter-cress
Carex bushii	sedge
Carex glaucodea	sedge
Carex squarrosa	sedge
Corya glabra	pignut hickory
Carya ovata	shagbark hickory
Celtis laevigata	hackberry

**Convolvulus arvensis*	bindweed
Crotalaria sagittalis	crotalaria
Cvperus bipartitus	nutsedge
Cyperus echinatus	nutsedge
Eupatorium album	thoroughwort
**Festuca pratensis*	fescue
Galium aparine	bedstraw
Galium tinctorium	swamp bedstraw
Helenium autumnale	autumnal sneezeweed
Helianthus maximilianii	Maximilian's sunflower
Helianthus strumosus	prairie golden aster
Hypericum hypericoides	St. John's wort
Hypericum mutilum	slender St. John's wort
Hypoxis hirsuta	yellow stargrass
**Iva annua*	marsh-elder
Juglans nigra	black walnut
Lechea mucronata	hairy pinweed
Lechea tenuifolia	narrow-leaved pinweed
Lepidiun virginicum	peppergrass
Lithospermum canescens	hoary puccoon
Lonicera sempervirens	trumpet honeysuckle
Luzula echinata	woodrush
Malus angustifolia	crabapple
Orbexilum onobrychis	scurf-pea
Orbexilum pedunculatum	Sampson's snake root
Panicum flexile	panic grass
Panicum polyanthes	panic grass
Panicum virgatum	switch grass
Parthenium integrifolium	quinine root
Paspalum floridanum	Florida knotgrass
Phytolacca americana	pokeweed
Platanthera ciliaris	yellow fringed orchis
Podophyllum peltatum	mayapple
Polygonatun biflorum	Solomon's seal
Populus grandidentata	big-tooth aspen
**Potentilla recta*	five finger
Quercus alba	white oak
Rhexia virginica	Virginia meadow beauty
Rhynchospora globularis	Small, rush
Rudbeckia subtomentosa	sweet coneflower
**Rumex acetosella*	sheep sorrell
Sambucus canadensis	elderbeny
Sanicula canadensis	snakeroot
Scutellaria integrifolia	skullcap
Senna marilandica	wild senna
**Seteria faberi*	foxtail grass
Silphium laciniatum	compass plant

Smilax rotundifolia	catbrier
Solidago rugosa	rugose goldenrod
**Sorghum halepense*	Johnson grass
Sporobolus vaginiflorus	poverty grass
Thalictrum revolutum	meadow rue
**Tragopogon dubius*	salsify
Verbena hastate	vervain
Verbena uticifolia	vervain
Verbesina alternifolia	Britton, yellow crownbeard
Verbesina helianthoides	crownbeard
Veronicastrum virginicum	Culver's root
Viola rafinesquii	field pansy
Yucca filamentosa	yucca

Species preceded by an asterix are considered invasive species.

Finding of No Significant Impact (FONSI):
Implementation of the 2020-2025 Integrated Natural Resources Management Plan (INRMP) for Fort Campbell, Kentucky

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Fort Campbell has prepared a Programmatic Environmental Assessment (PEA) that evaluates the potential environmental impacts associated with the implementation of the 2020-2025 Integrated Natural Resources Management Plan (INRMP), and all associated plans and actions, for Fort Campbell, Kentucky. During the preparation of the PEA, the proposed action, no management and no-action alternatives were evaluated. After careful consideration, it was determined that only the proposed action would satisfy the Army's requirement without causing significant environmental impacts and incurring substantial additional costs. The attached PEA was prepared pursuant to 32 Code of Federal Regulations Part 651 and U.S. Council on Environmental Quality regulations (Title 40, U.S. Code, Parts 1500-1508) for implementing the procedural requirements of the National Environmental Policy Act.

Description of the Proposed Action

The Proposed Action is to fully implement the Fort Campbell INRMP. The INRMP provides a comprehensive list of resource goals, objectives, management actions, and monitoring activities that are planned for implementation between fiscal years 2020 and 2025, inclusive. It utilizes information from the various baseline studies and surveys to establish and implement multiple- use practices in support of the training mission. However, execution of actions is contingent upon receipt of adequate funds. While Fort Campbell will attempt to implement all of the projects planned for each fiscal year, only a portion of planned projects may be executed depending upon the appropriation for that fiscal year. Provided the INRMP is fully implemented according to the definition of DODI 4715.03, the conclusions of this assessment are valid even if 100 percent of planned projects are not implemented in a given fiscal year.

No Action Alternative

Under the No Action Alternative, natural resources on Fort Campbell would be managed without implementing the INRMP 2020-2025, essentially maintaining the status quo of ecosystem management. Natural resources would be managed according to existing valid component plans, applicable federal and state laws, and DoD guidance (e.g., AR 200-1, CAM Reg 200 -1, CAM Reg 385 -5). Implementation of these plans and policies would take place without integration between component plans, and without overall coordination of natural resources management with the military mission.

No Management Alternative

Under the No Management Alternative, the INRMP would not be implemented and no management of natural resources would take place on Fort Campbell. The No Management Alternative would result in non-compliance with the Sikes Act, DoDI 4715.03, and AR 200-1. The No

Management Alternative is not feasible because it is likely to result in significant violation of federal and state regulations and does not support the military mission. Therefore, the No Management Alternative is dismissed from further consideration and is not carried forward through detailed analysis in this EA.

Environmental Consequences

Nine broad environmental components were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the significance of potential impacts. The environmental components considered are air quality, biological resources, cultural resources, health and safety , land use, noise, soils, socioeconomics, and water resources. Neither the effects of the Proposed Action nor the No Action Alternative are expected to be controversial, involve unique or unknown risks, or to establish a precedent for future actions. No significant negative effects to the environment are anticipated under either alternative.

Cumulative impacts of the Proposed Action to these environmental components were also analyzed. The Proposed Action promotes the development and maintenance of a healthy ecosystem suitable for multiple uses at Fort Campbell. However, implementing the INRMP is not expected to result in significant environmental improvements relative to the existing conditions. Therefore, the effects of the Proposed Action are not considered significant as defined by the NEPA implementing regulations (40 CFR 1508.27 and 32 CFR 651).

Conclusion

Based on the analysis presented in the PEA, I find that implementation of the proposed action, in conjunction with the implementation of specified mitigation measures, would have no significant negative impact on the human or natural environment. Therefore, a Finding of No Significant Impact is issued for the proposed action and no Environmental Impact Statement is required.

_____ _____

JEREMY D. BELL DATE
COL, SF
Commander USAG

Fort Campbell Integrated Natural Resources Management Plan 2020–2025 Programmatic Environmental Assessment

Prepared for
101st Airborne Division (Air Assault) and Fort Campbell

Prepared by
Fort Campbell, Directorate of Public Works
Environmental Division, Fish and Wildlife Program

August 2020

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TABLES

1.0 INTRODUCTION

This Programmatic Environmental Assessment (PEA) has been prepared to address effects of implementing the Fort Campbell Integrated Natural Resources Management Plan 2020-2025 (INRMP) and all associated plans and actions. The INRMP is a five year planning document that is the primary mechanism for integrating natural resources management with the Fort Campbell military mission. The INRMP establishes goals, objectives, and standard procedures for managing natural resources on the installation.

The objective of this PEA is to inform decision makers and the public of the likely consequences of the proposed action and alternatives. If impacts of the proposed action are found to be insignificant, a Finding of No Significant Impact (FNSI) will be prepared and the selected alternative will be implemented. If the environmental impacts of the proposed action are found to be significant according to Council on Environmental Quality criteria (40 CFR 1508.27), a Notice of Intent will be published and an Environmental Impact Statement will be prepared.

This PEA has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA; Title 42 of the United States Code [U.S.C.] 4321-4347); the Council on Environmental Quality "Regulations for Implementing the Procedural Provisions of NEPA," 40 Code of Federal Regulations (CFR), Parts 1500 through 1508; and 32 CFR Part 651 "Environmental Analysis of Army Actions."

Fort Campbell is a military reservation located on approximately 105,000 acres in Tennessee and Kentucky. It is home to the 101st Airborne Division (Air Assault) and contains the combined headquarters of the 101st Airborne Division (Air Assault) and installation staff, as well as several tenant units. The mission of the 101st Airborne Division (Air Assault) is to train to maintain combat readiness needed to deploy rapidly anywhere in the world, to fight and win, and to sustain combat operations. The 101st Airborne Division (Air Assault) has a major role in current conflicts in Afghanistan, Iraq, and elsewhere in the world. Training and supporting troops for those conflicts is of primary importance to the nation's security and foreign policy.

The undeveloped maneuver space of Fort Campbell provides realistic terrain on which the 101st Airborne Division and tenant units train to combat proficiency in mounted, dismounted, and airborne mission activities. The mix of forested and open areas is favorable for light infantry maneuvers. Additionally, the maneuver space provides a large expanse of habitat for wildlife and plants, including some rare, threatened, or endangered species. The maneuver space includes some sensitive habitat types, such as karst and wetlands. The U.S. Army is dedicated to stewardship of natural resources on Army lands to comply with federal laws, provide for multiple land uses (e.g., outdoor recreation) and conserve natural ecosystems. The Environmental Division, Conservation Branch is tasked with management of natural resources to support the military mission, sustain a healthy ecosystem, and provide for multiple use of the land. The INRMP is the mechanism for planning, organizing, and evaluating natural resources management on the installation.

1.1 Purpose and Need for the Proposed Action

The INRMP describes natural resources management activities between the years 2020 and 2025 and provides a foundation from which to build the program beyond the year 2025. Implementation of the INRMP is needed to comply with federal law and DoD guidance, and to coordinate natural resources management efforts among the responsible parties. Implementation of the INRMP supports the military mission by ensuring regulatory compliance and integrating requirements for training land use into natural resources management goals.

Development of an INRMP is mandated by the Natural Resources Management on Military Lands Act of 1960 (Title 16 U.S.C., Section 670a and following), commonly known as the Sikes Act (as amended according to the Sikes Act Improvement Act [SAIA] of 1997 and Public Law 108-136, the National Defense Authorization Act of 2004). Preparation of the INRMP is also guided by DODI 4715.3, AR 200-1, and the Army Memorandum (21 March 1997) *Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and Integrated Natural Resources Management Plans (INRMP)*, as described in Section 1.3.2 of the INRMP.

As a planning document, the INRMP establishes the ecosystem management approach that is outlined in DODI 4715.3 and AR 200-1. The ecosystem management approach is focused on sustaining healthy ecosystem processes rather than managing for a single species. A successful ecosystem management approach requires integration of management efforts for all resources. Additionally, part of the ecosystem management approach is the concept of adaptive management. Adaptive management has been incorporated into the INRMP to monitor resources and to adjust the management objectives based upon the effects of management activities. Monitoring programs in the INRMP indicate whether management measures and strategies are effective in achieving intended goals and objectives.

The INRMP is the mechanism for coordinating natural resources management activities within the Conservation Branch. The INRMP integrates several component management plans, such as the forest, endangered species, and watershed management plans (see INRMP Section 1.1 for a complete list). The INRMP provides management principles and goals that unite efforts of the Conservation Branch and helps to avoid duplication or conflicts of management efforts.

The INRMP is also the primary mechanism for coordinating natural resources management activities conducted by the Conservation Branch with those conducted by the Directorate of Plans, Training, Mobilization, and Security (DPTMS) Range Division and military units. Range Division and the Conservation Branch have responsibilities for monitoring and managing soil, vegetation, and open areas on Fort Campbell. The INRMP integrates these efforts, promotes coordination between the organizations, and avoids duplication or conflicts of activities. Army Regulation 350-4 Integrated Training Area Management (ITAM) requires that the ITAM program be included in the INRMP to ensure the plan reflects mission requirements for ranges and training areas.

The INRMP is the mechanism for coordinating natural resources management efforts on Fort Campbell with the U.S. Fish and Wildlife Service (USFWS), the Tennessee Wildlife Resources Agency (TWRA) and the Kentucky Department of Fish and Wildlife Resources (KDFWR), which is mandated by the Sikes Act. These agencies are involved in the preparation and update of the INRMP. Cooperative planning allows Fort Campbell to draw on data and expertise of those agencies, facilitates natural resources management on an

ecosystem scale, and pro-actively addresses regulatory issues, such as management of endangered species.

1.2 Scope

This PEA is a programmatic document that evaluates effects of implementing the Fort Campbell INRMP 2020-2025. The INRMP is a 5-year planning document containing goals, objectives, and management actions that are in the preliminary planning and budgeting phase. In many instances, projects forecast in the INRMP have not been planned in detail. Implementation of individual projects is contingent upon funding allocations in each fiscal year. Therefore, because details of specific projects are not yet known, this PEA does not address effects of individual projects (e.g., clearing woody vegetation from a particular open area). Rather, this PEA addresses the effect of establishing and implementing natural resources management objectives that are integrated with other Fort Campbell activities (e.g., military training) and generalized resource impacts from the implementation of actions supporting those goals and objectives. When individual projects have been planned in sufficient detail, a project-specific analysis of effects shall be completed to fully comply with the NEPA and 32 CFR 651. NEPA documentation will be developed following the Fort Campbell Sustainable Installation Management System (SIMS) NEPA procedure prior to initiating any action that may impact the human and natural environment.

This PEA addresses effects likely to occur within the boundaries of Fort Campbell. Management activities described in the INRMP are focused primarily on the maneuver space (INRMP Section 1.2).

This PEA evaluates effects of the Proposed Action (implementing the INRMP), No Action Alternative (managing natural resources without the INRMP), and No Management Alternative (no management of natural resources) to the human environment, including the installation military mission.

1.3 Agency and Public Involvement

The NEPA process is designed to involve the public in federal decision-making. Public involvement and intergovernmental coordination and consultation are recognized as essential elements in the development of a PEA. Fort Campbell will coordinate with federal and state governments, as well as the public, during the EA process.

A copy of this PEA will be made available for review on the Fort Campbell Environmental Division webpage. Public comment will be invited for a period of thirty days following publication of a Notice of 30-Day Period for Public Comment in the Leaf Chronicle (Clarksville, Tennessee), Fort Campbell Courier (Fort Campbell, Kentucky), Cadiz Record (Trigg County, Kentucky), Stewart County Standard (Stewart County, Tennessee), and the Kentucky New Era (Hopkinsville, Kentucky.

1.4 Decision to Be Made

The decision maker is the Garrison Commander of Fort Campbell, Kentucky. The decision the Garrison Commander will make is whether to fully implement the INRMP 2020-2025, or to implement alternative course of actions (managing natural resources at Fort Campbell without an INRMP or no management at all).

The INRMP 2020-2025 integrates natural resources management activities that are currently being implemented under ongoing component management plans. Because those management plans will be implemented under both the Proposed Action and the No Action Alternative, the fact that those activities are in progress should not influence selection of one alternative over the other. The INRMP 2020-2025 has not been authorized and funding has not been secured to implement projects unique to the INRMP. Therefore, there has been no commitment of resources that would prejudice the selection of either alternative addressed herein.

2.0 DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action is to implement the Fort Campbell INRMP 2020-2025. The INRMP provides a comprehensive list of resource goals, objectives, management actions, and monitoring activities that are planned for implementation between fiscal years 2020 and 2025, inclusive. Section 5.0 of the INRMP describes the goals and objectives set to guide installation natural resource management and planning using an ecosystem-based approach that supports the military mission. Section 7.0 of the INRMP lists conservation standards that are designed to minimize adverse effects to natural resources and are required for all training and non-training activities on Fort Campbell. The INRMP integrates the goals, objectives, actions, and conservation standards of several component documents (See INRMP Section 1.1 for a complete list). While many of the objectives, actions, and conservation standards originate in component management plans, some are unique to the INRMP. Objectives, actions, and conservation standards that are unique to the INRMP would only be implemented if the INRMP is fully implemented.

In addition to listing planned management activities, the INRMP provides detailed descriptions of the current state of natural resources on Fort Campbell (INRMP Section 2.0). The INRMP also defines the roles, responsibilities, and interactions of natural resources management programs within the Conservation Branch, Range Division, ITAM program, and the interaction of those programs with the military mission (INRMP Section 3.0).

The INRMP provides a mechanism for adapting the 5-year management plan in accordance with changed circumstances and new information/data. Section 1.8 of the INRMP describes the role of adaptive management in the INRMP. The INRMP is reviewed annually and may be adjusted to ensure objectives are realistic, fine-tune projects to improve achievement of goals, meet budget appropriations, or accommodate new land use requirements for training.

The Proposed Action is to fully implement resource management actions supporting resource specific goals and objectives as well as actions included within component plans of the INRMP. However, execution of actions is contingent upon receipt of adequate funds. While Fort Campbell will attempt to implement all projects planned for each fiscal year, only a portion of planned projects may be executed depending upon the appropriation for that fiscal year. Sections 6.0 of the INRMP address project prioritization and INRMP implementation. Because this assessment is programmatic, the effects analysis is largely qualitative. Provided the INRMP is fully implemented according to the definition of DODI 4715.3, the conclusions of this assessment are valid even if 100 percent of planned projects are not implemented in a given fiscal year.

Prior to preparation of the INRMP 2020-2025, Fort Campbell prepared an INRMP for the period 2014 through 2019 (Fort Campbell 2015), an INRMP for 2008 through 2012, and INRMP updates from the

original installation INRMP from 1999 in 2001 (Fort Campbell 2001) and 2003 (Fort Campbell 2003). The INRMP 2020-2025 has been substantially updated from previous versions. Many of the projects listed in previous versions of the INRMP are complete and therefore are not part of the Proposed Action. In some cases, ongoing actions have been revised in accordance with new data, mission requirements, or management objectives.

3.0 ALTERNATIVES

3.1 No Action Alternative

Under the No Action Alternative, natural resources on Fort Campbell would be managed without implementing the INRMP 2020-2025. Natural resources would be managed according to existing valid component plans (Table 1), applicable federal and state laws, and DoD guidance (e.g., CAM Reg 385-5). Implementation of these plans and policies would take place without integration between component plans, and without overall coordination of natural resources management with the military mission.

Table 1. Existing valid component plans for natural resources management on Fort Campbell.

Title	Effective Date
Endangered Species Management Component	2017
Bald Eagle Management Plan	2018
Forest Management Plan	2015
Integrated Wildland Fire Management Plan	2017
Fish and Wildlife Management Plan	2017
Integrated Pest Management Plan	2017
Agricultural Outlease Tract Management Plans	various
Grassland Management Plan	2017
Watershed Management Plan	2017
ITAM 5-year Plan	2019
Migratory Bird Management Strategy	2018
Fort Campbell Stormwater Management Plan	2016

In the absence of an INRMP assessed herein, there are no component plans specifically designed to manage wetlands, rare plants, game and non-game fish and wildlife, riparian zones, outdoor recreation, wildfire, or prescribed fire.

3.2 No Management Alternative

Under the No Management Alternative, the INRMP 2020-2025 would not be implemented and no management of natural resources would take place on Fort Campbell. The No Management Alternative would result in non-compliance with the Sikes Act, Endangered Species Act, Clean Water Act, Migratory Bird Treaty Act, DoDI 4715.3, and AR 200-1. Lack of management of wetlands and soil erosion also may

result in violation of the Clean Water Act and state water quality regulations. The No Management Alternative conflicts with Fort Campbell's military mission because without active management (e.g., mowing, cultivation, prescribed burning) open areas (agricultural fields, drop zones) in the maneuver space would become unsuitable for training. The No Management Alternative is not feasible because it is likely to result in significant violation of federal and state regulations and does not support the military mission. Therefore, the No Management Alternative is dismissed from further consideration and is not carried forward through detailed analysis in this EA.

4.0 EXISTING ENVIRONMENT

Section 2.0 of the INRMP provides a detailed description of existing environmental conditions on Fort Campbell. That information is incorporated by reference and information relevant to the effects analysis is summarized below. Where appropriate, the discussion below refers to figures found in the INRMP. This section also describes the approach to management of each resource, including the primary programs responsible for management, and component plans used to guide management of each resource.

4.1 Environmental Setting

Fort Campbell is located in southwestern Kentucky and northwestern Tennessee, within portions of four counties: Christian and Trigg counties in Kentucky, and Montgomery and Stewart counties in Tennessee. Fort Campbell lies within the Western Highland Rim physiographic province, which forms a transition area between Kentucky farmlands to the north, the steeply dissected and wooded rim of the Cumberland River to the south and west, and gently rolling hills of low to moderate relief to the east.

4.2 Land Use

Fort Campbell covers approximately 105,000 acres. The installation consists of training and maneuver areas (approximately 68,000 acres), range and impact areas (approximately 27,000 acres), and built-up areas (INRMP Figure 2). A detailed description of land use on Fort Campbell is provided in Section 2.0 of the INRMP. The majority of natural resources management activities on Fort Campbell occur in the maneuver space, which includes the entire installation except the 14,000-acre cantonment area.

The maneuver space contains the Impact Area (22,144 acres) and Small Arms Impact Area (4,494 acres). While wildlife and natural habitat exist, and wildfires occur, within the impact areas, they are off-limits to natural resources personnel due to hazards associated with unexploded ordnance. Management activities and objectives described in the INRMP do not involve the impact areas. Wildfires that occur in the impact areas may be allowed to burn or may be suppressed by the Forestry wildland firefighters.

Land in the maneuver space is used for training activities conducted on Fort Campbell. It also provides habitat for fish and wildlife, space for agricultural and timber production, and opportunities for outdoor recreation. In accordance with the Sikes Act, the maneuver space is managed for multiple use to the extent practicable consistent with the military mission.

Coordinated planning among military trainers and natural resources personnel is essential to ensure appropriate space and conditions for training, maintaining regulatory compliance, implementing productive reimbursable programs (e.g., agricultural leases), and sustaining a healthy ecosystem. The ITAM Program

and the Conservation Branch are responsible for developing and maintaining conditions in the maneuver space that support the military mission and other uses.

The Range Development Plan (RDP)(Nakata 2004) describes conditions of the maneuver space required to support necessary training, including the number and size of ranges, and the amount and characteristics of open area required for mounted and aerial training activities. Numerous other natural resources component plans guide management of the maneuver space, including the Forest and Open Area management plans. The role of component plans is described below in sections that address individual resources. The INRMP serves to integrate actions supporting the RDP and multiple component plans, with the result of providing clear comprehensive guidance for maneuver space land management.

4.3 Natural Resources

About 87 percent of the installation is undeveloped maneuver space. In the maneuver space, forests, streams, fields, and other natural settings are maintained to provide a realistic context for training activities. The maneuver space also contains substantial habitat for fish and wildlife, sensitive natural communities, and area for outdoor recreation. Natural resources found in the maneuver space are briefly described below. A detailed description of existing conditions is provided in Section 2.0 of the INRMP.

4.3.1 Soils

Twenty-three soil mapping units occur on Fort Campbell (INRMP Figure 6). Soil types are primarily silt loam, with some types containing clay or gravel. Characteristics of soil types are described in Table 2 of the INRMP. Control of soil erosion is a challenge at Fort Campbell. Three soil types that cover 52 percent of the total installation acreage are highly erodible. A large proportion of the maneuver space is located on highly erodible soils. Activities that disturb soil (e.g., excavation, use of tracked vehicles, cultivation, establishment of firebreaks) potentially result in substantial soil erosion without proper control and restoration efforts.

Three of the soil types on Fort Campbell are hydric or contain hydric inclusions and may be associated with wetlands. Wetlands are addressed in Section 4.3.2 below. Fifteen of the soils on Fort Campbell are classified by the Natural Resources Conservation Service as prime farmland. Prime farmland soils cover approximately 60 percent of the installation and underlie numerous land uses including impact areas, ranges, drop zones, training areas, agricultural fields, native grasslands, and forests.

4.3.2 Water Resources and Aquatic Habitat

The major uses of Fort Campbell's water resources are water supply, recreation, training, and aquatic habitat. Protecting the quality of ground and surface water is of primary importance in maintaining a healthy human environment and a self-sustaining ecosystem.

Two aquifers are present under the installation. One is a shallow aquifer that is recharged by sinkholes in the area. A second, deeper aquifer is associated with Boiling, Quarles, and Blue springs (INRMP Figures 5 and 10). The abundant karst formations on Fort Campbell form direct links between the ground surface and groundwater. Quality of ground water on Fort Campbell is protected through the establishment of 100-foot wide vegetated buffers around karst features.

Surface water systems on Fort Campbell include approximately 700 watercourses totaling about 453 stream miles (INRMP Figure 10; BHE 2004). Approximately 160 miles of streams are within impact areas, and 293 miles are outside impact areas. The installation waterways are divided into nine subwatersheds (INRMP Table 3; Figure 9).

According to monitoring reports from the states of Tennessee and Kentucky, five streams on the installation are classified as impaired for one or more designated uses (INRMP Table 3). Fort Campbell monitors water quality to assess baseline conditions of streams, and to detect point/non-point source discharges into streams. Surveys for aquatic macroinvertebrates also are conducted to assess the relative condition of aquatic communities. As part of Fort Campbell's Watershed Management Plan, selected subwatersheds are surveyed to monitor habitat conditions and water quality. Details of the water quality assessment methods and findings are presented in Section 2.7 of the INRMP.

Three man-made impoundments lie within the installation boundaries: Lake Kyle, Joe Swing Quarry, and an unnamed lake, that are used for recreational purposes. A detailed description of these surface water resources can be found in Section 2.7 of the INRMP.

From 1999 through 2009, Fort Campbell coordinated with the Natural Resources Conservation Service (NRCS) and the United States Army Corps of Engineers to conduct wetland delineations throughout the installation. The locations of potential wetlands were mapped using digital photographs, NRCS soil maps, and National Wetland Inventory (NWI) maps. Each potential wetland area was delineated using the "Routine Onsite Determination Method" described in the U. S. Army Corps of Engineers' *Wetlands Delineation Manual* (USACE 1987). All potential wetlands thought to be "jurisdictional" were submitted for a jurisdictional determination by the USACE, Nashville District. A total of 617 wetlands meeting jurisdictional requirements totaling 2,533 acres have been identified on Fort Campbell. All identified wetlands were mapped using Global Positioning System (GPS) technology, and the location of the wetland boundaries are maintained in a GIS database. Most wetlands on Fort Campbell are palustrine types (US Infrastructure 2000).

4.3.3 Terrestrial Habitat

Terrestrial habitats are classified by their plant communities and include native grassland barrens, old fields, agricultural fields, and forest. Results of floral surveys conducted on Fort Campbell are provided in Appendix D of the INRMP. Originally the terrestrial habitats present on Fort Campbell consisted of native prairie and woodlands. The land was cleared in the mid-1800's for agriculture but has since been allowed to convert back to hardwood forest through natural succession. Loblolly pines also have been planted. Currently, 91,794 acres of undeveloped land on Fort Campbell are composed of several terrestrial habitat types. Of the undeveloped areas, approximately 19,000 acres are open area, with 6,000 acres in agricultural leases and 13,000 acres managed as native grass barrens or old fields (INRMP Figure 11). Approximately 36,600 acres are hardwood timber and 11,600 acres are pine plantations, for a total of 48,200 acres of forest. Brief descriptions of these habitat types are provided below and detailed information is provided in Section 2.0 and Appendix H of the INRMP.

Native grassland barrens and old fields are the non-forested, non-developed areas that are not currently under agricultural lease and not classified as wetlands. Together these two habitat types are referred to as

open areas. Native grassland barrens are a unique ecological community. The habitat type was historically more extensive in the region. Currently the native grassland barrens on Fort Campbell are some of the largest remaining remnants of this habitat. Native grassland barrens are characterized by endemic grasses and shrubs, including some rare species, and many species that are fire-adapted. Native grasslands are a high priority for protection by state and federal agencies as natural areas (Shea 2005). Old fields are open areas that do not contain plant species associated with native grassland barrens. In old fields, herbaceous plants and grasses are the dominant vegetation types, with some woody shrubs and trees present. Both native grassland barrens and old fields provide important areas for training activities. Fort Campbell has developed the Grassland Management Plan to guide the maintenance of open areas on the installation.

Approximately 6,000 acres on Fort Campbell are managed by the Agricultural Outlease (AO) Program, of which approximately 4,400 acres of agricultural fields leased to farmers in the local community. The AO Program is a reimbursable program that provides funds for land management. Crops grown on the installation include hay, wheat, corn, grain sorghum, and soybeans. The AO Program manages leases, develops Tract Management Plans for each field, and coordinates with mission planners to facilitate military training in and around agricultural fields.

About 48,200 acres of woodlands make up approximately 46 percent of the total area of the installation. Woodlands are predominately deciduous hardwoods but also contain mixed mesophytic forests and pine plantations (INRMP Figure 12). Dominant forest types include upland and bottomland hardwood, which are described in the Fort Campbell Forest Management Plan (FMP) and summarized in Section 2.0 and Appendix K of the INRMP. Forest on Fort Campbell is managed to provide realistic conditions for training exercises, timber and other forest products, and habitat for wildlife including endangered species.

Riparian areas are terrestrial habitats that occur along streams. Riparian areas serve an important function in maintaining the water quality of streams by reducing input of sediment, nutrients, and contaminants into surface water. Fort Campbell protects riparian areas and stream water quality by establishing vegetated buffers along streams; buffers are 100 feet wide along perennial streams and 50 feet wide along intermittent streams. Within vegetated buffers, training and non-training activities that may impact water quality (e.g., excavation) are limited. Approximately 2,897 acres of riparian areas exist on Fort Campbell. Additional information about riparian areas is provided in Section 2.0 of the INRMP.

Part of terrestrial habitat management is control of noxious and invasive plant species. Sixty seven plants on Fort Campbell are classified as exotic invasive species (INRMP Table 6). Executive Order 13112 requires coordination and enhancement of Federal activities to control and minimize the economic, ecological, and human health impacts caused by invasive species. Department of the Army Memo “Army Policy Guidance for Management and Control of Invasive Species” (26 June 2001) provides guidance on implementing the Executive Order. The Fort Campbell Integrated Pest Management Plan (IPMP) directs the management of noxious and invasive plants. Additional information about noxious and invasive species is provided in Section 2.0 of the INRMP.

4.3.4 Fauna

The mixture of natural habitat types on Fort Campbell supports a diverse group of game and non-game wildlife and fish. Fort Campbell has conducted surveys to identify the presence of mammals, birds, fish, amphibians, reptiles, and insects on the installation (INRMP Appendix D). Detailed information about

wildlife and fish on Fort Campbell is provided in Section 2.0 of the INRMP. Most wildlife and fish species on the installation are locally common and are not provided protection under federal or state laws, except those state laws governing wildlife collection and hunting. The exceptions are migratory birds and species that are federally listed as threatened or endangered. Because natural resources management at Fort Campbell is based upon an ecosystem approach, there generally are no species-specific management activities except as required by law. Fort Campbell monitors certain game and non-game species to identify population trends as part of evaluation of overall ecosystem health.

Nearly 200 species of birds have been recorded on Fort Campbell. The installation supports diverse groups of songbirds, game birds, waterfowl, wading birds, and raptors. Several of the bird species that are found on the installation are listed as endangered, threatened, special concern, imperiled, declining, or in need of management by the Kentucky State Nature Preserves Commission (KSNPC) Natural Heritage Program and/or the TDEC Division of Natural Heritage. In 2005, Fort Campbell developed the *Migratory Bird Management Strategy: a conservation strategy for protecting and managing migratory birds on Fort Campbell, Kentucky* (MBMS). Fort Campbell annually conducts point count surveys to comply with Executive Order 13186 by evaluating trends in the diversity of migratory songbirds.

In addition to promoting sustainable populations of game and non-game fish and wildlife, Fort Campbell controls certain species of animal pests such as mice, groundhogs, pigeons, and feral hogs. The IPMP guides management of pest species. Additional information about pest management on Fort Campbell is provided in Section 2.0 and Appendix P of the INRMP.

4.3.5 Rare, Threatened, and Endangered Species

Rare species are animals and plants listed by the states of Kentucky or Tennessee as threatened, endangered, in need of management, imperiled, special concern, or declining. Rare species are state-listed species that are not also federally listed. Sixty species of wildlife and 20 species of plants found on Fort Campbell are state-listed but not federally listed (INRMP Tables 4 and 5; Figure 13). For species considered rare by the state of Kentucky or Tennessee, Fort Campbell does not manage at the species level, but rather at the ecosystem level. Management goals are established to sustain a variety of natural habitat types likely to support a diverse group of species, including rare species. Fort Campbell attempts to minimize impacts to rare plants to the maximum extent practicable by recording locations in the GIS database, planning habitat management activities (e.g., prescribed burns, mowing) to avoid damage to plants, and communicating with mission planners on ways to avoid rare plants during training exercises.

Threatened and endangered species are those listed by the USFWS under the Endangered Species Act. Two federally endangered species, the gray bat (*Myotis grisescens*) and the Indiana bat (*M. sodalis*), and one federally threatened species, Northern long-eared bat *M. septentrionalis*), occur on Fort Campbell. No designated Critical Habitat for any one of these federally listed species exists on Fort Campbell. Three species proposed for federal listing, little brown bat (*M. lucifugus*), tri-colored bat (*Peromyotis subflavus*), and Monarch butterfly *(Danaus plexippus),* occur on Fort Campbell. The Endangered Species Act of 1973 as amended (U.S.C. 1531 et seq.) provides legal protection for federally listed species. Because of their protected status, Fort Campbell has established specific monitoring and management activities for the gray, Indiana, and Northern long-eared bats. In accordance with the Endangered Species Act (ESA) and AR 200-1, Fort Campbell has developed an Endangered Species Management Component (ESMC) that includes detailed information for each species about natural history, presence on Fort Campbell, and

management activities implemented on the installation. Section 2.0 of the INRMP also provides detailed descriptions of each species.

4.4 Cultural Resources

Cultural resources found on Fort Campbell include archaeological artifacts, cultural items, historic properties, and historic districts. Cultural resources at Fort Campbell date from the Paleoindian Period (ca. 10,000 B.C.) to the 20th century. To date, 1,424 archaeological sites have been recorded within the installation. Of the known archaeological sites or components, 17 sites are considered eligible and 293 sites are considered potentially eligible for inclusion on the National Register of Historic Places (NRHP). Work is ongoing to identify additional sites and evaluate eligibility for the NRHP of known archaeological sites and historic structures, objects, and districts.

Protection of cultural resources on the installation is required under the National Historic Preservation Act (NHPA), the Antiquities Act, Archaeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA), and AR 200-1. Fort Campbell has established a Programmatic Agreement with the Kentucky and Tennessee State Historic Preservation Offices and the Advisory Council on Historic Preservation. The Programmatic Agreement establishes measures for preservation of historic and archaeological resources on Fort Campbell. Section 10.0 of the INRMP addresses protection of cultural resources during natural resources management activities. Natural resources management specialists maintain awareness of cultural resources sites via a GIS system, which includes locations of known artifacts, sites, and historic structures. The INRMP also addresses procedures for identifying and reporting newly discovered sites.

4.5 Air Quality

The Clean Air Act (CAA) requires that the U.S. Environmental Protection Agency (USEPA) establish National Ambient Air Quality Standards (NAAQS) that are benchmarks for the establishment of air emission limitations for pollutants that may be harmful to public health or the environment The USEPA has established two classes of NAAQS: (1) primary standards, which protect public health including the most sensitive of populations, and (2) secondary standards, which protect public welfare. USEPA has defined NAAQS for seven criteria pollutants: carbon monoxide (CO); lead (Pb); nitrogen dioxide (NO_2); ozone; fine particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$); and sulfur dioxide (SO2) (Table 2; USEPA 2004a).

Table 2. Federal National Ambient Air Quality Standards (USEPA 2004a).

Criteria Air Pollutant	Averaging Time	Primary NAAQS	Secondary NAAQS
CO	8-hour maximum 1-hour maximum	9 ppm (10 mg/m^3) 35 ppm (40 mg/m^3)	None None
Pb	Maximum quarterly arithmetic mean	1.5 µg/m^3	Same as primary
NO_2	Annual arithmetic mean	0.05 ppm (100 µg/m^3)	Same as primary
Ozone	1-hour average 8-hour average	0.12 ppm (235 µg/m^3) 0.08 ppm (157 µg/m^3)	Same as primary Same as primary

$PM_{2.5}$	Annual arithmetic mean 3-year average 24-hour average, 98th percentile	15 μg/m³ 65 μg/m³	Same as primary Same as primary
PM_{10}	Annual arithmetic mean 24-hour average	50 μg/m³ 150 μg/m³	Same as primary Same as primary
SO_2	Annual arithmetic mean 24-hour maximum 3-hour maximum	0.03 ppm (80 μg/m³) 0.14 ppm (365 μg/m³) N/A	None None 0.50 ppm (1,300 μg/m³)

CO – Carbon monoxide; Pb – Lead; NO_2 – Nitrogen dioxide
$PM_{2.5}$ – particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
PM_{10} – particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
SO_2 – Sulfur dioxide

The USEPA has divided the United States into Air Quality Control Regions (ACQR) to evaluate NAAQS compliance. An ACQR is considered in "attainment" for a specific pollutant when the area meets the primary or secondary NAAQS criteria and in "nonattainment" for a pollutant when it does not meet the primary or secondary criteria. Within Kentucky, the Kentucky Department for Environmental Protection (KDEP), Division for Air Quality administers the CAA on behalf of the USEPA. The portion of Fort Campbell in Kentucky is located within the Paducah-Cairo Interstate AQCR (KDEP 2004). Within Tennessee, the Tennessee Department of Environment and Conservation (TDEC), Division of Air Pollution administers the CAA. The portion of Fort Campbell in Tennessee is located within the Middle Tennessee Intrastate AQCR (Stewart, pers. comm.).

Fort Campbell is located in counties that are currently in attainment for CO, Pb, NO_2, PM_{10}, $PM_{2.5}$, and SO_2 (USEPA 2004b). Christian County, Kentucky and Montgomery County, Tennessee are located in the Clarksville-Hopkinsville Metropolitan Service Area (MSA) that was designated as a nonattainment area for 8-hour ozone (Brewer, pers. comm.; Stewart, pers. comm.; USEPA 2004b). In 2005, the two counties requested re-designation as attainment areas. In November 2005, Montgomery County was re-designated as an attainment area for all NAAQS; however, Montgomery County will be identified as a maintenance area for the next 12 years. Maintenance plan requirements for Montgomery County are designed to maintain average ozone concentrations at or below the maximum allowed concentration. Christian County, Kentucky has been redesignated as a maintenance area (CH2MHill 2005). Both Trigg County, Kentucky and Stewart County, Tennessee are in attainment for NAAQS.

Under the federal Title V program, Fort Campbell is considered a major source of NO_2, SO_x (sulfur oxides), CO, and VOC (volatile organic compounds) in the region. Fort Campbell is also a major source for hazardous air pollutants (HAP) due to the cumulative total of emissions from portions of the installation located in Kentucky and Tennessee. Fort Campbell has Title V air permits from both KDEP and TDEC for installation point sources of emissions, which includes paint spray booths, woodworking shops, hot water heaters, fossil fuel boilers, incinerators, and underground and above ground storage tanks (DPW 2003). Primary nonpoint sources of air pollution on the installation are military equipment and vehicles (DPW 2003).

4.6 Noise

The Federal Government has established noise guidelines and regulations to protect citizens from potential hearing damage and other adverse physiological, psychological, and social effects associated with noise. The Noise Control Act of 1972 (Public Law 92-574) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations.

The Army manages the potential for noise impact on adjacent communities through the Environmental Noise Management Program (ENMP), which incorporates and replaced the Installation Compatible Use Zone (ICUZ) Program described in Chapter 14 of AR 200-1. The goals of the ENMP are to: 1) control environmental noise in order to protect the health and welfare of people on- and off-post impacted by Army-produced noise; and 2) reduce community annoyance from environmental noise to the extent feasible while remaining consistent with mission activities.

Fort Campbell has developed the Installation Environmental Noise Management Plan (IENMP; USACHPM 2000) that provides a strategy for noise management at the installation. The IENMP includes recommendations regarding education, complaint management, noise and vibration mitigation, and noise abatement procedures.

Training activities are the primary sources of noise at Fort Campbell and include fixed- and rotary-wing aircraft operations, small arms and heavy weapons firing, detonating explosives, and artillery and armor (DPW 2003). Other, less intense, sources of noise include military and civilian vehicles.

4.7 Facilities

Transportation facilities on Fort Campbell (roads, airfields, railroad) are described in Section 2.5 of the INRMP. Utilities including potable water, waste water, electricity, natural gas, and solid waste and storm water management systems are described in Section 2.5 of the INRMP. Natural resources management activities generally do not affect transportation systems or utilities on Fort Campbell. Maintenance of vegetation along roads and around facilities in the maneuver space is handled by the Maintenance Division of the Directorate of Public Works. While storm water management involves aspects of soil erosion control and quality of surface and ground water, natural resources management does not affect the systems (e.g., basins, drains) established to manage storm water flow. Because neither the Proposed Action nor the No Action Alternative is expected to beneficially or adversely affect facilities or utility systems on Fort Campbell, effects to those facilities and systems are not addressed in detail herein.

4.8 Socioeconomics

The socioeconomic environment of Fort Campbell is characterized by demographics, economic development, public services (police, fire) and public outdoor recreation. The majority of factors influencing the socioeconomic environment are based within the Fort Campbell cantonment area, which is outside the scope of this assessment. Those factors are addressed only briefly here.

Fort Campbell supports the third largest military population in the Army and the seventh largest in the DoD. The Army Stationing and Installation Plan for the fiscal year of 2005 established the base population at

29,321 active duty military personnel, 2,934 civilian personnel and 4,983 other personnel on Fort Campbell. Approximately 40,000 family members live on Fort Campbell and 112,000 retirees and their dependents live in surrounding communities. Army Reserve and National Guard also work on the installation, and number approximately 18,000 individuals.

There are about 4,200 housing units on the installation for officers, enlisted soldiers and their families. Installation facilities include seven schools operated by the DoD, a major hospital, child care facilities, numerous chapels, banks, restaurants, post exchanges, service stations, campgrounds, and five swimming pools (CH2MHill 2005).

Clarksville, located east of Fort Campbell in Montgomery County, Tennessee, has a metropolitan area population of slightly over 150,000 people (U.S. Census Bureau 2018). Hopkinsville, Kentucky, located 17 miles northeast of Fort Campbell in Christian County, has a population of approximately 33,000 people (U.S. Census Bureau 2005). These two cities are the primary urban centers in the area. The nearest large city is Nashville, located 55 miles to the southeast. The economy of the general region is diversified, with major sectors being agriculture, manufacturing, government, retail, and wholesale (CH2MHill 2005). Fort Campbell is the largest employer in the four counties in which the installation occurs (CH2MHill 2005). Army operations at Fort Campbell generate substantial revenues to local economies as wage and salary payments to military and civilian employees, construction contractor payments, and operating costs such as rent and lease payments for equipment, utilities, telephone service, office supplies, and non-construction contracts. It is estimated that Fort Campbell contributes approximately $10 billion annually to the economy of the area (*Center for Economic Research in Tennessee*, February 2019). Because neither the Proposed Action nor the No Action Alternative will beneficially or adversely affect demographics or economics on Fort Campbell or the surrounding area, effects to those elements of socioeconomics are not addressed in detail herein.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994), requires federal agencies to achieve environmental justice "to the greatest extent practicable" by identifying and addressing "disproportionately high adverse human health or environmental effects of…activities on minority populations and low-income populations." Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risk (1997), requires that federal agencies identify and assess environmental health and safety risks that may disproportionately affect children. Neither the Proposed Action nor No Action Alternative will affect minority or low-income populations or children.

Security and police protection is provided by the Military Police. Gate security is provided through Military Police and DoD civilian law enforcement. Fire protection in the Fort Campbell cantonment area is provided by the Fort Campbell Fire Department. Management of wildland fires in the maneuver space is provided by Fort Campbell Forestry and DPTMS, with support from the Fort Campbell Fire Department, and this would remain the same under the proposed action and alternatives. Therefore, because neither the Proposed Action nor the No Action Alternative will affect public services, those services are not addressed in detail herein.

Recreational facilities such as gymnasiums, swimming pools, bowling alleys, movie theaters, and sports fields are provided by Fort Campbell in the cantonment area. Neither the Proposed Action nor the No Action Alternative will beneficially or adversely affect any public recreation facility or opportunity in the

cantonment area; those facilities are not addressed in detail here. This assessment addresses outdoor recreation in the maneuver space. The Sikes Act requires military installations to provide public outdoor recreation opportunities within the constraints of the military mission. Fort Campbell provides many opportunities for public outdoor recreation in the maneuver space including hunting, fishing, hiking, boating, kayaking, off road vehicle trails, and camping (INRMP Section 9.0). The Fish and Wildlife Program plans, coordinates, administers, and implements fish and wildlife management programs in accordance with AR 200-1; responsibilities include hunting and fishing management, habitat enhancement, setting hunting bag limits, and stocking fish. The Military Police and the USFWS enforce hunting and fishing regulations.

4.9 Hazardous and Toxic Materials

Hazardous and toxic materials commonly used at Fort Campbell include antifreeze; brake and deicing fluids; motor, hydraulic, and fuel oils; grease; diesel and aircraft fuels; motor gasoline (MOGAS); battery acid; kerosene; paint; and solvents (USGS 1996). Also incorporated into the hazardous waste stream are hospital wastes, lead-based paint, pesticides, herbicides, and unexploded ordnance. Hazardous waste is generated primarily by site operations and maintenance of aircraft, vehicles, buildings, and grounds. Hazardous and toxic materials are used and stored nearly exclusively in the cantonment area and airfields. Because the scope of this EA is limited to the maneuver space, hazardous materials used in the cantonment area are not addressed in detail. Hazardous materials used in the maneuver space are petroleum, oils, and lubricants (POL) associated with vehicles and equipment, gasoline in drip torches used to ignite prescribed burns, fertilizer used in agricultural fields, and pesticides used to control noxious weeds or undesirable woody plants.

To ensure proper handling of hazardous and toxic materials, and response to spills of those materials, Fort Campbell's Compliance Branch has established spill prevention and response instructions for all tenants and facilities on the installation. A spill response team is on call to assist the installation with a spill or release of hazardous substances. The Fort Campbell Environmental Handbook (https://home.army.mil/campbell/index.php?cID=875) provides guidance and instructions for spill prevention control, countermeasures, and site-specific contingency planning. Each tenant unit is required to maintain a site-specific spill prevention and control plan, and to train unit personnel in spill prevention and control. Spill control materials are required in motor pools, aircraft hangars, and on board all fuel-carrying vehicles. Programs for collection and safe disposal of antifreeze, petroleum, oil, and lubricants are in place to avoid improper disposal. Vehicles are washed at the central vehicle wash facility and at wash racks. These facilities are designed to capture mud, grease, and petroleum products washed off the vehicles, and prevent contamination of storm water collection system, surface water, and groundwater.

5.0 CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVE

This section describes the anticipated effects to the environment from the Proposed Action and the No Action Alternative. In addition to environmental consequences, implications to the military mission and regulatory compliance are described.

Under the Proposed Action and No Action Alternative, natural resources on Fort Campbell would be managed in a manner that would comply with federal and state laws governing specific resources (e.g., wetlands, streams). Natural resources management activities are designed, by definition, to benefit the environment and support natural ecological processes. Generally, natural resources management activities

do not involve activities that result in significant adverse environmental impacts, such as conversion of natural habitat to impervious surfaces (i.e., pavement, buildings), use of hazardous materials, or generation of pollutants or noise. No significant negative effects to the environment are anticipated under either alternative. The primary differences between the alternatives are:

- Unification of numerous programs and component management plans in the INRMP,
- Coordinated management of wildfires and prescribed burns,
- Integration of natural resources and fire management with the military mission, and
- Objectives, monitoring actions, and conservation standards unique to the INRMP (i.e., not found in other component management plans) that are designed to enhance management of natural resources on Fort Campbell.

The INRMP promotes a coordinated approach that improves the efficiency and effectiveness of individual management activities. Therefore, this analysis identifies the effects to the environment from implementation of multi-disciplinary, long-term plans (the INRMP and component plans) under the Proposed Action, versus uncoordinated implementation of several component plans under the No Action Alternative. The effects of individual actions described in the INRMP are not evaluated here but are generally assessed and will be evaluated during the Installation NEPA review process, if necessary, when the project is planned in sufficient detail.

Direct, indirect, and cumulative effects of the Proposed Action and the No Action Alternative were assessed. A direct impact is an effect to the environment caused by the action and occurring at the same time and place. An indirect impact is an effect to the environment caused by the action but distant in time or space. Indirect impacts include reasonably foreseeable land use changes that may occur in the vicinity as a result of implementing the project. A cumulative impact results from the incremental or collective impact to the environment by the action when combined with other past, present, and reasonably foreseeable future actions.

Neither the effects of the Proposed Action nor the No Action Alternative are expected to be controversial, involve unique or unknown risks, or to establish a precedent for future actions. Because the Proposed Action and the No Action Alternative do not involve park lands or wild and scenic rivers, effects to those resources are not analyzed in detail.

5.1 Irreversible or Irretrievable Commitment of Resources

The Proposed Action and No Action Alternative involve the implementation of management plans. The “action” in each of the alternatives is the establishment of a land management approach and the processes of planning, coordinating, monitoring, and budgeting for the projects listed in the management plans. The “action” in each of the alternatives does not include execution of the projects within the management plans, because project execution depends upon availability of funds and, in some instances, the outcome of other projects. As such, the irreversible or irretrievable commitment of resources under either alternative will be minimal. Because the INRMP and other component management plans are “living documents” designed to include adaptive management, none of the plans irretrievably commits natural resources or human resources to specific uses. Commitment of resources under both alternatives involves human and financial

resources, i.e., the time and salaries required to coordinate, implement, and monitor the respective management plan(s).

Selection of the Proposed Action will commit the time and salary required for the INRMP Coordinator to conduct the annual INRMP review described in Section 6.8 of the INRMP. The position of INRMP Coordinator will be filled by an existing member of the Conservation Branch staff; INRMP coordination tasks are expected to require no more than four person-weeks per year. Additionally, natural resources program managers will spend time preparing funding requests, coordinating with others, attending the Land Management Forum, and assisting the annual INRMP review.

Selection of the No Action Alternative will commit the time and salary of Conservation Branch and ITAM Program staff responsible for implementation of component management plans. The existing staff will accommodate the time and salary requirements of the No Action Alternative.

5.2 Compliance with Pertinent Regulations and Guidance

5.2.1 Proposed Action

Implementation of the INRMP complies with the Sikes Act, Section 101(a)(1)(B):

> "To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the United States…"

and Section 101(a)(2):

> "The Secretary of a military department shall prepare each (INRMP) … in cooperation with the Secretary of the Interior, acting through the Director of the United States Fish and Wildlife Service, and the head of each appropriate State fish and wildlife agency for the State in which the military installation is located. …the resulting plan for the military installation shall reflect the mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources."

Implementation of the INRMP is required by DoD Directive 4700.4 (24 January 1989), which states that integrated natural resources management plans shall be maintained for DoD lands for the purpose of guiding planners and implementers of mission activities as well as natural resources managers. The Directive also states natural resources management plans shall be prepared cooperatively with appropriate Federal, State, and local officials, and that the plans shall be continually monitored, annually reviewed, and revised at least every five years.

Implementation of the INRMP, preparation of the Plan in cooperation with Federal and State wildlife agencies, and systematic review of the natural resources management program is required under Department of Defense Instruction 4715.3 (3 May 1996) and Army Regulation 200-1 (December 2007) Section 9, and the Headquarters Department of the Army Policy Memorandum (21 March 1997) entitled "Army goals and Implementing Guidance for Natural Resources Planning Level Surveys and Integrated Natural Resources Management Plan."

Implementation of the IWFMP complies with Army Wildland Fire Policy Guidance (4 September 2002), which states, “Installations with unimproved grounds that present a wildfire hazard and/or installations that use prescribed burns as a land management tool will develop and implement an Integrated Wildland Fire Management Plan (IWFMP) that is compliant and integral with the INRMP, the installation’s existing fire and emergency services program plan(s), and the ICRMP.”

5.2.2 No Action Alternative

Under the No Action Alternative, Fort Campbell would not implement the INRMP or component plans and would fail to comply with:

- The Sikes Act
- DoD Directive 4700.4
- DoDI 4715.3
- AR 200-1
- The HQDA INRMP Policy Memorandum
- The Fort Campbell Sustainability Plan
- Army Wildland Fire Policy Guidance

The Sikes Act is a federal law designed, in part, to protect the environment by requiring the Secretary of the Army to develop INRMPs. Under NEPA Section 1508.27, violation of a federal law is one of the factors to be considered in determining the severity of effects to the human environment.

Fort Campbell would not coordinate with the USFWS or state wildlife agencies to develop multi-disciplinary, long-term plans for conservation and management of fish and wildlife resources. Coordination with those agencies regarding natural resources management would be limited to agency coordination during project-specific NEPA analyses or ESA Section 7 processes.

Under the No Action Alternative, Fort Campbell would not conduct an annual comprehensive review of natural resources management activities, which is described in Section 6.8 of the INRMP. DoD Instruction 4715.3 requires that installations with INRMPs must conduct annual self assessments to review achievement of the conservation measures of merit.

5.3 Natural Resources

5.3.1 Soils

Soil conservation and management on Fort Campbell involves preventing/minimizing the development of bare and disturbed soil areas, identifying soil erosion, and restoring areas undergoing or susceptible to erosion. The Farmland Protection Policy Act (7 U.S.C. 4201 *et seq*; FPPA) is designed to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. The FPPA requires federal agencies to evaluate adverse effects to preservation of farmland and consider alternative actions to lessen those adverse effects. Federal agencies must also ensure federal programs, to the extent practicable, are compatible with State, local, and private programs and policies to protect farmland.

5.3.1.1 Proposed Action

Under the Proposed Action, Fort Campbell would implement the INRMP, which describes the following goals for soil management:

- Prevent/minimize damage to soils by educating soldiers
- Reduce erosion by rehabilitating existing areas with bare/damaged soils
- Maintain vegetated riparian zones to stabilize soil on streambanks and minimize sediment run off and pollution-laden water into streams
- Avoid/minimize disturbance to the ground that results in bare soil and potentially leads to erosion

Five goals, 26 objectives and five monitoring actions are listed in the INRMP for soil conservation. All of the goals, objectives, and monitoring actions for soil conservation originate in other guidance and component management plans. The INRMP contains the conservation standard: “encourage trainers to site intensive land-disturbing activities, when possible, on the least erodible lands.” The INRMP promotes the coordination of soil conservation activities with other natural resources management actions. The landscape-scale planning generated by the INRMP will facilitate evaluation of options to conserve prime farmlands on the installation. The INRMP annual checklist provides a useful mechanism for monitoring progress on soil conservation projects.

Disturbance of steep slopes and unstable or poorly drained soils is to be minimized. The INRMP provides a unified planning process that ensures the limitations of soils will be considered and managed to the maximum extent practicable. The IINRMP also outlines objectives for improving the firebreak system by eliminating a large proportion of unnecessary firebreaks and upgrading the necessary firebreaks, as well as standard procedures for minimizing soil erosion from existing and new firebreaks.

Implementation of the INRMP will not cause direct beneficial or adverse effects to soils. No prime farmland soils now in agricultural use will be permanently converted to other uses. The effects of individual INRMP projects to soils, including prime farmlands, will be assessed in project-specific environmental analyses. However, implementation of the plans will benefit soil conservation, including prime farmlands, by improving the effectiveness of soil conservation efforts on Fort Campbell.

5.3.1.2 No Action Alternative

Under the No Action Alternative, Fort Campbell would conduct all of the actions in the INRMP that pertain to soil conservation and rehabilitation. Soil conservation would be carried out under CAM Reg 385-5, the FMP, the ESMC, the Fort Campbell Policy for Storm Water Erosion and Sediment Control at Construction Projects, the ITAM 5-year Plan, the Watershed Management Plan, and Agricultural Tract Management Plans.

The CAM Reg 385-5 contains requirements for minimizing and remediating damage to soil during military activities such as excavation of berms and travel in vehicles. Because input of sediment-laden run-off into streams can affect water quality, the ESMC identifies maintenance of healthy aquatic communities and

clean water as primary goals for conservation of endangered bats, which feed on aquatic insects and drink from streams. The ESMC establishes Conservation Branch efforts to identify areas where soil is eroding and development of a prioritized list of soil rehabilitation projects that is coordinated with the efforts of the ITAM Program. The Fort Campbell Storm Water Management Plan establishes erosion prevention requirements for ground disturbing activities including establishment of new firebreaks and construction projects. The Watershed Management Plan describes routine surveys along streams to identify sources of eroding soil. Tract Management Plans prepared for agricultural outleases specify soil conservation measures required for those plots.

Because the INRMP promotes coordination among programs, soil conservation efforts without the INRMP are expected to be less efficient under the No Action Alternative. Without the review of the INRMP annual checklist, progress on soil conservation activities will not be monitored as frequently. Additionally, without coordination among programs implementing prescribed burns, more soil may be disturbed to create firebreaks and bog lines than would be necessary using a centrally-coordinated burning program. No direct adverse or beneficial effects to soils are expected from implementation of several component management plans. No prime farmland soils now in agricultural use will be converted to other uses. The effects to soils and prime farmlands from individual projects will be assessed in project-specific environmental reviews.

5.3.2 Water Resources and Aquatic Habitat

Conservation of surface and groundwater resources is an important aspect of maintaining a healthy ecosystem at Fort Campbell. Water quality must be protected to provide drinking water, recreation, and resources for wildlife. Reducing impacts to water quality from sediment is critical to support high quality streams. Maintaining healthy aquatic habitat and good quality water is important for conservation of the two federally endangered bat species present on Fort Campbell. Wetlands must be protected in accordance to federal laws and are an important component of the Fort Campbell ecosystem.

5.3.2.1 Proposed Action

Under the Proposed Action, Fort Campbell will implement the INRMP, which includes the following goals for conservation of aquatic and wetland habitats:

- Prevent/minimize water pollution and degradation of aquatic habitat by educating soldiers, residents, and employees, and contractors, and distributing accurate information about surface and groundwater resources in the GIS database
- Minimize input of sediment and other contaminants in storm water run-off entering surface water and groundwater (sinkholes)
- Improve the quality of water and aquatic habitat in streams that are currently not supporting of designated uses
- Ensure compliance with the Clean Water Act Sections 404 and 401
- Prevent/minimize degradation of wetlands by educating soldiers, residents, and employees about wetlands
- Minimize damage to vegetation, and input of sediment and other contaminants to wetlands

- Restore degraded wetlands to support future mitigation requirements (i.e., mitigation bank) as resources are available

Each of the goals, objectives and monitoring actions listed in the INRMP for protecting the quality of surface water or ground water quality originates in other guidance and management plans. Protection of surface water quality is an important factor in the conservation of habitat suitable for endangered bats that forage on Fort Campbell. Consequently, conservation standards, objectives and monitoring actions designed to conserve and monitor water quality originate in the ESMC. The Fort Campbell Stormwater Management Plan also establishes measures to prevent pollution of surface water and groundwater. The INRMP coordinates the efforts of various programs involved in protection of aquatic habitats and water quality. The INRMP annual checklist provides a useful mechanism for monitoring progress on aquatic habitat conservation projects.

The INRMP is the primary planning document addressing specific activities designed to comply with the Clean Water Act, Executive Order 11990, and the Army's "no net loss of wetlands" policy. The nine objectives and two monitoring actions established in the INRMP for wetland conservation are not found in other management plans. The INRMP also includes two conservation standards pertaining to wetlands. One standard establishes vegetated buffers at least 100 feet wide around wetlands, and the second states that construction projects and training should be planned to avoid wetlands to the maximum extent practicable (INRMP Section 7.0). Activities within the buffers are limited to those that would cause little or no disturbance to the wetland. Inspection of vegetated buffers around wetlands is one of the objectives established in the INRMP. The INRMP provides a mechanism for maintaining wetland delineations up to date (not older than 5 years), and for ensuring current information about wetland boundaries are contained in the GIS system. The INRMP promulgates education and coordination between the Conservation Branch and other organizations regarding avoiding damage to wetlands. The INRMP also establishes a mechanism for initiating wetland restoration.

Implementation of the INRMP will not directly beneficially or adversely affect surface or ground water resources, including wetlands. The effects of individual INRMP projects and prescribed burns to water resources will be assessed in project-specific environmental analyses. However, implementation of the INRMP will support efforts to improve water resources, including wetlands, on the installation by integrating protection of these resources into other management activities. The Proposed Action also is expected to indirectly benefit surface and groundwater resources downstream of the installation by maintaining good quality water flowing out of the installation. The INRMP provide unified planning processes that ensure sensitive natural resources, such as aquatic habitats, will be considered and protected to the maximum extent practicable. Furthermore, the Proposed Action will indirectly benefit wetlands and surface waters by maintaining vegetated buffers around those features that reduce inputs of sediment and pollution. Indirect benefits to water resources result in maintenance of existing habitat quality, rather than habitat improvements, and therefore are not considered significant effects.

5.3.2.2 No Action Alternative

Under the No Action Alternative, Fort Campbell will conduct all of the actions in the INRMP that pertain to conservation of aquatic habitat and protection of water quality. Education programs, updating the GIS system, establishing and monitoring water quality standards will take place under the ESMC and Watershed Management Plan. The ITAM Program would design and implement hardened water crossings

and implement the LRAM Program to minimize input of sediment into streams and sinkholes. The Fort Campbell Stormwater Management Plan would be implemented to minimize pollution of surface and groundwater from construction projects. These activities would indirectly benefit surface and ground water resources downstream of the installation by maintaining good water quality flowing out of the installation.

Because the INRMP promotes coordination among programs, efforts to protect aquatic habitat and water quality without the INRMP may be less efficient and effective than under the Proposed Action. Without the review of the INRMP annual checklist, progress on water resources conservation may not be monitored as frequently.

Under the No Action Alternative, Fort Campbell would comply with the Clean Water Act, Executive Order 11990, and Army policy regarding wetlands. The CAM Reg 385-5 requires that actions involving disturbing a “low area” be reviewed by the Directorate of Public Works (DPW). Environmental impact assessments associated with the NEPA process would evaluate effects of proposed actions, including prescribed burns, to wetlands. However, wetland compliance would not be integrated with other natural resources management or military training programs. Efforts to educate soldiers and other Fort Campbell personnel would not occur. Efforts to initiate wetland restoration would not occur.

No significant direct adverse or beneficial effects to water resources, including wetlands, are expected under the No Action Alternative. The effects to water resources from individual projects will be assessed in project-specific environmental reviews.

5.3.3 Terrestrial Habitat

Management of terrestrial habitats on Fort Campbell involves management of open areas (native grasslands and old fields), agricultural lands, and forest. Native grassland barrens on Fort Campbell are a unique ecological community.

5.3.3.1 Proposed Action

Under the Proposed Action, Fort Campbell will implement the INRMP, which includes the following goals for terrestrial habitat management:

- Manage the landscape to achieve the amount of suitable training and maneuver area described in the 2004 Range Development Plan
- Manage open areas on Fort Campbell on a landscape scale to support multiple uses of open areas, sustain native species, and maximize efficiency of management actions
- In a manner consistent with (the two goals above), expand the acreage of native grassland barrens by approximately 10,000 acres
- Support regional planning efforts for grassland areas to restore native habitat types and enhance habitat for wildlife
- Maintain a reimbursable program that provides lease opportunities for local farmers, revenue for the U.S. Army, and promotes sustainable agricultural activities consistent with the conservation of soil, water, and other natural resources
- Manage forest resources in the maneuver space to support planned military use of the land

- Maintain a healthy, sustainable forest on Fort Campbell that provides for natural habitat, conservation of endangered species, revenue from timber sales, and recreational opportunities
- Manage fire in a manner that protects human life and safety, minimizes damage to property, natural and cultural resources, and contributes to ecosystem management goals.

The INRMP is the primary mechanism for coordinating management of the landscape to meet requirements for training and other land uses. The INRMP translates land use requirements from the RDP and Sustainability Plan into natural resources management actions designed to achieve the desired conditions. Setting objectives for land use in the INRMP allows land use planning to incorporate multiple factors, including characteristics (e.g., soil erodibility, presence of rare species or habitats) that influence suitability for training, agriculture, and native grassland barrens.

Under the Proposed Action, Fort Campbell will implement the IWFMP, which integrates a primary tool for managing terrestrial habitat, prescribed burning, with the INRMP and other Fort Campbell plans. The IWFMP provides a unified approach to planning and coordinating prescribed burns to keep terrestrial habitat suitable for military training and ecological purposes (e.g., grassland birds). Prescribed fire is the primary management tool used to control encroachment of woody growth, which hinders military training, in grassland training areas. The IWFMP integrates the goals of military training and natural resources conservation into a single efficient approach. Implementation of the IWFMP supports effective management of terrestrial habitats.

Implementation of the INRMP will not result in direct beneficial or adverse effects to terrestrial habitats, including unique ecological communities (native grassland barrens). The effects of individual INRMP projects (e.g., expansion of grassland barrens) and prescribed burns will be assessed in project-specific environmental analyses. However, implementation of the plans will indirectly benefit terrestrial habitat by promoting landscape scale, long-term planning for land use and habitat management. The Proposed Action also results in indirect beneficial effects to native grassland barrens by supporting Fort Campbell's role in regional conservation efforts such as seed collection.

5.3.3.2 No Action Alternative

Under the No Action Alternative, Fort Campbell would implement the Grassland Management Plan, individual tract management plans for agricultural outleases, and the Forest Management Plan. Agricultural outlease and forest products reimbursable programs would continue. Prescribed fire would be implemented by the Forestry, Fish and Wildlife, and ITAM programs. However, management activities would not be coordinated among plans. For example, plans to apply fire to maintain old fields may not be coordinated efficiently with habitat improvement for migratory birds. Goals for eliminating noxious weeds in the IPMP likely will not be coordinated with vegetation control in the FMP or agricultural tract management plans. The No Action Alternative will not cause direct adverse or beneficial effects to terrestrial habitats, including unique ecological communities. The NEPA process would evaluate impacts of specific projects (e.g., creation of a new training range). However, there would be no pro-active planning on a landscape scale to avoid effects to sensitive resources. The military mission may not be as effectively supported without integrated, long-term plans. The land use requirements of the RDP and Sustainability Plan would not be integrated into natural resources management activities. The volume and condition of lands needed for

training would not be coordinated with plans for managing terrestrial habitats. Management of native grassland barrens as a unique ecological community would not be coordinated with the Range Development Plan, ITAM Program activities, agriculture, and other natural resources management activities. Fort Campbell would not participate in regional efforts to conserve grassland barrens. Without the review of the INRMP annual checklist, progress toward terrestrial habitat management goals would be monitored less frequently, and adaptive management would not be used to improve projects not meeting goals.

5.3.4 Fauna

This section addresses effects to game and non-game wildlife and fish species on Fort Campbell. Federally listed and state-listed species of animals and plants are addressed separately in Section 2.7 below.

5.3.4.1 Proposed Action

Under the proposed Action, Fort Campbell will implement the INRMP. The INRMP includes the following goals for management of wildlife and fish:

- Manage habitat to promote a balance of natural ecological processes and trophic structure that sustain native wildlife and fish,
- Enhance habitat to support abundant, self-sustaining populations of native game and non-game wildlife and fish,
- Promote the goals for the MBTA and Executive Order 13186 “Responsibilities of Federal Agencies to Protect Migratory Birds” by implementing the Fort Campbell Migratory Bird Management Strategy,
- Manage the hunting and angling programs to provide adequate recreational opportunities consistent with requirements of the Sikes Act, and to establish self-sustaining populations of game wildlife that are an integral part of the ecosystem, and
- Educate the Fort Campbell community about wildlife management initiatives, associated recreational opportunities, and wildlife native to the installation.

Management of wildlife and fish populations on Fort Campbell supports the requirement of the Sikes Act, which states that installations shall provide for fish and wildlife management, habitat enhancement/modification for fish and wildlife, public recreation associated with fish and wildlife, and public access to the installation (consistent with the military mission) for such recreation. The INRMP is the primary mechanism for planning habitat management activities to support wildlife and fish populations, and programs to monitor the health of those populations. Implementing the INRMP includes habitat improvements to support native species, surveys of various populations, and public education about fish and wildlife on the installation. Fish and wildlife surveys conducted under the INRMP support the adaptive management process; population trends identify which habitat management activities need more or less emphasis.

Fort Campbell manages fish and wildlife primarily with a landscape-level approach with the goal of providing a variety of high-quality natural habitats (e.g., forest of various ages, native grasslands, streams and riparian zones) that will sustain diverse populations of native fauna.

Coordination of several management programs is essential to achieve an appropriate balance of land uses across the landscape. The INRMP promotes coordination of fish and wildlife management with programs such as forestry and agriculture as well as military land use requirements. The INRMP integrates the federally-mandated Migratory Bird Strategy with other natural resources management initiatives, such as the Grassland and Forest Management Plans. In instances of pest animals (e.g., skunks, groundhogs, deer), the INRMP promotes coordination between the Fish and Wildlife Program and the Pest Management Program.

The Proposed Action also includes implementation of the IWFMP. Prescribed Burn Guidelines found in the IWFMP outline procedures for minimizing damage to important habitats, including rare wildlife and sensitive wildlife habitat. Damage to snag trees and nesting sites is to be minimized. The IWFMP provides a unified planning process that ensures sensitive natural resources will be considered and protected to the maximum extent practicable. Implementation of the IWFMP beneficially affects the management of habitat for native fauna.

5.3.4.2 No Action Alternative

Under the No Action Alternative, the hunting and fishing permit program would continue *status quo*. Therefore, the requirements of the Sikes Act pertaining to recreation would be met. No direct beneficial or adverse effects to fauna under the No Action Alternative are expected. However, habitat management activities designed to support wildlife and fish (e.g., creation of wildlife ponds) would not occur. The waterfowl management plan would not be prepared, and monitoring programs for fish and wildlife populations would not be conducted. While wildlife populations would adapt to the natural successional habitat changes, certain communities (e.g., grassland species) would decline as grasslands convert to forest in the absence of active management. Fort Campbell would not conduct long-term population monitoring, which is important for setting bag/creel limits and for managing habitat to support sustainable populations. Public education about recreational opportunities and native wildlife would not occur. Because the IWFMP would not be implemented, pre-burn planning and coordination regarding rare wildlife and sensitive wildlife habitat may not be as efficient.

Under the No Action Alternative, Fort Campbell would implement the Migratory Bird Strategy and the installation would conduct activities necessary to maintain compliance with the Migratory Bird Treaty Act and Executive Order 13186. The objectives listed in the INRMP that pertain to migratory birds (Section 5.10) would be implemented. However, management activities designed to sustain migratory birds and their habitat would not be integrated with other natural resources management activities.

5.3.5 Rare, Threatened, and Endangered Species

Protection of federally listed species and their habitat is required by the Endangered Species Act and AR 200-1. Army Regulation 200-1 also supports conservation of rare species on Army installations.

5.3.5.1 Proposed Action

Under the Proposed Action, Fort Campbell will implement the INRMP. The INRMP includes six goals and associated objectives that originate from the ESMC. Conservation standards designed to avoid effects to

federally listed species are implemented under both the INRMP and ESMC. The INRMP coordinates efforts to conserve the gray bat and Indiana bat with other natural resources management and military land use activities on Fort Campbell. The INRMP 5-year planning and annual update process provides a mechanism for coordination among Fort Campbell, the USFWS, and State wildlife agencies, which supports the protection of endangered species on Fort Campbell.

The INRMP also includes the following goal, which is not found in any other component plan, pertaining to rare (not federally listed) species: “Maintain self-sustaining populations of state-listed and rare species on Fort Campbell to the maximum extent practicable.” The INRMP is the primary planning document addressing conservation of rare species. Objectives found in the INRMP include maintaining location data in the GIS system, conducting surveys for rare species, monitoring known populations, and avoiding impacts to known populations. The INRMP establishes a mechanism for monitoring and adaptive management if populations of rare species on the installation begin to decline.

The IWFMP includes Prescribed Burn Guidelines that address identification and avoidance of federally listed and rare species and their habitat. The Fish and Wildlife Program Manager must be consulted to identify the location of federally listed or rare species and sensitive sites on or near the proposed burn site. The IWFMP provides a unified planning process that ensures sensitive natural resources will be considered and protected to the maximum extent practicable, and that the minimum number of fires will be set to achieve habitat conditions favorable for native flora and fauna, including listed and rare species.

Implementation of the INRMP will not directly beneficially or adversely affect rare, threatened, or endangered species. The effects of individual INRMP projects and prescribed burns to rare and listed species will be assessed in project-specific environmental analyses. However, implementation of the INRMP and IWFMP will indirectly benefit rare and listed species, by integrating protection of these resources into other management activities. The INRMP and IWFMP provide unified planning processes that ensure sensitive species will be considered and protected to the maximum extent practicable. Indirect benefits to rare and listed species result in maintenance of the *status quo*, rather than significant improvement, and therefore are not considered significant effects.

5.3.5.2 No Action Alternative

Under the No Action Alternative, Fort Campbell would implement the ESMC, thereby maintaining compliance with the ESA and AR 200-1. Conservation standards, goals, objectives for conservation and recovery of the gray bat and Indiana bat would be implemented. Under Fort Campbell’s NEPA process, effects of proposed actions, including prescribed burns, to federally listed and rare species would be evaluated. Therefore, no adverse or beneficial effects will occur under this alternative. However, efforts to conserve federally listed species may not be as efficiently coordinated with other management activities.

Under the No Action Alternative, Fort Campbell would not conduct surveys for rare flora and fauna and would not monitor known populations of rare plants. Measures to avoid impacts to rare species of plants may not be integrated with other natural resources management activities such as prescribed burning and forestry. During the environmental review process, Fort Campbell would evaluate effects to known populations of rare species from proposed projects. However, conservation of rare species will not be as effective without monitoring and surveys described in the INRMP, and the pre-burn planning process described in the IWFMP.

5.4 Cultural Resources

Natural resources management does not directly involve identification or conservation of cultural resources on Fort Campbell. Natural resources management personnel are required to protect cultural resources during activities, and to notify the CRM Program if new artifacts are found. Protection of cultural resources is required by Federal laws, Army regulations, an interagency Programmatic Agreement, and the Fort Campbell ICRMP.

5.4.1 Proposed Action

Under the Proposed Action Fort Campbell would implement the INRMP which reinforce the importance of protecting cultural resources during natural resources management activities. Protection of cultural resources is one of the natural resources conservation standards listed in Section 3.0 of the INRMP. INRMP actions that involve mapping spatial data in the GIS database contribute to protection of cultural resources. For example, comparison of planned soil restoration projects with the CRM database may identify eroding areas where archaeological artifacts need protection.

The IWFMP includes Prescribed Burn Guidelines that address the identification and avoidance of cultural resources. Cultural resources inventories must be consulted to identify the location of known resources on or near the proposed burn site. The IWFMP provides a unified planning process that ensures cultural resources will be considered and protected during prescribed burns.

Beneficial effects to cultural resources are expected to occur under the Proposed Action. The effects of individual INRMP projects will be assessed in project-specific environmental analyses. Implementation of the INRMP is expected to promote more efficient coordination between the natural and cultural resources personnel, and compliance with pertinent regulations is likely to be highest under the Proposed Action.

5.4.2 No Action Alternative

Under the No Action Alternative, Fort Campbell would implement the Cultural Resources Management Program, the interagency Programmatic Agreement, the Dig Permit Program, and the ICRMP. Requirements to avoid impacts to cultural resources will be enforced. The Dig Permit and environmental review processes will ensure ground disturbance for military training, agricultural cultivation, development of firebreaks, and new construction do not affect known cultural resources. No adverse or beneficial effects to cultural resources will be caused by the No Action Alternative. Effects of individual INRMP projects and prescribed burns will be assessed in project-specific environmental reviews when the projects are planned in detail.

5.5 Air Quality

Generally, natural resources management activities do not generate or emit air pollutants. None of the activities conducted to manage natural resources, including prescribed burning, requires an air quality permit from the State of Tennessee or Commonwealth of Kentucky. Vehicles and equipment (e.g., tractors, bulldozers) used by natural resources personnel may emit exhaust and generate dust. Prescribed burning may temporarily increase particulates in the air. Emissions resulting from natural resources management

activities will be small quantities, temporary, and localized. Emissions generated during natural resources activities will not significantly increase the amount of the seven criteria pollutants in the environment. Natural resources management activities are not expected to influence air quality monitoring or the regional air quality attainment status.

5.5.1 Proposed Action

Under the Proposed Action, Fort Campbell would implement the INRMP. Implementation of these plans is not expected to affect the use of vehicles or equipment, and therefore will not affect the quantity, location, or duration of emissions or dust.

The IWFMP contains a standard operating procedure for planning and implementing burns to minimize the presence of smoke and dispersion of smoke into unwanted areas (e.g., active training areas, residential areas, across roads, outside the installation). The IWFMP also contains a decision matrix in which unacceptable smoke conditions leads to wildfire suppression. Under the Proposed Action, planning and coordination of prescribed burning and wildfire suppression are expected to maximize air clarity and visibility.

5.5.2 No Action Alternative

Under the No Action Alternative, Fort Campbell would not implement the INRMP or IWFMP. No significant change in the use of vehicles or equipment is expected, therefore the quantity, location, or duration of emissions from those mobile sources would not change.

The Forestry, Fish and Wildlife, and ITAM programs would plan and set prescribed burns without coordinating with the Installation Wildland Fire Program Manager. There would be no standard operating procedure for smoke management during prescribed burns. Smoke from prescribed burns may not disperse as effectively as when the smoke management standard operating procedure is implemented. Direct effects from smoke may result in temporary reduction of visibility on the installation, which may impede military training or civilian activities. Indirect effects from smoke may result in temporary reduction of visibility outside the installation if smoke disperses outside installation boundaries. However, smoke will not significantly affect air quality or Fort Campbell's compliance with laws or guidance regulating air pollution.

5.6 Noise

Natural resources management activities conducted by the Conservation Branch do not contribute to noise generated on Fort Campbell. No adverse effects from noise are expected under either alternative. However, the Forestry Program contributes to management of noise. Certain forest stands near airfields are managed to reduce the visibility of noise sources, thereby reducing awareness of the sound in the surrounding community. Forest stands that contribute to noise management are identified in the GIS database and are specifically managed by the Forestry Program to minimize noise. Management objectives for these stands are described in the Forest Management Plan, which will be implemented under the Proposed Action and No Action Alternative. Therefore, actions conducted under both alternatives slightly benefit efforts to manage noise on the installation.

5.7 Socioeconomics

The only aspect of socioeconomics that may be affected by the Proposed Action or No Action Alternative is outdoor recreation.

5.7.1 Proposed Action

The INRMP is the primary document for planning natural resources management to support outdoor recreation activities including hunting, fishing, camping, hiking, and birdwatching. Under the Proposed Action, Fort Campbell will implement the INRMP, which includes goals and objectives for consumptive and non-consumptive uses such as enhancing habitat for wildlife and fish, stocking fish, setting bag and creel limits, monitoring populations of game species, and monitoring use of Fort Campbell by anglers (INRMP Sections 5.9 and 5.12). Management activities specified in the INRMP are designed to support outdoor recreation programs on the installation. The Proposed Action will sustain the quality of human life on Fort Campbell by enhancing the quantity and quality of outdoor recreation opportunities, and by managing the natural resources in which recreational activities occur.

5.7.2 No Action Alternative

Under the No Action Alternative, the public would be allowed access to the maneuver space, provided such use is consistent with the military mission. The iSportsman office and portal (DPW Environmental Division) would perform the administrative functions associated with outdoor recreation; hunting and fishing permits would be issued to the public. Therefore, requirements of the Sikes Act would be met. However, fish stocking would not occur. Habitat management projects designed to enhance game species populations, such as placement of fish attractors or development of native grasslands, would not occur. Monitoring of game species, predators, and waterfowl would not occur. Electroshocking surveys to monitor sport fish populations would not occur. Information would not be collected from hunters and anglers for the purpose of evaluating public demand for recreation opportunities. No adverse effects to game species are expected under the No Action Alternative. However, without active management and monitoring of game species and their habitat, the quality of outdoor recreation opportunities on Fort Campbell is expected to decline over time.

5.8 Human Health and Safety

Aspects of natural resources management that affect human health and safety include management of hazardous materials and fire safety.

5.8.1 Proposed Action

The amount of hazardous materials used by natural resources personnel in the maneuver space is miniscule relative to the POL and pesticides stored and used in the airfields and cantonment area. Under the Proposed Action, natural resources management personnel adhere to the Spill Control, Containment, and Countermeasures Plan and the instructions in the Environmental Handbook. Implementing the INRMP and IWFMP is not expected to significantly change the amount of hazardous materials used in the maneuver space. The INRMP contains two pertinent natural resources management standards:

- Do not apply pesticides, fertilizers, and other chemicals into, or within 100 feet of perennial and intermittent streams, sinkholes, and other karst features
- Refuel vehicles and conduct other activities with potential for pollutant spills at least 100 feet from sinkholes

These two standards reinforce the importance of managing hazardous substances such that none enters the environment.

The INRMP contains goals and objectives for pest management that originate in the Fort Campbell Integrated Pest Management Plan (IPMP). The IPMP directs pest management efforts in compliance with Federal laws and Army policies (Appendix P). The IPMP establishes guidance for the storage, handling, and tracking of pesticides, and for the certification and training of pesticide applicators. Appendix P of the INRMP identifies points of coordination between the Pest Management and Forestry, Agricultural Outlease, and other programs. Because the INRMP reaffirms guidance on integrating pesticide safety procedures with natural resources management activities, adherence to the safety procedures is expected to be most effective under the Proposed Action.

The IWFMP establishes standards for the training and certification of personnel fighting wildfires and conducting prescribed burns. The Plan clearly describes roles and responsibilities for planning prescribed burns and suppressing wildfires. It lists requirements for personal protective equipment and procedures designed to maximize personal safety Implementation of a single plan and establishment of the Integrated Wildland Fire Program Manager will ensure pertinent training, certification, and safety requirements are met in all programs implementing prescribed fire on Fort Campbell. The IWFMP will improve human safety on the installation.

5.8.2 No Action Alternative

Under the No Action Alternative, Fort Campbell would implement the IPMP. Measures established in the IPMP for storage, handling, and tracking of pesticides, and for the certification and training of pesticide applicators would be implemented. Fort Campbell would comply with laws and regulations pertaining to pesticide management. However, coordination of pesticide management requirements with other natural resources management programs (e.g., Forestry, Agricultural Outlease) would not be maximized under the No Action Alternative. Guidelines for vehicle refueling and applications of chemicals near karst and water features would be implemented under the ESMC.

Under the No Action Alternative, the IWFMP would not be implemented. Standards for training and certification of personnel, personal protective equipment, and safety procedures may not be uniform across programs.

Generally, under the No Action Alternative, handling of hazardous materials will be compliant with pertinent laws and guidelines. Measures to protect human safety will be in place. However, activities of various programs will not be integrated, which may eliminate efficiencies (e.g., sharing trained personnel among programs, minimizing amounts of pesticides needed) that are gained by implementing a long-term, unified plan.

5.9 Indirect Effects

Indirect effects are caused by the action but are distant in time or space. Temporal indirect effects of the Proposed Action and No Action Alternative would occur after the 5-year period specified in the INRMP (2020–2025). Implementing the Proposed Action will provide a 5-year plan upon which to build natural resources management beyond the year 2025. Because it addresses all natural resources and involves all programs that manage natural resources, the INRMP facilitates the ecosystem management approach. Implementing the INRMP will sustain over time a healthy, balanced ecosystem and conditions that support the military mission. The process of annual review and update of the INRMP provides a mechanism to keep natural resources management projects consistent with reasonable goals. The annual review also ensures that natural resources management projects maintain compliance with pertinent federal and state regulations and remain consistent with the military mission. Implementing the INRMP provides the indirect benefit of a comprehensive, detailed plan from which future management plans can be developed.

Under the No Action Alternative, several resource-specific plans will be implemented by various programs to manage natural resources on Fort Campbell. Absence of a single unifying plan makes the ecosystem management approach more difficult. Failure to coordinate project plans and data are likely to result in inefficiencies or duplication of efforts. Resource-specific management may result in ecosystem imbalances that magnify over time. Some resource-specific plans include periodic review and updates, while some do not. Without the annual review process, planned projects may become inconsistent with the military mission; no corrective mechanism would be in place to address that inconsistency. While no significant adverse indirect effects are anticipated, absence of the INRMP reduces the likelihood that the Fort Campbell environment will, on a long-term basis, be suitable to support the military mission and the ecosystem balance.

Spatial indirect effects of the Proposed Action and No Action Alternative involve water quality downstream of the installation, regional conservation efforts for native grassland barrens, and smoke from prescribed burns/wildfires dispersing across installation boundaries. Those indirect effects are addressed in Sections 5.3.2, 5.3.3, and 5.5 respectively.

5.10 Cumulative Effects

Cumulative effects result from the incremental or collective impact to the environment when combined with other past, present, and reasonably foreseeable future actions. Cumulative effects of the Proposed Action and No Action Alternative relate to the function of the INRMP in other long-range planning efforts at Fort Campbell. Cumulative effects related to the IWFMP are not anticipated.

Implementing the INRMP supports long-range land use planning on Fort Campbell. Divisions other than Environmental, such as Master Planning, use the INRMP to identify conditions of the Fort Campbell environment. The Range Development Plan (Nakata 2004) prepared for DPTMS used the INRMP to characterize existing training resources and to identify opportunities and constraints for modifying the landscape to improve training resources. Because the INRMP is an integrated, long-term plan, it supports gradual management over time, rather than short-term, drastic changes to the environment. The INRMP provides a mechanism for integrating land use plans into natural resources management objectives. For example, the need for additional grassland suitable for training is incorporated into INRMP objectives for

managing terrestrial habitat. Once integrated into the INRMP, the potential effects of those land use plans on other resources (e.g., forest, wetlands, outdoor recreation) can be evaluated and addressed. Therefore, the cumulative effect to the environment from the Proposed Action is expected to be beneficial.

Under the No Action Alternative, Fort Campbell planners must gather and synthesize numerous resource-specific management plans. The lack of an INRMP will not prevent master planning, range development, or the environmental review process. However, those processes may not be as efficient. Without the INRMP, land use requirements for training, housing, and other purposes will be disconnected from management conducted for the purpose of ecological conservation. While no significant adverse cumulative effects to the environment are expected, land management under the No Action Alternative is likely to be less effective and efficient.

6.0 CONCLUSION

In summary, the Proposed Action is not expected to cause significant beneficial or adverse effects to the environment (Table 3). Because the No Action Alternative will lead to violation of federal law (the Sikes Act), that alternative involves significant adverse effects to the human environment. Other negative aspects of the No Action Alternative are related to non-compliance with Army policies requiring implementation of an INRMP, reduction in efficiency and effectiveness of natural resources management activities, and reduced ability to support the Fort Campbell military mission. However, because resource-specific management plans would be implemented and legal requirements for resource protection would be met, these aspects of the No Action Alternative do not result in significant effects to the human environment.

Positive aspects of the Proposed Action relate to the improved efficiency and effectiveness resulting from a long term plan that is routinely evaluated and adapted. The Proposed Action most effectively supports the military mission. Generally, the Proposed Action promotes the development and maintenance of a healthy ecosystem suitable for multiple uses at Fort Campbell. However, implementing the INRMP and IWFMP is not expected to result in significant environmental improvements relative to the existing conditions. Therefore, the effects of the Proposed Action are not considered significant as defined by the NEPA implementing regulations (40 CFR 1508.27 and 32 CFR 651).

Table 3. Summary of consequences of the Proposed Action and No Action Alternative.

Resource	Proposed Action	No Action Alternative
Compliance with pertinent laws, regulations, and guidance	Full compliance	Significant adverse effect resulting from violation of the Sikes Act. Negative aspect of non-compliance with DoD guidance (DoD Directive 4700.4, DoDI 4715.3, AR 200-1, HQDA INRMP Policy Memorandum, Fort Campbell Sustainability Plan, and Army Wildland Fire Policy Guidance)
Soils (including prime farmlands)	Maximum soil conservation from improved coordination among programs, landscape-scale planning, project effectiveness, and efficiency	Positive soil conservation measures found in several component plans and the Fort Campbell Stormwater Management Plan
Water resources/aquatic habitat (including wetlands)	Maximum water quality and aquatic habitat preservation from improved coordination among programs, project effectiveness and efficiency, integration of wetlands into planning	Positive water quality and aquatic habitat preservation from several component plans and the Fort Campbell Stormwater Management Plan. No formal management plan for wetlands
Terrestrial habitat	Maximum effectiveness/efficiency with terrestrial habitat management and support of military mission	Positive conservation of native grass barrens under Grassland Management Plan. No formal mechanism for integrating military mission
Fauna	Maximum coordination among programs, project effectiveness and efficiency, population monitoring to support future decisions about hunting and habitat management	No significant direct adverse or beneficial effect. No formal plan to manage fish/wildlife habitat likely to lead to decline of certain populations in the long term. No population monitoring.
Rare, threatened, and endangered species	Maximum coordination among programs, project effectiveness/efficiency, integration of rare plant conservation	Beneficial effect of ESMC. No formal management plan for rare plants
Cultural resources	Maximum coordination of natural resources management activities with CRM conservation efforts	No significant adverse or beneficial effects, ICRMP guides conservation of CRM
Air quality	No significant adverse or beneficial effect; improved control of smoke from fires	No significant adverse or beneficial effect; increased potential for smoke reducing visibility on and off the installation

Table 3 continued. Summary of consequences of the Proposed Action and No Action Alternative.

Resource	Proposed Action	No Action Alternative
Noise	No effect	No effect
Socioeconomics	Improved quantity and quality of outdoor recreation	No formal plan and fewer projects to manage land for recreation; decline in quality of recreation opportunities
Human health and safety	Improved coordination and efficiency of training for fire fighting and handling hazardous materials	No significant beneficial or adverse effect
Indirect Effects	More effective management of ecosystem in the long term	Less effective management of ecosystem in the long-term
Cumulative Effects	More effective coordination with and support of land use planning throughout the installation	Less effective coordination with and support of land use planning throughout the installation

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	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
Communication, Training, Education, and Outreach								
1	Annually review and update the INRMP. Revise the INRMP at least every five years; updates will be prepared cooperatively with USFWS, KDFWR, and TWRA.	INRMP Coordinator	0	x	x	x	x	x
2	Ensure adequate staffing is available to implement required resource management actions.	Conservation Branch Chief	0	x	x	x	x	x
3	Complete INRMP Goals and Objectives review with installation natural resource program managers, trainers and cooperating agencies review.	INRMP Coordinator	1	x	x	x	x	x
4	Complete the DoD Conservation Metrics Report.	INRMP Coordinator	1	x	x	x	x	x
5	Annually review EQO materials and the Environmental 101 Handbook and make necessary revisions to ensure those materials are up to date.	Conservation Branch Chief	1	x	x	x	x	x
6	Participate in national or regional scientific meetings and training sessions.	Conservation Branch	1	x	x	x	x	x
7	Coordinate with agencies, academics, and Non-Governmental Organizations to obtain support with surveys and monitoring.	Conservation Branch	1	x	x	x	x	x
8	Develop a best management practices guide for Fort Campbell.	Conservation Branch	2	x				
9	Support efforts to author/coauthor scientific papers.	Conservation Branch	NA					
10	Support requests to conduct projects or field trips that promote understanding of conservation, and Army natural resource stewardship.	Conservation Branch	NA					
11	Encourage academic research on Fort Campbell.	Conservation Branch	NA					
Training Area Management								
1	RTLA Monitoring in Piney Fork subwatershed and Small Arms Ranges.	ITAM	1	x			x	

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
2	RTLA Monitoring in Noah's Spring Branch subwatershed and Live Fire Ranges.	ITAM	1		x			x
3	RTLA Monitoring in Saline Creek subwatershed.	ITAM	1		x			x
4	RLTA Monitoring in Casey Creek and Skinner Creek subwatersheds.	ITAM	1		x			x
5	RTLA Monitoring in Fletcher's Fork Creek and Little West Fork Creek subwatersheds.	ITAM	1			x		
6	RTLA Monitoring in Jordan Creek subwatershed.	ITAM	1			x		
7	Conduct TOC/LOG Site Maintenance in Piney Fork subwatershed	ITAM	1	x			x	
8	Conduct TOC/LOG Site Maintenance in Noah's Branch subwatershed	ITAM	1		x			x
9	Conduct TOC/LOG Site Maintenance in Fletcher's Fork subwatershed	ITAM	1			x		
10	Conduct TOC/LOG Site Maintenance in Jordan Creek subwatershed	ITAM	1			x		
11	Range/Firing Point Maintenance in Fletcher's Fork subwatershed	ITAM	1			x		
12	Range/Firing Point Maintenance in Piney Fork subwatershed	ITAM	1	x		x	x	
13	Range/Firing Point Maintenance in Noah's Branch subwatershed	ITAM	1	x			x	
14	Range/Firing Point Maintenance in Saline Creek subwatershed	ITAM	1	x	x		x	x
15	Range/Firing Point Maintenance in Jordan Creek subwatershed	ITAM	1			x		
Soil Management								
1	Report failure of erosion control measures around construction sites to Compliance Branch.	All	0	x	x	x	x	x
2	Map areas of potential and known sites of erosion and input into GIS.	Conservation Branch, ITAM	0	x	x	x	x	x
3	Implement soil conservation best management practices on all timber harvest locations.	Forestry	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
4	Integrate soil conservation best management practices into 100 percent of natural resource project plans/contracts.	Forestry, F&W	0	x	x	x	x	x
5	Monitor sediment control structures along the forest access road system.	Forestry	1	x	x	x	x	x
6	Develop a list of projects to repair damaged soils.	All	1	x	x	x	x	x
7	Implement soil erosion/rehabilitation projects in support of training mission damage remediation.	ITAM	1	x	x	x	x	x
8	Restore at least five locations per year where firebreaks cross streams utilizing bioengineering techniques.	Forestry	1	x	x	x	x	x
9	Develop a soil management plan.	Conservation Branch	1	x	x			
10	Inspect riparian zones for sites of erosion and add these areas to the soil improvement project list.	F&W	2	x	x	x	x	x
11	Implement soil erosion remediation actions from areas of naturally occurring erosion (areas not considered caused by military training actions) or caused by natural resource management actions.	Forestry, AO	2	x	x	x	x	x
12	Stabilize all road shoulders in the training areas.	DPW Roads & Grounds	2	x	x	x	x	x
13	Establish an Installation Land Restoration Team.	Conservation Branch	2	x	x			
Water Resources and Aquatic Habitat Management								
1	Continue to coordinate with local agencies to improve practices designed to reduce nonpoint sources of pollution.	All	0	x	x	x	x	x
2	Inspect streams within target watershed(s) to identify degraded streambanks, damaged riparian buffers, and other sources of erosion. Add degraded areas to the water quality improvement project list.	F&W	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
3	Inspect vegetation in riparian zones and around sinkholes. Identify locations where potentially polluted storm water runoff is intentionally routed to sinkholes or other karst features. Record in the GIS database features that are non-vegetated and receiving potentially polluted runoff. Add those sites to the water quality improvement project list.	All	0	x	x	x	x	x
4	Develop and implement Sediment Total Maximum Daily Loads (TMDL) for all watersheds on Fort Campbell.	F&W	0	x	x	x	x	x
5	Annually sample aquatic macro-invertebrates at 22 sites. Compare results with local baselines established by TDEC.	F&W	1	x	x	x	x	x
6	Conduct habitat assessments along streams as described in the Fort Campbell WMP, using methods are based upon the EPA's Rapid Bioassessment Protocols.	F&W	1	x	x	x	x	x
7	Collect weekly baseline water quality measurements from six sample sites. Compare results to standards set by TN and KY agencies and/or the EPA for sustaining aquatic life.	F&W	1	x	x	x	x	x
8	Identify streambanks requiring rehabilitation.	F&W	1	x	x	x	x	x
9	Identify vehicle stream crossings at undesignated areas and develop a GIS database to map "unauthorized stream crossings" and provide the data to the ITAM Program to encourage enforcement crossing at appropriate locations.	All	1	x	x	x	x	x
10	Design and implement hardened crossings for sites where crossing a stream is necessary to the training mission.	ITAM	1	x	x	x	x	x
11	Sample water from 22 locations in May and June each year.	AO	1	x	x	x	x	x
12	Ensure that 100 percent of lease agreements and Tract Management Plans minimize input of sediment, chemicals, and other contaminants into water resources.	AO	2	x	x	x	x	x
13	Ensure that 100 percent of timber sale contracts require forestry best management practices that minimize surface and ground water pollution.	Forestry	2	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
14	Ensure that 100 percent of pesticide applicators are properly certified and trained about pesticide applications in and near surface water, sinkholes, and wetlands.	Pest Mgmt	2	x	x	x	x	x
15	Develop and implement site-specific plans for minimizing polluted run-off into sinkholes or karst features.	F&W	3	x	x	x	x	x
Native Grasslands, Barrens, and Old Field Management								
1	Identify potential effects to native grass barrens and barrens restoration areas during the NEPA review process.	F&W	0	x	x	x	x	x
2	Survey at least 50 percent of native grass/barrens restoration areas and adjust the Grassland Management Plan if necessary.	F&W	0	x	x	x	x	x
3	Update the Grassland Management Plan.	F&W	0	x	x	x	x	x
4	Inspect at least 10 percent of Tier 1 and 2 barrens for biological integrity and adjust the Grassland Management Plan if necessary.	F&W	1	x	x	x	x	x
5	Implement Grassland Management Plan (GMP) prescriptions.	F&W, AO, ITAM	1	x	x	x	x	x
6	Conduct open field management in Fletcher's Fork subwatershed.	ITAM	1	x			x	
7	Conduct open field management in Piney Fork subwatershed.	ITAM	1	x	x		x	x
8	Conduct open field management in Noah's Spring Branch subwatershed.	ITAM	1	x	x		x	x
9	Conduct open field management in Jordan Creek subwatershed.	ITAM	1	x		x	x	
10	Conduct open field management in Saline Creek subwatershed.	ITAM	1	x	x		x	x
11	Maintain a current record of boundaries of native grass barrens and old fields, along with use restrictions, in the GIS database.	F&W	2	x	x	x	x	x
12	Identify 500 acres of old fields suitable for native grass barrens restoration.	F&W	2	x	x	x	x	x
13	Implement activities prescribed by the Grassland Management Plan on an average of 500 acres per year to expand Tier 1 and Tier 2 barrens.	F&W	2	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
14	Develop and implement a method to evaluate prescribed burn results based upon multiple burn objectives.	F&W	2	x	x	x	x	x
15	Convert power line right-of-ways to grassland cover.	F&W	2	x	x	x	x	x
16	Provide high quality stocks of locally adapted native seed and plants to support revegetation projects on Fort Campbell and in the region.	F&W	3	x	x	x	x	x
Agricultural Lease Management								
1	Manage noxious weeds in agricultural lease fields.	AO	0	x	x	x	x	x
2	Inspect each agricultural field annually to ensure adherence to the TMP and GLUR.	AO	0	x	x	x	x	x
3	Review annual reports of pesticide use to ensure appropriate application.	AO	0	x	x	x	x	x
4	Develop a Tract Management Plan (TMP) and General Land Use Regulations for each new field included in the AO Program.	AO	1	x	x	x	x	x
5	Increase the acreage managed by the agricultural outleasing program to the extent practicable subject to the requirements of the military mission.	AO	1	x	x	x	x	x
6	Convert as many leases as possible to hay, rather than row crops, as the leases are renewed within the central area of the installation.	AO	1	x	x	x	x	x
7	Develop a Tract Management Plan (TMP) and General Land Use Regulations for each new field included in the AO Program.	AO	1	x	x	x	x	x
8	Maintain the GIS database of agricultural field boundaries with data that are not more than five years old.	AO	2	x	x	x	x	x
Forest Management								
1	Coordinate with G3, DPTMS and other natural resource programs annually to ensure forestry DFCs support the military mission.	Forestry	0	x	x	x	x	x
2	Review the FMP annually and make necessary revisions every five years.	Forestry	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
3	Train and certify Conservation Branch staff and support personnel to the minimum standards described in the Wildland and Prescribed Fire Qualification System Guide, PMS 310-1 from the National Wildfire Coordinating Group, January 2000.	Forestry	0	x	x	x	x	x
4	Review and update, if necessary, the IWFMP.	Forestry	0	x	x	x	x	x
5	Prepare an annual analysis of wildfires to determine causes.	Forestry	0	x	x	x	x	x
6	Continually monitor fire danger and report it at least once daily to Range Control.	Forestry	0	x	x	x	x	x
7	Prepare timber sales in compliance with regulatory requirements.	Forestry	0	x	x	x	x	x
8	Implement the fire prevention/suppression measures described in the IWFMP.	Forestry	1	x	x	x	x	x
9	Manage pine stands to a basal area of 30-50 in support of open canopy conditions.	Forestry	1	x	x	x	x	x
10	Implement forestry best management practices on all timber harvest locations.	Forestry	1	x	x	x	x	x
11	Reduce forest cover and manage forest at 60 percent forest cover by 2018.	Forestry	1	x	x	x	x	x
12	Implement the Forest Management Plan to achieve the DFCs for forest in each watershed.	Forestry	1	x	x	x	x	x
13	Update volume inventories for forest stands every ten years or more frequently.	Forestry	1	x	x	x	x	x
14	Conduct the CFI every five years, as described in the FMP, to monitor forest health.	Forestry	1			x		
15	Monitor for presence of forest pests (gypsy moth and southern pine beetle).	Forestry	2	x	x	x	x	x
16	Control or eradicate exotic tree species.	Forestry	2	x	x	x	x	x
17	Implement the objectives and prescribed burning projects established in Section 6.4.3.3 of the FMP.	Forestry	2	x	x	x	x	x
18	Conduct post-burn evaluations to determine success of prescribed burns.	Forestry	2	x	x	x	x	x
19	Plant short-leaf pine on 1,000 acres existing loblolly pine plantations by 2018.	Forestry	2	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
Fire Management								
1	Implement the IWFMP and Prescribed Fire protocols for all installation wildland and prescribed fires.	Forestry, F&W, ITAM	0	x	x	x	x	x
2	Annually review and update the IWFMP, if required.	Forestry	0	x	x	x	x	x
3	Plant short-leaf pine on 1,000 acres existing loblolly pine plantations by 2018.	Forestry	0	x	x	x	x	x
4	Provide daily burn index calculations to Range Control and the Emergency Operations Center.	Forestry	0	x	x	x	x	x
5	Prohibit fire plow operations in endangered species habitat except when life or property is being threatened.	Forestry	0	x	x	x	x	x
6	Establish and maintain reservation boundary fire control lines to minimize the chances of wildland fire escape.	Forestry	0	x	x	x	x	x
7	Implement IWFMP smoke management procedures for every fire.	Forestry	0	x	x	x	x	x
8	Minimize earthen fire control lines when appropriate.	Forestry	1	x	x	x	x	x
9	Use prescribed fire as a tool to shape ecological communities.	Forestry, F&W	1	x	x	x	x	x
Wetland Management								
1	Conduct timely reviews of proposed project plans to identify potential effects to wetlands.	Wetland	0	x	x	x	x	x
2	Conduct wetland surveys, jurisdictional determinations, and functional assessments as necessary to assess effects of proposed projects, and to maintain the database.	Wetland	0	x	x	x	x	x
3	Coordinate with appropriate Directorates to encourage project managers to notify the Wetland Program about potential projects early in the planning process.	Wetland	0	x	x	x	x	x
4	During other natural resource management activities, inspect vegetated buffers around wetlands.	Wetland, Forestry, F&W	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
5	Prepare and implement monitoring plans for each mitigation area, in coordination with USACE.	Wetland	1	x	x	x	x	x
6	Maintain a database of wetland boundaries with data that are not more than five years old. Review the GIS database annually to ensure data are accurate.	Wetland	1	x	x	x	x	x
7	Review operations and maintenance programs/activities that potentially affect wetlands, and develop guidelines to avoid degradation of wetland functions.	Wetland	1	x	x			
8	When impacts to wetlands are unavoidable, prepare appropriate permit applications and mitigation plans in coordination with the USACE.	Wetland	1	x	x	x	x	x
9	Continue to disseminate guidance about conservation of wetlands to G3 prior to training on Fort Campbell.	Wetland, ITAM	2	x	x	x	x	x
10	Identify areas where wetlands formerly existed, or wetlands that have degraded functions and values. The AO program manager will identify in the GIS database fields that are drained/tile and not needed for the AO program.	Wetland, AO	3	x	x			
11	Prepare and implement restoration plans designed to improve the wetland function and value.	Wetland	3		x	x	x	x
Fish and Wildlife Management								
1	Coordinate annually with KDFWR and TWRA to stay informed about regional trends in wildlife population changes, particularly the State Comprehensive Wildlife Conservation Strategies.	F&W	0	x	x	x	x	x
2	Integrate migratory bird habitat and population conservation principles, measures, and practices into land management plans.	F&W	0	x	x	x	x	x
3	Coordinate with other agencies and nonfederal partners, especially Partners in Flight.	F&W	0	x	x	x	x	x
4	Ensure that the environmental review process and NEPA documents evaluate effects to migratory birds.	F&W	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
5	Coordinate with the USFWS prior to any intentional take of migratory birds, and avoid or minimize intentional take to the maximum extent practicable.	F&W	0	x	x	x	x	x
6	When a military readiness or non-military readiness activity may adversely affect a BCC species, develop project-specific mitigation measures based upon the four Resource Categories and associated mitigation objectives described in the MBMS.	F&W	0	x	x	x	x	x
7	Annually review information collected from hunters to determine if the hunting program meets public demand.	F&W	0	x	x	x	x	x
8	Initiate, in conjunction with TWRA or the USFWS, annual surveys to capture and band wood ducks and resident geese to monitor population densities and movements.	F&W	0	x	x	x	x	x
9	Conduct annual waterfowl surveys on impoundments and selected wetlands to assess the abundance and diversity of waterfowl present on Fort Campbell.	F&W	0	x	x	x	x	x
10	Every two years, use the TN Amphibian Monitoring Program and Amphibian Research and Monitoring Initiative protocols to monitor amphibian populations and compare results to local data, where available.	F&W	0	x		x		x
11	Annually monitor wood duck boxes.	F&W	0	x	x	x	x	x
12	Survey impoundments and conduct creel surveys to monitor populations of sport fish. Creel surveys will be conducted annually. Electroshocking surveys will be conducted in at least one impoundment each year. Coordinate with the KDFWR Western Fishery District.	F&W	0	x	x	x	x	x
13	Conduct an electroshocking survey of the eight major streams, and Raccoon Branch, to monitor fish populations, IAW the WMP schedule.	F&W	0	x	x	x	x	x
14	Review angler reporting forms and interview anglers to ensure ease of access to preferred fishing sites, and to assess the effectiveness of recreational fishing opportunities offered by Fort Campbell.	F&W	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
15	Annually monitor populations of deer, quail, turkeys, and rabbits and compare results to population goals and hunting bag limits established for each species.	F&W	0	x	x	x	x	x
16	Evaluate the abundance and diversity of aquatic and terrestrial invertebrates to establish baseline population and biodiversity information.	F&W	1	x	x	x		
17	Sample small mammals every two years to determine population status and distribution throughout the training areas.	F&W	1	x		x		x
18	By FY 2009, establish standard procedures for sampling small mammals to monitor population trends that may affect sustainability of the ecosystem.	F&W	2	x	x			
19	By FY 2010, develop a work plan to survey population densities of coyote, bobcat, red fox and gray fox to evaluate function of predators in the ecosystem.	F&W	2	x	x	x		
20	Every two years, establish at least five new pools that provide drinking water for wildlife and breeding habitat for amphibians.	F&W	2		x		x	
21	Annually plant food plots for wildlife, including waterfowl food plots near wetlands.	F&W	2	x	x	x	x	x
22	Install recycled Christmas trees or broken concrete pipes in impoundments to enhance habitat for fish.	F&W	2	x	x	x	x	x
23	Stock triploid grass carp in lakes that require aquatic vegetation management.	F&W	2	x	x	x	x	x
24	Annually set hunting bag limits at levels that promote diversity of game wildlife, and avoid causing overpopulation of any one species.	F&W	2	x	x	x	x	x
25	Stock sport fish at locations and levels that promotes recreational fishing on the installation.	F&W	2	x	x	x	x	x
26	Continue to place nest boxes throughout the installation and foster involvement of local groups.	F&W	3	x	x	x	x	x
Endangered, Threatened, and Species At Risk Management								
1	Support project planning and timely environmental reviews under NEPA to identify potential effects to listed or rare species.	F&W	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
2	Annually evaluate the status of ESMP objectives and update the ESMC as necessary at least every five years.	F&W	0	x	x	x	x	x
3	Conduct installation-wide mist net surveys to monitor gray, Indiana, Northern long-eared bats on Fort Campbell.	F&W	0	x	x	x	x	x
4	Conduct acoustical monitoring for threatened and endangered bats to determine areas for mist net surveys.	F&W	0	x	x	x	x	x
5	Annually coordinate with the USFWS Tennessee and Kentucky Ecological Services Offices to discuss long-term conservation plans and regional trends associated with listed species (Indiana bats, gray bats, Northern long-eared bats, Henslow's Sparrow, Bachman's Sparrow).	F&W	0	x	x	x	x	x
6	Assist USFWS, State, and NGO biologist surveying caves for WNS in the region.	F&W	1	x	x	x	x	x
7	Conduct bunker surveys for the presence of WNS.	F&W	1	x	x	x	x	x
8	Investigate the presence and suitability of caves that may provide roosting habitat for gray bats or Indiana bats.	F&W	1	x	x	x	x	x
9	Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region. A) Review the results of mist net surveys conducted near Fort Campbell and determine the capture rate of gray bats (number of gray bats captured per net-night). B) Use acoustic ultrasound detectors to compare relative abundance of foraging gray bats at three sites on Fort Campbell to three sites outside the installation.	F&W	1	x	x	x	x	x
10	Inspect timber harvests to ensure compliance with project-specific conditions of agency coordination.	F&W	1	x	x	x	x	x
11	Conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities.	F&W	1	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
12	Allow 4000 acres of forest to achieve old growth conditions, with at least 2830 acres in the Saline Creek and Casey Creek watersheds. Identify in the GIS database those forest stands designated as old growth for bat conservation.	Forestry, F&W	1	x	x			
13	Conduct timber harvest operations in accordance with the FMP. By 31 December each year, report to the USFWS the number of acres, location, and timing of timber harvests.	Forestry, F&W	1	x	x	x	x	x
14	Maintain water quality for foraging gray bats and Indiana bats by developing a Total Maximum Daily Load (TMDL) for sediment and habitat alteration in the Fletcher's Fork, Piney Fork, Casey, Dry Fork East, and Skinner Creek watersheds.	F&W	1	x	x	x	x	x
15	The Fish and Wildlife Program Manager will review proposed construction projects and will advise project proponents to design and site projects such that removal of forest is minimized.	F&W	1	x	x	x	x	x
16	Evaluate results of CFI data to verify certain forest stands are progressing toward old growth status.	Forestry, F&W	1		x			
17	Annually contact the KDFWR and TWRA to obtain updated results of gray bat and Indiana bat monitoring (summer and winter), and wintering bald eagle results conducted by the states.	F&W	1	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
18	Monitor the status, health, and habitat use of migratory birds and raptors, with emphasis on rare species. A) Develop assessment protocols for BCC bird populations and associated habitats. Provide assessment protocols to the USFWS and state wildlife agencies. B) Develop conservation plans to refine best management practices for migratory birds on Fort Campbell. C) Continue participating in the national Partners in Flight neotropical migratory bird monitoring program. Conduct annual inventories for all breeding birds, including BCC, that breed on Fort Campbell.	F&W	1	x	x	x	x	x
19	Develop a layer in the GIS system indicating nesting and breeding grounds of state-listed birds, and the dates during which those areas are off-limits. In a separate layer, identify habitat types associated with migratory birds (e.g., wetlands, native grasslands), particularly those known to be used by BCC.	F&W	1	x	x	x	x	x
20	Conduct baseline surveys to determine presence of state-listed or rare terrestrial invertebrates.	F&W	1		x		x	
21	Every two years, inspect 283 acres of forest in the Casey Creek and Saline Creek watersheds that is designated to become old growth. By August 2006 develop a sampling protocol based upon the Indiana Bat Summer Habitat Suitability Index Model, and initiate the first year of monitoring.	F&W	1	x		x		
22	Conduct surveys for the bald eagle once per month between November and February according to USFWS protocol around Lake Kyle. Maintain database and report findings to USFWS by the end of each year.	F&W	2	x	x	x	x	x
23	Participate in the Tennessee Bat Working Group and the NMFWA Bat Working Group.	F&W	2	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
24	Maintain a GIS database of the location of state-listed wildlife and plants, including nesting sites of state-listed birds that are not more than two years old and conduct surveys as necessary to maintain the database.	F&W	2	x	x	x	x	x
25	Plan habitat management activities and prescriptions to avoid harm to state-listed plants and animals.	F&W	2	x	x	x	x	x
26	Plan and implement management activities that improve the availability and/or suitability of habitat for state-listed species of animals and plants.	F&W	2	x	x	x	x	x
27	Conduct stem counts or population estimates at least once per year to assess stability of state-listed plant populations.	F&W	2	x	x	x	x	x
28	The Endangered Species Manager will annually review EQO course materials, and brochures/flyers pertaining to listed species, and update those materials if necessary.	F&W	3	x	x	x	x	x
29	Present educational displays and/or talks about gray bats and Indiana bats during Fort Campbell's Earth Day event.	F&W	3	x	x	x	x	x
30	Use GIS to identify habitat types on Fort Campbell that may provide suitable habitat for state-listed species of animals or plants and conduct surveys to investigate presence of state-listed species in those areas.	F&W	3	x	x	x	x	x
31	Request notification when the USFWS is considering making a species in Kentucky or Tennessee a candidate for listing.	F&W	NA	x	x	x	x	x
Pest Management								
1	Implement the Integrated Pest Management Plan (IPMP).	Pest Mgmt	0	x	x	x	x	x
2	Review the IPMP at least once per year and make revisions as necessary; have AEC review the plan annually.	Pest Mgmt	0	x	x	x	x	x
3	Maintain appropriate certifications and training for Professional Pest Management Personnel.	Pest Mgmt	0	x	x	x	x	x

	Project/Task	Lead Program(s)	Funding Priority	Fiscal Year				
				19	20	21	22	23
4	Maintain detailed records of all pesticide usages, spills and reportable human exposures.	Pest Mgmt	1	x	x	x	x	x
5	Maintain GIS database of pesticide applications.	Pest Mgmt	1	x	x	x	x	x
6	Implement IPMP Appendix H "West Nile Virus Management Plan."	Pest Mgmt	1	x	x	x	x	x
7	Implement IPMP Appendix B "IPM Outlines Golf Course."	Pest Mgmt	2	X	X	X	X	X
8	Implement portions of IPMP Appendix C "IPM Outlines other than Golf Course" that address undesirable vegetation; control noxious plants as described in the IPMP.	Pest Mgmt, AO, Forestry, F&W	2	x	x	x	x	x
9	Implement portions of IPMP Appendix C "IPM Outlines other than Golf Course" that address pigeons, rats, mice, moles, beaver, and deer.	Pest Mgmt, F&W	2	x	x	x	x	x
10	Eliminate feral hogs on the installation.	F&W	3	x	x	x		
11	Develop management recommendations for the control of feral cats to minimize predation on songbirds and other native wildlife.	Pest Mgmt, F&W	3	x	x	x	x	x
12	Monitor deer populations in the cantonment area and at CAAF and apply appropriate deer control measures.	F&W	3	x	x	x	x	x
13	Monitor beaver activity for potential threats to training activities, infrastructure, or real estate and apply appropriate beaver control measures.	Pest Mgmt, F&W	3	x	x	x	x	x
Outdoor Recreation Management								
1	Manage the recreational aspects of the hunting and fishing program.	F&W	1	x	x	x	x	x
2	Assign rear area passes for hunting and fishing activities.	F&W	1	x	x	x	x	x
3	Evaluate proposals for a new Riding Stable location.	MWR	2	x	x			
4	Develop a recreational trail system that will support hiking and cycling.	MWR, F&W	2	x	x	x	x	x
5	Develop a primitive campground at Lake Kyle.	MWR	2	x	x	x		
6	Develop an interpretative trail along Lake Kyle and the remnant of Lake Taal.	MWR, F&W	2	x	x	x	x	

Endangered Species Management Component for the Gray Bat (*Myotis grisescens*), Indiana Bat (*Myotis sodalis*), and Northern Long-eared Bat (*Myotis septentrionalis*) on Fort Campbell Military Installation, Fort Campbell, Kentucky

2020–2025

Developed by:

Fort Campbell Directorate of Public Works
Environmental Division, Conservation Branch
Endangered Species Program
Fort Campbell, Kentucky 42223

July 2020

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ENDANGERED SPECIES MANAGEMENT COMPONENT, 2020-2025
FORT CAMPBELL, KENTUCKY

This Endangered Species Management Component update has been prepared for the 101st Airborne Division (Air Assault) and Fort Campbell, in cooperation with the United States Fish and Wildlife Service. Army Regulation 200-1, Chapter 4(d)5, requires all installation ESMCs be reviewed annually. The installation Environmental Officer may approve minor changes to the ESMC. NEPA documentation for this ESMC update can be found in the INRMP Appendix E.

This ESMC update is approved.

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10/08/2020

JEREMY D. BELL
COL, U.S. Army
Garrison Commander
Fort Campbell, Kentucky

Date

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1.0 Introduction

1.1 Background

Fort Campbell is located in Montgomery and Stewart counties, Tennessee, and Christian and Trigg counties, Kentucky (Figure 1). Fort Campbell is home to the 101st Airborne Division (Air Assault) and supports frequent and intense military training exercises. The presence of three federally listed species has been documented at Fort Campbell: the Indiana bat (*Myotis sodalis*) and gray bat (*M. grisescens*) are listed as endangered and the Northern long-eared bat (*M. septentrionalis*) is listed as threatened. Under the Endangered Species Act (ESA), take of federally listed species by Federal agencies is prohibited without an incidental take permit. Surveys indicate all three bats forage on Fort Campbell. No species that are proposed or candidates for federal listing occur on Fort Campbell. The little brown bat (*M. lucifugus*), and Eastern small-footed bat (*M. leibii*) have been petitioned for emergency protection under the Endangered Species Act due to the emergence of White-Nose Syndrome. This emerging infectious disease will be discussed in depth in Section 3.3 below. Therefore, the listing of one or all of these species will require immediate revision of this Endangered Species Management Component (ESMC).

A detailed description of existing conditions at Fort Campbell is provided in the Integrated Natural Resources Management Plan (INRMP). Fort Campbell totals approximately 105,000 acres in a mixture of forest and open areas. The installation consists of training and maneuver areas (approximately 63,000 acres), range and impact areas (27,000 acres), and built-up areas (approximately 15,000 acres) that include the cantonment area, the former Clarksville Base, and various solid waste management units.

Topography at Fort Campbell is gently rolling, with the exception of a comparatively flat area along the eastern boundary, and approximately 5,000 acres of steep, highly dissected, hilly land along the western boundary. The surface water systems on Fort Campbell include approximately 700 watercourses, totaling about 453 stream miles. Approximately 160 miles of streams are within impact areas, and 293 miles are outside impact areas. The installation contains nine major streams: Dry Fork East, Piney Fork, Jordan, Fletcher's Fork, Noah's Spring Branch, Little West Fork, Saline, Casey, and Skinner creeks. Creeks flowing toward the east side of the installation drain to the Little West Fork Creek, which drains to the Red River. Saline Creek drains to the Cumberland River. Casey Creek and its tributaries, including Skinner Creek, drain into the Little River in Kentucky, which then flows into Lake Barkley. Four man-made impoundments, between 4 and 75 acres in size, also lie within Fort Campbell boundaries.

Approximately 95,000 acres of undeveloped land on Fort Campbell are composed of several terrestrial habitat types including native grassland barrens, old fields, agricultural fields, and forest. Approximately 6,089 acres on the installation are leased agricultural fields.

Woodlands currently occupy more than 63,000 acres on Fort Campbell, nearly 60 percent of the installation's total area. The forests consist primarily of deciduous (hardwood) communities, although pine plantations are predominant in the southwest part of the installation. Oak and oak-hickory associations occur most frequently, though more mesophytic community types occur on some slopes and ravines.

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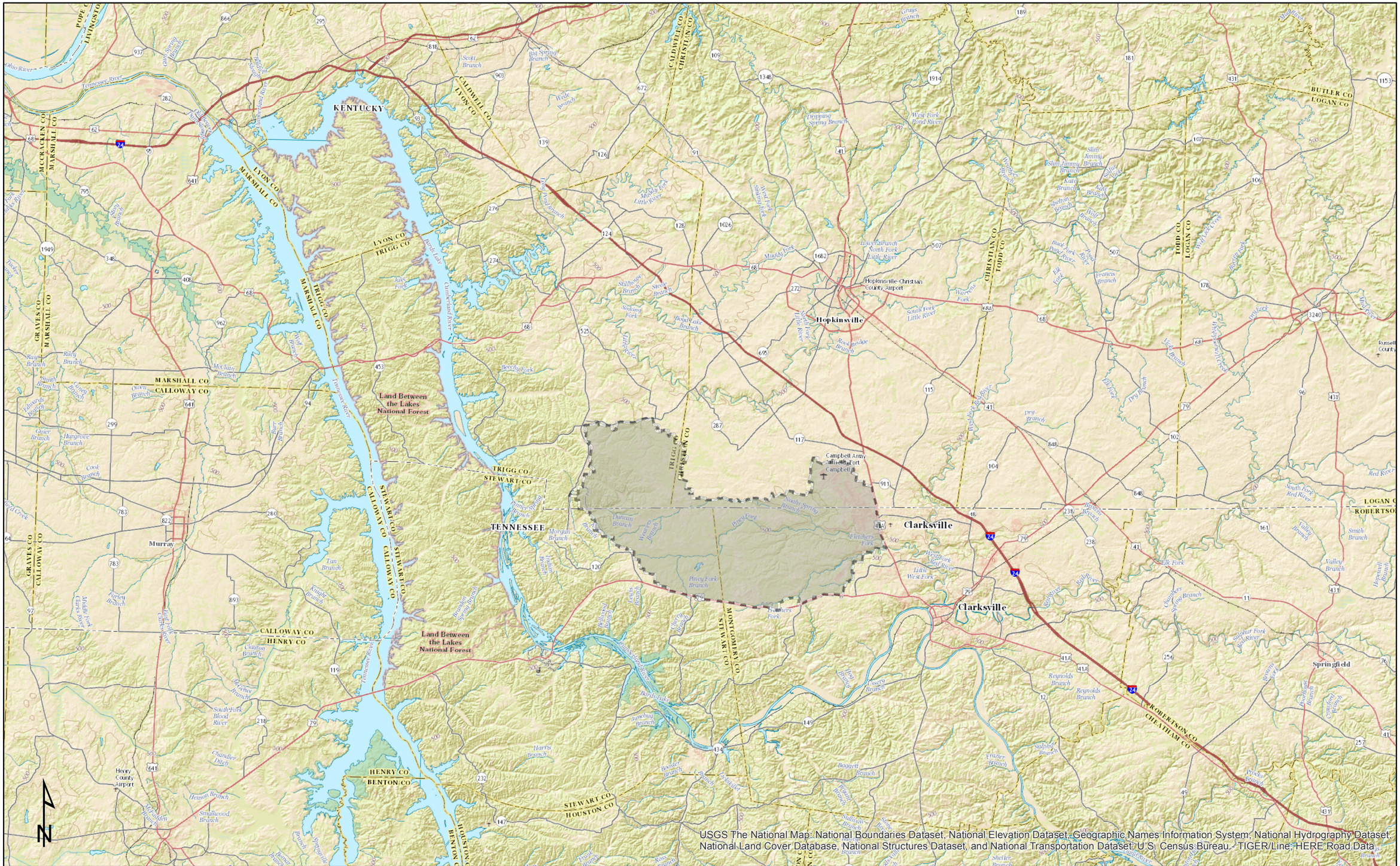

Figure 1. Location of Fort Campbell in southwestern Kentucky and northwestern Tennessee.

Upland hardwood forests are the dominant forest type on Fort Campbell, though they vary considerably in composition depending on topography, soil, and land use history. Some of the more common overstory tree species found in these forests are white oak (*Quercus alba*), black oak (*Q. velutina*), northern red oak (*Q. rubra*), yellow poplar (*Liriodendron tulipifera*), hackberry (*Celtis occidentalis*), sweetgum (*Liquidambar styraciflua*), sugar maple (*Acer saccharum*), and red maple (*A. rubrum*). Riparian hardwood forest and pine plantations are also found on Fort Campbell.

Land surrounding Fort Campbell consists of natural woodlands, farmlands, and some urban development.

1.2 Authority

This Endangered Species Management Component update is required by Chapter 4(d)5 of Army Regulation (AR) 200-1. This ESMC update is subject to requirements of the National Environmental Policy Act (NEPA) and Section 7 of the Endangered Species Act of 1973, as amended (ESA; Public Law 93-205; 16 U.S.C. 1531–1544). This document is consistent with the ESA, the Gray Bat Recovery Plan (USFWS 1982), Indiana Bat Draft Recovery Plan (USFWS, 2007), Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-eared Bat with 4(d) Rule; Final Rule & Interim Rule (2015), Range-wide Indiana Bat Summer Survey Guidance (USFWS 2016), and the Northern Long-Eared Bat Interim Conference and Planning Guidance (USFWS 2014).

1.3 Purpose

The goal of this ESMC update is to ensure compliance with the ESA, while supporting the Fort Campbell military mission. Identified in this ESMC are conservation goals and objectives designed to protect all federally listed bats occurring on Fort Campbell and assist in their recovery.

The purpose of this ESMC is to:

- Include information on the newly listed northern long-eared bat,
- document current information regarding the gray bat and Indiana bat on Fort Campbell,
- discuss potential impacts to threatened and endangered bats on Fort Campbell,
- describe conservation standards designed to protect bats and their habitat on Fort Campbell,
- define conservation goals for threatened and endangered bats on Fort Campbell,
- describe objectives designed to achieve conservation goals, and monitoring actions designed to evaluate progress toward goals, and
- describe the U.S. Army's policy on endangered bat management in response to White-Nose Syndrome (WNS) (Appendix B).

This ESMC describes conservation goals and associated projects (objectives and monitoring actions) Fort Campbell intends to implement during the years 2020 through 2025. This plan was developed by Fort Campbell in cooperation with the USFWS. Conservation goals in this ESMC are consistent with, and support achievement of, goals contained in each species' recovery plan. Objectives and monitoring actions identified in this ESMC update are necessary to achieve conservation goals for all listed bats on Fort Campbell.

2.0 Federally Listed Species on Fort Campbell

2.1 Gray bat

2.1.1 Description

The gray bat is the largest member of the genus *Myotis* in the eastern United States, weighing 7–16 grams, with a right forearm length of 40–46 millimeters. The body length ranges from 79 to 95 millimeters (Schwartz and Schwartz 2001). Monochromatic dorsal fur distinguishes the gray bat from all other bat species within its range. The fur is dark gray, but may fade to russet or chestnut brown between molts. Unlike other Myotid species, the wing membrane of the gray bat connects to the foot near the ankle (as opposed to near the base of the toes in other Myotid bats). The calcar is not keeled, and each claw has a prominent notch.

2.1.2 Distribution and Range

The range of the species includes the karst regions of the southeastern and midwestern United States (Figure 2). Distribution of the gray bat was historically patchy, and isolation and fragmentation of gray bat populations have increased over time. Gray bats migrate between summer roosts and winter hibernacula (USFWS 1982). Populations of gray bats primarily are found in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. Smaller populations also occur in northwestern Florida, western Georgia, southeastern Kansas, southern Illinois, southern Indiana, northeastern Oklahoma, northeastern Mississippi, western Virginia, and possibly western North Carolina (Barbour and Davis 1969, USFWS 1982).

Gray bats occur throughout much of Kentucky and Tennessee. The Gray Bat Recovery Plan identifies important summer and winter caves for the species. However, intensive surveys of caves in Tennessee, Kentucky, and elsewhere in the species range have been conducted between 1990 and 2006, yielding new data to describe gray bat use of caves. Certain caves identified as important in the Recovery Plan have been abandoned. Conversely, the population in certain caves has increased significantly. This discussion summarizes data provided in the Gray Bat Recovery Plan and provides updated information where available.

Nearly 99 percent of gray bats wintering in Kentucky hibernate in Jesse James and Coach (Hundred Domes) caves in Edmonson County (USFWS 1982). In western Kentucky, a few hibernacula contain ≤12 individual gray bats (Wethington 2001). Gray bats banded on Fort Campbell during summer in 1999 were observed hibernating in Coach Cave, approximately 70 miles northeast of the installation (BHE 2001a). Priority 1 maternity caves (in Tennessee, caves occupied by ≥50,000 bats; in Kentucky, caves occupied by ≥40,000 bats) in Kentucky include Cool Springs Cave (Trigg County), Holland Cave (Allen County), and Chrismans and Overstreet caves (Jessamine County) (USFWS 1982).

The Gray Bat Recovery Plan identifies three Priority 1 hibernacula in Tennessee: Pearson (Hawkins County), Tobaccoport (Stewart County), and Hubbards caves (Warren County) (USFWS 1982). Priority 1 maternity colonies identified in the Gray Bat Recovery Plan are in Claiborne, De Kalb, Grainger, Marion, Montgomery, and Union counties (USFWS 1982). Harvey and Britzke (1999) observed gray bats during summer in 22 caves in 20 Tennessee counties, with an estimated total of 169,290 gray bats observed in those caves. The only cave surveyed by Harvey and Britzke (1999) in Montgomery or Stewart counties was

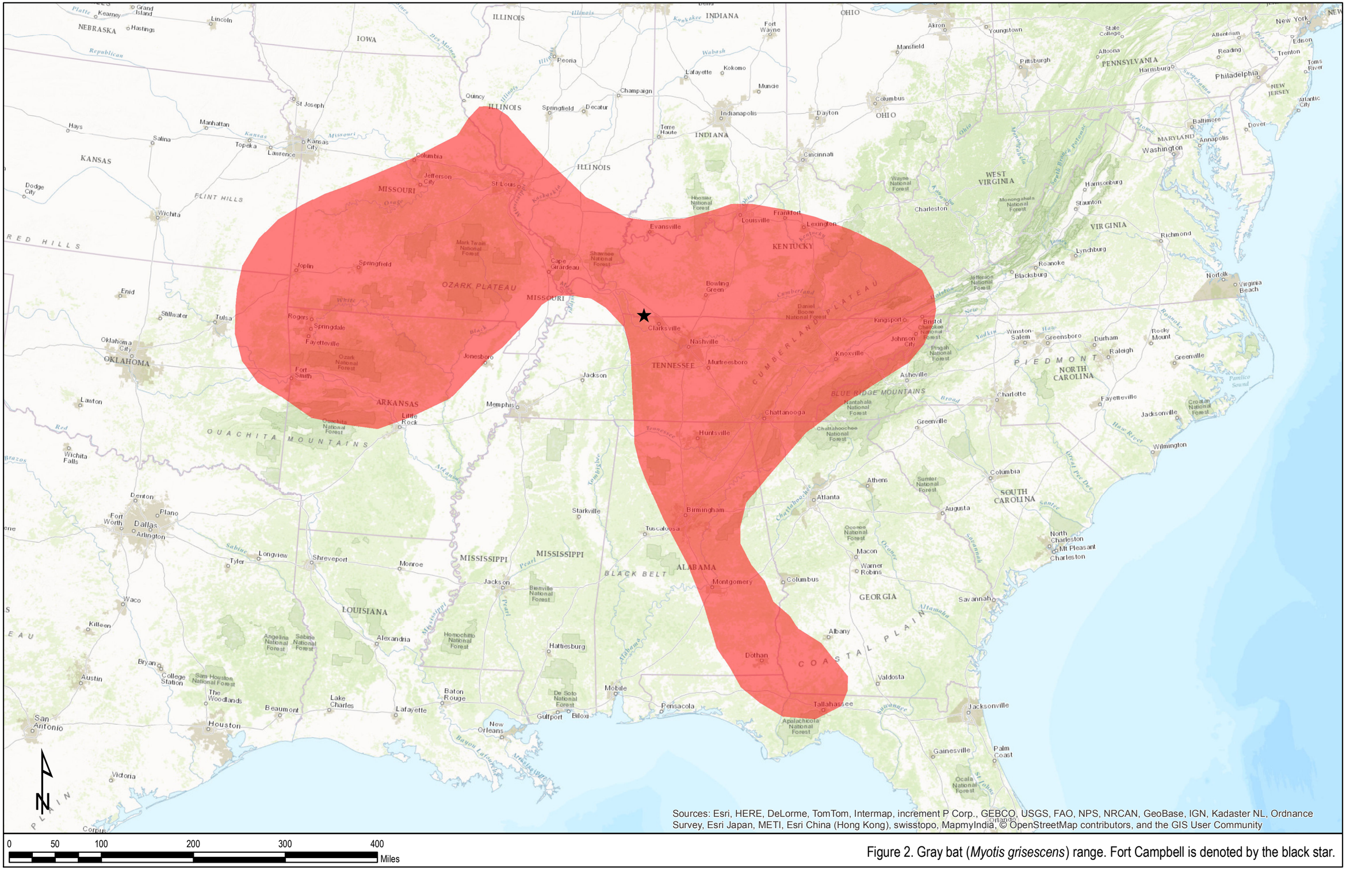

Figure 2. Gray bat (*Myotis grisescens*) range. Fort Campbell is denoted by the black star.

Tobaccoport Cave; they estimated 13,600 gray bats occupied Tobaccoport Cave during summer of 1999 based upon the amount of fresh guano present. In winter 2001, seven male gray bats trapped on Fort Campbell were identified hibernating in Bellamy Cave (BHE 2001a). Bats observed in Bellamy Cave included 2 juvenile males trapped during summer 1999, 5 adult males captured during summer 2000, and approximately 20 other gray bats captured and banded on Fort Campbell (BHE 2001a).

2.1.3 Habitat

2.1.3.1 Summer Roosts and Hibernacula

Gray bats inhabit caves year-round, but the species is limited to few caves that provide a narrow range of microclimate conditions. Different caves are occupied by gray bats during the summer maternity season and winter hibernation. Approximately 95 percent of the known gray bat population hibernates in only nine caves, and less than 5 percent of available caves appear to provide suitable roosts for gray bats (Tuttle 1979). Gray bat hibernacula are generally deep, vertical caves that act as cold air traps, with temperatures ranging from 6 to 11 degrees Celsius (°C). Gray bats hibernate in clusters of up to several thousand individuals.

Gray bats migrate to summer caves that provide microclimate conditions different than those in hibernacula. Reproductive females form maternity colonies in caves with dome ceilings that trap the body heat of bats. Air temperatures in maternity caves range from 14 to 25°C. The majority of gray bat maternity colonies are in caves that contain flowing water. Maternity caves are typically located within one kilometer of a water body that provides foraging habitat. Non-reproductive females and male gray bats form bachelor colonies in caves separate from maternity caves, and are less restricted in their selection of summer roosting caves.

Forested corridors between caves and foraging areas are important to the survival of gray bats. Limited observations indicate adults prefer to fly through forest canopy between the cave and foraging area to avoid predators (USFWS 1982). Canopy cover along riparian zones is thought to be important; fewer gray bats have been observed foraging along sections of river or reservoir where adjacent forest has been cleared. Newly volant young often forage in the forest surrounding a maternity cave. The Gray Bat Recovery Plan recommends maintaining forested shorelines and riparian zones near gray bat maternity colonies (USFWS 1982).

Several caves near the post support summer populations of gray bats (Figure 3). Telemetric studies conducted in the 2001 and 2002 identified these caves as well as documented travel corridors from the roost to the foraging sites on Fort Campbell.

2.1.3.2 Foraging Habitat

Gray bats emerge from summer roost caves at dusk to migrate through forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles within stream and forest flight corridors, which they catch while in flight using echolocation. The bat primarily forages along streams, forest roads, and forest clearings throughout the post. Hardwood forest corridors with relatively uncluttered understories is preferred.

2.1.3.3 Swarming Habitat

Swarming habitat includes suitable foraging and commuting habitat around hibernacula that is used during fall swarming. Swarming refers to the period of time prior to hibernation when gray bats mate at hibernacula entrances. The nearest gray bat hibernacula is approximately 2.5 miles south of the post; however, reproductively active bats have been recorded within the Saline Creek, Casey Creek, Piney Fork Creek, and Little West Fork Creek subwatersheds from August through September.

2.1.4 Life History

Following six to seven months of hibernation, adult female gray bats emerge in late March or early April, followed by juveniles and adult males. During autumn and spring migration, gray bats may roost temporarily in caves, referred to as transitional caves, which may not otherwise be used for maternity or hibernation. Individuals or groups of gray bats may inhabit transitional caves for brief periods in March and April, when migrating to summer roosts, and again in September and October before or during migration to hibernacula. Migration distances up to 326 miles have been reported (Tuttle 1976a).

Females congregate in maternity caves and give birth to a single young in late May or early June. Maternity colonies may contain tens of thousands of females and their young (USFWS 1982). Most males and non-reproductive females utilize non-maternity caves during this part of the summer. Most young are volant within 20–25 days of birth. Lactation typically ends by late July, and most females and juveniles subsequently leave the maternity caves (LaVal and LaVal 1980). During late July and August, gray bats of mixed ages and sexes roost in caves throughout the summering area and frequently move among caves in the home range of the colony (LaVal and LaVal 1980). In September, females begin to congregate at transitional caves, and by the end of the month most females have left to return to hibernacula (LaVal and LaVal 1980). Most male gray bats leave summer habitat by November, although a small number of males may remain in transitional caves through winter (LaVal and LaVal 1980). Mating occurs after autumn migration when gray bats arrive at hibernacula. Females store sperm through the winter and fertilization occurs soon after emergence from hibernation (Guthrie and Jeffers 1938).

Each summer colony occupies a home range that often contains several roost caves. Female gray bats often return to the same summer range each year (Tuttle 1976b). The colony home range may encompass up to 40 miles of river or reservoir shoreline (USFWS 1982). Individuals are loyal to the colony home range, but may roost in several caves within the range (USFWS 1982, Goebel 1996, Pruitt 1999, Tuttle 1976a).

Gray bats often forage over streams, reservoirs, and lakes, and through the adjacent riparian vegetation. Newly volant young often forage in forests surrounding the maternity cave. Both large and small perennial streams provide suitable foraging habitat for gray bats (LaVal et al. 1977). Forested riparian zones may improve the suitability of a river or reservoir for foraging gray bats. For example, at a reservoir in Tennessee, gray bats typically were observed foraging over portions of the reservoir with slab rock bottom and forested riparian zones (USFWS 1982). In Missouri, a higher proportion of gray bats foraged along wooded bluffs than near cleared agricultural fields (LaVal and LaVal 1980, LaVal et al. 1977). Gray bats were also found foraging over wetland depressions at Arnold Air Force Base in Tennessee (Mitchell and Martin 2002).

Gray bats may fly great distances during nightly foraging trips (USFWS 1982). Tuttle (1976a) indicated gray bats regularly made trips of 9–21 miles in a single night. In Tennessee, gray bat foraging territories were

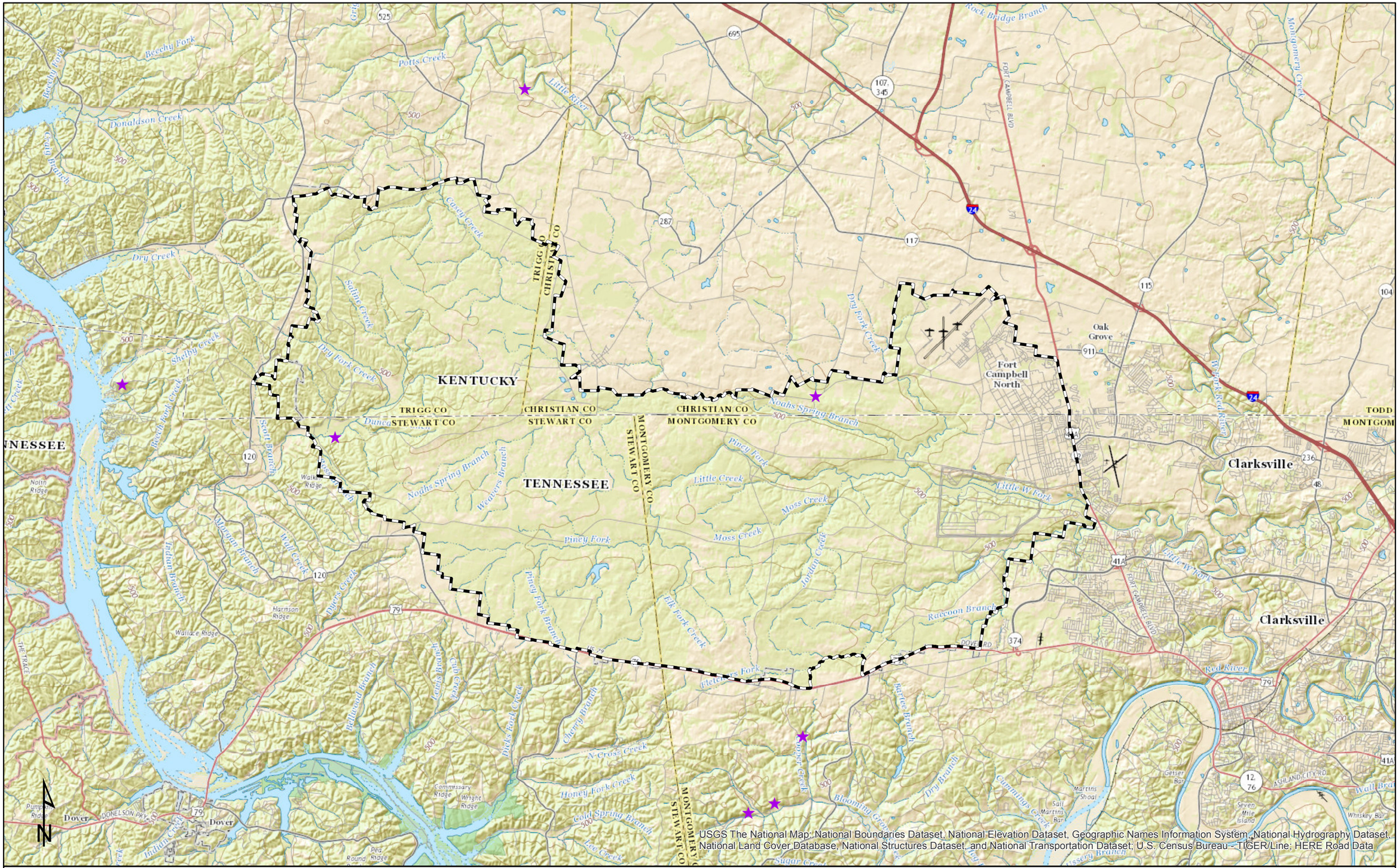

Figure 5. Cave locations known from Fort Campbell and within the surrounding areas.

identified up to 12 miles from the roost cave. In Missouri, gray bats were observed foraging as far as 12 miles from their roost cave, and other individuals traveled approximately 15 miles to reach a foraging area over a large lake (LaVal and LaVal 1980). In Alabama, gray bats foraged 3–13 miles from the roost cave (Goebel 1996).

Gray bats occasionally are found roosting in man-made structures rather than in caves. In Kansas, a gray bat colony roosted in a storm sewer pipe, and in Tennessee, two concrete dams contain colonies of gray bats that return every summer. Gray bats have been found roosting under bridges during day and night during summer (Johnson et al. 2002, 3D/I 1997). Bridges may provide nocturnal resting places for foraging gray bats, or temporary daytime roosts. Concrete bridges tend to retain solar heat, which may provide suitable conditions for roosting bats (Johnson et al. 2002).

Gray bats primarily consume flying insects emerging from aquatic life stages including flies (Order Diptera), beetles (Order Coleoptera), mayflies (Order Ephemeroptera), stoneflies (Order Plecoptera), and caddisflies (Order Trichoptera) (Clawson 1984, USFWS 1982). Terrestrial insects also are common prey, e.g., leaf hoppers (Order Homoptera) (Clawson 1984). Studies comparing prey selection with prey availability have indicated gray bats are opportunistic feeders (Best et al. 1997). They appear to concentrate on the aquatic insects available where they forage, but take advantage of other insects (especially Homoptera, Lepidoptera, and Coleoptera) when they are abundant in foraging areas (Clawson 1984, LaVal and LaVal 1980). Water pollution and siltation that adversely affect aquatic insect larvae may, therefore, also affect the survival of gray bat colonies (USFWS 1982, Tuttle 1979).

2.1.5 Reasons for Listing

The gray bat was listed as endangered on 28 April 1976 (41 FR 17740). The USFWS (1982) cites five primary causes for the decline in gray bat populations: 1) human disturbance to the bats, 2) human disturbance to the environment, 3) destruction of roost caves by collapse or river impoundment, 4) cave commercialization, and 5) natural sources of mortality. Gray bats are sensitive to human disturbance, particularly between late May and mid-July when flightless young occupy maternity caves, and between October and late March in hibernacula. Other potential causes of decline include natural disturbances within caves (e.g., flooding), exposure to pesticides and their byproducts, and disturbances within waterways that decrease habitat quality for prey species. Deforestation near maternity caves, between caves and waterways used for foraging, and in foraging areas may decrease prey availability and foraging efficiency and increase vulnerability of bats to predators, especially owls (Tuttle 1979).

Range-wide and regionally, numbers of individual gray bats have increased since listing (USFWS 2009). While gray bat populations increased approximately 104% from 1982-2007 (Martin 2007), the emergence of White-Nose Syndrome threatens the species' long-term recovery potential (USFWS 2009). In Kentucky, the number of gray bats has increased since the 1970's when commercial tours in Jesse James and Coach caves were discontinued (Wethington 2001). Gating and other cooperative efforts (acquisition, fences, and signage) at those Priority 1 hibernacula are supporting population increases (USFWS 2009). Gray bat populations in Tennessee appear to be stable and may be increasing (Harvey and Britzke 1999).

2.1.6 Species Status on Fort Campbell

Since identification of gray bats at Fort Campbell in 1998, several investigations have been conducted to improve understanding of the species distribution and activity on the installation. Studies include:

- Installation-wide mist net surveys conducted annually from 1999 through 2004; and additional mist net surveys conducted in 2010 through 2015
- Use of radiotelemetry to track movements of ten gray bats in 2001, three gray bats in 2002, and 13 gray bats in 2005
- Searches for, and inspection of, caves to assess habitat suitability for roosting bats
- Inspection of concrete bridges to assess habitat suitability for roosting bats
- Inspection of, and climatic monitoring in, concrete storage bunkers to assess habitat suitability for roosting bats
- Sampling of aquatic macroinvertebrates to assess abundance of prey available to bats
- Water sampling in the seven primary drainages on Fort Campbell to identify unusual characteristics of water quality that potentially affect gray bats or their invertebrate prey
- Use of acoustic monitoring equipment annually from 2008-2015.

Results of investigations are summarized below.

Results of extensive mist net surveys indicate gray bats forage on the installation from April through September. A total of 792 gray bats were captured during mist net surveys conducted between 1999 and 2011 (BHE 2000, 2001a, 2002a, 2002b, 2003, 2004, 2005; Aerostar 2012; EcoTec 2013; Fort Campbell 2013, 2014, 2015) (Figure 4). Most perennial and some intermittent streams on Fort Campbell provide suitable foraging habitat for gray bats; they have been identified in seven of the nine subwatersheds on Fort Campbell (primarily Fletcher's Fork, Piney Fork, Jordan, and Saline creeks subwatersheds). Gray bats have not been identified in the Dry Fork East Creek Subwatershed, which covers much of the cantonment area, Campbell Army Airfield, and much of the small arms impact area. No surveys for bats have been conducted in the Skinner Creek Subwatershed, which covers a small area in the northwest section of the installation. Gray bat captures have included numerous adult males and pregnant females, suggesting both bachelor and maternity colonies are located nearby. Gray bats captured and banded on Fort Campbell have been recaptured on five occasions, indicating fidelity to foraging areas on the installation (BHE 2001a; Aerostar 2012; Ecotec 2013).

Radiotelemetry studies of adult and juvenile male gray bats conducted in 2001 and 2002 have helped identify foraging areas on the installation as well as roost sites outside the installation (BHE 2001a, 2002c). Radio-equipped gray bats were detected flying over Lake Taal, Fletcher's Fork Creek upstream and downstream from Lake Taal, the Fort Campbell golf course, and Jordan Creek. One gray bat was observed emerging at dusk from Bellamy Cave, and a gray bat captured over Casey Creek was detected emerging from Big Sulphur Cave in Kentucky (Figure 5). In 2005, 22 gray bats were captured from sites in the Fletcher's Fork and Jordan creek subwatersheds, and 13 were equipped with radio transmitters (BHE 2005). Fort Campbell identified 11 of the 13 gray bats roosting in Bellamy and/or Cooper Creek caves. The majority of gray bats captured on Fort Campbell returned to the installation on subsequent nights, presumably to forage. Gray bats tracked in 2005 were detected over much of Fort Campbell east of Palmyra Road; results of the study appear to indicate gray bats flew along streams, through forest, and over open areas (BHE 2005).

Two caves have been known on the installation for several years. Noah's Cave and Morgamie Cave (formerly Nerd Hole Cave) along Saline Creek have been inspected for bats. Descriptions for those two caves are provided below.

The entrance to Noah's Cave is located in a large sinkhole near the intersection of Angels and Palmyra roads, in Training Area 15 (Figure 5). It is a swallow hole for a sinking stream and becomes flooded during heavy rains. The entrance to Noah's Cave is obstructed by woody debris and mud, making inspection of the cave interior difficult. The cave entrance is situated at the base of a rock bluff within a forested bottomland, is oval in shape and approximately 3–4 meters (10–12 feet) wide and 1–1.2 meters (3–4 feet) tall. Approximately 6–7.5 meters (20–25 feet) into the entrance, water from the stream rises to within a foot of the ceiling and appears to flood the cave on a regular basis. The cave was inspected during spring 2004. No bats were observed using the cave.

The entrance to Morgamie Cave is in the far western part of the installation, along Saline Creek in Training Area 49 (Figure 5). The cave is gated to protect natural and cultural resources inside. The cave is situated on a northern aspect bluff, along the southern creek bank, approximately 7.5–9 meters (25–30 feet) above Saline Creek. The entrance to the cave is approximately 2.7–4 meters (9–10 feet) wide and 0.5 meters (2 feet) tall. The cave interior opens immediately into a room measuring approximately 23 meters (75 feet) by 4.5 meters (15 feet) by 6 meters (20 feet). The walls slant inwards giving the inside cave tunnel a triangular shape. At the back of the room, the floor begins to rise until it eventually meets the ceiling. A corridor approximately 0.7 meters (2.5 feet) in diameter and 2.4 meters (8 feet) long branches off the main room along the eastern wall of the cave near the main entrance.

The cave was inspected during March 2004. The interior was wet, with the walls and ceiling dripping water. There was no perceptible air flow in the cave and no other entrances were observed. The "peak" of the ceiling did contain folds and crevices in the rock, which have the potential to trap warm air. No bats were observed roosting near the ceiling. Four tri-colored bats (*Pipistrellus subflavus*) were found roosting singly on the walls of the cave. Two cave salamanders (*Eurycea lucifugua*) were also found utilizing the cave. No sign of extended use by bats (i.e. urine staining or guano piles) was found. On June 18, 2004, a harp trap was used to investigate presence of bats inside the cave near Saline Creek. No bats were captured or observed exiting the cave. The cave was again inspected in February 2012. Five tri-colored bats were observed roosting singly on the walls of the cave. Additionally, 3 unknown myotis spp. bats were observed roosting deep inside crevices on the ceiling of the cave near the entrance. Three of the observed bats had signs of WNS and were collected for diagnostic testing. It was later confirmed that these individuals were positive for WNS (Holliday 2012).

Caves on Fort Campbell apparently do not provide suitable summer or winter habitat for gray bats. No Critical Habitat has been designated by the USFWS for the gray bat on Fort Campbell. However, gray bats have been observed roosting in caves near the installation (Tobaccoport, Dunbar, Bellamy, Cooper Creek, Coleman, and Big Sulphur caves; Figure 4). Gray bats have also been identified in Lock C on the Cumberland River (Tennessee Natural Heritage Database 2001). Tobaccoport Cave, located approximately 5 miles west of Fort Campbell along Saline Creek, is a primary hibernaculum (historically or presently occupied by 25,000–50,000 gray bats) and a secondary bachelor cave (historically or presently occupied by 5,000–50,000 gray bats) in summer (USFWS 1982). Bellamy Cave is a primary hibernaculum and secondary maternity cave and is located approximately 2 miles south of the post (USFWS 1982). Descriptions of historic observations of gray bats on or near the installation are found in *Endangered Bat Monitoring at Fort Campbell, Kentucky and Tennessee* (BHE 2001a).

Bridges that provide cave-like characteristics such as darkness, flowing water, and/or protection from disturbance, may provide suitable roosts for gray bats (Kiser et al. 2002, Keeley and Tuttle 1999). Of the 34 bridges on Fort Campbell, 17 were examined for signs of roosting bats, e.g., live bats, guano, stains on the

ceiling and walls, or bat carcasses (BHE 2002b). Six bridges that appeared to be suitable for roosting bats were each surveyed four additional times, twice during the day to search for day-roosting bats, and twice again at night to look for either emerging bats or night-roosting bats. While all of the bridges examined contained some or all of the characteristics considered suitable for roosting bats, no gray bats were identified beneath bridges. A single bat, apparently a big brown bat (*Eptesicus fuscus*), was observed beneath a bridge spanning Little West Fork Creek.

During 2003 and 2004, seven storage bunkers were inspected and monitored to assess suitability for roosting bats. The bunkers are located in Old Clarksville Base on the eastern side of the installation and are excavated into limestone bluffs. The bunkers consist of a narrow passage of varying length that opens into a large storage room. Most bunkers are sealed and have no openings where bats could enter. A few bunkers have doors that do not seal completely, which provide access for bats. In February 2003, Hobo™ data loggers were installed in each bunker to record temperature and relative humidity each hour for one year. In each bunker, two data loggers were installed on a wall approximately 3–6 feet above the floor. One data logger was placed near the entrance, and one in the storage room at the farthest point from the entrance. Bunkers were entered weekly to download data from the loggers and survey for roosting bats. The high, low, and average air temperature and relative humidity were calculated for summer (16 March through 15 September) and winter (16 September through 15 March) periods.

During summer, air temperatures in all seven bunkers ranged from 8.6 to 31.1°C, minimum and maximum temperatures averaged 11.4°C and 14.6°C, respectively (Fort Campbell 2004). Relative humidity ranged from 39 to 100 percent, and averaged 88 to 100 percent. During winter, air temperatures in all seven bunkers ranged from 6.6 to 29.5°C; minimum and maximum temperatures averaged 9.5°C and 14°C, respectively. Relative humidity ranged from 24 to 100 percent, and averaged 46–100 percent. Bats were observed inside bunkers on 28 occasions in six of seven bunkers surveyed. Species identified were the big brown bat (*Eptesicus fuscus*), the little brown bat, and the tri-colored bat. Bats were observed during winter; no bats were identified inside bunkers during summer.

The same bunkers were surveyed in February/March 2012. A total of 4 big brown bats and 2 other bats thought to be big browns were observed in 4 of the 23 bunkers surveyed. The two questionable bats had white fungus along their forearms, appeared to be deceased, and were not within reach of the surveyors.

Air temperature in gray bat summer roost caves is typically 14–25°C. Therefore, on average, the storage bunkers provide temperatures slightly cooler than caves typically occupied by summering gray bats. Relative humidity in bunkers during summer was consistent with that found in gray bat summer roost caves. None of the bunkers contain water, which is typically found in caves used by gray bat maternity colonies.

Air temperature in gray bat hibernacula typically is 6–11°C. On average, most storage bunkers provide air temperatures warmer than typical gray bat hibernacula. Furthermore, it appears to be difficult for bats to enter the bunkers; openings in unsealed doors were no more than two inches wide. Gray bats tend to roost in caves or mines with entrances large enough to fly into; bats have abandoned caves after installation of gates that restrict flight. While individual bats may land and crawl into the bunker through the door or an air vent, unhindered flight into the bunker is not possible. Additionally, no gray bats or evidence of bat colonies were observed inside any of the seven bunkers during surveys conducted weekly between February 2003 and February 2004 or during the bunker survey in 2012. The storage bunkers do not provide optimal

summer or winter roost habitat for gray bats, but it is possible transient gray bats may occasionally roost in the bunkers. Therefore, observations of bats inside bunkers must be reported to the Endangered Species Program.

Fort Campbell regularly monitors the abundance and diversity of aquatic insect fauna in streams where gray bats forage. Annually, samples of aquatic insects are collected from 20 sites. Fort Campbell identifies insects in each sample and calculates the Index of Biological Integrity, the EPT (Ephemeroptera, Plecoptera, Trichoptera) ratio, and the percentage of emerging species to evaluate water quality and availability of prey for gray bats. Samples are being analyzed and will be used to establish baseline data for Fort Campbell streams.

Endangered gray bats forage along streams in nearly every subwatershed on Fort Campbell. Because they typically forage over water and in associated riparian areas, a significant portion of the gray bat diet is insects with aquatic life stages. Gray bats also drink water from streams and lakes. Maintenance of good water quality is critical to management and conservation of the gray bat on Fort Campbell. As part of the Watershed Management Plan, the Wildlife Program conducts water quality assessments in certain subwatersheds. A water quality monitoring work plan is developed annually. Water quality assessments include measurement of physiochemical parameters (dissolved oxygen, pH, temperature, total dissolved solids, turbidity, nitrates, ammonia, and conductivity). Additionally, the assessment includes a Bioreconnaissance (BR), which is similar to the EPA's Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (RBP; USEPA 1998). The BR is a screening-level evaluation of the relative health of the biological community. The BR is used primarily for general subwatershed assessments and for determining where more intensive monitoring is needed. When more detailed data collection is warranted, a semi-quantitative single habitat survey is conducted using EPA RBP standards. Detailed description of site selection and assessment methods is provided in the Watershed Management Plan.

To date, under the Watershed Management Plan, the Fish and Wildlife Program has evaluated water and habitat quality in four of the subwatersheds that support a large proportion of the foraging gray bat population on Fort Campbell. Monitoring results for Jordan Creek, Fletcher's Fork Creek, Piney Fork Creek and Noah's Spring Branch are as follows:

- physiochemical parameters met all state water quality standards for each designated use,
- turbidity increased following rain events but returned to normal levels in one week,
- macroinvertebrate community structures were similar to local reference streams, and
- moderately pollution tolerant species of macroinvertebrates are present.

Evidence of suboptimal habitat and excessive siltation were recorded along all four streams, indicating impaired habitat quality. Continued management efforts to reduce sediment runoff into streams in Jordan Creek and Piney Fork Creek subwatersheds are warranted. Water quality assessments will be conducted in other subwatersheds on Fort Campbell through 2018.

2.2 Indiana Bat

The Indiana bat was originally listed as being in danger of extinction on March 11, 1967 under the Endangered Species Preservation Act of 1966 (USFWS 1967) and is currently listed as an endangered

species under the ESA. A summary of the species' distribution and range, habitat preferences, life history, and potential threats are discussed in the following sections.

2.2.1 Description

The Indiana bat is a medium-sized member of the genus *Myotis*. It is a distinguished from other *Myotis* by pelage coloration, presence of keeled calcar, and short, sparse hairs on the toes (Schwartz and Schwartz 2001). The pelage of an Indiana bat ranges in color from light brown to nearly black. Schwartz and Schwartz (2001) describe the pelage as slightly tri-colored, with ventral fur typically slightly lighter in color than dorsal fur. The tragus is blunt, and measures less than the total length of the ear. The average weight of an Indiana bat is 7.1 g for males and 7.4–7.5 g for females (Thomson 1982). The right forearm length ranges from 36 to 40.4 millimeters, total length is 70.8–90.6 millimeters (Whitaker and Hamilton 1998).

2.2.2 Distribution and Range

The Indiana bat occurs in most of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida (Barbour and Davis 1969)(Figure 4). The species is migratory, and this range includes both summer and winter habitat. The winter range is associated with regions of karst topography, primarily Indiana, Kentucky, and Missouri. Over 80 percent of the known Indiana bat population hibernates in 23 Priority 1 caves/mines in seven states (USFWS 2006). Priority 1 hibernacula contain or have contained greater than or equal to 10,000 bats. Multiple Priority 1 hibernacula are found in Indiana (n=7), Missouri (n=6), Kentucky (n=5), and New York (n=2). A single Priority 1 hibernaculum is found in Tennessee (USFWS 2012b). The remaining 20 percent of the population utilizes greater than 200 Priority 2, 3, and 4 hibernacula throughout 24 states. Priority 2 hibernacula contain 1,000 to 9,999 bats, Priority 3 hibernacula contain 50 to 999 bats, and Priority 4 hibernacula contain fewer than 50 bats (USFWS 1999). Records for small populations and individuals also exist from Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Iowa, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

Limited data from the Midwest indicate that females and some males migrate north in the spring upon emergence from hibernation (USFWS 1999). While these observations suggest that many female Indiana bats in the Midwest migrate north in the spring and south in the fall, potentially significant numbers also may migrate in other directions. Additional research is needed to better understand Indiana bat summer range (USFWS 1999).

Indiana bats occur throughout much of Kentucky and Tennessee. The species has been identified in each of the four counties occupied by Fort Campbell. During winter, nearly 50 percent of Indiana bats in Kentucky hibernate in Carter County (USFWS 1999, Wethington 2001, USFWS 2007). Other Priority 1 Indiana bat hibernacula in Kentucky occur in Carter, Edmonson, and Letcher counties (USFWS 2007). Kentucky counties with hibernacula supporting up to 100 individuals include Livingston, Trigg, Pulaski, Jackson, Menifee, Hart, and Wayne counties (USFWS 1999, KBWG 2005). Indiana bats have been identified during summer throughout much of the state of Kentucky, and are presumed to be present state-wide during summer. Bat and Coach Caves are designated as critical habitat for the Indiana bat (USFWS 2007). One Priority 3 hibernacula, Big Sulphur Cave, is located several miles north of the installation in Trigg County, Kentucky.

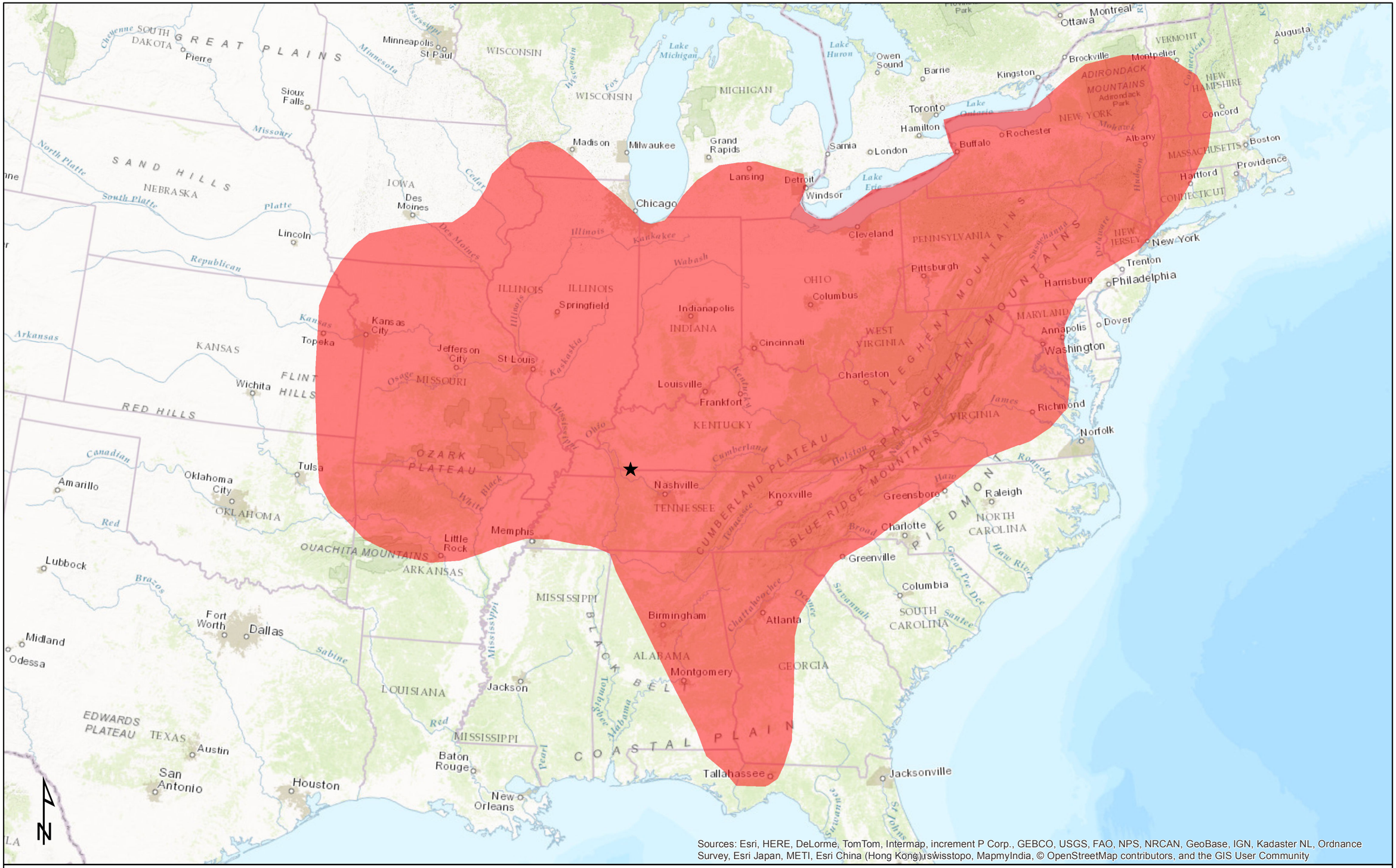

Figure 6. Indiana bat (*Myotis sodalis*) range. Fort Campbell is denoted by the black star.

The majority of Indiana bats hibernating in Tennessee occur within Priority 2 hibernacula in Blount, Campbell, Fentress, Hawkins, Montgomery, and Warren counties (USFWS 1999). Tobaccoport Cave is a Priority 3 hibernacula located several miles west of the installation in Stewart County, Tennessee. Summer records of Indiana bats have been documented widely in Tennessee.

2.2.3 Habitat

2.2.3.1. Winter Hibernacula

Indiana bats require specific habitat conditions during hibernation, and for summer roosting and foraging. The species hibernates in caves or mine shafts that provide a narrow range of climatic conditions. Comparison of 50 occupied and unoccupied caves and mines in Maryland, Pennsylvania, and West Virginia found that Indiana bat hibernacula in those states tended to have larger openings (9.7 vs. 2.8 square meters), longer cave passages (859 vs. 132 meters), and higher ceilings (13 vs. 6 meters) than unoccupied sites (Raesly and Gates 1987). Indiana bats typically hibernate in caves where temperatures during mid-winter are between 4 and 8°C (USFWS 1999). Recent long-term monitoring in hibernacula indicates temperatures of 3 to 6ºC are ideal for Indiana bats (Tuttle and Kennedy 2002, USFWS 1999). However, mean air temperatures of up to 11ºC have been recorded between December and February in Priority I hibernacula (Tuttle and Kennedy 1999) and other hibernacula containing significant populations of Indiana bats (Brack and Dunlap 1997). Warmer temperatures may increase metabolic rates and cause fat depletion during hibernation (Richter et al. 1993). Relative humidity for occupied hibernacula ranged between 70 to almost 100 percent (Hall 1962, Tuttle and Kennedy 2002). Preferred hibernacula also have noticeable airflow (Henshaw 1965).

2.2.3.2 Summer Roosts

During summer, reproductive female Indiana bats roost in riparian, floodplain, and upland forest (Cope et al. 1974, Humphrey et al. 1977b, Gardner et al. 1990, Gardner et al. 1991, Kurta 2005). Maternity roosts are formed primarily under exfoliating bark or in crevices/cavities of live or dead trees. Maternity colonies may use both primary and alternate roost trees (Humphrey et al. 1977b, Callahan 1993, Callahan et al. 1997, Kurta 2005). Callahan (1993) described primary roost trees in Missouri as large dead trees that are exposed to direct sunlight, and occupied by >30 bats on more than one occasion. Alternate roosts are those occupied by fewer than 30 individuals. In Missouri, alternate roosts were either dead or live trees and were similar to primary, except that many were located in the forest interior and were shaded by tree canopy (Callahan 1993). Use of primary and alternate roost trees may afford a maternity colony a variety of microclimates suitable for roosting in various weather conditions (Callahan 1993, Callahan et al. 1997, Miller et al. 2002).

Some studies indicate Indiana bat maternity roost trees tend to be larger than other trees nearby (Callahan 1993). Gardner et al. (1991) found the diameter of maternity roost trees averaged 36.7 cm while Callahan et al. (1997) found primary maternity roost trees averaged 58.4 and alternate maternity roost trees averaged 53 $\pm$ 4.1 cm. The use of snags by Indiana bats may be influenced by bark characteristics. In Missouri, primary and alternate maternity roosts had approximately 65–75 percent of the bark remaining attached (Callahan et al. 1997). Because virtually all maternity roosts are found under exfoliating bark, the characteristics of a species as a snag may be more important than the tree species on which the bark is present (Rommé et al. 1995). The ability of a tree species to produce exfoliating bark probably influences Indiana bat use (Callahan et al. 1997; Rommé et al. 1995). Maternity roosts often are found in species that

tend to have loose bark including shagbark and shellbark hickory (*Carya ovata* and *C. laciniosa*), ash (*Fraxinus* spp.), and oaks (*Quercus* spp.). However, suitable roosts are not limited to hardwood species; in western North Carolina and east Tennessee, Britzke et al. (2003) found Indiana bat maternity colonies numbering 23–81 individuals in a pine (*Pinus sp.*) snag, a pitch pine (*P. rigida*) snag, and an eastern hemlock (*Tsuga canadensis*).

Snags providing suitable habitat for roosting Indiana bats are an ephemeral resource. A maternity colony often uses several (10–20) roost trees, including 1–3 primary roosts and several alternate roost trees (Callahan et al. 1997). Indiana bats have been documented using up to 18 different roost trees in a single season (Kurta and Williams 1992). Females are philopatric, and may use the same roosts in successive years if the trees remain standing and retain exfoliating bark (Kurta et al. 2002, Gumbert et al. 2002, Gardner et al. 1991, Callahan et al. 1997, kurta 2005). If the primary roost tree is destroyed, surviving members of the maternity colony may move to one of the alternate roosts. A maternity colony may use several roosts up to 8 kilometers (5 miles) apart (Kurta et al. 2002). Alternate roosts have been reported as far as 3.2 kilometers (2 miles) from the primary roost tree. Adult male Indiana bats roost separately from the females and often use several different roost trees in an area from night to night (Rommé et al. 1995, Gardner et al. 1991). Forest providing optimal conditions for Indiana bat summer habitat typically has overstory canopy cover of 60–80 percent and five or more suitable roost trees per acre (Rommé et al. 1995).

While nearly all maternity colonies are established in tree roosts as described above, some exceptions have been documented. In Pennsylvania, a large and stable maternity colony occupies a church attic (Butchkoski and Hassinger 2002).

During summer, male Indiana bats may be found throughout the range of the species (USFWS 1999). They roost singly or in small groups and often select roosts smaller in diameter and with less exfoliating bark than trees typically used by reproductive females. Male Indiana bats may roost during the day in caves, including their hibernacula. Male Indiana bats have been observed roosting in trees, utility poles, and occasionally in artificial roost boxes (Butchkoski and Hassinger 2002, Gumbert 2001, Harvey 2002, Salyers et al. 1996). Trees used by roosting Indiana bats may be as small as 6.4 cm DBH (Gumbert 2001). Males may roost in snags, live trees, broken tops of trees, and lightning scars in tree bark (Kiser and Elliot 1996, Gumbert 2001).

2.2.3.3 Foraging Habitat

Adult Indiana bats feed exclusively on flying insects, including those from the orders Lepidoptera (moths and butterflies), Coleoptera (beetles), Diptera (flies) and Tricoptera (caddisflies)(Brack 1983, Brack and LaVal 1985, Murray and Kurta 2002). Indiana bats forage most frequently in upland and riparian forests, but they also may forage along wooded edges between forests and croplands, over ponds and streams, over wetlands and over fallow fields (Brack 1983, LaVal and LaVal 1980, Garner and Gardner 1992, Kurta et al. 1996). They frequently use open space over streams as travel corridors. Studies in Illinois, Indiana, and Pennsylvania found the maximum distance an Indiana bat traveled from its daytime roost to its foraging area was 4–4.5 km (2.5–2.7 miles; Gardner et al. 1991, Butchkoski and Hassinger 2002, 3D/International 1996). In Michigan, reproductive female Indiana bats foraged 0.5–4.2 km (0.3–2.6 miles) from their roost trees, and appeared to forage most frequently along wooded corridors rather than flying over open fields (Murray and Kurta 2004). Radiotelemetry studies indicate Indiana bats often return to the same foraging areas night after night (3D/International 1996, Murray and Kurta 2004).

2.2.3.4 Swarming Habitat

Swarming habitat includes suitable roosting, foraging, and commuting habitat around hibernacula that is used during fall swarming. Swarming refers to the period of time prior to hibernation when Indiana bats congregate at hibernacula entrances to mate. After nightly swarming activities end, bats typically roost in trees near the hibernacula during the day and travel to the hibernacula at night. Roost trees used by bats during swarming are similar to those used during the summer, and bats typically utilize several trees in close proximity to each other (USFWS 2007). The USFWS quantifies the amount of swarming habitat around a hibernaculum based on the number of bats hibernating in the feature (USFWS KFO 2016b). Historical winter roosting records occur in Bellamy and Tobaccoport Caves in Tennessee and Big Sulphur Spring Cave in Kentucky; therefore, all forested habitat containing trees with a DBH of five inches or greater located within five miles of the cave is considered to be suitable swarming habitat for this species.

Approximately 37,673 acres of the forested habitat on the installation are located within “Known Swarming 1” habitat and approximately 4,420 acres are located within “Known Swarming 2” habitat for the Indiana bat.

2.2.4 Life History

For approximately six months (mid-October through mid-April) each year, Indiana bats hibernate in caves or mines. Upon emergence from hibernation, Indiana bats are active near the hibernaculum during a period called staging. Spring staging occurs from approximately mid-April through early May. Females typically leave caves before males (Humphrey 1978; LaVal and LaVal 1980). In western Virginia, a radio-marked male Indiana bat left the hibernaculum in late April, traveled 16 km (10 miles) from the cave during the next few days, and roosted and foraged in that area throughout the two weeks the radio transmitter was active (Hobson and Holland 1995). During staging, Indiana bats emerging from hibernation roost in trees and forage near the hibernaculum. In Missouri, staging male and female Indiana bats traveled between 1.9 and 10.3 kilometers (1.2 and 6.4 miles) from their hibernaculum during nightly foraging (Rommé et al. 2002).

Between April and May and again between August and September, Indiana bats migrate between winter and summer habitat. Some individuals may travel 483 to 644 km (300 to 400 miles) between summer and winter roosts (USFWS 1999). Kurta and Murray (2002) found Indiana bats migrated 325 km (202 miles) from summer habitat to a hibernaculum, and not all members of the summering colony hibernated in the same cave. Others, particularly males, may roost in trees near hibernacula in summer. Limited recovery records of banded Indiana bats from the Midwest indicate females and some males migrate north in the spring upon emergence from hibernation (USFWS 1999).

During summer months (approximately mid-May through mid-August), Indiana bats occupy summer habitat. Female Indiana bats gather in maternity roosts in trees, where they give birth and raise a single young each year (Barbour and Davis 1969, Whitaker and Hamilton 1998).

Autumn swarming occurs from approximately mid-August through September. During swarming, numerous bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in caves during the day (Cope and Humphrey 1977). In Missouri, swarming Indiana bats foraged up to 4 miles from roost sites (Rommé et al. 2002). In Kentucky, male Indiana bats radiotracked during October were found to forage up to 1.7 miles from their roost sites, and roost in trees between 0.8 and 2.4 km (0.5 and 1.5 miles) from the hibernaculum (Kiser and Elliot 1996). In eastern Kentucky and West Virginia, roosts were located

predominately in medium-size hardwood snags and trees with a mean DBH of 27.0 cm and 33.1 cm (10.6–3 inches), respectively (Kiser and Elliot 1996). These snags and trees were located in small forest openings.

The importance of staging for Indiana bats is rarely addressed in the literature; however, foraging and other activity during staging may influence survival during migration. Swarming is significant because most mating occurs during that period, and foraging during swarming helps individuals accumulate fat reserves necessary to survive winter in hibernation (Barbour and Davis 1969, Guthrie 1933, Hall 1962, Thomson 1982). The USFWS, Tennessee Field Office issued guidelines for activities within 8 km (5 miles) of Indiana bat hibernacula when Indiana bats may be present.

2.2.5 Reasons for Listing

Across the species range, the population (as recorded from counts in hibernacula) has declined dramatically since the late 1950s. In 1960, the Indiana bat population was estimated to be nearly 900,000 individuals. The current total population was estimated at approximately 457,000 individuals in 2005 (USFWS 2007).

Population trend data, both range-wide and for Kentucky, show a decrease in population on the order of hundreds of thousands of individuals (Wethington 2001, USFWS 2007). Between 1960 and 1975, the decline of Indiana bats within Kentucky hibernacula was greater than that documented in any other state (USFWS 1999). Although greater than 20 percent of Indiana bat hibernacula in Kentucky are gated, total population numbers for the most important Kentucky hibernacula continued to decline through 2000 (USFWS 1999, Wethington 2001). Those data potentially signify a trend of increasing population in the state, but more data are needed before reaching a conclusion. Population trend data for Tennessee show a similarly severe decrease between 1960 and 2000 for the smaller population that hibernates in that state (Clawson 2002).

Documented causes of population decline are destruction of hibernacula from disturbance and vandalism by humans, improper protective cave gates and structures, and natural hazards (i.e., river flooding, ceiling collapse, severe or extreme weather) (USFWS 1999). Because bats are misunderstood by the general public and are often considered to be nuisance animals or threats to public health, vandalism is common. Sudden arousal events can accelerate fat depletion, result in premature emergence, and lower body condition and survival in the spring (Clawson 1984, Tuttle and Kennedy 1999). In 1960, approximately 10,000 Indiana bats were deliberately killed in Carter Cave State Park in eastern Kentucky (Mohr 1972). Similar examples of intentional destruction of other bat colonies have been recorded. Hibernacula that are regularly disturbed are unlikely to support wintering Indiana bats. In most instances, recolonization has not occurred (Harvey and McDaniel 1986). Discontinuation of winter cave tours has led to increased numbers of hibernating Indiana bats in some caves.

Forest habitat is essential to the survival of the Indiana bat. Indiana bats utilize forested areas as roosting and foraging habitat in the spring, summer, and fall. Forested corridors between summer colony sites and foraging habitat facilitate travel of Indiana bats. Maternity colonies use several roost trees during a summer season and return to the same areas in subsequent seasons. A single colony may occupy suitable roost trees located several miles apart. In Michigan, a maternity colony used up to 18 different roost trees during one summer (Kurta et al 1996). The colony used trees up to 5.8 km (3.6 miles) apart during a single year, and over several years occupied trees up to 9.2 km (5.7 miles) apart (Murray and Kurta 2002). Several

studies show foraging Indiana bats used a variety of habitat types, but one study indicated foraging Indiana bats avoided open fields to travel along forested corridors, even though this increased commuting distance by 55±11 percent (Murray and Kurta 2002).

Large-scale clear-cutting or other forms of extensive tree removal may eliminate Indiana bat maternity roosts, reduce the suitability of foraging habitat, and remove forested travel corridors between roosts and foraging habitat, leaving the bats vulnerable to predation. Removal of riparian forest may also result in degradation of water quality and elimination of prey species (USFWS 1999). Commercialization of caves and increased visitation by spelunkers has resulted in disturbance of hibernating Indiana bats, and may alter the climatic conditions within the caves. Because Indiana bats are very restrictive in selection of hibernacula, such alteration frequently results in abandonment of the cave. Even attempts to protect bat colonies by gating or fencing cave openings can have adverse effects on the bats if the gate or fence is improperly designed or installed.

Environmental contaminants have been directly implicated in extirpations and are suspected in the decline of some species of insectivorous North American bat species (Clark et al. 1981). Although many modern pesticides are targeted at specific species of pests, non-target organisms, including bats, may experience adverse chronic effects. The Indiana bat is an insectivorous species and likely has been affected to some degree by use of pesticides (USFWS 1999).

2.2.6 Threats

Threats to the species vary with its annual cycle. The greatest threat to the Indiana bat is White-nose Syndrome (WNS). Bats with WNS exhibit uncharacteristic behavior during hibernation, including frequent arousal, flying outside during the day, and clustering near the entrances of hibernacula, and are often found sick and dying in and around caves and mines (USFWS 2011a). In some hibernacula, 90 to 100 percent of the population has died (USFWS 2015a). WNS was first confirmed in Kentucky in a cave in Trigg County in 2011 (KDFWR 2011) and was discovered in two additional counties in 2012 (KDFWR 2012). Since this time, WNS has been confirmed in multiple counties across the state, as well as Mammoth Cave National Park and Carter Caves State Park. Measures are being taken to help control the disease and prevent its spread via human activity; however, WNS represents one of the greatest threats to bats in recorded history. Other threats include modifications to caves, mines, and surrounding areas that result in changes in airflow and alteration of microclimates in hibernacula (Humphrey 1978, Johnson et al. 2002). Human disturbance and vandalism pose significant threats to the species during hibernation by inducing arousal and consequent depletion of fat reserves (Thomas et al. 1990, Speakman et al. 1991, Thomas 1995) and through direct mortality (Humphrey 1978, Murphy 1987). Natural catastrophes (flooding and freezing events) can also have a significant effect on the population during winter, due to the large number of individuals that hibernate at only a few sites (Hall 1962, Humphrey 1978, Richter et al. 1993, Johnson et al. 2002).

During summer months, possible threats relate to the loss and degradation of forested habitat (Gardner et al. 1990, Garner and Gardner 1992, Whitaker and Brack 2002). Migration pathways and swarming sites can also be affected by habitat loss and degradation (Hall 1962, Fleming and Eby 2003). The effects of environmental contaminants, climate change, and wind turbines present additional threats to the species.

2.2.7 Species Status on Fort Campbell

Indiana bats were first documented on Fort Campbell in 1998. Eight adults and one juvenile male bats were recorded over the 22 year period (Eco-Tec 1998, BHE 2002; Aerostar 2009, 2011; Tahoma 2016; ESI 2017). At present, no critical habitat has been designated for the Indiana bat on Fort Campbell. Current information indicates Indiana bats may be present on Fort Campbell during summer and autumn while migrating between summer habitat and winter hibernacula. In late August 1998, one adult male and one juvenile male were captured on the Installation in mist nets over Casey and Saline creeks, respectively (BHE 2000). No surveys for the species have been conducted on the Installation during spring. However, because data suggest Indiana bats are present during autumn when migrating to hibernacula, it is reasonable to assume Indiana bats are present during spring when migrating from hibernacula.

Between 1999 and 2001, installation-wide summer mist net surveys were conducted for 240 net-nights for the purpose of confirming presence of the Indiana bat (BHE 2000, 2001a, 2002a). No Indiana bats were captured during that time. On 24 June 2002, the capture of an adult male Indiana bat over Piney Fork Creek established the first summer record on Fort Campbell (BHE 2002b). It was also the first Indiana bat captured on the installation since 1998. The bat was fitted with a radio transmitter and was documented flying near the southern border of the Impact Area and along Piney Fork Creek (BHE 2002c). Results of radiotracking suggest the bat spent time foraging over bottomland and riparian forests. However, the radio signal could not be detected continuously from dusk to dawn, and no diurnal roost tree was identified on Fort Campbell. Interestingly, this bat was observed foraging and night-roosting in approximately the same location near the Impact Area during three nights when training activities (frequent, low altitude helicopter flights and artillery firing) occurred, as well as during nights when little or no training occurred. There was no apparent difference in the nightly movements of the Indiana bat on nights when training occurred as compared to nights when no training occurred (BHE 2002c). During mist net surveys conducted between 10 and 25 June 2003, a third adult male Indiana bat was captured over Casey Creek on the installation (BHE 2003). The capture site was within 8 km (5 miles) of Big Sulphur Cave, an Indiana bat hibernaculum. That bat was not equipped with a radio transmitter. No Indiana bats were captured during a survey of 20 sites (80 net-nights) in summer 2004 (BHE 2004), or during surveys conducted in summer 2005 (BHE 2005). No Indiana bats were captured during surveys conducted annually during autumn between 2000 and 2004. In July 2011, the capture of a single adult male Indiana bat marked the first species record since 2003 during a mist-netting study (Aerostar 2012). No radiotracking was conducted during this survey. Four more male Indiana bats were recorded during summer surveys, 2 in 2016 from Trigg County, Kentucky and 2 in 2017 from Montgomery County, Tennessee, bringing the capture total to 9 male bats over a 21-year period (Tahoma 2017, ESI 2017). Data from a telemetric study in 2016 suggests the Trigg County bats were utilizing roost sites within the impact area on Fort Campbell. Exact roost locations were not determined since access to the impact area is prohibited due to the presence of unexploded ordnance. Telemetric studies in 2017 determined the Montgomery County bats were utilizing snags within a wetland just north of U.S. Highway 79 on the southeastern boundary of Sukchon Drop Zone.

While confirming summer presence of the species on the installation, capture of one juvenile male and eight adult male bats does not imply presence of maternity colonies. To date, no maternity colonies have been identified on Fort Campbell. There are no data available to determine if the juvenile Indiana bat captured in 1998 over Saline Creek roosted in a maternity colony nearby, or was migrating to a hibernaculum. However, Indiana bats have been found roosting during spring and winter in caves located within 5 miles of the Installation (Big Sulphur Cave located in Trigg County, Kentucky; Cooper, Bellamy, and Coleman caves located in Montgomery County, Tennessee; and Tobaccoport Cave located in Stewart

County, Tennessee)(BHE 2001). No caves providing suitable winter roost habitat for Indiana bats are known to exist on the Installation.

Evidence from intensive surveys suggests presence of Indiana bats on Fort Campbell is sporadic and infrequent. According to records maintained by the Indiana Bat Recovery Team, Fort Campbell is located near the periphery of this species' summer range, where Indiana bat populations are likely to be small and scattered. Forests on Fort Campbell appear to provide suitable spring, summer, and fall roosting and foraging habitat for the Indiana bat. Woodlands currently occupy nearly 49,000 acres on Fort Campbell, about 50 percent of the installation's total area. The forests consist primarily of deciduous (hardwood) communities, although pine plantations are predominant in the southwest part of the installation. Oak and oak-hickory upland forest and bottomland hardwood forest on Fort Campbell are similar to forests where Indiana bats are typically found in other parts of the United States (Menzel et al. 2001). Suitable roost trees and foraging habitat on Fort Campbell may be used during fall and spring by Indiana bats migrating to and from nearby caves, or by Indiana bats that remain near hibernacula throughout summer.

No caves providing suitable summer or winter roost habitat for Indiana bats are known to exist on the Installation. Two caves on Fort Campbell were surveyed in the spring and summer of 2004, and again in the winter of 2012, for presence of bats. No Indiana bats were observed utilizing either cave during those surveys.

2.3 Northern Long-eared Bat

The northern long-eared bat was listed as threatened under the ESA on April 2, 2015 (USFWS 2015a), with a rule under authority of Section 4(d) of the ESA finalized on January 14, 2016 (USFWS 2016). A summary of the species' distribution and range, habitat preferences, life history, and potential threats are discussed in the following sections.

2.3.1 Description

The northern long-eared bat is a medium-sized bat species with an average adult body weight of 5 to 8 g (0.18 to 0.28 oz) and average body length of 77 to 95 mm (3.03 to 3.74 in) (Caceres and Barclay 2000). The northern long-eared bat is a relatively long-lived species, with ages up to 19 years recorded in the wild (Caceres and Pybus 1997). It has medium to dark brown fur on its back, dark brown ears and wing membranes, and tawny-to pale-brown fur on the ventral side (Nagorsen and Brigham 1993; Whitaker and Mumford 2009). This species is distinguished from other *Myotis* species by its large ears (average 17 mm (0.67 in), Whitaker and Mumford 2009) that, when laid forward, extend (less than 5 mm (0.20 in)) beyond the muzzle (Caceres and Barclay 2000). The tragus is long and pointed (average 9 mm (0.35 in), Whitaker and Mumford 2009), and often curved (Nagorsen and Brigham 1993; Whitaker and Mumford 2009). Females tend to be slightly larger and heavier than males (Caceres and Pybus 1997).

2.3.2 Distribution and Range

The northern long-eared bat ranges across much of the eastern and north central United States, and all Canadian provinces west to the southern Northwest Territories and eastern British Columbia (Nagorsen and Brigham 1993; Caceres and Pybus 1997)(Figure 5). However, in all these places, the species is patchily distributed and rarely found in large numbers (Barbour and Davis 1969). The species' range includes: Alabama, Arkansas, Connecticut, Delaware, the District of Columbia, Florida, Georgia, Illinois,

Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin (Matteson 2010). The species is considered rare in the northwestern part of its range (Nagorsen and Brigham 1993; Caceres and Pybus 1997) and in some southern States (Crnkovic 2003).

The bat has been captured in all four counties that comprise Fort Campbell and has scattered records throughout both states. The majority of captures on Fort Campbell have occurred in Stewart County, Tennessee and Trigg County, Kentucky. Both sexes, age groups, and female reproductive conditions (pregnant, lactating, and post-lactating) have been recorded on the installation. The captures of female bats exhibiting reproductively active conditions suggests Fort Campbell possibly supports numerous maternity roosts due to their small forage range (1.5 mi radius) from their maternity roosts.

2.3.3 Habitat

The northern long-eared bat utilizes different habitats during the summer and winter months. Hibernacula vary from large caves and abandoned mines with large entrances and passages to smaller features. Preferred features have relatively constant, cool temperatures (0 to 9° C), high humidity, and minimal air currents (Raesly and Gates 1987, Caceres and Pybus 1997). Sites used within hibernacula are often in very high humidity areas, and condensation is often observed on hibernating bats (Barbour and Davis 1969). This species typically roosts in small crevices and cracks in walls and ceilings; however, individuals have also been observed roosting in the open, although less frequently (Barbour and Davis 1969, Caceres and Pybus 1997, Whitaker and Mumford 2009). In addition to mines, northern long-eared bats have been found hibernating in other cave-like man-made structures, including abandoned railroad tunnels, storm sewers, and dams (Goehring 1954, Kurta and Teramino 1994, USFWS 2015a).

2.3.3.1 Winter Hibernacula

Northern long-eared bats prefer multi-species hibernacula such as caves or cave-like structures. The bats will utilize man-made structures as hibernacula as well (Hoffmeister 1989, Caire et al. 1979). Hibernacula possessing large passages with significant cracks and crevices for roosting; relatively constant, cool temperatures (0-9 degrees Celsius) and with high humidity and minimal air currents are preferred (USFWS 2014). Northern long-eared bats prefer deep cracks or crevices for hibernation and roost with only their muzzle and ears showing.

2.3.3.2 Summer Habitat

Summer habitat for the northern long-eared bat consists of a variety of forested habitats used for roosting, foraging, and commuting, including forest blocks and woodlots, as well as linear features such as fencerows, riparian forests, and other wooded corridors. These forested areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Non-wooded areas adjacent to forested habitat may also be utilized, including emergent wetlands, old fields, and agricultural land (USFWS 2014a). Suitable summer roosting habitat consists of live or dead trees and snags with a DBH of three inches or greater that exhibit any of the following characteristics: exfoliating bark, crevices, cavities, or cracks (USFWS 2016b). This species is more likely to roost in crevices, cracks, and cavities than other Myotis species (Carter and Feldhamer 2005, Lacki et al. 2009), and is more opportunistic when selecting a roost

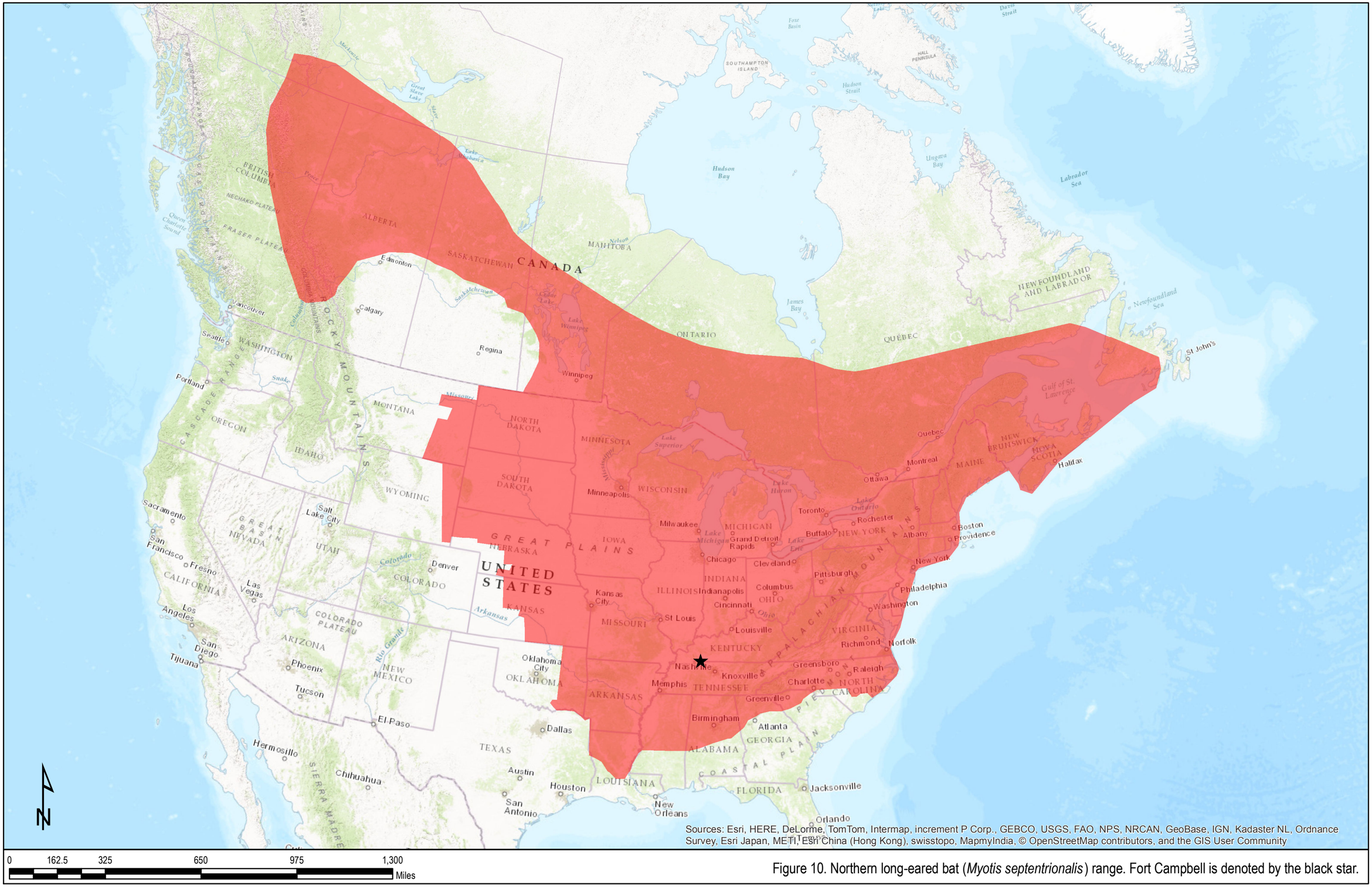

Figure 10. Northern long-eared bat (*Myotis septentrionalis*) range. Fort Campbell is denoted by the black star.

tree, often utilizing shorter trees with smaller DBHs and tree stumps. Bats roost singly or in colonies within these tree features, depending on sex and time of year (USFWS 2015a). Reproductive females typically prefer taller trees with larger DBHs located in more open areas. Non-reproductive females and males use trees of varying size and age, but may also roost in caves and mines during the summer (Foster and Kurta 1999, Perry and Thill 2007, Timpone et al. 2010). Northern long-eared bats have also been found roosting in man-made structures, including barns, sheds, and bat houses (Barbour and Davis 1969, Amelon and Burhans 2006, Whitaker and Mumford 2009).

2.3.3.3 Foraging Habitat

Foraging habitat includes mature upland forests along hillsides and ridges (LaVal et al. 1977, Brack and Whitaker 2001), where bats primarily forage under the canopy three to 10 feet above the ground (Nagorsen and Brigham 1993). This species may also forage in more open areas, such as forest clearings, over open water, and along roads (van Zyll de Jong 1985); however, it is less likely to forage in riparian areas (LaVal et al. 1977, Brack and Whitaker 2001). Commuting habitat is used to travel between roosting and foraging areas and typically includes forest edges and linear features, such as riparian corridors and fencerows (USFWS 2015a).

Northern long-eared bats emerge at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation. This bat also feeds by gleaning motionless insects from vegetation and water surfaces. The bat forages along streams, forest roads, and forest clearings. Females forage any available habitat within a 1.5 mile radius of their summer roost. This small forage range increases their vulnerability to timber removal since the removal of forage corridors near maternity roost can adversely impact the species.

All forested habitat on Fort Campbell that contains trees with a DBH of three inches or greater is considered to be suitable summer roosting, foraging, and commuting habitat for the northern long-eared bat for the purposes of this biological assessment. This includes the approximately 48,000 acres of forested habitat available for forest management practices, as well as the approximately 15,723 acres of forested habitat in the range and impacts areas and cantonment area. Individual trees that are three inches or greater in DBH are also considered to be suitable summer habitat. As discussed in Section 3.1, “Known Summer 1” habitat for this species is present on Fort Campbell, and approximately 28,653 acres of the 63,702 acres of forested habitat on the installation are located within this designated habitat.

2.3.3.4 Swarming Habitat

Swarming habitat includes suitable roosting, foraging, and commuting habitat around hibernacula that is used during fall swarming. Swarming refers to the period of time prior to hibernation when northern long-eared bats mate at hibernacula entrances. During the day, bats roost in trees near the hibernacula and travel to the entrance each night. Roost trees used during swarming are similar to those used during the summer, with greater variation in tree species, size, and type of roost used (USFWS 2015a). The USFWS considers forested habitat within five miles of a known northern long-eared bat hibernaculum to be swarming habitat (USFWS 2016b). Due to the proximity of Bellamy and Tobaccoport Caves in Tennessee and Big Sulphur Cave in Kentucky, all forested habitat containing trees with a DBH of three inches or greater within five miles of the caves is classified as “Known Swarming 2” habitat. The total amount of “Known Swarming 2” habitat on the installation totals approximately 60,244 acres and corresponds with the “Known Swarming 2” habitat discussed in Section 3.1.

2.3.4 Life History

Although summer roost habitat is defined variably across the species' range, its presence is generally correlated with old-growth forests composed of trees 100 years old or older (Caceres and Pybus 1997). The species is reliant on intact interior forest habitat, with low edge-to interior ratios (Yates and Muzika 2006). Relevant late-successional forest features include a high percentage of old trees, uneven forest structure (resulting in multilayered vertical structure), single and multiple tree-fall gaps, standing snags, and woody debris (Krusic et al. 1996; Foster and Kurta 1999). These late successional forest characteristics may be favored for several reasons, including the large number of partially dead or decaying trees that the species uses for breeding, summer day roosting, and foraging (Krusic et al. 1996; Caceres and Pybus 1997; Waldien et al. 2000). Males typically roost singly and prefer coniferous trees in conifer-dominated stands, while females roost singly or in small groups, preferring shade-tolerant deciduous trees of mid-stage decay in mature stands (Broders and Forbes 2004). Females may form small maternity colonies behind exfoliating bark, in tree snags, and in stumps, as well as in bat houses and behind building shutters (Waldien et al. 2000; Whitaker and Mumford 2009). Females exhibit a high philopatry (tendency to return) to their natal sites (Arnold 2007). While the northern long-eared bat is not a migratory species, movements of the species between summer roost and winter hibernacula covering up to 56 km (34.8 mi) have been documented (Nagorsen and Brigham, 1993).

Northern long-eared bats may hibernate solitarily or in multispecies hibernacula, and are commonly found in caves or inactive mines, although they generally constitute less than 25 percent of the total number of individuals present in multispecies hibernacula (Barbour and Davis 1969; Caceres and Pybus 1997). The species appears to favor small cracks or crevices in cave ceilings, preferring cooler, higher humidity areas for hibernation than do many other *Myotis* species (Barbour and Davis 1969; Whitaker and Mumford 2009). Hibernation during the winter months conserves energy by precluding the need for maintaining high body temperature when food is unavailable. To increase energy savings, individuals enter a state of torpor (a state of slowed body function used to conserve energy), where internal body temperature approaches ambient temperature, metabolic rates are significantly lowered, and all unnecessary movement is avoided (Thomas et al. 1990; Thomas and Geiser 1997; Caceres and Pybus 1997). However, intercave movements are not uncommon: During winter periods, this species is known to break torpor briefly and fly outside the hibernacula on warm winter nights (Whitaker and Mumford 2009).

The northern long-eared bat is an opportunistic insectivore, using both hawking and gleaning to forage on a variety of small insects, including moths, flies, leafhoppers, and beetles (Nagorsen and Brigham 1993). The species prefers forested hillsides and ridges, foraging at dusk over small ponds and forest clearings under the forest canopy (Nagorsen and Brigham 1993) or along streams (Whitaker and Mumford 2009). A study by Caceres and Pybus (1997) suggests that mature forest stands play an important role in foraging behavior of northern long-eared bats.

Mating takes place in late summer or early fall, and females store sperm until they emerge from hibernation in the spring, when ovulation and fertilization occur. Some individuals mate again upon emergence. Gestation lasts 50–60 days, and parturition occurs in early to mid-summer (Gutherie 1933). Females bear a single offspring annually, and young-of-the-year may mate prior to hibernation in the fall. Though some may roost alone, females often roost colonially; maternity or nursery colonies may be comprised of up to 90 individuals, including young. The largest maternity colony reported contained 39 adult females. Females exhibit high site fidelity to maternity roosts, returning annually to their natal sites.

The northern long-eared bat exhibits a delayed fertilization strategy, with mating taking place in late summer or early fall (Caceres and Pybus 1997). The sperm is stored until the female emerges from hibernation in the spring, when ovulation and fertilization takes place. However, some individuals mate again in the spring (Racey 1979; Racey 1982). After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30 to 60 bats, although larger maternity colonies have been observed. Gestation lasts 50 to 60 days, after which a single offspring is born (Caceres and Pybus 1997; Caceres and Barclay 2000). Most females within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Adult northern long-eared bats can live up to 19 years.

2.3.5 Reason for Listing

In 2010 the Center for Biological Diversity filed a petition for protection for the northern long-eared bat due to destruction, modification, or curtailment of bat habitat from anthropogenic disturbances. Scientific and USFWS data support the assertion that habitat loss, degradation and fragmentation from logging practices throughout its range negatively impacts the northern long-eared bat. Felling of individual trees can cause direct impacts to the species if maternity colonies or roosting bats are present. Reducing structural diversity within mature forests through even-age timber management practices (e.g., clearcutting, shelterwood harvests) lead to the loss, degradation, and fragmentation of mature forest habitat.

White-nose Syndrome: No other threat is as severe and immediate as the disease, white-nose syndrome. If this disease had not emerged, it is unlikely the northern long-eared population would be declining so dramatically. Since symptoms were first observed in New York in 2006, white-nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the northern long-eared bat's range where it was most common before this disease. Numbers have declined by 99 percent in the Northeast. Although there is uncertainty about the rate that white-nose syndrome will spread within the species' range, it is expected to spread throughout the United States.

Other Sources of Mortality: Although significant population declines have not been observed due to the sources of mortality listed below, they may now be important factors affecting this bat's ability to persist while experiencing dramatic declines caused by white-nose syndrome.
Impacts to Hibernacula: Gates or other structures to exclude people from caves and mines restrict bat flight and movement and change airflow and internal cave and mine microclimates. A few degrees change can make a cave unsuitable for hibernating bats. Also, cave-dwelling bats are vulnerable to human disturbance while hibernating. Bats use up their energy stores when aroused and may not survive the winter or females may not successfully give birth or rear young.

Loss or Degradation of Summer Habitat: Highway and commercial development, surface mining, and wind facility construction permanently remove habitat and are prevalent in many areas of this bat's range. Timber harvest and forest management can remove or alter (improving or degrading) summer roosting and foraging habitat.

Wind Farm Operation: Wind turbines kill bats, including northern long-eared bats, although only a small number have been documented to date. However, there are many wind projects within a large portion of the bat's range and many more are planned.

2.3.6 Threats

Threats to the northern long-eared bat vary with its annual cycle; however, the most severe threat to this species is white-nose syndrome (USFWS 2015a). Bats with WNS exhibit uncharacteristic behavior during hibernation, including frequent arousal, flying outside during the day, and clustering near the entrances of hibernacula, and are often found sick and dying in and around caves and mines (USFWS 2011a). It is estimated that WNS has killed more than 5.7 to 6.7 million bats in North America, and in some hibernacula, 90 to 100 percent of the population has died (USFWS 2015a). WNS was first confirmed in Kentucky in a cave in Trigg County in 2011 (KDFWR 2011) and was discovered in two additional counties in 2012 (KDFWR 2012). Since this time, WNS has been confirmed in multiple counties across the state, as well as Mammoth Cave National Park and Carter Caves State Park. Measures are being taken to help control the disease and prevent its spread via human activity; however, WNS represents one of the greatest threats to bats in recorded history. The northern long-eared bat is one of the most severely affected species of bats and has experienced a drastic decline in the northeastern portion of its range. Without WNS, this species would not be experiencing such a rapid decline, and protection under the ESA would likely not be necessary (USFWS 2015a).

Due to the dramatic reduction in the northern long-eared bat population as a result of WNS, other factors that were previously considered minor threats to the species have become a concern. Threats identified by the USFWS include: loss of habitat due to destruction or modification of hibernacula, mining, logging, and development; wind energy development; climate change; prescribed burning; and contaminants. Although these threats alone do not appear to result in significant effects to the northern long-eared bat, the presence of WNS may cause the species to be more susceptible to the cumulative effects of these threats (USFWS 2015a).

2.3.7 Species Status on Fort Campbell

Northern long-eared bats were first documented on Fort Campbell in 1998. At present, no critical habitat has been designated for the bat on Fort Campbell. A total of 72 individuals were captured during mist net surveys conducted between 1998 and 2015 (Eco-Tec 1998; BHE 2000, 2001, 2002, 2003, 2004, 2005, 2006; Aerostar 2009, 2011, 2013; Tahoma 2016; ESI 2017; Zirkle 2013, 2014, 2015)(Figure 3). Capture data from the 1998 through 2015 mist net surveys suggest that northern long-eared bats are present on the Installation during summer months, and although the majority of captures have been males (46), 16 females and 9 juveniles have been captured which suggests the installation supports maternity colonies or roosts. Since its listing in 2015, Fort Campbell has initiated a two-year survey to locate existing maternity roosts to meet the compliance requirements contained within the ESA 4(d) Rule. No maternity roosts have been located to date.

The northern long-eared bat shares similar habitat conditions as the Indiana bat and forests on Fort Campbell appear to provide suitable spring, summer, and fall roosting and foraging habitat. Woodlands currently occupy nearly 49,000 acres on Fort Campbell, about 50 percent of the installation's total area. The forests consist primarily of deciduous (hardwood) communities, although pine plantations are predominant in the southwest part of the installation. Oak and oak-hickory upland forest and bottomland hardwood forest common on Fort Campbell are similar to forests where Indiana bats are typically found in other parts of the United States (Menzel et al. 2001). Suitable roost trees and foraging habitat on Fort Campbell may be used during summering bats and by spring migrants from local hibernacula.

Morgamie Cave, located in Stewart County, Tennessee has a wintering record of a northern long-eared bat. No other hibernacula existing within the boundaries of Fort Campbell. Morgamie Cave was gated by the Fort Campbell Cultural Resource Management Program in the early 2000's to protect Native American relics. Cave access is controlled by the Fort Campbell Endangered Species Program due to the annual wintering bat counts, condition surveys, and WNS counts.

3.0 Range-wide Conservation Measures

3.1 Gray Bat

A Recovery Plan was prepared for the gray bat in 1982. Recommended conservation and recovery priorities include:

- continued purchase of high priority caves,
- continued protection through restricted usage of other gray bat caves,
- education of spelunkers and other cave visitors to reduce the potential for unintentional disturbance,
- minimizing impacts to forest and water quality that might affect foraging habitat quality within 15 miles (25 kilometers) of major gray bat caves, and
- continuation of federal efforts to reduce persistent pesticides in the environment.

Conservation measures undertaken by USFWS include purchase of high priority caves (summer maternity sites and hibernacula), and installation of cave gates to prevent disturbance to bat populations. The Nature Conservancy has purchased and will conserve in perpetuity land in Tennessee containing important caves for endangered bats. The Kentucky Department of Fish and Wildlife Resources, Tennessee Wildlife Resources Agency, and the Tennessee Valley Authority conduct periodic surveys of gray bat hibernacula and maternity caves to monitor population trends in Kentucky and Tennessee. Site-specific bat management plans have been developed to aid recovery of this species. For example, an existing comprehensive management plan developed for Land Between the Lakes (TVA 1996) includes conservation of gray bats.

3.2 Indiana Bat

The recovery plan for the Indiana bat is currently being revised into the Rangewide Indiana Bat Summer Survey Guidance (USFWS 2012a; Appendix E), and will incorporate new information regarding summer habitat requirements of the species. The current Indiana Bat Recovery Plan recommends protection of known hibernacula (e.g., protective gates or fences).

The Indiana Bat Draft Recovery Plan (USFWS 2007) also encourages conservation of summer habitat. The Plan indicates silvicultural practices should favor conservation of an adequate number of suitable roost trees. Special attention should be given to large diameter dead trees at forest edges or in forest openings. Forest management practices that vary from these requirements may be permitted under the revised plan, through consultation with the USFWS under Section 7 of the ESA. Staffs at several National Forests and Department of Defense (DoD) installations located within the summer range of the Indiana bat have begun to modify timber harvest practices to benefit Indiana bats by ensuring that adequate roosting and foraging habitat remains after timber harvest. USFWS biologists are making recommendations during review of

actions that will affect caves and/or forest habitat (e.g., highway construction, surface mining, pipeline construction) to minimize impacts to these habitats and to minimize degradation of water quality in streams over which Indiana bats and gray bats forage. Research is underway to determine if pesticides or other contaminants may contribute to reported declines in numbers of gray bats and Indiana bats, to determine the summer habitat requirements of the Indiana bat, and to improve understanding of winter habitat requirements for both species.

3.3 Northern Long-eared Bat

A recovery permit is not merited for the species at this time. However, the species is covered under the ESA 4(d) Rule (USFWS 2015) which addresses critical life history requirements for protection and enhancement of habitat throughout its range.

Following the northern long-eared bat (*Myotis septentrionalis*) listing as threatened under the ESA on 04 May 2015, the Army Installation Management Command (IMCOM) initiated an informal conference and subsequent consultation to evaluate military operations and sustainment/enhancement activities on installations and facilities that may affect, but are not likely to adversely affect the species (IMCOM 2015). The resulting conference and guidance proposed conservation measures to avoid or minimize adverse effects to bat habitat, habits, and behavior. The programmatic informal conference and programmatic informal consultation determined all activities that occur in unsuitable habitat will result in no effects to the species and do not require the implementation of any conservation measures. The Northern Long-eared Bat Interim Conference and Planning Guidance (USFWS 2014) states, “Trees found in highly-developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable habitat.” Therefore, IMCOM considered that all sites within highly-developed urban areas that are not within 1000 feet of suitable forested/wooded habitat are excluded from these guidelines and ESA conference/consultation requirements. Examples of highly-developed areas include but are not limited to: some cantonment areas, some housing areas, industrial areas, highly developed training sites, and developed testing facilities.

For installations that contain habitat elements for the northern long-eared bat within its range, IMCOM adopted conservation practices for activities that may affect the northern long-eared bat. The primary purpose of IMCOM installations is to provide for the sustainment, enhancement, and readiness of the U.S. Military. Military training and enhancement activities are generally divided into the following categories: sustainment operations, engineering operations, air operations, water operations, field training operations, live munitions training, demolition, smokes/obscurants, and research, development, testing, and evaluation (RDTE). All of these activities occur in dispersed Training Areas; some of these activities occur in localized Training Areas year-round at all times of the day and night. Natural resource management activities also occur on most IMCOM installations which may include forest management, prairie management, wildlife management, recreation, erosion control, and other land management activities and uses as described in each installations INRMP. The conservation measures adopted within the informal conference and guidance provides specific measures each installation must implement to ensure compliance with the ESA.

Specific activities that have been determined to “may affect” northern long-eared bats and have conservation measures to reduce the impacts on the species are:

- Existing Military Training, Firing and Maneuver ranges
- Aircraft Operations

- Military Training Smoke and Obscurants
- Construction
- Forest management
- Prescribed Burns
- Specific Single, Group, or Hazard Tree Removal
- Pesticide Use
- Pest Control
- Recreational Activities

Conservation measures proposed supporting each of the "may affect" activities are considered necessary to either avoid adverse effects or to ensure the expected effects are beneficial, insignificant or discountable. IMCOM installations have adopted the measures and utilize a project screening checklist to ensure compliance. An annual reporting requirement is also include within the conference to provide the USFWS visibility of Army efforts in implementing the tenants of the 4(d) Rule. All activities that either cannot conform to the conservation measures or are not included within the informal conference must initiate consultation pursuant to Section 7(a)(2) of the ESA prior to initiation of the action.

3.4 White-nose Syndrome

White-Nose Syndrome is a fungal infection that is afflicting North America's hibernating bats. The infection is caused by the newly described fungus *Pseudogymnoascus destructans*. *P. destructans* thrives in the cold, humid conditions of caves and mines utilized by bats for hibernation. Confirmation of the disease is achieved by microscopic examination of skin erosion caused by the fungus, but field signs include white fungal growth on the muzzle and/or wing tissue infected bats (USGSNWHC 2012). Although much remains unknown about this disease, it is believed that cave-dwelling bats infected with the fungus tend to arouse from torpor more often and for longer periods of time than uninfected bats. These arousals deplete fats reserves crucial to hibernation (Blehert et al. 2011).

Since its discovery in North America in 2006, it is estimated to have killed more than 5.5 million bats (USFWS 2012c). To date 9 species of bats have been affected, including the big brown bat (*Eptesicus fuscus*), eastern small-footed bat (*M. leibii*), little brown bat (*M. lucifigus*), northern long-eared bat (*M. septentrionalis*), tri-colored bat (*Perimyotis subflavus*), cave bat (*M. velifer*), southeastern bat (*M. austroriparius*), and the federally listed gray (*M. grisescens*) and Indiana (*M. sodalis*) bats. About half of bats species native to the United States are obligate hibernators; therefore many more species could become affected as the disease continues on its path across the continent (Blehert, et al. 2011)

Fort Campbell is the first Department of Defense property to report presence of WNS within installation boundaries. All 8 bats recorded in the February 2012 visit to Morgamie Cave exhibited symptoms of the infection (i.e. white fungal growth on their muzzles, forearms, wing tissue, etc.). The disease was later confirmed by the U.S. Geological Survey - National Wildlife Health Center. Additionally, the five bats observed in the Cold War Era bunkers in March 2012 had what appeared to be white powdery fungus on their forearms, ears, tragus and/or wing membrane. No bats from the bunkers were sent to the lab for disease confirmation. The bunkers are located in Montgomery County, Tennessee, which already had a confirmed case of the disease. Upon discovery of the WNS affected bats the Fort Campbell Fish and Wildlife Program manager secured a key to access the infected bunkers, and installed signs warning of the presence of infected bats within those bunkers.

The devastating effects that White-Nose Syndrome will have on gray and Indiana bat populations has yet to be fully realized making management and protection for both species more important than ever. The collection of and inter-agency sharing of data is critical as WNS continues its spread across North America. Equally as important is the comparison of pre-WNS data with current and future data both locally and regionally.

As the first DoD property to confirm WNS within installation boundaries, Fort Campbell has the opportunity to set the bar for post-WNS data collection and management among other installations. Since the inception of the first Endangered Species Management Plan (now Component) in 2001, Fort Campbell has maintained a proactive approach to endangered species management through cooperation with and coordination with the USFWS.

4.0 Conservation on Fort Campbell

This ESMC provides guidelines for management activities on Fort Campbell that are designed to conserve listed species on the installation. The ESMC was designed in coordination with the USFWS to integrate conservation and management of listed species with training and non-training activities on Fort Campbell.

Management activities primarily address the foraging, flight, and roosting habitat required by gray, Indiana, and Northern long-eared bats. The gray bat occurs frequently throughout the installation. Indiana bats occur infrequently on the installation, but Fort Campbell has developed detailed conservation activities for the species due to its relative rarity. Conservation efforts for the Northern long-eared bat are similar to the Indiana bat due to similar summer roosting behavior; however, conservation efforts will revolve around the 2015 Department of Defense Biological Opinion and agreed upon habitat conservation measures.

The primary goal of this ESMC is to conserve individual bats and their habitat, as well as to assist in the recovery of all species. Fort Campbell approaches conservation of listed bats both by avoiding adverse effects to individuals and by establishing proactive conservation standards and goals. Conservation goals are designed to obtain information about the species distribution and habitat use, and to identify and protect suitable habitat for the species on the installation.

Fort Campbell conducts mist net and acoustic studies to document population size, species abundance, habitat utilization, and determine land management impacts to these species annually. To date, Fort Campbell has collected bat data from 164 point locations (Figure 6) totaling 2,172 net nights of effort, acoustic data from 110 point locations (Figure 7) and 114 miles of mobile transects (Figure 8).

4.1 Conservation Standards

The following conservation standards are requirements that apply to all activities, including training, testing, maintenance, recreation, and natural resources management, at Fort Campbell. These standards have been developed in coordination with the USFWS and are designed to protect summering bats and their habitats. Deviation from these standards requires prior coordination with the Endangered Species Program.

1. During forest management activities (including those under contract), leave all snags and trees with cavities, except where they are hazardous to humans.

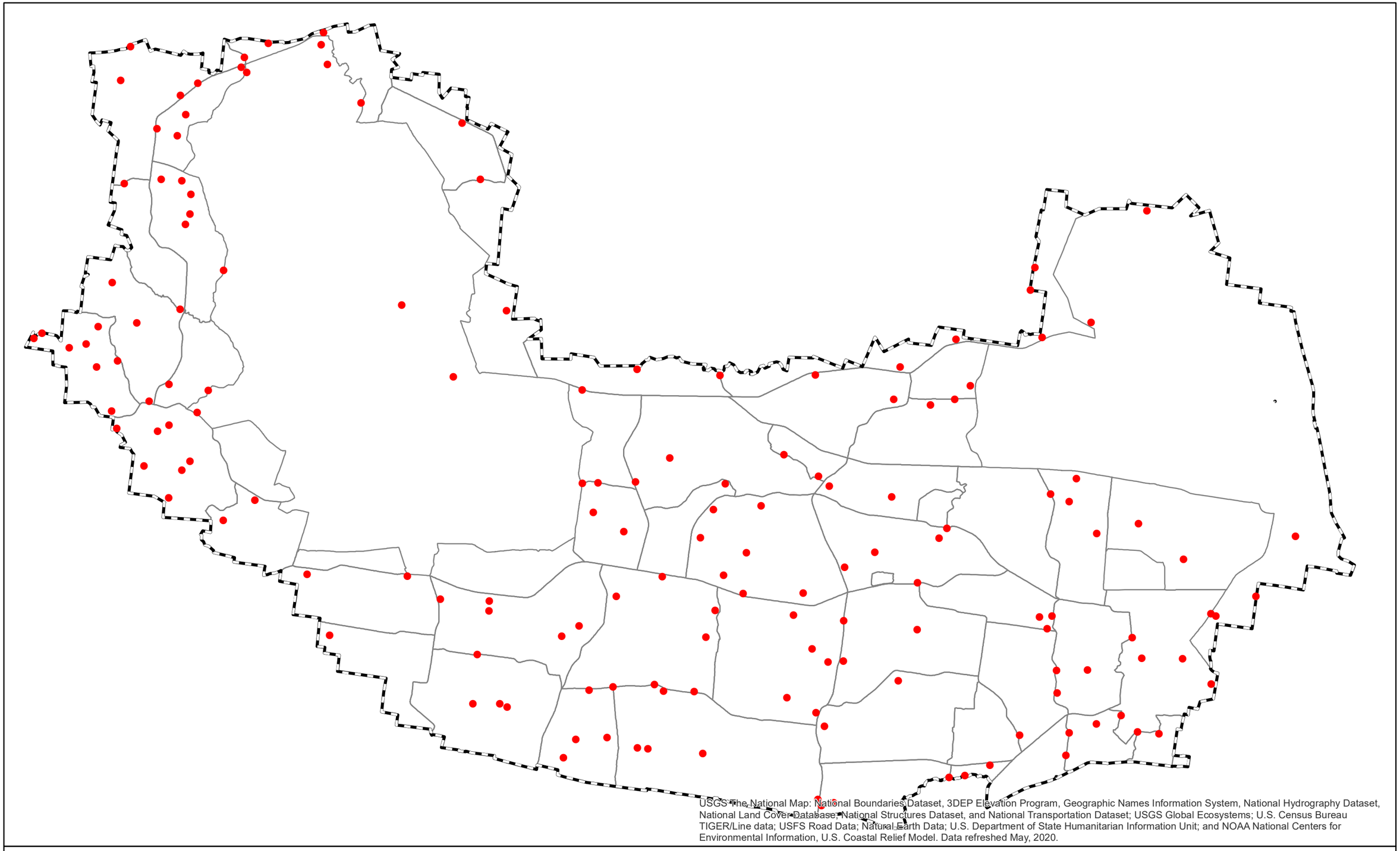

Figure 6. Endangred bat inventory/monitoring (mist net) sites that have been estabished since 1998.

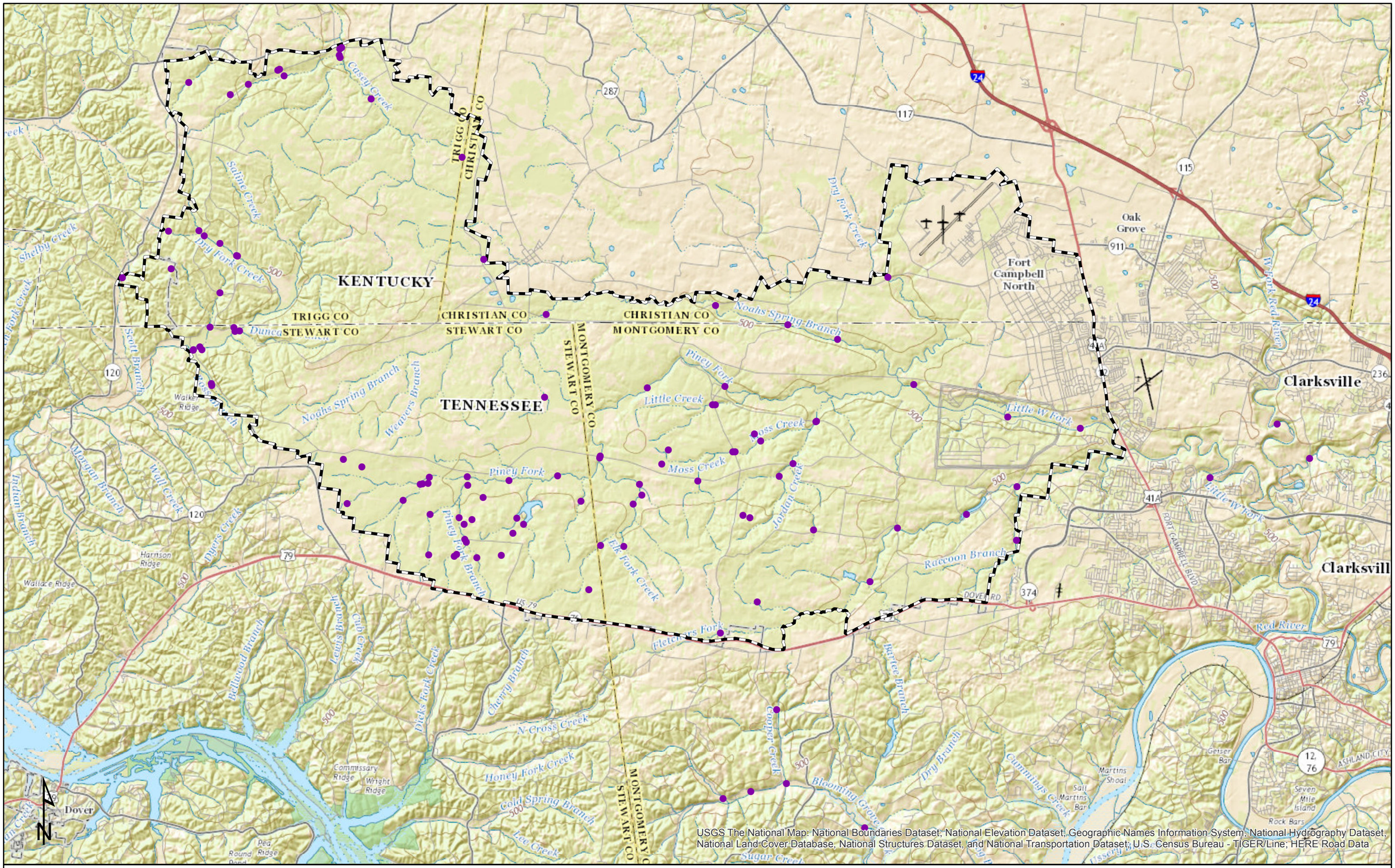

Figure 7. Location of stationary acoustic monitoring sites on Fort Campbell and within close proximity to the installation.

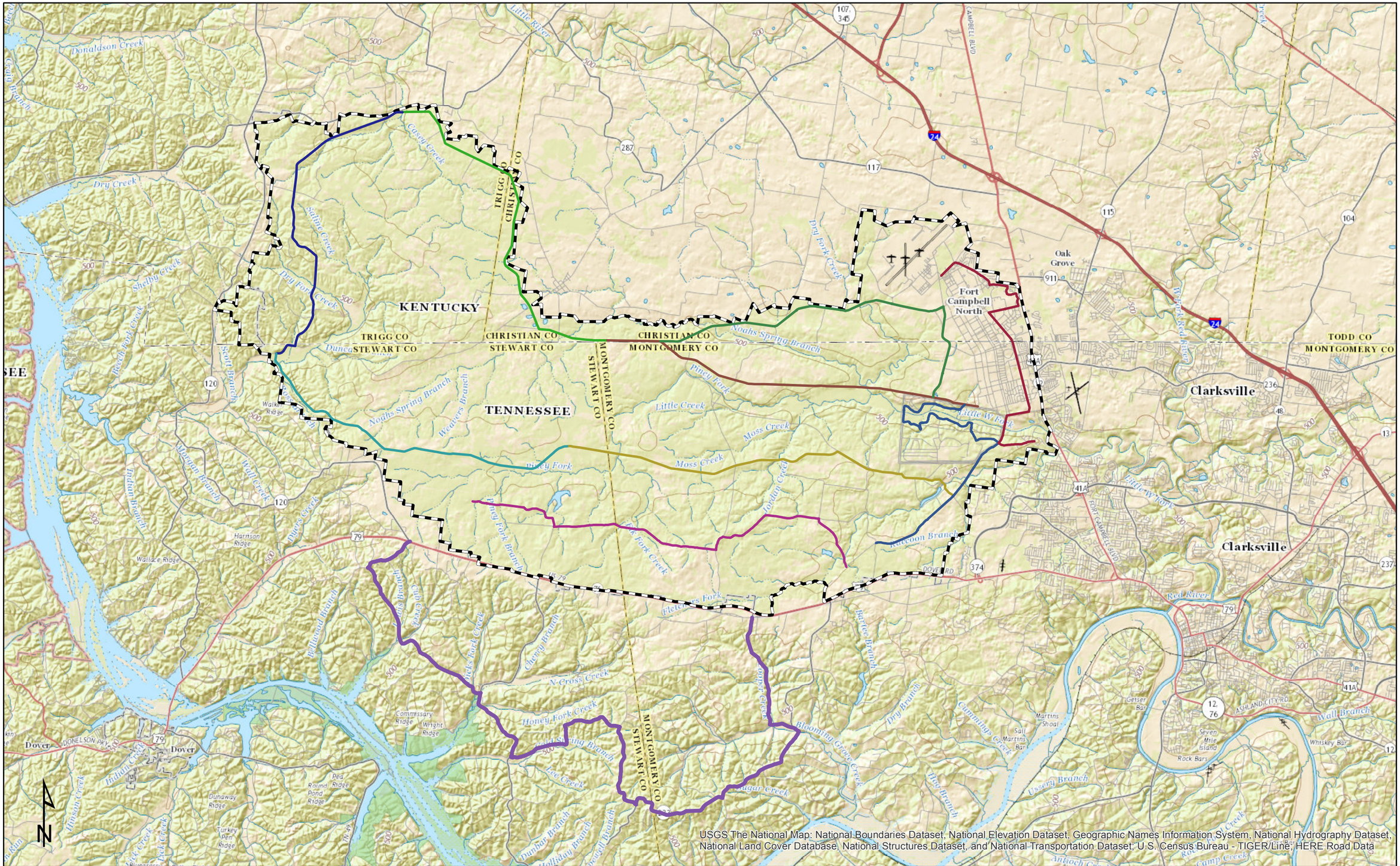

Figure 8. Location of mobile acoustic monitoring routes on Fort Campbell and within close proximity to the installation.

2. Restrict removal of trees to times of the year when tree roosting bats are not present, 15 November through 15 March, to avoid take of roosting bats.

3. The Endangered Species Program will evaluate tree removal activities proposed anywhere on the installation and will provide recommendations to the Forestry Program for conserving habitat for endangered species and other wildlife. The Endangered Species Program Manager will ensure seasonal restrictions are implemented, and, if necessary, lead coordination with the USFWS.

4. Other than clear cuts prescribed for management of forest pests or sanitation cuts, clearcuts will be minimized to blocks no larger than 20 acres per Army Regulation 200-1.

5. Minimize tree clearing, especially of highly suitable roost trees including snags (dead trees), shagbark hickories (*Carya ovata*), other trees with shaggy or exfoliating bark, and trees of any species over 26 inches dbh.

6. To the maximum extent practicable, develop old growth forest stands within areas that support Indiana and northern long-eared bats.

7. Vehicles must not cross streams except at bridges or designated, hardened fords.

8. Maintain riparian zones to improve water quality and provide foraging habitat for gray bats and Indiana bats. The area within 100 feet along each side of perennial streams (first-order and larger) must be kept vegetated. The area within 50 feet of intermittent streams must be forested. For first- and second-order streams, the buffer area is measured from the center of the stream. For larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from the stream bank.

- Avoid removing trees and other vegetation in these areas during training and NR management activities.
- Encourage development of forest within 50 feet of streams by planting trees, and/or avoiding actions that inhibit natural succession to forest.
- Limit training activities within the buffer zone to foot travel; tracked and wheeled vehicles should be kept outside the buffer zone.
- No timber harvest will occur within 100 feet of streams and impoundments (FMP Section 5.4).
- Skid trails for timber harvest will be established outside these zones (FMP Section 5.4).
- Timber stand improvement and prescribed fire, when used in riparian zones, will be carefully planned to maintain overstory canopy cover at 70 percent or greater. Trees >9 inches dbh should be retained in riparian zones to the maximum extent practicable.

9. Maintain vegetative cover on side slopes of sinkholes, and 100-foot vegetated buffers around sinkholes.

10. Avoid disturbance to areas known to be used for foraging, summer maternity, and migration route habitats. Preserve and restore wooded upland buffers at least 150-feet-wide on wetlands and open waters, and at least 300-feet-wide where possible.

11. Do not apply pesticides, fertilizers, and other chemicals into, or within 100 feet of perennial and intermittent streams, sinkholes, and other karst features.

12. Refuel vehicles and conduct other activities with potential for pollutant spills at least 100 feet from sinkholes.

13. Only individuals authorized by the Fish and Wildlife Program are permitted to enter caves or cave-like structures on the installation (including Cold War Era bunkers). Anyone entering a cave or cave-like structure (including Cold-War Era bunkers) must adhere to the nationwide decontamination protocols for White-Nose Syndrome (Appendix C).

4.2 Activities with Potential to Affect Listed Species on Fort Campbell

Activities conducted on Fort Campbell that are not consistent with the standards and guides described in Section 4.1 above have potential to adversely affect listed species. Deviation from standards and guides require prior coordination with the Endangered Species Program.

Activities on Fort Campbell that may potentially affect federally listed bats include:

- timber harvest activities,
- operation of tracked or wheeled vehicles on bare soil, vegetation, or other unimproved surfaces,
- operation of tracked or wheeled vehicles on unimproved stream crossings,
- excavation for engineering/force protection (e.g., foxholes, berms),
- construction without appropriate sediment control management,
- unimproved firebreaks lacking erosion control measures,
- improper use of pesticides,
- unstable streambanks,
- construction within forest habitat determined to be suitable roosting habitat,
- untreated or poorly treated discharges into streams on the installation, and
- military/non-military readiness activities that support large caliber weapons systems resulting in high explosive detonations within the impacts areas.

Activities on Fort Campbell that result in removal of forest or degradation of water quality in streams may result in indirect affects to protected species. All species typically forage within or near forested areas, and forest vegetation is thought to protect foraging or traveling bats from predators. Therefore, clearing of forested tracts may affect the quality of habitat used by endangered bats for foraging and traveling.

Input of sediment or contaminants into streams may indirectly affect bat species by degrading aquatic habitat for prey species. Increased turbidity and sedimentation of streams has adverse effects on stream organisms at all trophic levels, from zooplankton to aquatic insects, mollusks, and fish (Cordone and Kelley 1961, Waters 1995, Wood and Armitage 1997). These effects include mortality, reduced physiological function, and avoidance of the polluted area (Henley et al. 2000). Tuttle (1979) hypothesized that siltation could affect populations of larval forms of the aquatic insects consumed by gray bats. Colonies of gray bats with stable numbers during his observation periods did not forage over waterways with heavy siltation. One colony located near streams with marked siltation problems experienced an 86 percent decline; however, the colony also was affected by extreme vandalism in the roost cave. Tuttle concluded that the effects of silt pollution on aquatic insects and resultant effects to gray bats require more investigation.

Military/non-military readiness activities that support large caliber weapons systems resulting in high explosive detonations within the impacts areas are considered to have a potential to affect federally listed species. These activities are included within the list since many of the targets are located within open areas and annual herbicide maintenance is required to maintain line of sight. A determination of affect for this activity is not feasible since access to the impact area is prohibited due to the risk of loss of life. The impact areas support hundreds of acres of forest that are considered potential roosting habitat. Many stands have been given a desired future condition of old growth forest due to inaccessibility.

To avoid adverse effects to bats, the Fort Campbell Fish and Wildlife Program evaluates all installation activities that have the potential to affect federally listed species. The Fish and Wildlife Program will evaluate habitat suitability and conduct acoustical and mist net surveys to assess the potential for effects to listed bats. When a proposed activity may affect a listed species, consultation with the USFWS is conducted under Section 7 of the ESA, and a Biological Evaluation or Assessment, depending on the nature of the activity, is conducted.

The Fort Campbell Endangered Species Program must be notified and consulted prior to implementation of training or non-training activity that may affect a federally listed bat. Coordination procedures are described in Section 4.3 below.

4.3 Consultation Procedures

Per a letter from the USFWS dated 12 September 2012 (Appendix D), the current consultation procedure will be as follows:

1. An installation-wide habitat assessment was completed in 2013 which concluded suitable summer foraging and roosting habitat exists within the boundaries of the post. This determination provides the foundation for future bat management actions that support timber removal operations during the summer roosting period for Indiana and northern long-eared bats. All forest habitat, including pine plantations and hardwood stands, on Fort Campbell is considered potential roosting habitat.

2. If suitable roosting habitat is present within a proposed project area, biologists will follow USFWS protocols to survey for the presence or probable absence (acoustic monitoring and/or mist-netting surveys) of Indiana and northern long-eared bats within the proposed project area prior to project commencement. Survey work will follow the most updated USFWS survey protocols available.

3. In areas with little or no suitable habitat present, individual or groups of trees can be surveyed utilizing a single, group, or cluster tree survey methodology between 15 May and 15 August from sunset to complete darkness. If no bats are observed, the individual or group of trees can be felled within 24 hours of survey.

4. Tree roosting bat management and monitoring procedures will adhere to the guidelines set forth in the Revised Indiana Bat Summer Survey Guidance (Appendix E). This survey guidance is applicable to the northern long-eared bat as well.

5. Following completion of a survey, the Endangered Species program will develop a biological assessment that shall provide a determination of effect and provide data supporting the determination. A complete survey report is a required enclosure of the biological assessment. Survey report format shall follow USFWS guidelines within the Survey Guidance.

6. The Endangered Species Program Manager will determine the consultation level (informal/formal) based upon the conclusion of the biological assessment. The informal procedure is the preferred method for all consultations and modification of the project scope may be required to ensure informal consultation level.

7. All ESA Section 7 documentation and opinions received from the USFWS are forwarded to the NEPA Program for inclusion into the administrative record for the project.

4.4 Conservation Goals and Management

4.4.1 Management Approach

Management of federally listed species on Fort Campbell is conducted in accordance with the ESA, endangered species recovery plans, U.S. Army regulations and guidance, and this Endangered Species Management Component. The ESA requires all federal agencies to conserve listed species. Conservation, as defined by the ESA, means the use of all methods and procedures necessary to bring any listed species to the point where protections pursuant to the ESA are no longer necessary. The ESA specifically requires agencies not to "take," or to "jeopardize the continued existence of" listed species, or to destroy or adversely modify habitat critical to any listed species. All Army land uses, including military training and testing, timber harvesting, and recreation, are subject to ESA requirements for the protection of federally protected bats.

Fort Campbell Fish and Wildlife Program biologists have implemented surveys to determine the distribution and abundance of gray bats, Indiana bats, and northern long-eared bats on the Installation. Other investigations designed to improve knowledge of these bats and their habitat on Fort Campbell are described in Sections 2.2 and 2.3 above. Forest and stream habitat on Fort Campbell is actively managed to provide suitable foraging areas for both listed species.

Conservation goals adopted by Fort Campbell to meet requirements set forth in species recovery plans, the ESA, and AR 200-1 are discussed in this section. Specific objectives designed to achieve each goal are described. Associated monitoring actions are designed to measure ecosystem conditions and progress toward goals. Objectives are described in as much detail as practicable, to allow Fort Campbell to monitor progress toward implementation of objectives. Goals and associated objectives and monitoring actions are designed to avoid adverse impacts to federally listed bats, and to provide suitable habitat for the long-term stability of current resident populations.

Management of natural resources at Fort Campbell, including endangered species and their habitat, must remain flexible to achieve long-term success. Fort Campbell NR managers employ adaptive management to ensure conservation goals and objectives are realistic and effective. Monitoring activities provide data to evaluate the success of management goals and objectives. During the annual review of the INRMP, or more often as appropriate, NR managers evaluate the status of management objectives and progress toward goals. Based upon results of monitoring and other new information (e.g., new scientific literature, updated water quality standards), NR managers may adjust management objectives to improve achievement of goals and continue support of the military mission. The NR management program may also be required to adapt to unforeseen changes in military mission and legal requirements.

Fort Campbell takes a landscape-scale, watershed-based approach to land management, in which emphasis is placed on maintaining an ecosystem suitable for native flora and fauna, including the federally protected bats. Suitable foraging habitat is necessary to support all three bats on Fort Campbell. Maintaining healthy aquatic habitat and good quality water is important for conservation of bats that forage upon insects from aquatic habitat and drink from streams, lakes, and ponds. Water quality and the condition of in-stream habitat determine the types and quantities of aquatic macroinvertebrates inhabiting streams. Water quality assessments have indicated all surface streams on the Installation are slightly impaired due to excessive sedimentation and excessive bed loading. Several of the goals below address improvement and monitoring of water quality, which benefits listed species of bats directly by providing clean drinking water, as well as indirectly by providing a sustainable ecosystem that offers abundant prey and foraging habitat in the long term.

4.4.2 Conservation Goals and Objectives

Conservation goals for federally protected bats are described below. Goals are numbered sequentially, with associated objectives and monitoring actions in subheadings beneath each goal.

Goal 1: Ensure all proposed projects on Fort Campbell are in compliance with the ESA.

Objective 1: The Fish and Wildlife Program will support project planning and timely environmental reviews under NEPA to identify potential effects to listed or rare species. Installation biologists will prepare appropriate biological documentation to determine if a proposed project may affect a federally listed species. If a proposed project may affect federally listed species, Fort Campbell Fish and Wildlife will coordinate and consult with the USFWS.

Objective 2: The Fish and Wildlife Program will conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities.

Objective 3: The Fish and Wildlife Program will inspect timber harvests within 10 days of harvest to ensure compliance with project-specific conditions of agency coordination (e.g., number of large-diameter trees or snags left in place, erosion control measures are in place).

Objective 4: The Fish and Wildlife Program will request notification when the USFWS is considering making a species in Kentucky or Tennessee a candidate for listing or are conducting a 12-month review of a species petitioned for listing.

Goal 2: Continue to provide suitable habitat on Fort Campbell for federally protected bats.

Objective 1: To provide suitable roosting and foraging habitat for tree roosting bats on the installation, allow 4,000 acres of forest to achieve old growth conditions, characterized by numerous large-diameter trees with dominant trees between 100 and 200 years old, snags and dying trees of all sizes, and downed rotting trees. Detailed description of old growth forest conditions is provided in Section 5.2.3 of the 2005 Forest Management Plan. At least 2,830 acres in the Saline Creek and Casey Creek subwatersheds, where Indiana and northern long-eared bats have been captured, will be allowed to achieve and maintain old growth status. Identify in the GIS database those forest stands that contribute to the old growth area established for bat conservation.

Monitoring Action 1: Every two years, inspect 500 acres of forest designated to become old growth. Using an established sampling protocol, evaluate forest habitat parameters identified in the Indiana Bat Summer Habitat Suitability Index Model (Rommé et al. 1995) to verify that habitat suitable for summer roosting and foraging Indiana and Northern long-eared bats is present in the Casey Creek and Saline Creek subwatersheds. Develop a sampling protocol based upon the HSI Model and initiate the first year of monitoring. If average habitat suitability in sampled areas is less than 0.5, the Fish and Wildlife and Forestry program managers will coordinate and develop treatments to improve parameters that are contributing to low suitability. Potential improvements may include girdling certain trees to increase availability of potential roost trees, or thinning.

Objective 2: Conduct timber harvest operations in accordance with the Forest Management Plan. By 31 December each year, report to the USFWS the number of acres, location, and timing of timber harvests. Conduct presence/probable absence surveys for all projects that require timber removal.

Objective 3: Maintain water quality for foraging federally protected bats by developing a Total Maximum Daily Load (TMDL) for sediment in each subwatershed on Fort Campbell where one or more streams are non-supporting or partially supporting of designated uses. TMDLs will be developed in coordination with TDEC Division of Water Pollution Control and KDOW using state water quality criteria, ecoregion reference site data, land use data, digital elevation data, a sediment loading and delivery model, and an appropriate margin of safety factor. TMDLs will establish reductions in sediment loading which will result in reduced in-stream concentrations of sediment and the attainment of water quality standards. Methods for monitoring and adaptive management will be described for each TMDL established. The Fort Campbell Watershed Management Plan establishes the schedule of evaluation for each subwatershed on the installation; development of TMDLs will follow the WMP schedule.

Objective 4: Conduct timber stand improvements (TSI) to reduce understory clutter to improve bat flight corridors and develop oak and hickory dominated forests. TSI actions are targeted in areas of deemed poor habitat tom increase the acreage of suitable roosting habitat within the installation boundaries.

Objective 5: The Endangered Species Program Manager will review proposed projects (e.g. new construction, training area maintenance) and will advise project proponents on design and location of projects to minimize the removal of forest cover. Especially in areas that lie between foraging areas and roost caves (Tobaccoport, Big Sulphur, and Bellamy caves [Figure 4]) used by Indiana, gray, and northern long-eared bats.

Objective 6: Construct and maintain bat boxes throughout the Cantonment Area to mitigate tree removal from the developed portion of the Installation.

Goal 3: Improve understanding about the habitat use by federally protected bats on Fort Campbell, and the regional significance of Fort Campbell to those species.

Objective 1: Conduct installation-wide mist net surveys annually to monitor presence of threatened and endangered bats on Fort Campbell. Mist net surveys will be conducted throughout the installation between 15 May and 15 August, when bats occupy summer habitat. Methods should follow the most current methods recommended by the USFWS. Results will be compared to surveys conducted between

1999 and 2006. Results of the survey will be communicated to the USFWS by the end of each calendar year per federal permit requirements.

Objective 2: Continue to conduct annual acoustic surveys for Indiana bats. Acoustic surveys will be conducted between 15 April and 15 October, to account for spring emergence from hibernacula through the fall swarming season. Acoustic surveys will include stationary/passive sampling efforts, as well as mobile transect/active sampling. Methods should follow the most current methods recommended by the USFWS.

Objective 3: Investigate the presence of caves on Fort Campbell that may provide suitable habitat for gray bats or Indiana bats. When caves are identified, use protocols established by KDFWR to conduct a Phase I evaluation of habitat suitability for bats (Appendix F). If the cave appears suitable for bats, develop and implement a plan for investigating presence of bats and assessing human disturbance of the cave. The plan will include methods (e.g., internal cave inspection, harp trap at entrance), and the timing, frequency, duration, and other conditions of the survey. The plan will be implemented within one fiscal year after the cave is identified. Until a Fort Campbell biologist has determined whether endangered bats are present, caves will be considered potential habitat for endangered bats; human entry and other disturbance to the cave will be strictly limited. If the survey indicates suitable habitat for bats and frequent human disturbance, consider techniques for preventing access/visitation by humans.

Objective 4: Continue monitoring the presence of bats in Cold War Era bunkers in the Old Clarksville Base portion of the installation. Survey will be conducted twice per year, once in the winter and once in the summer, to check for hibernating bats and summer roosting bats, respectively. Fort Campbell biologists will strictly adhere to recommended decontamination methods (Appendix C) while conducting surveys in the Cold War Era bunkers.

Objective 5: Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region.

Monitoring Action 1: Review the results of regional mist net surveys conducted at Land Between the Lakes. Coordinate with USFWS, TWRA, KDFWR, and the Tennessee Valley Authority to obtain other reports of mist net surveys conducted in middle Tennessee and southwestern Kentucky. Compare historic capture rates (number of bats captured per net-night) for gray bats and Indiana bats on Fort Campbell to capture rates at other regional sites.

Monitoring Action 2: Compare relative abundance of foraging gray bats at sites on Fort Campbell (Fletcher's Fork Creek, Piney Fork Creek, and Saline Creek) to sites outside the installation. Sites selected will be as similar as possible in stream characteristics (channel width, stream flow, riparian vegetation type, and canopy closure), distance from gray bat summer roost caves, and other factors (illumination from man-made sources, human disturbance). Surveys will be conducted at all sites on the same nights, for at least ten nights, between 15 May and 15 August.

Objective 6: Develop and carry out a seismic study to determine the impacts from the training mission on local hibernacula.

Goal 4: Continue to participate in regional conservation planning efforts for federally protected bats.

Objective 1: Annually, or more frequently, the Fish and Wildlife Program will coordinate with the USFWS Tennessee and Kentucky Ecological Services Offices to discuss long-term conservation plans and regional trends associated with Indiana, gray, and northern long-eared bats.

Objective 2: Annually, or more frequently, the Endangered Species Program will contact the Kentucky and Tennessee State Natural Heritage Divisions to obtain updated results of cave surveys conducted by the states to monitor summer and winter populations of gray bats and winter populations of Indiana bats. In particular, Fort Campbell will obtain current data regarding population monitoring in Tobaccoport, Bellamy, and Big Sulfur Springs caves. Fort Campbell will coordinate with the state agencies to support analysis of regional population trends, changes in distribution, or regional management initiatives for these species.

Objective 3: At least one biologist from the Fish and Wildlife Program will participate in the Tennessee Bat Working Group and the National Military Fish and Wildlife Association Bat Working Group to stay informed about studies and management initiatives related to endangered bats that are occurring locally and on other DoD installations.

Goal 5: Maintain the ESMC up to date as required by AR 200-1.

Objective 1: The Endangered Species Program will annually evaluate the status of ESMC objectives, will identify where revised information potentially creates opportunities or conflicts with other INRMP goals/objectives, and will coordinate with appropriate NR managers to resolve the issue. Major revision of the ESMC will be accomplished at least every five years. If any species previously recorded on Fort Campbell becomes listed under the ESA, the ESMC will be subject to immediate revision.

Goal 6: Educate Fort Campbell soldiers and installation personnel about federally listed species on the installation.

Objective 1: The Fish and Wildlife Program will support the portion of the Environmental Quality Officers (EQO) course pertaining to listed species on Fort Campbell. The program educates soldiers and other personnel on individual responsibilities and liabilities under Federal law; the importance of protecting listed species; and the need for balancing the mission with the conservation of the listed species and their habitats. The Endangered Species Coordinator will annually review EQO course materials, and brochures/flyers pertaining to listed species, and update those materials if necessary.

Objective 2: The Fish and Wildlife Program will provide the brochure in Appendix G, which addresses conservation of endangered bats on Fort Campbell, to the EQP course and other appropriate users on Fort Campbell. The document will be kept up to date and available for distribution.

Objective 3: The Fish and Wildlife Program will provide the brochure in Appendix H, which address White-nose Syndrome, to the EQO course and other appropriate users on Fort Campbell. The document will be kept up to date and available for distribution.

Goal 7: Prevent/minimize degradation of aquatic habitat and water pollution by educating soldiers, residents, employees, and contractors; and distributing accurate information about surface and groundwater resources in the GIS database.

Objective 1: The Agricultural Outlease Program will ensure that 100 percent of lease agreements and Tract Management Plans require site-specific measures (e.g. contour farming, no till cultivation, placement of vegetated buffer strips, maintenance of cover crops, vegetated riparian areas) for minimizing input of sediment, chemicals, and other contaminants into surface and ground water.

Objective 2: The Forestry Program will ensure that 100 percent of timber sale contracts require Forestry Best Management Practices designed to minimize input of sediment, chemicals, and other contaminants into surface and ground water. Best management practices from the "Field Guide to Best Management Practices for Timber Harvesting in Kentucky, FOR-69" and the "Guide to Forestry Best Management Practices in Tennessee (2003)" will be applied as appropriate.

Goal 8: Minimize input of sediment and other contaminants in storm water run-off entering Fort Campbell surface water (streams, impoundments, ponds) and groundwater (sinkholes).

Objective 1: As part of stream inspections conducted under the Watershed Management Plan (WMP) identify vehicle crossings at undesignated areas. Stream inspections conducted as part of WMP implementation will follow the schedule and approach described in the WMP. The Fish and Wildlife Program will create a database in the GIS system to map "unauthorized stream crossings," and will provide the data to the Integrated Training Area Management (ITAM) Program to encourage enforcement of crossing at designated locations.

Objective 2: The ITAM Program will design and implement hardened stream crossings for sites essential to the training mission.

Objective 3: As part of the WMP, inspect streams within target subwatershed(s) to identify degraded streambanks, riparian buffers that are damaged or of insufficient width, and other sources of erosion. Degraded areas identified during monitoring will be added to the list of water quality improvement projects.

Objective 4: During the course of routine NR management activities, inspect vegetated buffer zones along streams and around sinkholes. Identify locations in the rear area where potentially polluted storm water run off is intentionally routed to sinkholes or other karst features. Record in the GIS database features that are non-vegetated and receiving potentially polluted run-off.

Objective 5: Develop site-specific plans to re-vegetate slopes, and/or minimize potentially polluted storm water run-off into sinkholes or karst features in the rear area.

Objective 6: Continue to coordinate with the local soil and water conservation district, state agricultural extension service, Tennessee Department of Conservation, and Kentucky Division of Water to improve management practices designed to reduce nonpoint sources of pollution.

Goal 9: Maintain or improve the quality of water and aquatic habitat on Fort Campbell to provide suitable habitat for foraging bats.

Objective 1: Improve quality of water and aquatic habitat in streams that are currently not fully supporting designated uses. Habitat quality in the stream reaches located on Fort Campbell should meet or exceed standards for the Western Pennyroyal Karst (Region 71e) found in TDEC's *Habitat Quality of Least-Impacted Streams* and *Regionally-Based pH*. Diversity and abundance of invertebrates in those stream reaches should be similar to the Western Pennyroyal Karst (Region 71e) reference streams as described in TDEC's *Regionally-Based Biological Integrity Criterion*.

Monitoring Action 1: Sample aquatic macroinvertebrates at 20 sites in late spring each year. Calculate the following indices to evaluate the health of the stream including the Index of Biotic Integrity (IBI), EPT richness, EPT composition, species richness, biotic index (tolerance), the Shannon-Wiener diversity index, and the Pielou's Evenness index for taxa evenness. Compare results with the target score established for Region 71e (Western Pennyroyal Karst) in the State of Tennessee in *Regionally Based Biological Integrity Criterion*. Where the index score, averaged over two years, falls below a score of 30, implement Objective 9.2 below.

Monitoring Action 2: Conduct habitat assessments along streams as described in the Fort Campbell Watershed Management Plan. Assessment methods are based upon the EPA's Rapid Bioassessment Protocols. Where the habitat score falls below 112, which is the minimum for maintaining biological integrity in reference streams in Region 71e (Western Pennyroyal Karst; as established in the State of Tennessee in *Habitat Quality of Least-Impacted Streams*), implement Objective 9.2 below.

Objective 2: Improve water quality in streams by identifying and rehabilitating eroding streambanks.

Monitoring Action 1: Develop a list of projects necessary to improve water quality in streams. Projects may include installation of erosion control structures appropriate for the site (e.g., check dams, wind breaks, diversions), streambank stabilization, restoration of natural stream channels, revegetation of riparian zones, or other measures needed to protect or enhance water quality in streams. The cost of each project should be estimated to assist project prioritization, funding, and scheduling.

Monitoring Action 2: Implement the LRAM program to address as many sites as possible on the water quality improvement list.

Monitoring Action 3: Projects on the water quality improvement list that are not addressed by the LRAM program will be implemented by NR programs in the Conservation Branch.

Objective 3: Maintain concentrations of chemicals/nutrients related to agricultural activities below minimum detection limits in streams with sources on Fort Campbell. Where concentrations of agricultural chemicals/nutrients collected at sample sites (see M9.3.1 below) exceed minimum detection limits, identify the probable source. For sources originating on Fort Campbell, the Agricultural Outlease Program Manager will modify of the Tract Management Plan (e.g., frequency or formula of pesticide/fertilizer application), improve vegetated strips surrounding the field, improve riparian vegetation to minimize run off, or implement other methods as needed.

Monitoring Action 1: Sample water from 22 locations each year, at the same sites, and using the same methods as studies conducted in 2004, to identify presence of chemicals /nutrients associated with agricultural activities. The first sampling will be conducted before pesticides have been applied; the second sampling will occur post-treatment.

Goal 10: The Fish and Wildlife Program will continue proactive management efforts of endangered bats specifically pertaining to White-Nose Syndrome related issues.

Objective 1: Work cooperatively with the USFWS, TNC, KDFWR and TWRA to stay abreast of new and emerging data regarding WNS.

Monitoring Action 1: The Endangered Species Program will maintain a file of updated decontamination procedures, new species that are affected, USFWS News Releases, etc.

Objective 2: Assist USFWS, State, and NGO biologists with local and regional WNS surveys.

Monitoring Action 1: Assist USFWS, State, and NGO biologists with surveying caves for WNS in the region.

Monitoring Action 2: Assist USFWS, State, and NGO biologists in other WNS surveys affecting local and regional bat populations.

Objective 3: Design and implement bunker exclusion structures for four bunkers known to support bats with symptoms of WNS.

Goal 11: Continue to pursue conservation easements through the Army Compatible Use Buffer (ACUB).

Objective 1: Pursue conservation easements within areas that support critical habitat for federally protected bats.

Monitoring Action 1: Assist DPW, Master Planning with determination of properties that support habitat of federally protected bats.

Monitoring Action 2: Assist USFWS, State wildlife agencies in securing conservation easements for the protection of forests.

4.5 Internal and External Coordination

All management activities conducted pursuant to this ESMC will be coordinated with the appropriate stakeholders at Fort Campbell (e.g., G3/ Directorate of Plans, Training, and Mobilization, Cultural Resources Staff).

The Endangered Species Program reviews plans for proposed actions to determine if the activity potentially affects listed species. The Endangered Species Program may evaluate habitat suitability or conduct site-specific surveys in the proposed project area to determine the potential for effects to listed bats. Management activities and future projects that may affect federally protected bats will be coordinated with

the USFWS through informal or formal consultations (as described in Section 7 of the ESA, and Army Regulation 200-1).

Based upon coordination with the USFWS, the Endangered Species Program has identified certain routine activities that have no potential to affect federally protected bats:

- removal of a single live or dead tree within the cantonment area (city portion of the reservation) that is more than ½ mile from a minimum 50-acre forested area;
- removal of water from small impoundments for military training exercises;
- overflights of aviation assets on the installation;
- military training exercises on defined ranges and within the maneuver space;
- military readiness activities that result in small caliber projectiles entering the impact areas (Small Arms Impact Area);
- all field management activities that do not involve removal of trees greater than 3" dbh with defined erosion control measures;
- removal of trees that are hazardous to humans; and
- removal of trees during military training exercises.

Military readiness activities that result in high explosive detonations or small caliber projectiles entering the impacts areas are included within the list of no potential to affect federally listed species. This activity is included within the list since many of the targets are located within open areas and are not adjacent to forested areas. A determination of affect for this activity is not feasible since access to the impact area is prohibited due to the risk of loss of life. The impact areas support hundreds of acres of forest that are considered potential roosting habitat.

Single tree removal within potentially suitable Indiana bat habitat may occur by following the guidelines for visual surveys set forth in a letter from the USFWS dated 12 September 2012 (Appendix D) and the 2013 Fort Campbell Tree Removal Policy Memorandum. Tree removal restrictions apply to all construction activities and timber harvests, however military readiness activities are excluded.

The Endangered Species Program will review tree removal activities proposed anywhere on the installation. Activities solely characterized as one of the activities listed above require no additional coordination regarding federally protected bats. The Endangered Species Program will ensure seasonal restrictions are implemented, and, if necessary, lead coordination with the USFWS. The Endangered Species Program will also provide recommendations to the Forestry Program for conserving habitat for endangered species and other wildlife.

All other activities that potentially affect (beneficially or adversely) federally protected bats must be coordinated with the Endangered Species Program. Questions regarding the potential for an activity to affect listed species should be directed to the Endangered Species Program.

Fort Campbell's natural resource activities, including those contained in this ESMC update, are addressed in Fort Campbell's Integrated Natural Resources Management Plan (INRMP), which is coordinated with the USFWS. Additionally, on-going training and non-training activities are coordinated with the USFWS via consultation on a programmatic biological assessment. Fort Campbell's Endangered Species Program will

be the primary point of contact for all agency coordination and consultation involving threatened and endangered species.

The Integrated Training Area Management (ITAM) Program is the primary Army program for balancing land use for military training with natural resources conservation requirements, including the protection of listed species. The ITAM Program and the Fish and Wildlife Program will coordinate management needs and integrate ESMC management goals and objectives into ITAM yearly work plans as appropriate. Fort Campbell's INRMP is the means by which ITAM and ESMC activities will be integrated. Coordination will also be achieved through the exchange of GIS data. ITAM will ensure G3/Directorate of Plans, Training, and Mobilization considers endangered species data and internal coordination procedures in scheduling and authorizing training activities.

4.6 Surveys, Inspections, and Monitoring

Surveys, inspections, and monitoring are described in Section 4.3 above. These efforts are intended to evaluate habitat conditions and monitor progress toward achievement of goals. Inspections are utilized to ensure compliance with the ESA, Section 7 consultations, and implementation of conservation measures to minimize impacts to habitat required by both species. Surveys for Indiana bat will adhere strictly to the protocols described in the Final Indiana Bat Summer Survey Guidance (Appendix E).

5.0 Time and Personnel

Table 1 below provides a checklist of objectives and monitoring actions (projects) to be conducted in FY 2020 through FY 2025. Tables 2-6 provide annual checklists of ESMC projects for which Endangered Species Program will request funding. Projects in Table 1 that are to be executed by other programs, or are part of the regular duties of Endangered Species Program staff (i.e., require no additional funds beyond salaries) are not listed in Tables 2-6.

This Plan is designed to integrate the efforts of several natural resources management programs. While the Endangered Species Program is responsible for overall implementation of the ESMC, the Integrated Training Area Management (ITAM), Forestry, Land Management, Pest Management, and Agricultural Outlease (AO) programs each implement projects that contribute to endangered species conservation.

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Table 1. Objectives and monitoring actions to be conducted annually during FY 2020 through FY 2024 to achieve endangered species conservation goals.

Goals, Objectives and Monitoring Actions	Lead Program(s)	Priority (Funding Class)	FY 20	FY 21	FY 22	FY 23	FY 24
G1/O1 Support project planning and timely environmental reviews under NEPA to identify potential effects to federally listed species.	F&W	0	X	X	X	X	X
G1/O2 Conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities.	F&W	0	X	X	X	X	X
G1/O3 The Fish and Wildlife Program will inspect timber harvests within 10 days of harvest to ensure compliance with project-specific conditions of agency coordination.	F&W	0	X	X	X	X	X
G1/O4 Request notification when the USFWS is considering making a species in Kentucky or Tennessee a candidate for listing.	F&W	0	X	X	X	X	X
G2/O1 Allow 4,000 acres of forest to achieve old growth conditions, with at least 2830 acres in the Saline Creek and Casey Creek subwatersheds. Identify in the GIS system those forest stands that will contribute to the old growth area established for bat conservation.	Forestry, F&W	1	X				
MA Every two years, inspect 500 acres of forest in the Casey Creek and Saline Creek subwatersheds in areas designated to become old growth. Develop a sampling protocol based upon the Indiana Bat Summer Habitat HSI Model.	F&W	1	X		X		X
G2/O2 By 31 December each year, report to the USFWS the number of acres, location, and timing of timber harvests.	Forestry, F&W	1	X	X	X	X	X
G2/O3 Develop a Total Maximum Daily Load (TMDL) for sediment in the Fletcher's Fork, Piney Fork, Casey, Dry Fork East, and Skinner Creek subwatersheds.	F&W	2	X	X	X	X	X
G2/O4 The Fish and Wildlife Program Manager will review proposed construction projects and advise project proponents to design and site projects within the Casey Creek, Saline Creek, Fletcher's Fork Creek, Jordan Creek and Piney Fork Creek subwatersheds such that removal of forest is minimized.	F&W	0	X	X	X	X	X
G2/O5 Construct and maintain bat boxes throughout the Cantonment Area to mitigate tree removal from the developed portion of the Installation.	F&W	2	X	X	X	X	X
G3/O1 Conduct installation-wide mist net surveys annually to monitor presence of listed bats on the installation.	F&W	0	X	X	X	X	X
G3/O2 Implement annual acoustic surveys for Indiana bats (to include active/mobile and passive/stationary surveys).	F&W	0	X	X	X	X	X
G3/O3 Develop and implement plans to investigate the presence of bats and habitat suitability in caves that may provide roosting habitat for gray bats or Indiana bats.	F&W	1	X	X	X	X	X
G3/O4 Continue monitoring the presence of bats in Cold War Era bunkers.	F&W	1	X	X	X	X	X
G3/O5 Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region. Review the results of mist net surveys conducted near Fort Campbell and determine the capture rate of gray bats and Indiana bats.	F&W	1	X	X	X	X	X
G3/O6 Develop and carry out a seismic study to determine the impacts from the training mission on local hibernacula.	F&W	2	X	X	X	X	X
G4/O1 Annually coordinate with the USFWS Tennessee and Kentucky Ecological Services Offices to discuss long-term conservation plans and regional trends associated with Indiana bats and gray bats.	F&W	0	X	X	X	X	X
G4/O2 Annually contact the KY and TN State Natural Heritage Divisions to obtain updated results of gray bat and Indiana bat monitoring conducted by the states.	F&W	2	X	X	X	X	X
G4/O3 Participate in the Tennessee Bat Working Group and the NMFWA Bat Working Group.	F&W	2	X	X	X	X	X
G5/O1 Annually evaluate the status of ESMC objectives; update the ESMC as necessary at least every five years.	F&W	0	X	X	X	X	X
G6/O1 Annually review the endangered species brochure and other EQO course materials pertaining to listed species, and updates those materials as necessary.	F&W	3	X	X	X	X	X
G6/O2 Provide the brochure in Appendix G to the EQO course and other appropriate installation users.	F&W	3	X	X	X	X	X
G6/O3 Provide the brochure in Appendix H to the EQO course and other appropriate installation users.	F&W	3	X	X	X	X	X
G7/O1 Ensure 100 % of lease agreements and Tract Management Plans minimize input of sediment, chemicals, and other contaminants into water resources.	AO	1	X	X	X	X	X
G7/O2 Ensure 100 % of timber sale contracts require Forestry Best Management Practices that minimize surface and ground water pollution.	Forestry	1	X	X	X	X	X
G8/O1 During inspections for the WMP, identify and create a GIS layer showing where vehicles cross streams at undesignated areas. Provide the data to the ITAM Program to encourage enforcement of crossing at designated locations.	F&W	2	X	X	X	X	X
G8/O2 Design and implement hardened stream crossings for sites essential to the training mission.	ITAM	3	X	X	X	X	X
G8/O3 Inspect streams within subwatershed(s) targeted in the WMP to identify degraded streambanks, damaged riparian buffers, and other sources of erosion. Add degraded areas to the water quality improvement project list.	F&W, ITAM	1	X	X	X	X	X

Goals, Objectives and Monitoring Actions	Lead Program(s)	Priority (Funding Class)	FY 20	FY 21	FY 22	FY 23	FY 24
G8/O4 During other NR management activities, inspect vegetation around sinkholes. Identify locations in the rear area where potentially polluted storm water run-off is intentionally routed to sinkholes or other karst features. Record in the GIS database features that are non-vegetated and receiving potentially polluted run-off. Add those sites to the water quality improvement project list.	F&W, Forestry, ITAM	2	X	X	X	X	X
G8/O5 Develop and implement site-specific plans to re-vegetate slopes and/or minimize polluted run-off into sinkholes or karst features.	ITAM	2	X	X	X	X	X
G8/O6 Continue to coordinate with local agencies to improve practices designed to reduce nonpoint sources of pollution.	All	3	X	X	X	X	X
G9/O1 Improve quality of water and aquatic habitat in streams not fully supporting designated uses, such that water quality and diversity/abundance of invertebrates are similar to regional benchmarks.	F&W	1	X	X	X	X	X
MA Annually sample aquatic macro-invertebrates at 20 sites. Compare results with the score established for Region 71e in *Regionally Based Biological Integrity Criterion*.	F&W	1	X	X	X	X	X
MA Conduct habitat assessments along streams as described in the WMP. Compare the habitat score with that established for Region 71e in *Habitat Quality of Least-Impacted Streams*.	F&W	1	X	X	X	X	X
G9/O2 Improve water quality in streams by identifying and rehabilitating eroding streambanks.	All	2	X	X	X	X	X
G9/O2a. Develop a list of projects to improve water quality in streams.	F&W	2	X	X	X	X	X
G9/O2b. Implement the LRAM program to address projects on the water quality improvement list.	ITAM	1	X	X	X	X	X
G9/O2c Implement water quality improvement projects not addressed by LRAM.	F&W, Forestry	3	X	X	X	X	X
G9/O3 Maintain concentrations of chemicals/nutrients related to agricultural activities below minimum detection limits in streams with sources on Fort Campbell. Where concentrations exceed minimum detection limits and the source is on Fort Campbell, the AO Program Manager will modify the TMP (e.g., frequency or formula of pesticide/fertilizer application), improve vegetated strips surrounding the field, or improve riparian vegetation to minimize run off.	AO	2	X	X	X	X	X
MA Sample water from 22 sites to identify presence of chemicals/nutrients associated with agricultural activities.	F&W	1	X	X	X	X	X
G10/O1 Work cooperatively with USFWS, TNC, KDFWR and TWRA to stay abreast of new and emerging data regarding WNS.	F&W	1	X	X	X	X	X
MA Maintain a file with updated decon procedures, new species affected, USFWS news releases, etc.	F&W	3	X	X	X	X	X
G10/O2 Assist USFWS, State and NGO biologists with local and regional WNS surveys.	F&W	2	X	X	X	X	X
MA Assist USFWS, State and NGO biologists with surveying caves for WNS in the region.	F&W	2	X	X	X	X	X
MA Assist USFWS, State and NGO biologists with other WNS surveys affecting local and regional bat populations.	F&W	2	X	X	X	X	X
G10/O3 Design and implement bunker exclusion structures for four bunkers known to support bats with symptoms of WNS.	F&W	2	X	X	X	X	X

Table 2. Checklist of projects required in the INRMP for which the Fish and Wildlife Program will request funds to implement during Fiscal Year 2020.

FY 2020 Projects	Priority (funding class)	Funds requested (Y/N)
Program staff salaries and recurring program costs.	0	
Conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities.	0	
Inspect timber harvests within 10 days to ensure compliance with project-specific conditions of agency coordination.	0	
Develop a protocol for inspecting forest in the Casey Creek and Saline Creek subwatersheds that is designated to become old growth.	1	
Construct and maintain bat boxes throughout the Cantonment Area to mitigate tree removal from that portion of the Installation.	2	
Implement annual mist-netting surveys to monitor presence of gray bats and Indiana bats.	0	
Implement annual acoustic surveys for Indiana bats (stationary and mobile).	0	
Investigate presence and suitability of caves that may provide roosting habitat for gray bats or Indiana bats.	1	
Continue monitoring the presence of bats in Cold War Era bunkers.	1	
Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region. Review the results of mist net surveys conducted near Fort Campbell. Use Anabat ultrasound detectors to compare relative abundance of foraging gray bats at three sites on Fort Campbell to three sites outside the installation.	1	
Develop and carry out a seismic study to determine the impacts from the training mission on local hibernacula.	2	
Participate in the Tennessee Bat Working Group and the NMFWA Bat Working Group (request funds for travel to meetings/training).	2	
Annually review the endangered species brochures and other EQO course materials pertaining to listed species, and update those materials as necessary.	3	
Provide the brochure in Appendix G to the EQO course and other appropriate installation users (request funds for printing).	3	
Provide the brochure in Appendix H to the EQO course and other appropriate installation users (request funds for printing).	3	
Sample aquatic macro-invertebrates at 20 sites. Compare results with local baselines established by TDEC.	1	
Conduct habitat assessments along streams as described in the WMP. Compare the habitat score with that established for Region 71e.	1	
Implement selected projects on the water quality improvement list that are not addressed by LRAM.	3	
Sample water from 22 sites to identify presence of chemicals/nutrients associated with agricultural activities.	1	
Design and implement bunker exclusion structures for four bunkers known to support bats with symptoms of WNS.	2	

Table 3. Checklist of projects required in the INRMP for which the Fish and Wildlife Program will request funds to implement during Fiscal Year 2021.

FY 2021 Projects	Priority (funding class)	Funds requested (Y/N)
Program staff salaries and recurring costs.	0	
Conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities.	0	
Inspect timber harvests within 10 days to ensure compliance with project-specific conditions of agency coordination.	0	
Construct and maintain bat boxes throughout the Cantonment Area to mitigate tree removal from that portion of the Installation.	2	
Implement annual mist-netting surveys to monitor presence of gray bats and Indiana bats.	0	
Implement annual acoustic surveys for Indiana bats (stationary and mobile).	0	
Investigate presence and suitability of caves that may provide roosting habitat for gray bats or Indiana bats.	1	
Continue monitoring the presence of bats in Cold War Era bunkers.	1	
Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region. Use Anabat ultrasound detectors to compare relative abundance of foraging Indiana bats at three sites on Fort Campbell to three sites outside the installation.	1	
Develop and carry out a seismic study to determine the impacts from the training mission on local hibernacula.	2	
Participate in the Tennessee Bat Working Group and the NMFWA Bat Working Group (request funds for travel to meetings/training)	2	
Annually review the endangered species brochures and other EQO course materials pertaining to listed species, and update those materials as necessary.	3	
Sample aquatic macro-invertebrates at 20 sites. Compare results with local baselines established by TDEC.	1	
Implement selected projects on the water quality improvement list that are not addressed by LRAM.	3	
Sample water from 22 sites to identify presence of chemicals/nutrients associated with agricultural activities.	1	
Design and implement bunker exclusion structures for four bunkers known to support bats with symptoms of WNS.	2	

Table 4. Checklist of projects required in the INRMP for which the Fish and Wildlife Program will request funds to implement during Fiscal Year 2022.

FY 2022 Projects	Priority (funding class)	Funds requested (Y/N)
Program staff salaries and recurring costs.	0	
Conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities	0	
Inspect timber harvests within 10 days to ensure compliance with project-specific conditions of agency coordination.	0	
Inspect 500 acres of forest in the Casey Creek and Saline Creek subwatersheds to verify progress toward old growth conditions.	1	
Construct and maintain bat boxes throughout the Cantonment Area to mitigate tree removal from that portion of the Installation.	2	
Implement annual mist-netting surveys to monitor presence of gray bats and Indiana bats.	0	
Implement annual acoustic surveys for Indiana bats (stationary and mobile).	0	
Investigate presence and suitability of caves that may provide roosting habitat for gray bats or Indiana bats.	1	
Continue monitoring the presence of bats in Cold War Era bunkers.	1	
Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region. Use Anabat ultrasound detectors to compare relative abundance of foraging Indiana bats at three sites on Fort Campbell to three sites outside the installation.	1	
Develop and carry out a seismic study to determine the impacts from the training mission on local hibernacula.	2	
Participate in the Tennessee Bat Working Group and the NMFWA Bat Working Group (request funds for travel to meetings/training)	2	
Annually review the endangered species brochures and other EQO course materials pertaining to listed species, and update those materials as necessary.	3	
Sample aquatic macro-invertebrates at 20 sites. Compare results with local baselines established by TDEC.	1	
Implement selected projects on the water quality improvement list that are not addressed by LRAM.	3	
Sample water from 22 sites to identify presence of chemicals/nutrients associated with agricultural activities.	1	

Table 5. Checklist of projects required in the INRMP for which the Fish and Wildlife Program will request funds to implement during Fiscal Year 2023.

FY 2023 Projects	Priority (funding class)	Funds requested (Y/N)
Program staff salaries and recurring costs.	0	
Conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities.	0	
Inspect timber harvests within 10 days to ensure compliance with project-specific conditions of agency coordination.	0	
Construct and maintain bat boxes throughout the Cantonment Area to mitigate tree removal from that portion of the Installation.	2	
Conduct installation-wide mist net survey to monitor presence of gray bats and Indiana bats.	0	
Implement annual acoustic surveys for Indiana bats (stationary and mobile).	0	
Investigate presence and suitability of caves that may provide roosting habitat for gray bats or Indiana bats.	1	
Continue monitoring the presence of bats in Cold War Era bunkers.	1	
Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region. Use Anabat ultrasound detectors to compare relative abundance of foraging Indiana bats at three sites on Fort Campbell to three sites outside the installation.	1	
Develop and carry out a seismic study to determine the impacts from the training mission on local hibernacula.	2	
Participate in the Tennessee Bat Working Group and the NMFWA Bat Working Group (request funds for travel to meetings/training)	2	
Annually review the endangered species brochures and other EQO course materials pertaining to listed species, and update those materials as necessary.	3	
Annually sample aquatic macro-invertebrates at 20 sites. Compare results with local baselines established by TDEC.	1	
Implement selected projects on the water quality improvement list that are not addressed by LRAM.	3	
Sample water from 22 sites to identify presence of chemicals/nutrients associated with agricultural activities.	1	

Table 6. Checklist of projects required in the INRMP for which the Fish and Wildlife Program will request funds to implement during Fiscal Year 2024.

FY 2024 Projects	Priority (funding class)	Funds requested (Y/N)
Program staff salaries and recurring costs.	0	
Conduct surveys for listed species as required to analyze effects of proposed projects or ongoing mission activities.	0	
Inspect timber harvests within 10 days to ensure compliance with project-specific conditions of agency coordination.	0	
Inspect 500 acres of forest in the Casey Creek and Saline Creek subwatersheds to verify progress toward old growth conditions.	1	
Construct and maintain bat boxes throughout the Cantonment Area to mitigate tree removal from that portion of the Installation.	2	
Implement annual mist-netting surveys to monitor presence of gray bats and Indiana bats.	0	
Implement annual acoustic surveys for Indiana bats (stationary and mobile).	0	
Investigate presence and suitability of caves that may provide roosting habitat for gray bats or Indiana bats.	1	
Continue monitoring the presence of bats in Cold War Era bunkers.	1	
Assess the relative abundance of foraging gray bats on Fort Campbell compared to similar sites in the region. Use Anabat ultrasound detectors to compare relative abundance of foraging Indiana bats at three sites on Fort Campbell to three sites outside the installation.	1	
Develop and carry out a seismic study to determine the impacts from the training mission on local hibernacula.	2	
Participate in the Tennessee Bat Working Group and the NMFWA Bat Working Group (request funds for travel to meetings/training).	2	
Initiate a 5-year review and update of the ESMC.	0	
Annually review the endangered species brochures and other EQO course materials pertaining to listed species; update materials as needed.	3	
Annually sample aquatic macro-invertebrates at 20 sites. Compare results with local baselines established by TDEC.	1	
Implement selected projects on the water quality improvement list that are not addressed by LRAM.	3	
Sample water from 22 sites to identify presence of chemicals/nutrients associated with agricultural activities.	1	

The source of funding for projects to achieve ESMC goals, objectives, and monitoring actions is primarily the Department of the Army. The Fort Campbell Endangered Species Program will request funds to implement the projects shown in Table 2. The ESMC objectives and monitoring actions listed in Table 2 are prioritized in accordance with Department of Defense Instruction 4715.3:

> Class 0: Recurring natural resources conservation management requirements. Activities needed to cover the recurring administrative, personnel, and other costs associated with managing the conservation program, and are necessary to meet applicable compliance requirements (Federal and State laws, regulations, Presidential Executive Orders [EOs], and DoD policies) or which are in direct support of the military mission.
>
> Class 1: Current compliance. Includes projects and activities needed because an installation is currently out of compliance; has a signed compliance agreement or has received a consent order; has not met requirements based on applicable Federal or State laws, regulations, standards, EOs, or DoD policies; and/or are immediate and essential to maintain operational integrity or sustain readiness of the military mission. Class 1 also includes projects and activities needed that are not currently out of compliance but shall be if projects or activities are not implemented in the current program year.
>
> Class 2: Maintenance requirements. Includes those projects and activities needed that are not currently out of compliance, but shall be out of compliance if projects or activities are not implemented in time to meet an established deadline beyond the current program year.
>
> Class 3: Enhancement actions beyond compliance. Includes those projects and activities that enhance conservation resources or the integrity of the installation mission, or are needed to address overall environmental goals and objectives, but are not specifically required under regulation or EO and are not of an immediate nature.

The Instruction indicates that Class 0 and 1 projects are “must fund,” while projects in Class 2 and Class 3 address maintenance and enhancement activities. Projects addressing legal requirements and the military mission are afforded first funding priority. Not all projects listed in the ESMC are “must fund,” and, due to budget constraints, Fort Campbell may not receive funds to execute all ESMC projects.

The Fort Campbell Fish and Wildlife Program employs five full-time professional biologists; two biologist specifically complete tasks that support endangered species management. The Fish and Wildlife Program has been successfully implemented at that staffing level and Fort Campbell expects to implement the program, as described in this ESMC, using the same level of staffing. Support from contractors will be sought on a project-specific basis depending upon the work load and expertise of Fort Campbell biologists.

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Appendix A
National Environmental Policy Act (NEPA) Documentation

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Appendix B
U.S. Department of the Army Interim Policy on Management of White-Nose Syndrome in Bats

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OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

SEP 2 0 2011

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY OF THE ARMY
(ENVIRONMENT, SAFETY AND OCCUPATIONAL HEALTH)
DEPUTY ASSISTANT SECRETARY OF THE NAVY
(ENVIRONMENT)
DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE
(ENVIRONMENT, SAFETY AND OCCUPATIONAL HEALTH)

SUBJECT: Interim Policy on Management of White Nose Syndrome in Bats

White-nose Syndrome (WNS) is a disease associated with the *Geomyces destructans* fungus that is rapidly spreading south and west across North America and causing unprecedented mortality of hibernating bats in the United States. As it spreads, the challenges for understanding and managing the disease continue to increase. Although WNS affects bats during hibernation, the effects extend well outside the cave and onto the summer maternity range. Thus, the effects from WNS-associated mortality may be observed across the landscape.

It is incumbent on DoD to manage its natural resources to ensure no net loss to readiness. Similarly, DoD activities must comply with legal requirements to protect listed bat species under the Endangered Species Act (ESA). Bats perform vital ecological services, such as eating nocturnal insects. WNS threatens the recovery of federally listed bat species populations and may hasten the listing of additional bat species, thereby posing a direct threat to mission readiness. All nine threatened and endangered bat species in the U.S., including the Indiana and gray bats, can occur on or near DoD military installations. The Indiana bat hibernates in many WNS positive sites, and the endangered gray bat recently tested positive for the fungus that causes WNS, postponing the possible delisting of this species with potential long-term consequences for DoD.

Research indicates that WNS may be transmitted in two ways: bat-to-bat transmission is believed to be the primary route, and circumstantial evidence suggests humans may inadvertently carry WNS from site-to-site. Should WNS spread to caves located on military installations, these caves, along with surrounding areas, may become access-restricted, which could significantly reduce the number of caves available for training. It is imperative that installations develop strategies to mitigate potential military mission impacts.

All military installations and ranges with known populations of bats shall implement, to the extent feasible and when appropriate, strategies to help combat the spread of WNS. Specifically, affected military installations shall:

- Incorporate WNS management strategies into installation Integrated Natural Resources Management Plans, including strategies to identify, avoid, and mitigate effects prior to the arrival of WNS.

- Ensure procedures are in place to guarantee the cleaning and sanitization of any clothing and equipment that may have come in contact with the *Geomyces destructans* fungus.
- Ensure surveillance procedures are in place to monitor bats for any new or expanding occurrences of WNS.
- Consider the recommendations in the U.S. Fish and Wildlife Service's *National Plan for Assisting States, Federal Agencies and Tribes in Managing WNS in Bats*, as appropriate.
- Work with the U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service, and other related agencies regarding WNS reporting and the management of caves, mines, and other affected sites.
- Share up-to-date information with the U.S. Fish and Wildlife Service and state fish and wildlife agencies.

My point of contact is Mr. Peter Boice, who can be reached at 703-604-0524.

Maureen Sullivan
Director, Environmental Management
Office of the Deputy Under Secretary of Defense
(Installations and Environment)

Appendix C
White-Nose Syndrome Decontamination Protocol

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National White-Nose Syndrome Decontamination Protocol - Version 04.12.2016

I. INTRODUCTION

The fungus *Pseudogymnoascus destructans* (*Pd* – formerly identified as *Geomyces destructans*) is the cause of white-nose syndrome (WNS), a disease that has resulted in unprecedented mortality of hibernating bats throughout eastern North America. Since first documented in New York in 2006, WNS continues to threaten hibernating populations of bats across the continent, having spread rapidly through the Northeast, mid-Atlantic, Midwest, and Southeast states, as well as eastern Canada.

Best available science indicates that *Pd* arrived in North America from a foreign source. Once *Pd* has been detected, either on bats or in the hibernaculum environments, the county of occurrence is considered contaminated indefinitely due to the long-term persistence of the fungus. Because of the devastating effects of WNS in North America, recommendations detailed in this document were developed to minimize the risk of human-assisted transmission. All persons who come into contact with bats, their environments, and/or associated materials for any reason (*e.g.*, research, recreation, etc.) are advised to take precautions to avoid additional, inadvertent transport of *Pd* to uncontaminated bats or habitats.

Observations of live or dead bats (multiple individuals at a single location) should be reported to local USFWS Field Office or State agency wildlife office http://www.whitenosesyndrome.org/partners. **Do not handle bats unless you are properly trained, vaccinated, and, where necessary, authorized in writing to do so by the appropriate government agency.**

II. PURPOSE:

The purpose of this document is to provide recommendations based on the best available scientific information known to effectively clean and treat (herein referred to as decontaminate, or similar derivation thereof) clothing, footwear, and/or gear (herein collectively referred to as equipment) that may have been exposed to *Pd*. When activities involve contact with bats, their environments, and/or associated materials the following decontamination procedures are designed to reduce the risk of human-assisted transmission of the fungus to other bats and/or habitats.

For the protection of bats and their habitats: 1) comply with all current cave and mine closures, advisories, and regulations on federal, state, tribal, and private lands; 2) follow relevant recommendations found in this document; and 3) **do not transport any equipment into or out of the United States of America** (USA) that has been in contact with bats or their environments.

Local, state, federal, or other management agencies may have additional requirements or clarifications for equipment used on lands under their jurisdictions[1] or work involving public trust resources. Always follow all state and/or federal permit conditions. Contact the respective agency representatives for supplemental documents or additional information.

III. PRODUCT USE:

Ensuring the safety of individuals using any of the applications and/or products identified in this document must be the first priority. Safety data sheets (SDS) for chemicals and user's manuals for equipment developed by product manufacturers provide critical information on the physical properties, reactivity, potential health hazards, storage, disposal, and appropriate first aid procedures for handling, application, and disposing of each product in a safe manner. Familiarization with the SDS for chemical products, and manufacturer's product care and use standards, will help to ensure appropriate use of these materials and safeguard human health. Read

product labels in advance of intended field use. Ensure availability of adequate emergency eye-wash supplies or facilities at intended site of use. Always store cleaning products out of the reach of children or pets.

It is a violation of federal law to use, store, or dispose of a regulated product in any manner not prescribed on the approved product label and associated SDS. Products, or their contaminated rinse water, must be managed and disposed of in accordance with local environmental requirements and, where applicable, product label, to avoid contamination of groundwater, drinking water, or non-municipal water features such as streams, rivers, lakes, or other bodies of water. Follow all local, state and federal laws. Requirements for product disposal may vary by state. Note: Quaternary ammonium wastewaters should not be drained through septic systems because of the potential for system upset and subsequent leakage into groundwater.

IV. TRIP PLANNING/ORGANIZATION:

1.) Identify the appropriate WNS Management Area (Figure 1) in which the equipment has been used and will be used in the future. Users of new or site-dedicated equipment (that has been and will be used in only one site) may skip to #3.

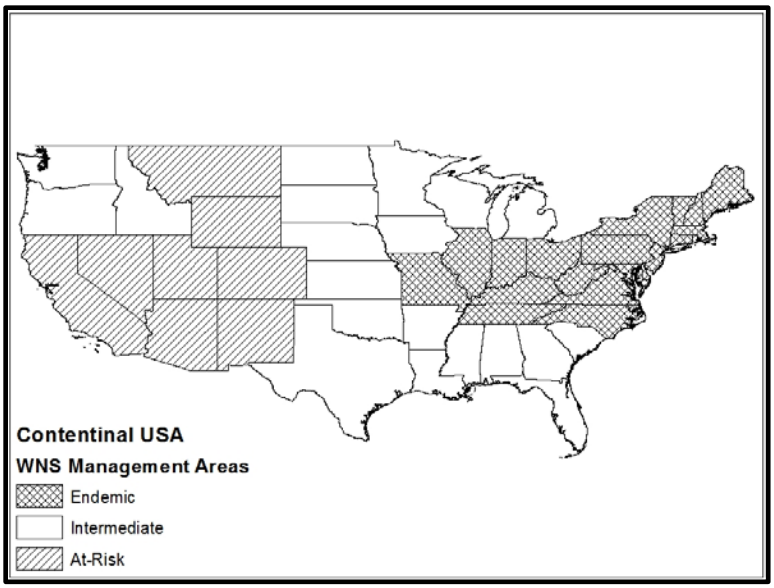


Figure 1. WNS Management Areas by state.

"Site" is loosely defined in this document as the location of a discrete bat roost (cave, barn, talus slope, etc.) or as a specific field location for mist netting or other trapping. Since conditions vary considerably, delineating sites will be at the discretion of the appropriate local regulatory or land management agency.

2.) Once the appropriate Management Areas have been determined using Figure 1, use Figure 2 to determine appropriate uses for A. Subterranean Equipment or B. Terrestrial Equipment. **"Subterranean equipment" includes any equipment that has ever been exposed to a cave/mine environment. "Terrestrial equipment" includes any equipment that has not previously been exposed to a cave/mine environment.** Regardless of the equipment designation, equipment should only be reused at similarly classified or progressively more contaminated locations[2]. In addition, given uncertainties in the distribution of *Pd* in the Pacific Northwest (i.e., ID, OR, & WA), subterranean and terrestrial equipment should not be transferred between the PNW and eastern USA (endemic/intermediate).

3.) Contact local state/federal regulatory or land management agencies for additional requirements, exemptions, or addendums on lands under its jurisdiction that supplement guidance provided in Figure 2A and 2B.

4.) Choose equipment that can be most effectively decontaminated [*e.g.*, rubber or synthetic rather than leather boots], otherwise commit use of equipment to a specific location (herein referred to as equipment dedication)**.** Equipment should always be inspected for defects prior to use. Replace all defective or degraded equipment with new equipment. Brand new equipment can be used at any location where access is permitted, as long as it has not been stored or come in contact with contaminated equipment.

After cleaning and decontamination, the following symbols indicate that equipment transfer/movement is:

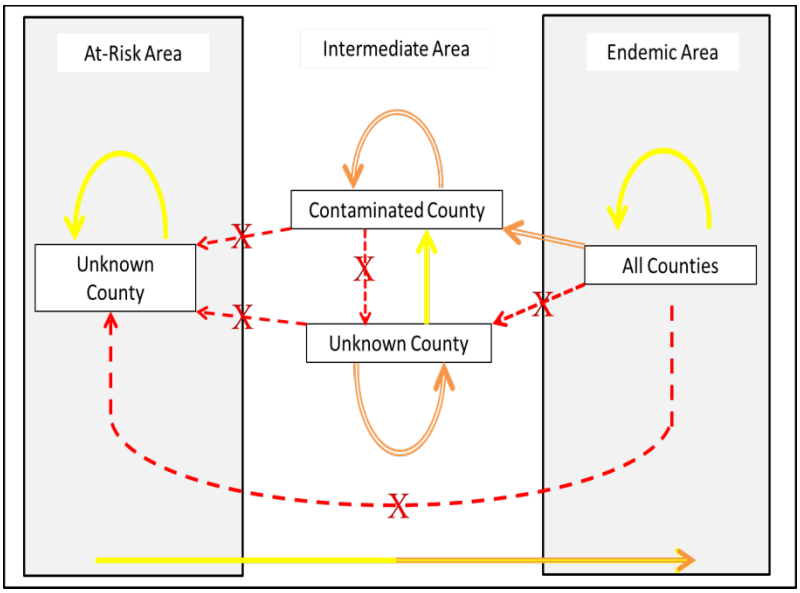
Not recommended

At the discretion of the responsible state/federal land management agency

Acceptable

A. <u>Subterranean</u> Equipment recommendations by WNS Management Area and

<u>COUNTY</u>



B. <u>Terrestrial</u> Equipment recommendations by WNS Management Area and

<u>STATE</u>

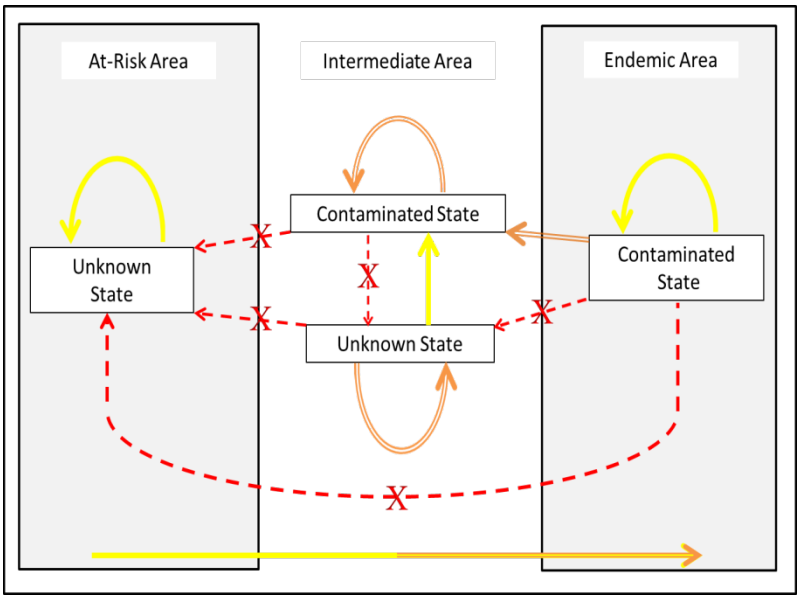


Figure 2. Movement recommendations for decontaminated (A) Subterranean and (B) Terrestrial equipment.

5.) Prepare a strategy (*i.e.*, Outline how/where all equipment and waste materials will be contained, stored, treated and/or discarded after returning to the vehicle/base area) that allows daily decontamination of equipment and, where applicable, between individual sites visited on the same day, **unless** otherwise directed by local state/federal or land management agency instructions. Confirmed *Pd* contaminated sites or those with a high index of suspicion for contamination should be visited **only after** those sites of unknown *Pd*/WNS status[2] have been visited, to further reduce the risk of inadvertent transmission.

V. PROCEDURES FOR DECONTAMINATION:

1.) On site:

a.) Thoroughly remove sediment/dirt from equipment immediately upon exiting from the site.

b.) Contain all exposed and potentially contaminated equipment in sealed bags/containers for treatment away from the location. Decontaminate the outside hard, non-porous surfaces of containers and bags prior to moving them to a secondary location (*e.g.*, vehicles, labs, or storage). Store all exposed and decontaminated equipment separately from unexposed equipment.

c.) Clean hands, forearms, and exposed skin using hand/body soaps/shampoos and, when feasible, change into clean clothing and footwear prior to entering a vehicle.

2.) Off site:

a.) REMOVE dirt and debris from the outside of vehicles (especially wheels/undercarriage) prior to additional site visits, especially when traversing WNS Management areas or scenarios categorized as "Not Recommended" (Figure 2).

b.) CLEAN submersible and non-submersible equipment according to manufacturer's specifications. Sediments and debris significantly reduce the effectiveness of treatments. Laboratory trials[3&4] demonstrate that the use of conventional cleansers like Woolite® detergent or Dawn® dish soap aided in the removal of sediments and debris prior to treatment, contributing to the effectiveness of decontamination.

c.) TREAT submersible or non-submersible equipment only in a safe manner according to the equipment and product labels using the most appropriate application or product listed in Table 1. For equipment that cannot safely be treated in accordance with both the manufacturer's recommendations and product labeled instructions, dedicate to individual sites as determined appropriate in Section IV.

i. Submersible Equipment (*i.e.*, equipment that can safely withstand submersion in water or other specified product for the recommended amount of time without compromising the integrity of the item):

Treatment of submersible equipment must be done in accordance with manufacturer's recommendations for your equipment. The preferred treatment for all submersible equipment is submersion in hot water that maintains a temperature of at least 55ºC (131ºF) for a minimum of 20 minutes. Ensure that all equipment surfaces remain in direct contact (*i.e.*, avoid all trapped air) with the hot water treatment for the duration of the treatment period. Consider that although many commercial and home washing machines with sanitize (or allergen) cycles may be capable of submerging gear in the recommended hot water application for the required time, it is incumbent on the user to be sure that machines to be used attain and sustain the needed temperatures throughout the process. If heat may comprise the safety and/or integrity of the otherwise submersible equipment, consider equipment dedication or other products listed in Table 1. When considering other products found in Table 1, recognize that the applicability and effect of such products on the safety and integrity of equipment remains untested. Be aware the use of preferred applications and products in Table 1 should be done with extreme caution and proper personal protective gear due to the risk of personal injury.

ii. Non-submersible Equipment (*i.e.*, equipment that may be damaged by liquid submersion):

Treat all non-submersible equipment using the most appropriate application or product in Table 1 that complies with the equipment manufacturer's recommendations and product label instructions, where applicable. The listed applications or products may not be appropriate or safe for non-submersible equipment. Dedication of equipment should always be considered the preferred application in these circumstances.

d.) RINSE equipment, as appropriate, thoroughly in clean water, particularly items that may contact humans, bats, or sensitive environments. Allow all equipment to completely dry prior to the next use.

e.) DECONTAMINATE the equipment bins, sinks, countertops and other laboratory, office, or home areas with the most appropriate applications or products in Table 1.

Table 1. Applications and products with demonstrated efficacy against Pd [3, 4, 5, 6, & 7]. Remember to consult equipment labels, registered product labels, and the appropriate SDS for regulations on safe and acceptable use.

	Tested Applications & Products [3, 4, 5, 6, & 7]	Federal Reg No.:	Laboratory Results
Preferred Applications	Equipment Dedication	N/A	Clean according to manufacturer standards and dedicated to a site
	Submersion in Hot Water[4, 6, & 7]	N/A	Laboratory effectiveness demonstrated upon submersion in water with sustained temperature $\geq 55^{o}C$ *(131°F)* for 20 minutes.
Other Products	Ethanol (60% or greater)[4, 6, & 7]	CAS - 64-17-5	Laboratory effectiveness demonstrated upon exposure in solution for at least 1 minute.
	Isopropanol (60% or greater)[4, 6, & 7]	CAS - 67-63-0	
	Isopropyl Alcohol Wipes (70%)[4, 6, & 7]	CAS - 67-63-0	Laboratory effectiveness demonstrated immediately following contact and associated drying time.
	Hydrogen Peroxide Wipes (3%)[4, 6, & 7]	CAS - 7722-84-1	
	Accel®[4, 5, 6, & 7]	EPA - 74559-4	Laboratory effectiveness demonstrated when used in accordance with product label.
	Clorox® Bleach[3, 4, 5, 6, & 7]	EPA - 5813-100	
	Clorox® Wipes[4, 5, 6, & 7]	EPA - 5813-79	
	Clorox® Clean-Up Cleaner + Bleach[4, 5, 6, & 7]	EPA - 5813-21	
	Hibiclens®[4, 5, 6, & 7]	NDA - 017768	
	Lysol® IC Quaternary Disinfectant Cleaner [3, 4, 5, 6, & 7]	EPA - 47371-129	

Other effective treatments with similar water based applications or chemical formulas (e.g., a minimum of 0.3% quaternary ammonium compound) may exist but remain untested at this time. Find more information on the EPA or FDA registered product labels by accessing the individual hyperlink or searching EPA or FDA Registration Numbers at: http://iaspub.epa.gov/apex/pesticides/f?p=PPLS:1 or http://www.accessdata.fda.gov/scripts/cder/drugsatfda/index.cfm.

Products with USEPA registration numbers mitigate persistence of living organisms on surfaces and are regulated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA, 7 USC 136, et seq.). FIFRA provides for federal regulation of pesticide distribution, sale, and use. Within FIFRA, pesticides are defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. FIFRA further defines pests as any insect, rodent, nematode, fungus, weed, or any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other micro-organism (except viruses, bacteria, or other micro-organisms on or in living man or other living animals) which the Administrator declares to be a pest under section 25(c)(1). Find more information on FIFRA at: http://www.epa.gov/oecaagct/lfra.html.

VI. EQUIPMENT AND ACTIVITY SPECIFIC RECOMMENDATIONS:

It is the responsibility of the users of this protocol to read and follow the product label and SDS. The product label is the law!

A. Clothing & Footwear:

IMPORTANT: All clothing (*i.e.*, inner and outer layers) and footwear should be decontaminated after every site visit using the most appropriate Application/Product in Table 1 or otherwise cleaned and dedicated for use at individual sites or areas as determined appropriate in Section IV.

Use of a disposable suit (*e.g.*, Tyvek® or ProShield®) or site-dedicated, reusable suit (*i.e.*, coveralls) is an appropriate strategy to minimize sediment/soil accumulation on clothing during a cave/mine or bat research activity. As stated earlier, all clothing layers should still be decontaminated or otherwise cleaned and dedicated after every use.

Disposable items, regardless of condition, should not be reused. Contain all used equipment in plastic bags upon final exit from a site, separating disposable materials from reusable equipment. Seal and store plastic bags in plastic containers until trash can be properly discarded, and/or exposed reusable equipment can be properly decontaminated off site.

B. Cave/Mine and other Subterranean Equipment:

Dedicate, as necessary, or decontaminate all cave/mine equipment (*e.g.*, backpacks, helmets, harness, lights, ropes, etc.) using the most appropriate guidance in Section V. Most types of equipment, including but not limited to, technical and safety equipment, have not undergone testing for safety and integrity after decontamination. Therefore carefully review and adhere to the manufacturer's care and use standards to maintain equipment functionality and safety protective features. If the application/product options in Table 1 are not approved by the manufacturer's care and use standards for the respective type of equipment, clean and inspect equipment according to manufacturer's specification and dedicate to similarly classified caves/mines/bat roosts and only reuse in progressively more contaminated caves/mines/bat roosts.

C. Scientific Equipment:

Always consider the use of disposable scientific equipment and materials between individual bats. All disposable scientific equipment (*e.g.*, work surfaces, bags/containers/enevelopes, exam gloves, etc.) should only be used on one bat, then discarded after use. Re-useable equipment (e.g., cotton bags, plastic containers, etc.) must be decontaminated between individual bats using the most appropriate application or product in Table 1. In all cases, use breathable bags (*e.g.*, paper, cotton, mesh, etc.).

At the completion of daily activities and when allowable by equipment and product labels, equipment may be autoclaved before reuse; otherwise use the guidance in Section V to determine the relevant procedure for decontamination of all work surface area(s) and equipment (*e.g.*, light boxes, banding pliers, holding bags, rulers, calipers, scale, scissors, wing biopsy punches, weighing containers, etc.).

D. Mist-Nets:

Contamination of trapping equipment is possible year-round when used at *Pd* contaminated hibernacula (NWHC, unpublished data). Dedicate, as necessary, or decontaminate all netting equipment (*e.g.*, netting, tie ropes, poles, stakes, etc.) using the most appropriate guidance in Section V for the particular equipment. All nets that are contacted by one or more bats must be decontaminated after each night of use according to the submersion in hot water application (Table 1). All nets should be completely dry prior to the next use.

E. Harp Traps:

Contamination of trapping equipment is possible year-round when used at *Pd* contaminated hibernacula (NWHC, unpublished data). Dedicate, as necessary, or decontaminate all trapping equipment (*e.g.*, lines,

frame, feet, bags, etc.) using the most appropriate guidance in Section V for the particular equipment. All trapping equipment that comes in contact with one or more bats OR enters a cave/mine/bat roost must be decontaminated after each night of use according to the most appropriate application or product (Table 1). Explore the use of disposable trap bags or liners to reduce transmission risks throughout each trapping effort. Disposable trap bags should be discarded at the end of each night.

F. <u>Acoustic Monitor, Camera, and Related Electronic Equipment:</u>

Dedicate, as necessary, or decontaminate all acoustic monitoring, camera, and related electronic equipment (*e.g.*, detector, camera, tablets, cell phones, laptops, carrying case, lenses, microphone(s), mounting devices, cables, etc.) using the most appropriate guidance in Section V for the particular equipment. The material composition of this equipment requires careful review and adherence to the manufacturer's care and use standards to maintain their functionality and protective features. If application/product options in Table 1 are not approved by the manufacturer's care and use standards for the respective type of equipment, clean equipment accordingly and dedicate to similarly classified caves/mines/bat roosts or only reuse in progressively more contaminated caves/mines/bat roost. Electronic devices used as terrestrial equipment, independent of bat handling work, pose a limited risk of transmission (*i.e.*, driving transects or fixed point detector surveys not associated with a cave/mine/bat roost entrance).

Equipment used in a cave/mine/bat roost may be placed in a sealed plastic casing, plastic bag, or plastic wrap to reduce the potential for contact/exposure with contaminated environments. Prior to opening or removing any plastic protective wrap, first clean, then remove, and discard all protective wrap. This technique has not been tested and could result in damage to, or the improper operation of, equipment.

These recommendations are the product of the multi-agency WNS Decontamination Team, a sub-group of the Disease Management Working Group established by the National WNS Plan (A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats, finalized May 2011). On 15 March 2012 a national decontamination protocol was approved and adopted by the WNS Executive Committee, a body consisting of representatives from Federal, State, and Tribal agencies which oversees the implementation of the National WNS Plan. The protocol will be updated as necessary to include the most current information and guidance available.

1 To find published addenda and/or supplemental information, visit http://www.whitenosesyndrome.org/topics/decontamination.

2 Visit http://www.whitenosesyndrome.org/resources/map for the most updated information on the status of county and state. County and state level determination is made after a laboratory examination and subsequent classification of bats according to the current WNS case definitions. Definitions for the classification can be found at http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/Case%20Defintions%20for%20WNS.pdf . Contaminated determination includes both confirmed and suspect WNS classifications.

3 Information from : V. Shelley, S. Kaiser, E. Shelley, T. Williams, M. Kramer, K. Haman, K. Keel, and H.A. Barton – Evaluation of strategies for the decontamination of equipment for *Geomyces destructans*, the causative agent of White-Nose Syndrome (WNS) Journal of Cave and Karst Studies, v. 75, no. 1, p. 1–10. DOI: 10.4311/2011LSC0249

4 Efficacy of these agents and treatments are subject to ongoing investigation by the Northern Research Station, USDA Forest Service Cooperative Agreement 13-IA-11242310-036 (U.S. National Park Service and U.S. Forest Service) & 16IA11242316017 (U.S. Fish and Wildlife Service and U.S. Forest Service). Information contained in this protocol from work associated with either agreement will continue to be revised, as necessary, pending results of these investigations.

5 The use of trade, firm, or corporation names in this protocol is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by state and/or federal agencies of any product or service to the exclusion of others identified in the protocol that may also be suitable for the specified use.

6 Product guidelines should be consulted for compatibility of use with one another before using any decontamination product. Also, detergents and quaternary ammonium compounds (*i.e.*, Lysol® IC Quaternary Disinfectant Cleaner) should not be mixed directly with bleach as this will inactivate the bleach and in some cases produce a toxic chlorine gas. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

7 Final determination of suitability for any decontaminant is the sole responsibility of the user. All users should read and follow all labeled instructions for the products/applications and/or understand associated risks prior to their use. Treatments and the corresponding procedures may cause irreversible harm, injury, or death to humans, bats, equipment or the environment when used improperly. Always use personal protective equipment in well-ventilated spaces to reduce exposure to these products or applications.

Appendix D
USFWS Communications

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

September 12, 2012

Mr. Gene Zirkle
Directorate of Public Works
Environment Division
United States Army Garrison, Fort Campbell
Building 865, 16th Street
Fort Campbell, Kentucky 42223

Dear Mr. Zirkle:

This message is being provided to regulatory agencies, land managers, biological consultants, and others to describe the approach used by the Tennessee Ecological Services Field Office (TFO) of the U. S. Fish and Wildlife Service to ensure protection and recovery of the federally endangered Indiana bat (*Myotis sodalis*) in Tennessee. The TFO seeks to close the gap in our knowledge of the species' behavior and habitat use in Tennessee during non-hibernation periods. We intend to use this information to identify measures for the conservation of foraging and roosting habitats and to provide guidance and assistance so that projects potentially affecting Indiana bats or their habitats are consistently evaluated.

The Indiana bat is broadly distributed throughout much of the eastern United States, and Tennessee is near the southern extent of its range. The species hibernates, often in large colonies, in caves or mine shafts; and it roosts primarily in trees during the non-hibernation season. Female Indiana bats exhibit year-to-year fidelity to roosting areas, returning to sites occupied during previous summers. Maternity colonies (groups of adult females and their offspring) often reach numbers of 30 to 100 bats, and individual bats' attempts to re-establish colony dynamics may become more difficult if primary or secondary roosting structures have been removed—especially in situations where these structures are locally limited.

Indiana bats have undergone a precipitous decline in the northeastern United States because of white-nose syndrome (WNS), a disease that has affected several bat species. WNS was first discovered in New York in 2006, spreading throughout the range of the Indiana bat, and it was first documented in Tennessee in 2010. The disease has recently been implicated in observed shifts in seasonal Indiana bat activity, but the full impacts of continued spread of the disease remain to be documented.

In general, the relationships between hibernating Indiana bat populations and non-hibernating populations are poorly known. Specifically, little documentation exists regarding the species' summer distribution in Tennessee. Very few Indiana bat summer surveys were conducted in the state prior to 2010. As a result, it is difficult to interpret how the loss of potential summer habitat in Tennessee might affect national, regional, and local population trends. Protecting summer roosting habitat from project-related indirect and cumulative effects may be much more important to Indiana bat recovery than previously understood.

The TFO focused its earlier Indiana bat conservation and recovery efforts on protection of known hibernacula. In situations where proposed projects required tree clearing, felling during the period when bats were not present at project sites (i.e., during hibernation) was recommended. However, because of the uncertainty about Indiana bat summer distribution in Tennessee and the importance of these populations especially in light of range-wide WNS declines, the TFO has adopted a more conservative framework for evaluating potential project-related impacts and cumulative landscape-level changes to Indiana bats and their habitats. The TFO currently considers all forested portions of the state to potentially provide suitable roosting habitats for Indiana bats. Indeed, increased survey efforts have resulted in documentation of Indiana bat reproduction in previously unknown maternity roost areas. Evidence of the species' presence in other parts of Tennessee is expected with increased surveying during summer. In order to reduce or more clearly focus future survey efforts, however, we are assimilating positive and negative survey data for use in habitat suitability models that we hope will more precisely identify potential Indiana bat summer habitat specific to Tennessee's physiography.

A habitat survey will identify the appropriate steps to take to evaluate potential Indiana bat impacts that could result from a proposed project or activity. A biologist with knowledge of bat roosting habitat should conduct these surveys. If suitable roosting habitat is present within a proposed project area and its removal cannot be avoided, the next step is to conduct a bat survey using acoustic monitoring and mist-netting methods. Note that acoustic-only surveys (i.e., without netting during the initial survey stage) may be an option on a national level as the standard survey method in 2013. Biologists with knowledge of Indiana bats and state and federal permits allowing Indiana bat survey or collection should conduct bat surveys. An Indiana bat range-wide survey guidance document should be available next spring on the TFO web site.

An appropriate level of survey effort, as specified in the survey guidance document, will be required for the TFO to concur with a determination that the species may or may not be affected by a proposed project because the species is present or likely absent. Therefore, survey plans should be coordinated with and approved by the TFO. Survey reports should be submitted to us and to the Tennessee Wildlife Resources Agency (TWRA). Following receipt of field survey reports, the TFO will recommend appropriate actions to eliminate or reduce project-related impacts. TWRA may also provide input during this phase of project planning.

In situations where a minimal number of suitable roosting structures are present, individual suitable roosting structures could be surveyed between May 15 and August 15 from sunset to complete darkness. If no bats are observed exiting the structure, it could be felled within 24

hours. Depending upon the landscape context surrounding a proposed project, winter-time removal of a small proportion of roosting structures that are marginally suitable for use by Indiana bats may be acceptable.

Other methods for addressing potential impacts to Indiana bats may be available and would be discussed with the TFO and TWRA. For example, compensation through deposit of funds into an Indiana Bat Conservation Fund (IBCF) may be an option in situations where avoidance and minimization of impacts to Indiana bat roosting habitat are not sufficient. However, this option involves development of project-specific memoranda of agreement; and it should be a last resort.

We appreciate your cooperation as the TFO develops measures to protect and recover the Indiana bat and to incorporate new information about the species' distribution in Tennessee. The TFO welcomes your input to this process. For greater understanding of the TFO framework for conserving Indiana bat summer habitat, refer to the "Interim Indiana Bat Mitigation Guidance for the State of Tennessee", which can be found at http://www.fws.gov/cookeville/. Please continue to visit this site for update of the guidance. A list of contact information for consultants with permits required for conducting surveys for federally-listed bat species is also located at this web site, and a survey guidance document should be available there prior to the 2013 survey season. Please feel free to call David Pelren of my staff at 931-525-4974 or email him at *david_pelren@fws.gov* for assistance with this topic.

Sincerely,

Peggy W. Shute

for Mary E. Jennings
Field Supervisor

Appendix E
Indiana Bat Summer Survey Guidance

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U.S. Fish and Wildlife Service

RANGE-WIDE INDIANA BAT SURVEY GUIDELINES

March 2020

Table of Contents

Cover Photos/Graphics: Mike Coffey/USFWS, Mark Ford/USFS (USGS at present), Andrew King/USFWS, Keith Lott/USFWS, Alex Morrison/VA Tech, and Alex Silvis/VA Tech (RES at present).

RANGE-WIDE INDIANA BAT SURVEY GUIDELINES

(modifications from the previous guidelines are in **blue**)

INTRODUCTION

The Indiana bat (*Myotis sodalis*) was originally listed as being in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001, March 11, 1967), and is currently listed as endangered under the Endangered Species Act (ESA) of 1973, as amended. This survey protocol provides the U.S. Fish and Wildlife Service's (USFWS) recommended guidance on survey methods and outlines additional reporting requirements for surveyors.

The following guidance is designed to determine whether Indiana bats are present[1] or absent (P/A)[2] at a given site during the summer (May 15 to August 15; Table 1). The phased-approach, which includes coordination with the USFWS[3], habitat assessments, and acoustic, mist-net, radio-tracking, emergence, "outer-tier project", and potential bat hibernacula surveys, supersedes all prior summer survey guidance. Future changes to this guidance may occur and will be posted on the USFWS Indiana bat survey guidance website (http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html). Please check this website to ensure use of the most current version of the guidance.

These protocols may be different from those designed for general bat monitoring as part of the North American Bat Monitoring Program (NABat)[4]. NABat surveys may be thought of as similar to breeding bird surveys and are not project-specific surveys in most cases. Information from NABat surveys can be considered as part of "best available" information when assessing whether there is already some existing information on presence of Indiana bats in the vicinity of a given project.

NOTE: These protocols can also be used for northern long-eared bat (NLEB) P/A summer surveys. The only differences from Indiana bat guidelines at present are 1) our definition of suitable summer habitat for NLEBs, 2) a weather-related exception in the northern portion of the NLEB range, and 3) that internal P/A surveys of potential hibernacula are not allowed for NLEB due to difficulty/low confidence in visually detecting their presence.

OBJECTIVES

The objectives of Indiana bat survey guidelines are to: (1) standardize range-wide survey procedures; (2) maximize the potential for detection/capture of Indiana bats at a minimum acceptable level of

[1] The guidance are not intended to be rigorous enough to provide sufficient data to fully determine population size or structure.
[2] Recognizing protocols are not 100% likely to detect Indiana bats when present and identification errors may occur.
[3] Coordinate with the appropriate state natural resource agencies and any involved federal agency(ies) whenever "USFWS" coordination is listed. USFWS FO(s) may direct project sponsors to state agencies for existing occurrence information. Coordinate with your local USFWS FO(s) to understand the process for their area of jurisdiction.
[4] Loeb et al. 2015 available at https://www.fort.usgs.gov/products/23886

effort; (3) make accurate presence/absence determinations; and (4) aid in conservation efforts for the species by identifying areas where the species is present.

BACKGROUND

In 2011, the USFWS developed a multi-agency team to determine whether improvements could be made to the 2007 Indiana Bat Mist-Net Protocols. The team included members of the four USFWS regions (Midwest, Northeast, Southeast, and Southwest) where Indiana bats are known to occur, representatives of state natural resource agencies from three of those four regions (Midwest, Northeast, and Southeast), and representatives from three federal agencies (U.S. Geological Survey (USGS), Department of Defense, and U.S. Forest Service). We obtained informal peer review of the draft guidelines in February 2012, gathered additional information in 2012, and made a revised version available for public comment in 2013 [78 FR 1879, January 9, 2013, and 78 FR 9409, February 8, 2013]. The USFWS implemented revised guidance in 2014. The USFWS made some additional revisions to the guidelines each year from 2015 to 2019. The USGS conducted initial independent testing of automated acoustic software programs during the winter of 2014-15 and continues to test new versions of available software using software testing procedures updated in January 2019[5]. The USFWS continues to make revisions to the guidelines each year as appropriate.

We considered the best available information for all aspects of the guidance. For example, please see our white paper[6] and 2018 addendum outlining the methodologies used to determine the minimum level of survey effort. The USFWS continues to work with local, State, and Federal biologists; scientific and academic institutions; commercial organizations; and other interested parties to collect additional data on the distribution, ecology, and biology of the Indiana bat and looks forward to receiving any additional pertinent information.

GENERAL PROCESS

Indiana bat surveys for some proposed projects will require modification (or clarification) of this guidance through coordination with the USFWS FO(s) responsible for the state(s) in which the project occurs[7]. If not already required by federal permit, federal action agencies and surveyors should develop a proposed survey study plan in coordination with the USFWS FO(s) so that all parties fully understand which methods will be deployed, what assumptions will be made, and what the various outcomes would be based on the results of each step. Project proponents may stop survey work at any point once an assumption or documentation of Indiana bat presence occurs. Pre-survey

[5] Revised USFWS Software Testing Procedures are discussed at: https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/pdf/USFWS_Software_Testing_Procedures_13Jan2019.pdf

[6] The white paper and 2018 addendum are available at: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html

[7] For example, project sponsors for large acreage and/or landscape-scale projects that do not result in permanent habitat loss and would not pose an ongoing threat of lethal take, especially those proposed by land management agencies, may work with local USFWS FOs to apply different scales of surveys (broad vs. project-level) or different types of surveys, such as long-term monitoring results (e.g., forest-wide acoustic transect data) and/or targeted survey efforts (e.g., sub-sampling of large project areas), to address P/A concerns.

coordination typically will preclude the need for subsequent reviews of intermediate steps by USFWS FO(s) during the busy field season. An online directory of USFWS FO(s) is available at http://www.fws.gov/offices/. Unless otherwise agreed to by the USFWS, negative P/A survey results obtained using this guidance are valid for a minimum of five years[8] from their completion unless new information (e.g., other nearby surveys) suggest otherwise. If survey results are older than 5 years, please coordinate with the USFWS FO to discuss the pros and cons of conducting any additional surveys. If not already required by federal permit, please submit all results (negative or positive) from any phase to the USFWS FO(s). We strongly encourage this coordination as it improves the USFWS' understanding of (1) the level of survey effort underway and (2) the distribution of the species. A single report can be submitted at the end of all phases conducted for a given project.

USFWS FO-level coordination is also important during the survey planning process. The guidelines that are described in this document are designed to be implemented in typical habitats that are conducive to the standard survey techniques described herein. However, the USFWS recognizes that occasionally there may be some site-specific conditions in summer habitats or at potential hibernacula sites that do not lend themselves to being surveyed using the standard survey options (e.g., mist nets, acoustic detectors or harp traps) even though a site may otherwise meet the definition of suitable Indiana bat habitat. Therefore, we strongly encourage coordination with the FO(s) prior to using methods that may not be appropriate for site-specific habitat conditions.

Because surveys that result in the capture of Indiana bats result in take, such surveys should only be conducted by a qualified biologist[9]. Generally, a recovery permit for the Indiana bat authorizes the capture of bats for identification, and handling of bats for measurements, photography, and radio transmitter attachment; some (but not all) may also authorize entry into potential hibernacula to conduct internal surveys. Following this survey guidance will meet standard USFWS requirements; however, surveyors also need to ensure they meet all applicable state permitting and reporting requirements. Failure to follow the survey guidance, as written, and/or failure to follow a study plan which has received concurrence from the local USFWS FO(s), may result in a USFWS FO requesting additional survey effort.

The following provides a step-by-step outline of how Indiana bat summer surveys and/or potential hibernacula surveys should be conducted in 2020. Some of these steps can occur concurrently.

PHASE 1 – INITIAL PROJECT SCREENING

**Step 1. Coordinate with the U.S. Fish and Wildlife Service Field Office(s)[10] regarding existing Indiana bat summer and/or winter occurrence information. [*Projects located within known Indiana bat summer habitat and/or known hibernacula/spring-staging/fall-*

[8] The timeframe may be reduced if significant habitat changes have occurred in the area or increased based on local information.

[9] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for Indiana bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[10] Coordinate with the appropriate state natural resource agencies and any involved Federal Action agencies whenever "USFWS" coordination is listed. USFWS FO(s) may direct project sponsors to state agencies for existing occurrence information. Coordinate with your local USFWS FO(s) to understand the process for their area of jurisdiction.

***swarming zones will not proceed to Phase 2 of this process unless the project meets the definition of an "outer-tier project" outlined in Appendix G.*]**

a) If a project (located within or outside of a known maternity colony home range or spring-staging/fall-swarming zone of a known hibernaculum) is already covered under an existing Endangered Species Act (ESA) incidental take authorization (e.g., HCP, BO), then no further summer and/or potential hibernacula surveys are needed, follow the procedures previously authorized by the USFWS FO(s).

b) If there are known Indiana bat occurrences (e.g., known roost trees, capture locations, foraging locations or hibernacula) within the project action area[11]; **OR**

   if there are no known Indiana bat summer or spring/fall/winter occurrences within the proposed project area itself, but the project area is located within a known maternity colony home range and/or the spring-staging and fall-swarming zone of a known hibernaculum[12]; **OR**

   if the project is located outside a known maternity colony home range and/or spring-staging and fall-swarming zone of a hibernaculum, but is within the range of the Indiana bat (note this can change over time), then proceed to Step 2.

Step 2. Conduct Habitat Assessment (Desktop or Field-based; see Appendix A and Appendix H).

a) If suitable summer habitat and/or a potential hibernaculum(a) is present within the action area, then proceed to Step 3.

b) If both suitable summer and winter habitat (i.e., potential hibernaculum) are absent within the action area, then no further P/A surveys are recommended; however, additional coordination with the USFWS FO(s) may be recommended if Indiana bats may be present in an action area during other seasons (e.g., spring and fall migration) and may be affected by the proposed project.

Step 3. Assess potential for adverse effects to Indiana bats.

a) If the project is not anticipated to result in adverse effects to Indiana bats (as proposed), then no further summer and/or potential hibernacula surveys are recommended, coordinate with the USFWS FO(s).

b) If the project may result in adverse effects to Indiana bats, but the impacts can be adequately assessed and conservation measures can be designed to minimize those effects without additional P/A information (this includes **all** proposed projects within known summer maternity colony home ranges and/or at known hibernacula and their

[11] The "action area" is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. [50 CFR Section 402.02]
[12] See USFWS Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects (Questions 4 & 5) http://www.fws.gov/midwest/endangered/mammals/inba/WindEnergyGuidance.html

surrounding spring-staging and fall-swarming zones, but may include other areas as well), then no further surveys are recommended. Coordinate with the USFWS FO(s) regarding an assessment of the project's potential effects, development of conservation measures, determination of the need for any ESA incidental take authorization, and discussion of value of additional surveys.

c) If the project does not meet the conditions of 3a or 3b, then proceed to **Phase 2** and/or **Phase 5**.

PHASE 2 – SUMMER PRESENCE/ABSENCE SURVEYS (NETTING OR ACOUSTIC SURVEYS)[13]

Presence/probable absence of Indiana bats may be determined by conducting either Step 4 (mist-netting; see Appendix B) or Step 5 (acoustics; see Appendix C) as outlined below. It is the project proponent's choice as to which option to use, but they can only choose one method for each survey area unit (i.e., ≤123-acre area or 1-km section of linear project). Under no scenario can a project proponent use either mist-netting or acoustic Phase 2 surveys to challenge the other methods results. The USFWS accepts the results of either option and has no preference for methods. The USFWS FO(s) can discuss pros and cons of different approaches depending on project sponsor needs.

However, acoustics at the Phase 2 level of effort (LOE) (or otherwise agreed to with the USFWS FO) may be used as a coarse screening tool for conducting subsequent mist-netting at the Phase 2 LOE. For example, if NO high-frequency (HF) calls (≥35 kHz) are detected, then no netting is required within that 123-acre (non-linear) or 1-km (linear) survey area due to the probable MYSO absence. If ANY HF calls are detected, then mist-net at the Phase 2 LOE. Any project study plan that includes use of both acoustics and netting needs to be written clearly to avoid potential misunderstandings between the project proponent and the USFWS FO.

Also, Phase 2 acoustic results should be used to inform whether, when, and where to conduct any optional Phase 3 mist-netting. In this case, acoustics is the P/A method and if probable presence is detected (HF screen, automated/MLE, or manual vetting), then MYSO probable presence is established. Negative results from follow-up mist-netting (at any LOE) does not refute a previously established positive acoustic result. The goal of Phase 3 netting is simply to verify where MYSO are active and to capture and track individuals to document roost trees and population size to further inform consultation or coordination under the ESA.

The summer survey season is from 15 May through 15 August[14] for either survey option. The minimum prescribed survey level of effort for any given survey area unit (i.e., ≤123-acre area or 1-km section of linear project) **cannot** be completed in a single calendar night regardless of which

[13] NOTE: acoustic and/or mist-net surveys should be conducted in the best suitable habitat possible for each survey type to increase the likelihood of detecting/capturing Indiana bats. In some cases, the most suitable habitat for effectively conducting surveys may occur outside a project site boundary and may be sampled if landowner permission is available. For projects with multiple survey areas (e.g., >123 acres or >1 km), survey methods may be interchanged. For example, acoustics could be used for one 123-acre survey area and netting could be used for another 123-acre area.

[14] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

survey method (netting or acoustic) is used (i.e., minimum survey effort must be spread over at least 2 calendar nights). If netting is chosen as the preferred P/A method and an Indiana bat(s) is captured, then surveyors may immediately begin Phase 4/radio-tracking. Project proponents must decide whether they will proceed to Phase 4 in coordination with the USFWS FO before any mist netting occurs. Submit Phase 2 study plans to USFWS FO prior to conducting surveys.

Step 4. Conduct Mist-Netting Surveys following Recovery Unit-based Protocols[15] (see Figures 1 and 2 and Appendix B)

Northeast and Appalachia Recovery Units (CT, DE, MA, MD, NC, NJ, NY, PA, eastern TN, WV, VA, VT):

Linear projects: a minimum of 10 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 42 net nights per 123 acres (0.5 km^2) of suitable summer habitat.

For example:

- 7 sites, 2 nets/site for 3 calendar nights = 42 net nights
- 7 sites, 3 nets/site for 2 calendar nights = 42 net nights
- 3 sites, 2 nets/site for 7 calendar nights* = 42 net nights

*Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are recommended[16].

b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO.

Midwest and Ozark-Central Recovery Units (AL, AR, IA, IL, IN, GA, KY, MI, MO, MS, OH, OK, central & western TN, and Lee County, VA):

Linear projects: a minimum of 2 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 9 net nights per 123 acres (0.5 km^2) of suitable

[15] The Indiana bat populations in the Northeast and Appalachia Recovery Units have been most heavily impacted by white-nose syndrome to date; therefore, we recommend higher survey effort when compared to the Midwest and Ozark-Central Recovery Units. We have no recommendations for reducing the minimum level of effort required to demonstrate probable absence for projects <123 acres in size. Level of effort is based on detection probabilities and occupancy estimates that were derived from past survey efforts that used the same acreage threshold. Level of effort is designed to reach 90% confidence in negative survey results (see Niver et al. 2013).

[16] NOTE: For Phase 2 Presence/Absence Surveys, wherever the phrase "no further summer surveys are recommended" occurs within this document, the USFWS FO(s) is in affect assuming probable absence of Indiana bats.

summer habitat.

For Example:

- 3 sites, 1 net/site for 3 calendar nights = 9 net nights
- 1 site, 3 nets/site for 3 calendar nights = 9 net nights

The sampling period for each net shall begin at sunset[17] and continue for at least 5 hours (longer survey periods may also improve success).

*Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are recommended.
b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO.

OR

Step 5. Conduct Acoustic Surveys[18] (see Figures 1 and 2 and Appendix C)

Linear projects: a minimum of 2 detector nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 8 detector nights per 123 acres (0.5 km^2) of suitable summer habitat.

At least 2 detector locations per 123 acre "site" shall be sampled until at least 8 detector nights has been completed over the course of at least 2 calendar nights (may be consecutive).

For example:

- 4 detectors for 2 nights each (can sample the same location or move within the site)
- 2 detectors for 4 nights each (can sample the same location or move within the site)
- 1 detector for 8 nights (must sample at least 2 locations and move within the site – we recommend evenly distributing LOE among locations)

The acoustic sampling period for each site must begin at sunset[19] and end at sunrise each

[17] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

[18] Acoustic surveys are available as a Presence/Absence option throughout the range (i.e., Northeast, Appalachian, Midwest, and Ozark-Central Recovery Units).

[19] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

night of sampling.

Optional coarse screening - for high frequency (HF) or myotid calls (depending on available H/L frequency filters) or Proceed to Step 6

i) If no positive detection of HF calls[20] (≥35 kHz) or myotid calls, no further summer surveys recommended.

ii) If positive detection of HF or myotid calls, then
(a) proceed to Step 6 for further acoustic analysis; **OR**
(b) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
(c) assume presence and proceed to **Phase 3**.

Step 6. Conduct Automated Acoustic Analyses for each site that had HF or Myotid calls from Step 5 or ALL sites if Step 5 was not conducted.
(NOTE: cannot skip this step and proceed directly to Step 7)

Use **one or more** of the currently available 'approved' acoustic bat ID programs[21] (use most current approved software versions available and manufacturer's recommended settings for Indiana bat P/A surveys). 'Candidate' programs are not yet approved by USFWS for stand-alone use for Indiana bat P/A surveys, but may be used in conjunction with one or more of the approved programs. Include your plans for which specific software program(s) you will use in your survey study plan and submit for USFWS FO(s) review prior to conducting surveys. Beginning with acoustic data from night one at each acoustic site, run each night's data for each site through your chosen ID program(s). Review results by site by night from each acoustic ID program used[22].

a) If Indiana bat presence is considered unlikely by all of the approved and candidate program(s) used in analysis, then no further summer surveys recommended.

b) If Indiana bat presence is considered likely at one or more sites on one or more nights by any approved or candidate program(s) used in analysis, then

i) proceed to Step 7 for qualitative ID; **OR**
ii) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
iii) assume presence and proceed to **Phase 3**.

Step 7. Conduct Qualitative Analysis of Calls.

At a minimum, for each detector site/night a program considered Indiana presence likely

[20] HF calls are defined as individual call pulses whose minimum frequency is ≥35 kHz.
[21] Approved and candidate programs are listed at http://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html
[22] The approved acoustic identification programs all have implemented a maximum likelihood estimator (MLE) at this time. If the analysis of collected calls at a given site on a given night results in the probable presence of Indiana bats with high levels of certainty ($P<0.05$), then select one of the options available in Step 6b.

(from MLE results) review all files (including no IDs) from that site/night. Qualitative analysis[23] (i.e., manual vetting) must also include a comparison of the results of each acoustic ID program by site and night (see Reporting Requirements in Appendix C).

a) If no visual confirmation of probable Indiana bats, then no further summer surveys recommended[24].

b) If visual confirmation of probable Indiana bats, then

   i) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
   ii) assume presence and proceed to **Phase 3**.

PHASE 3. CONDUCT MIST-NETTING SURVEYS TO CAPTURE INDIANA BATS.

If netting was not conducted as the P/A method, then netting may be conducted in Phase 3 to capture and characterize (e.g., sex, age, reproductive condition) the Indiana bats that are present in an area and to facilitate Phase 4 efforts. We encourage working with the FOs to develop Phase 3 netting plans based on best available information (e.g., positive acoustic locations). There are no minimum requirements for this phase as this is not a P/A phase.

a) If no Indiana bats are captured, then coordinate with the USFWS FO.

b) If Indiana bats are captured, then proceed to **Phase 4**.

PHASE 4. CONDUCT RADIO-TRACKING AND EMERGENCE SURVEYS (See Appendices D and E).

PHASE 5. CONDUCT POTENTIAL HIBERNACULA SURVEYS

(See Appendix H)

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Amelon, S.K. 2007. Multi-scale factors influencing detection, site occupancy, and resource use by foraging bats in the Ozark Highlands of Missouri. PhD Dissertation. University of Missouri – Columbia.

Duchamp, J.E., M. Yates, R. Muzika, and R.K. Swihart. 2006. Estimating probabilities of detection for bat echolocation calls: an application of the double-observer method. Wildlife Society Bulletin 34(2):408-412.

[23] Qualitative analysis of each acoustic site and night with probable detections of Indiana bats during Step 6 must include the entire night's high-frequency call data and not just those files making it through the acoustic analysis tools as probable Indiana bats.

[24] If you identify any suspected mis-identifications from programs, the Service will share those results with the software manufacturer(s) and the USGS to assist with future improvements and testing of software.

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TABLE 1. Standard survey seasons for conducting P/A surveys for Indiana bats.

Survey Season	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Internal Winter Hibernacula Surveys[1]												
Acceptable survey window (1 Jan. - 28 Feb.)												
Traditional survey window of known sites (15 Jan. - 15 Feb.)												
Spring & Fall Surveys at Entrances of Potential Hibernacula[2,3]												
Acceptable survey window (1 - 21 Apr. & 15 Sep. - 31 Oct.)												
Summer Surveys of Suitable Summer Habitat[4]												
Acceptable survey window (15 May - 15 Aug.)												
Optimal survey window (1 Jun. - 31 Jul.)[5,6]												

[1] visual and photographic surveys conducted within known and/or potential hibernacula (if deemed safe to enter).

[2] conducted using harp traps or mist nets at cave/mine entrances.

[3] if State/USFWS FO approve, spring and fall survey windows can "drift" a bit earlier or later to better accommodate prevailing weather patterns and/or climate conditions in the location of the proposed survey. For example, the fall survey window in nothern portions of the Ibat range may begin on or after 1 Sep. and end prior to 31 Oct. pending local State and FO approval. Likewise, if agencies approve, spring surveys of potential hibernacula may be pushed back/extended a few days or longer due to an exended period of unseasonably cold spring weather.

[4] conducted using mist nets or acoustic detectors deployed within suitable flight corridors and foraging areas.

[5] the middle of the maternity season (June and July) is considered by many to be the best or "optimal" time to capture resident bats.

[6] due to concerns with transmission of white-nose syndrome, some USFWS FO(s) and state natural resource agencies have delayed the start of the Indiana bat summer field survey season/mist-netting until June 1. Surveyors/applicants should always coordinate with local USFWS FO(s) and state natural resource agencies to confirm acceptable dates before beginning surveys.

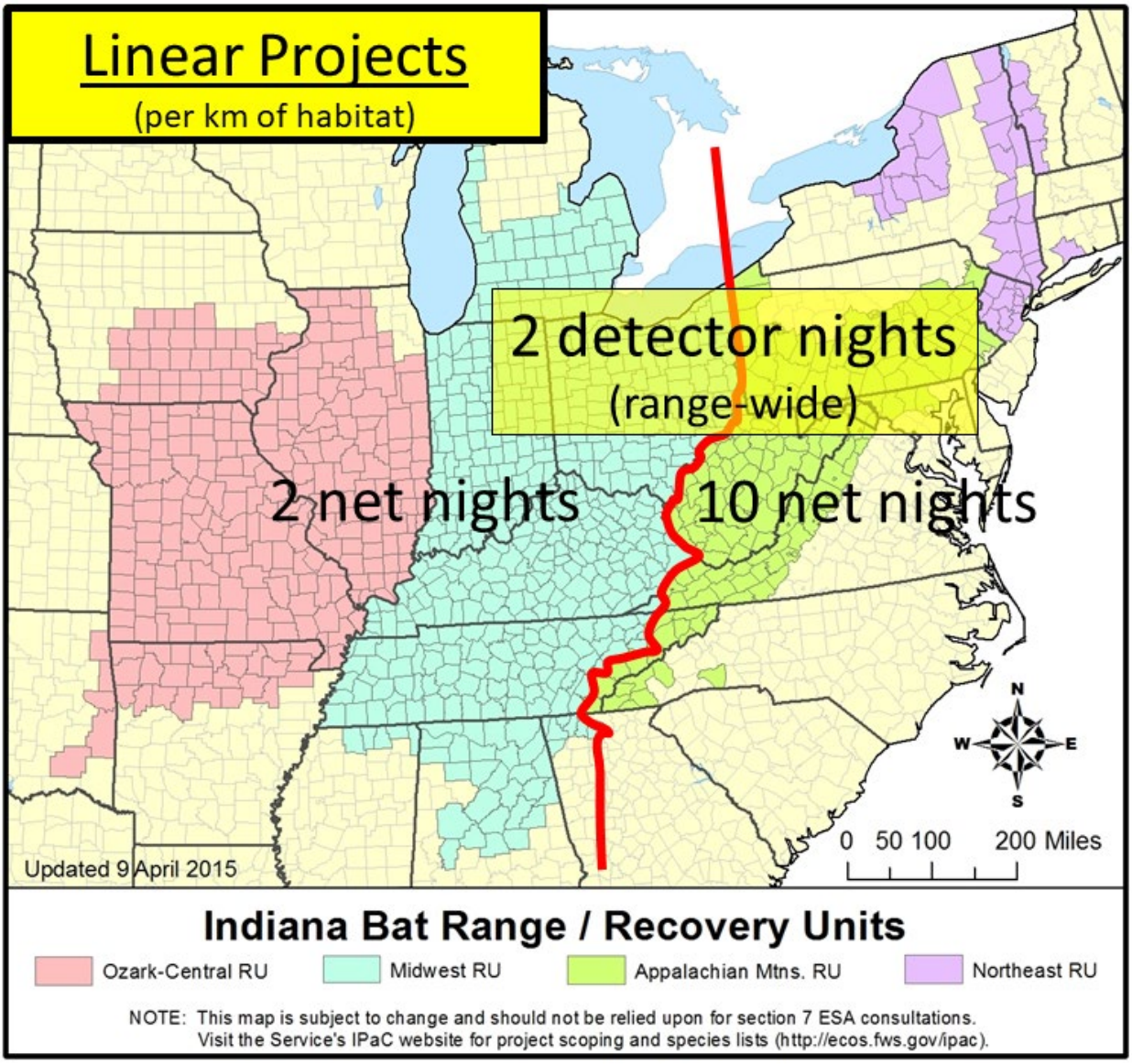

FIGURE 1. Minimum survey level of effort for mist netting and/or acoustic options for linear projects by recovery unit.

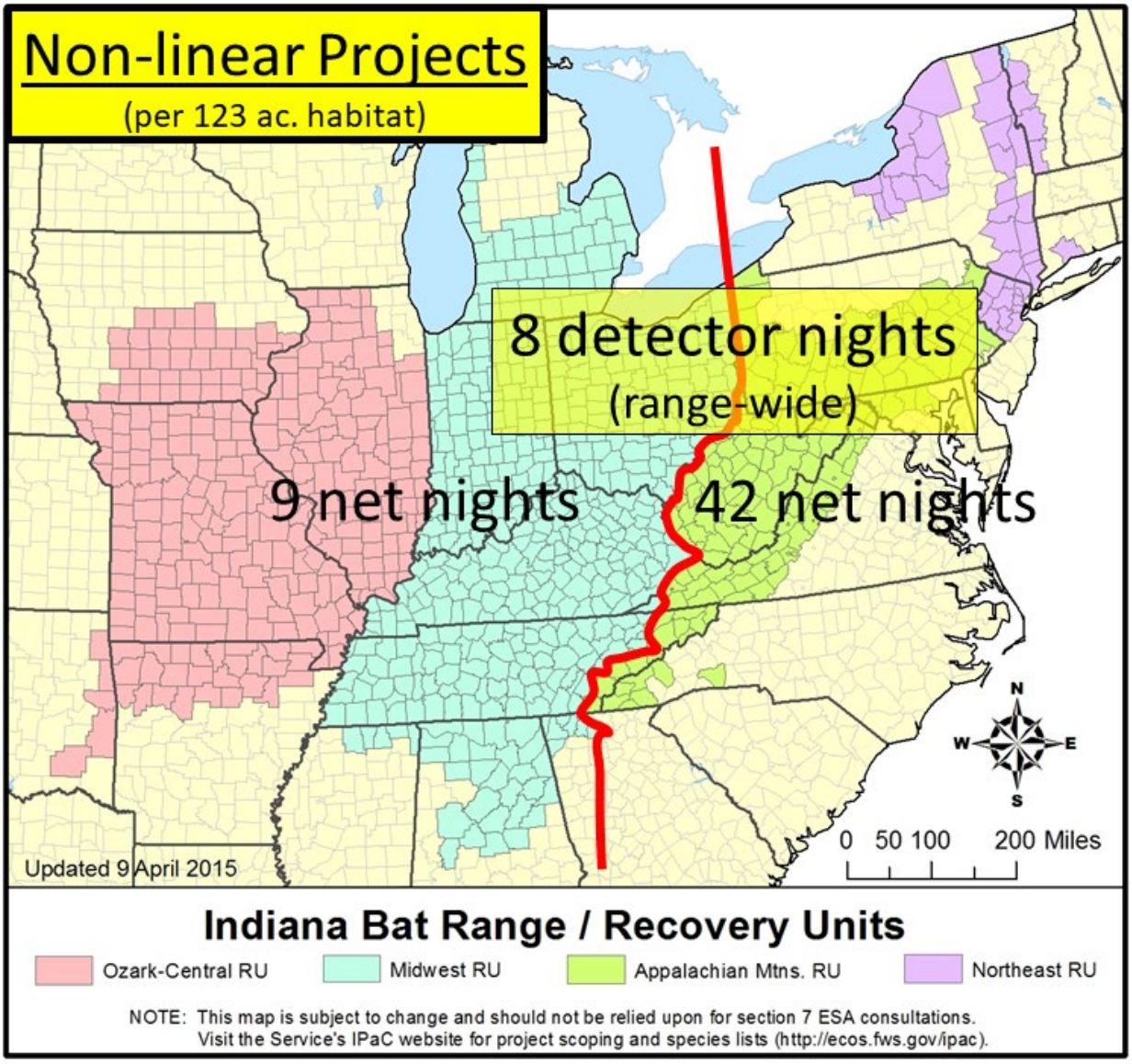

FIGURE 2. Minimum survey level of effort for mist netting and/or acoustic options for non-linear projects by recovery unit.

APPENDIX A: PHASE 1 HABITAT ASSESSMENTS

Summer habitat and potential hibernacula assessments are Step 2 of Phase 1- Initial Project Screening. The information below is provided to assist applicants, consultants, and/or project proponents (hereinafter termed the "applicant") in establishing whether surveys for Indiana bats should be conducted. As a reminder, the first step for determining presence of Indiana bats at a given site is to determine whether there is any existing occurrence data available for the vicinity of the project from the local USFWS FO. This step can be conducted remotely via a desktop analysis (e.g., use of aerial photography to assess the potential presence of suitable summer habitat). The applicant is responsible for developing and providing sufficient information as to whether suitable summer Indiana bat habitat and/or potential hibernacula exist within a proposed project area. If suitable habitat is present, the applicant should calculate the amount and submit this to the USFWS FO(s) and determine the need for any presence/absence surveys (Phase 2). **NOTE**: if Indiana bats are present or assumed to be present during any phase, more detailed habitat information may be necessary to adequately assess the potential for impacts (see attached example Indiana Bat Habitat Assessment Datasheet). If no suitable habitat is present or it is determined through discussions with USFWS FO(s) that no adverse effects are anticipated from the proposed project, no surveys are recommended to assess risk during the summer. Habitat assessments for Indiana bats can be completed any time of year and applicants are encouraged to submit results and proposed Phase 2 study plans well in advance of the summer survey season.

PERSONNEL

Habitat assessments should be completed by individuals with a natural resource degree or equivalent work experience.

DEFINITION FOR POTENTIALLY SUITABLE INDIANA BAT SUMMER HABITAT

Suitable summer habitat for Indiana bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats[25] such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥5 inches dbh[26] (12.7 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat.

[25] Non-forested habitats typically should be excluded from acreages used to establish a minimum level of survey effort for Phase 2 surveys.

[26] While trees <5 inches (<12.7 cm) dbh that have exfoliating bark, cracks, crevices, and/or hollows may have some potential to be male Indiana bat summer roosting habitat, the USFWS does not consider early-successional, even-aged stands of trees <5 inches dbh to be suitable roosting habitat for the purposes of this guidance. Suitable *roosting* habitat is defined as forest patches with trees of 5-inch (12.7 cm) dbh or larger. However, early successional habitat with small diameter trees may be used as foraging habitat by Indiana bats. Therefore, a project that would remove or otherwise adversely affect ≥20 acres of early successional habitat containing trees between 3 and 5 inches (7.6-12.7 cm) dbh would require coordination/consultation with the USFWS FO to ensure that associated impacts would not rise to the level of take. The USFWS may request P/A surveys if >20 acres of early successional habitat were proposed for removal.

Indiana bats have also been observed roosting in human-made structures, such as bridges and bat houses (artificial roost structures); therefore, these structures should also be considered potential summer habitat[27]. We recommend that project proponents or their representatives coordinate with the appropriate USFWS Field Office to more clearly define suitable habitat for their particular region as some differences in state/regional suitability criteria may be warranted (e.g., high-elevation areas may be excluded as suitable habitat in some states).

Examples of unsuitable habitat:

- Individual trees that are greater than 1,000 feet from forested/wooded areas;
- Trees found in highly-developed urban areas (e.g., street trees, downtown areas); and
- A pure stand of less than 3-inch dbh[28] trees that are not mixed with larger trees.

DEFINITION FOR POTENTIALLY SUITABLE NORTHERN LONG-EARED BAT SUMMER HABITAT

Suitable summer habitat for NLEB consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded habitat[29]. NLEB has also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat[30]. NLEBs typically occupy their summer habitat from mid-May through mid-August each year[31] and the species may arrive or leave some time before or after this period.

Examples of unsuitable habitat:

- Individual trees that are greater than 1,000 feet from forested/wooded areas;
- Trees found in highly-developed urban areas (e.g., street trees, downtown areas); and
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees.

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[27] If human-made structures are present within your project area, see Appendix E (Emergence Surveys) and then coordinate with the local USFWS FO(s) regarding how to determine presence/absence.

[28] Suitable *roosting* habitat is defined as forest patches with trees of 5-inch (12.7 cm) dbh or larger. However, early successional habitat with small diameter trees may be used as foraging habitat by Indiana bats. Therefore, a project that would remove or otherwise adversely affect ≥20 acres of early successional habitat containing trees between 3 and 5 inches (7.6-12.7 cm) dbh would require coordination/consultation with the USFWS FO to ensure that associated impacts would not rise to the level of take. The USFWS may request P/A surveys if >20 acres of early successional habitat were proposed for removal.

[29] This number is based on observations of bat behavior indicating that such an isolated tree (i.e., ≥1000 feet) would be extremely unlikely to be used as a roost. This distance has also been evaluated and vetted for use for the Indiana bat. See the "Indiana bat Section 7 and Section 10 Guidance for wind Energy Projects," question 33, found at: http://www.fws.gov/midwest/endangered/mammals/inba/WindEnergyGuidance.html

[30] Trees found in highly-developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable habitat.

[31] Exact dates vary by location.

APPENDIX A: PHASE 1 HABITAT ASSESSMENTS

SUBMISSION OF PHASE 1 HABITAT ASSESSMENT & PHASE 2 AND/OR PHASE 5 STUDY PLAN (IF NEEDED)

If a proposed project may affect (positively or negatively) Indiana bats and the conditions outlined in Step 3 a or b are not met, a habitat assessment report should be submitted to the appropriate USFWS FO(s) (and/or to the lead Federal Action Agency, such as the USACE, as appropriate) along with a draft study plan for the Phase 2 (acoustic or netting) and/or Phase 5 (potential hibernaculum) survey(s) (if suitable habitat(s) is present). Complete Phase 1 reports will include the following:

1. Full names and relevant titles/qualifications of individuals (e.g., John E. Smith, Biologist II, State University, B.S. Wildlife Science 2007) completing the habitat assessment and when the assessment was conducted
2. A map and latitude/longitude or UTM clearly identifying the project location (or approximate center point) and boundaries
3. A detailed project description (if available)
4. Documentation of any known/occupied spring staging, summer, fall swarming, and/or winter habitat for Indiana bats within or near the project area
5. A description of methods used during the habitat assessment
6. A summary of the assessment findings and a completed Indiana Bat Summer Habitat Assessment Datasheet (see example below; use of this particular datasheet is optional)
7. Other information that may have a bearing on Indiana bat use of the project area (e.g., presence of fall or winter habitat [caves, crevices, fissures, or sinkholes, or abandoned mines of any kind], bridges and other non-tree potential summer roosts.)
8. A Phase 1 Habitat Assessment on all potential hibernacula that could be affected by the proposed project (see Appendix H for additional instructions for completing this assessment and sample datasheet), if necessary
9. Any other information requested by the local USFWS FO(s) related to the project

In addition, Phase 2 Study Plans should contain the following:

1. A statement as to which type of P/A surveys will be conducted (i.e., mist netting or acoustic surveys) and how the proposed survey level of effort (i.e., total # of net nights or detector nights) was calculated/determined;
2. A map depicting the proposed number of survey sites (mist netting or acoustic) and their tentative distribution throughout the project area;
3. A tentative list of surveyors names and copies of relevant federal permits (if applicable);
4. A tentative survey schedule (e.g., start date, duration, end date);
5. For mist netting surveys with planned Phase 4 radio-tracking – the approximate number and distribution of transmitters (e.g., prioritization of sex/age, maximum number per site)

and a request that bats targeted for tracking may be held for up to 45 minutes[32] to allow for application of transmitters; and

6. For acoustic surveys - information on which specific program(s) will be used and what level of acoustic analyses will be conducted.

If potential hibernacula are identified, then Phase 5 Study Plans should contain the following:

1. A completed USFWS Project Proposal Form (see Appendix H);
2. A map depicting all potential hibernacula identified and their tentative distribution throughout the project area;
3. A written justification if an entrance(s) survey is proposed instead of an internal survey;
4. A written justification if mist-nets are proposed instead of harp traps; and
5. For surveys of entrances that are inter-connected and unfeasible to survey on the same night, a proposed modified method to complete the survey (see Phase 2, #5 in Appendix H).

[32] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes.

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name:_____ Date:_____

Township/Range/Section:_____

Lat Long/UTM/ Zone:_____ Surveyor:_____

Brief Project Description

Project Area				
Project	Total Acres	Forest Acres		Open Acres
Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing	

Vegetation Cover Types	
Pre-Project	**Post-Project**

Landscape within 5 mile radius
Flight corridors to other forested areas?
Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

Proximity to Public Land
What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): _____

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
Pools/Ponds (# and size)		Open and accessible to bats?		
Wetlands (approx. ac.)	Permanent	Seasonal		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
Dominant Species of Mature Trees				
% Trees w/ Exfoliating Bark				
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
No. of Suitable Snags				

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? _____

Additional Comments:

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX B: PHASE 2 or 3 MIST-NETTING

Mist-netting can be used as a presence/probable absence method (Phase 2 surveys) or it can be conducted for the purpose of attempting to capture Indiana bats after detection during acoustic presence/probable absence surveys (Phase 3 surveys). The same recommendations (e.g., season, personnel, equipment, net placement, checking nets) apply for either use of mist-netting surveys.

SUMMER MIST-NETTING SEASON: May 15[33] – August 15[34]

Capture of reproductive adult females (i.e., pregnant, lactating, or post-lactating) and/or young of the year during May 15 – August 15 confirms the presence of a maternity colony in the area. Since adult males and non-reproductive females have commonly been found summering with maternity colonies, radio-tracking results will be relied upon to help determine the presence or absence of a maternity colony or large concentrations of bats in the area when only males and/or non-reproductive females are captured.

PERSONNEL

A qualified biologist(s)[35] must (1) select/approve mist-net set-ups in areas that are most suitable for capturing Indiana bats, (2) be physically present at each mist-net site throughout the survey period, and (3) confirm all bat species identifications. This biologist may oversee other biological technicians and manage mist-net set-ups in close proximity to one another as long as the net-check timing (i.e., every 10 minutes) can be maintained while **walking** between nets.

COORDINATION WITH USFWS FO(s)

If not already required by federal permit, we recommend that applicants submit a draft study plan for all survey phases to the USFWS FO(s) for review and approval (See Appendix A for guidance on submitting a draft study plan).

EQUIPMENT

Use the finest, lowest visibility mesh mist-nets commercially available, as practicable. Currently, the finest net on the market is 75 denier, 2 ply, denoted 75/2 (Arndt and Schaetz 2009); however, the 50 denier nets are still acceptable for use at this time. The finest mesh size available is approximately 1½ inches (38 millimeters).

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[33] Due to concerns with transmission of white-nose syndrome, some USFWS FO(s) and state natural resource agencies have delayed the start of the Indiana bat summer field survey season/mist-netting until June 1. Surveyors/applicants should always coordinate with local USFWS FO(s) and state natural resource agencies before beginning surveys.

[34] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

[35] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for Indiana bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

No specific hardware is required. There are many suitable systems of ropes and/or poles to hold nets. The system of Gardner et al. (1989) has been widely used. See NET PLACEMENT for minimum net heights, habitats, and other netting requirements that affect the choice of hardware.

To minimize potential for disease transmission, any equipment that comes in contact with bats should be kept clean and disinfected, following approved protocols; this is particularly a concern relative to white-nose syndrome (WNS). Disinfection of equipment to avoid disease transmission (e.g., WNS) is required; protocols are posted at http://www.whitenosesyndrome.org/. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

MINIMUM PRESENCE/ABSENCE MIST-NETTING LEVEL OF EFFORT (PHASE 2)

The level of netting survey effort required for a non-linear project will be dependent upon the overall acreage of suitable habitat that may be impacted by the action (directly or indirectly). To determine the survey effort, quantify the amount of suitable summer habitat within the project area. **NOTE**: for projects where other impacts than tree removal are likely (e.g., collision), ensure that presence/probable absence surveys are designed to cover all suitable habitat within the entire project area (where exposure to any kind of impacts may be anticipated) and NOT just the locations where tree removal is planned. Additional guidance for linear project is in Appendix F.

Conduct Mist-Netting Surveys following Recovery Unit-based protocols[36] (See Figures 1 and 2)

Northeast and Appalachia Recovery Units (CT, DE, MA, MD, NC, NJ, NY, PA, eastern TN, WV, VA, VT):

Linear projects: a minimum of 10 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 42 net nights per 123 acres[37] (0.5 km^2) of suitable summer habitat.

For example:

- 7 sites[38], 2 nets[39]/site for 3 calendar nights = 42 net nights
- 7 sites, 3 nets/site for 2 calendar nights = 42 net nights
- 3 sites, 2 nets/site for 7 calendar nights* = 42 net nights

[36] The Indiana bat populations in the Northeast and Appalachia Recovery Units (RUs) have been more heavily impacted by white-nose syndrome; therefore, we recommend higher survey effort in these RUs than the Midwest and Ozark-Central RUs.

[37] We have no recommendations for reducing the minimum level of effort required to demonstrate probable absence for projects <123 acres in size. Detection probabilities and occupancy estimates were derived from past survey efforts that used the same acreage threshold (see Niver et al. 2013).

[38] A site is defined as a geographic area to be sampled. It can include one or more nets that can be managed by one Qualified Biologist.

[39] A net is defined as any combination of individual panels and poles (e.g., single, double, triple high) to fill the area (e.g., corridor) being sampled.

Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are recommended[40].
b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO(s).

Midwest and Ozark-Central Recovery Units (AL, AR, GA, IA, IL, IN, KY, MI, MO, MS, OH, OK, and central & western TN):

Linear projects: a minimum of 2 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 9 net nights per 123 acres (0.5 km^2) of suitable summer habitat.

- 3 sites, 1 net/site for 3 calendar nights = 9 net nights
- 1 site, 3 nets/site for 3 calendar nights = 9 net nights

Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are recommended.
b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO(s).

MIST-NETTING SURVEYS TO CAPTURE INDIANA BATS AFTER ACOUSTICS WERE USED AS P/A METHOD (PHASE 3)

If netting was not conducted as the P/A method, then netting may be conducted to capture and characterize (e.g., sex, age, reproductive condition) the Indiana bats (documented through the Phase 2 acoustic P/A survey) present in an area and to facilitate radio-tracking (Phase 4) efforts. We encourage working with the FO(s) to develop Phase 3 netting plans based on best available information (e.g., positive acoustic locations). There are no minimum requirements for this phase as this is not a P/A phase.

a) If no Indiana bats are captured, then coordinate with the USFWS FO.
b) If Indiana bats are captured, then proceed to **Phase 4** as previously decided in coordination with the FO(s).

[40] NOTE: For Phase 2 Presence/Absence Surveys, wherever the phrase "no further summer surveys are recommended" occurs within this document, the USFWS FO(s) is in affect assuming probable absence of Indiana bats during the summer.

NET PLACEMENT

Potential travel corridors (e.g., streams, logging trails) typically are the most effective places to net (although other places may also be productive; see Carroll et al. 2002). Place nets approximately perpendicular across the corridor. Nets should fill the corridor from side to side, extending beyond the corridor boundaries when possible, and from stream (or ground) level up to the overhanging canopy. Nets of varying widths and heights may be used as the situation dictates. A typical set is at least 5 m to 9 m high consisting of two or more nets stacked on top one another and from 6 m to 18 m wide. If netting over water, ensure there is enough space between the net and the water so that captured bats will not get wet.

Occasionally it may be necessary or desirable to net where a suitable corridor is lacking. The typical equipment described in the section above may be inadequate for these situations, requiring innovation on the part of the surveyor (see Humphrey et al. 1968). See Kiser and MacGregor (2005) for additional discussion about net placement.

Although no minimum spacing between mist-nets is being specified, surveyors should attempt to evenly distribute net set-ups throughout suitable habitat and must provide written justification in their report if net set-ups were not distributed throughout suitable habitat (i.e., why were they clumped?). Net set-ups can be repeatedly sampled throughout the project, but generally no more than 2-3 nights at a single location is recommended. In addition, changing locations within a project area may improve capture success (see Robbins et al. 2008; Winhold and Kurta 2008). Photo-document placement of nets.

SURVEY PERIOD

The survey period for each net shall begin at sunset[41] and continue for at least 5 hours (longer survey periods may also improve success).

CHECKING NETS

Each net set-up should be checked approximately every 10 minutes (Gannon et al. 2007). If surveyors monitor nets continuously, take care to minimize noise, lights and movement near the nets. Monitoring the net set-up continuously with a bat detector (ideally using ear phones to avoid alerting bats) can be beneficial: (a) bats can be detected immediately when they are captured, (b) prompt removal from the net decreases stress on the bat and potential for the bat to escape (MacCarthy et al. 2006), and (c) monitoring with a bat detector also allows the biologist to assess the effectiveness of each net placement (i.e., if bats are active near the net set-up but avoiding capture), which may allow for adjustments that will increase netting success on subsequent nights. There should be no other disturbance near the nets, other than to check nets and remove bats. Biologists should be prepared to cut the net if a bat is severely entangled and cannot be safely extracted within 3 or 4 minutes (CCAC 2003; Kunz et al. 2009).

[41] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php.

Capture and handling are stressful for bats. Emphasis should be on minimizing handling and holding bats to as short a time as possible to achieve field study objectives. Indiana bats should not be held for more than 30 minutes after capture, unless the individual is targeted for radio-tracking. Bats targeted for radio-tracking should be released as quickly as possible, but no longer than 30 minutes[42] after capture, or as allowed in federal and state permits. See Kunz and Kurta (1988) for general recommendations for holding bats.

WEATHER, LIGHTING, AND OTHER ENVIRONMENTAL CONDITIONS

Severe weather adversely affects capture of bats. Some Indiana bats may remain active despite inclement weather and may still be captured while others in the same area become inactive. Therefore, negative surveys combined with any of the following weather conditions throughout all or most of a sampling period are likely to require an additional night of mist-netting[43]: (a) temperatures that fall below 50°F (10°C)[44]; (b) precipitation, including rain and/or heavy fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/seconds; 3 on Beaufort scale) for 30 or more minutes.

NOTE: Provided that nets are not dripping wet, surveyors can resume netting to meet the minimum 5-hour requirement after short periods of adverse weather. If nets are under good cover, light rain may not alter bat behavior. However, if no bats are being captured during marginal weather, coordinate with the USFWS FO(s).

It is typically best to place net set-ups under the canopy where they are out of moonlight, particularly when the moon is half-full or greater. Net set-ups illuminated by artificial light sources should also be avoided.

The shining of lights, and noise should be kept to a minimum with no smoking around the survey sites. In addition, the use of radios, campfires, running vehicles, punk sticks, citronella candles and other disturbances will not be permitted within 300 feet of mist nets (or acoustic detectors) during surveys.

DOCUMENTATION OF INDIANA BAT CAPTURES

If an Indiana bat(s) is captured during mist-netting, protocols for radio-tracking and emergence survey requirements, as provided in Appendix D and E, respectively, should be followed. In addition, the appropriate USFWS FO(s) must be notified of the capture within 48 hours (or in accordance with permit conditions), and the sex and reproductive condition of the bat and GPS coordinates of the capture site should be provided. Ensure GPS coordinates are recorded for each individual net set on datasheets.

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[42] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes.

[43] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

[44] If using this guidance for NLEB: Overnight survey temperatures may be lower in northern portions of the NLEB range, please coordinate with the local USFWS FO in the northern portion of the range for any variation in temperature requirements.

Several species of bats from the genus *Myotis* share common features which can make identification difficult; Indiana bats and little brown bats (*Myotis lucifugus)* can be particularly difficult to distinguish. Photo-documentation of all bats captured and identified as Indiana bats and the first 10 little brown bats per project are requested to verify the identifications made in the field.

Photo-documentation should include diagnostic characteristics:

- a ¾-view of face showing ear, tragus, and muzzle
- view of calcar showing presence/absence of keel
- a transverse view of toes showing extent of toe hairs

If a bat from the genus *Myotis* is captured during mist netting that cannot be readily identified to the species level, then species verification may be attempted through fecal DNA analysis. Collect one or more fecal pellets (i.e., guano) from the bat in question by placing it temporarily in a holding bag (15 minutes is usually sufficient, no more than 30 minutes is recommended). The pellet (or pellets) collected should be placed in a small vial (e.g., 1.5 ml) with silica gel desiccant; pellets from each individual bat should be stored in separate vials and out of direct light. Fees charged by independent laboratories for sequencing fecal DNA samples is generally inexpensive (approx. $50 per guano sample), however, it has been challenging to identify labs willing to consistently conduct these analyses. Any additional information and a list of available laboratories will be made available on the Indiana bat webpage on the USFWS's Region 3 website (http://www.fws.gov/midwest/Endangered/mammals/inba/index.html).

SUBMISSION OF MIST-NETTING RESULTS

Provide results of netting surveys to the appropriate USFWS FO(s) in accordance with previously agreed upon[45] timeframes and formats[46]. If Indiana bats are captured, this report should also include the results of subsequent radio-tracking and emergence counts. Reports should include the following:

1. Copy of prior phase reports (if not previously provided).
2. Explanation of any modifications from original survey plan (e.g., altered net locations).[47]
3. Description of net locations (including site diagrams), net set-ups (include net heights), survey dates, duration of surveys, weather conditions, and a summary of findings.
4. Map identifying netting locations and information regarding net set-ups, including lat/long or UTM, individual net placement, net spacing (i.e., include mist-netting

[45] As discussed in the Introduction, we encourage coordination with USFWS FO(s) prior to implementation of any surveys to ensure that all parties agree upon the need for surveys, the methods proposed, and the decisions from various survey results.

[46] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using the standardized permit reporting spreadsheets available on the R3 Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

[47] If the USFWS previously agreed upon the study plan we need to understand whether the revised work still accomplished the agreed upon methods

equipment in photographs of net locations), and adequate justification if net set-ups are not evenly distributed across suitable habitat within the project area.

5. Full names of mist-netting personnel attending each mist-net site during an operation, including the federally-permitted/qualified biologist present at each mist-net site. Indicate on the field data sheet the full name of person who identified bats each night at each site.
6. Legible copies of all original mist-netting datasheets (see example datasheet below) and a summary table with information on all bats captured during the survey including, but not limited to: capture site, date of capture, time of capture, sex, reproductive condition, age, weight, right forearm measurement, band number and type (if applicable), and Reichard's wing damage index score (Reichard and Kunz. 2009).
7. Photographs of all net set-ups, as well as **all** Indiana bats and the first 10 little brown bats captured from each project, so that the placement of netting equipment and identification of species can be verified. Photographs of bats should include all diagnostic characteristics that resulted in the identification of the bat to the species level.
8. Any other information requested by the local USFWS FO(s) related to the project.

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Sample Data Sheets for Indiana Bat Surveys

Site No.				Project/Firm:								Date:
Location:												
County:				State:		Quad:						Quadrant:
Lat/Long (DMS):		N		W			Zone:					Surveyors:

#	Time	Species	Age	Sex	Repro. Cond.*	RFA (mm)	Mass (g)	Net/ Ht	Guano/ Hair	Wing Score	Band # Type
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
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22											
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24											
25											
26											
27											
28											
29											
30											

Moon Phase:		%
	Rise	Set
Moon:		
Sun:		

Time	Temp	Sky	Wind	# Bats
Avg				

Sky Code	
0	Clear
1	Few Clouds
2	Partly Cloudy
3	Cloudy or overcast
4	Smoke or fog
5	Drizzle or light rain
6	Thunderstorm

Beauford Wind Code	
0	Calm (0 mph)
1	Light wind (1-3 mph)
2	Light breeze (4-7 mph)
3	Gentle breeze (8-12 mph)
4	Moderate breeze (13-18 mph)

***Repro. Cond (Reproductive Condition): (P) pregnant; (L) lactating; (PL) post-lactating; (NR) non-reproductive, (TD) testes descended**

Sample Data Sheets for Indiana Bat Surveys

Net Site Diagram	Dominant Vegetation
	1
	2
	3
	4
	5

Net Site(s) by Habitat				
Habitat	A	B	C	
River				
Stream				
Pond				
Road Rut				
Corridor				
Cave/mine				
Total				

No. of Poles X Net length				
A	=		X	
B	=		X	
C	=		X	
D	=		X	

Other Species:

Comments:

APPENDIX C: PHASE 2 ACOUSTIC SURVEYS

SUMMER ACOUSTIC SURVEY SEASON: May 15 – August 15[48]

PERSONNEL[49]

Overall: Acoustic surveyors should have either completed one or more of the available bat acoustic courses/workshops (e.g., BCM, ERM, Titley/AnaBat, Wildlife Acoustics, USFWS) or be able to show similar on-the-job or academic experience.

Detector Deployment: Acoustic surveyors should have a working knowledge of the acoustic equipment and Indiana bat ecology. Surveyors should be able to identify appropriate detector placement sites and establish those sites in the areas that are most suitable for recording high-quality Indiana bat calls. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the proper placement of their field equipment.

Acoustic Analysis: Acoustic surveyors should have a working knowledge of the approved acoustic analysis programs. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the analysis of acoustic recordings.

Qualitative Analysis: Individuals qualified to conduct qualitative analysis of acoustic bat calls typically have experience: (1) gathering known calls as this provides a valuable resource in understanding how bat calls change and the variation present in them; (2) identifying bat calls recorded in numerous habitat types; (3) familiarity with the species likely to be encountered within the project area; and (4) individuals must have multiple years of experience and must have stayed current with qualitative ID skills. A resume (or similar documentation) must be submitted along with final acoustic survey reports for anyone making final qualitative identifications.

COORDINATION WITH USFWS FO(s)

If not already required by federal permit, we recommend that applicants submit a draft study plan for all survey phases to the USFWS FO(s) for review and approval. Study plans should include a map/aerial photo identifying the proposed project area boundaries, suitable bat habitats and acreages within the project area, the proposed number and tentative locations of acoustic monitoring sites, and the identification of the approved acoustic software program(s) (and version #) used for analysis of calls for the specific project. If a single software program is used for analysis, surveyors will not be allowed to switch programs from what was originally identified in their final study plan.

DETECTOR AND MICROPHONE REQUIRED CHARACTERISTICS

Full-spectrum (FS) and/or zero-crossing (ZC) detectors are suitable for use in this survey protocol. Directional, hemispherical, and omnidirectional microphones are acceptable for acoustic surveys. The use of external microphones on an extension cable is the preferred deployment as it further limits

[48] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.
[49] Coordinate with your local FO regarding any state-specific requirements.

degradation of call quality. Recording without directional horns on hemispherical and omnidirectional microphones is preferred as the addition of these systems may result in some signal degradation and directional microphones are commercially available.

Use recommended manufacturer detector settings for conducting Indiana bat P/A surveys unless otherwise noted on the Service's Indiana Bat Summer Survey Guidance webpage. For ZC detectors (as well as when converting WAV files to ZC files), the data-division ratio must be set to 8.

ACOUSTIC SAMPLING PROTOCOL

Detector/Microphone Placement

Detector/Microphone placement is critical to the successful isolation of high-quality bat call sequences for later analysis. The following locations are likely to be suitable sites for detectors/microphones, including, but not limited to: (a) forest-canopy openings; (b) near water sources; (c) wooded fence lines that are adjacent to large openings or connect two larger blocks of suitable habitat; (d) blocks of recently logged forest where some potential roost trees remain; (e) road and/or stream corridors with open tree canopies or canopy height of more than 33 feet (10 meters); and (f) woodland edges (Britzke et al. 2010). Of equal importance to acoustic site selection is the surveyor's working knowledge of the sampling volume and area of highest sensitivity within the zone of detection around a given microphone, which helps to ensure that detector placement as well as microphone selection and orientation are best suited for a particular site to ensure the detection zone is free of clutter. Detection distance, placement (e.g., location, orientation, height of microphone), and specific features (e.g., vegetation, water, and other obstructions) at the sample site should dictate whether a directional, hemispherical, or omnidirectional microphone is used. If detectors/microphones are placed in unsuitable locations, effective data analysis may be impossible, and the results of the sampling effort will likely be invalid.

Many features (e.g., vegetation, water, wind turbines, high-tensile power-lines, micro-wave towers) can obstruct and reflect call sequences recorded in the field and thereby reduce the surveyor's ability to record high-quality bat call sequences. The following recommendations are provided to aid surveyors in their selection of acoustic sites (also see Chenger and Tyburec 2014). If surveyors choose acoustic sites outside of these recommendations, then adequate justification for doing so should be provided with the acoustic survey report provided to the USFWS FO(s); otherwise, results from these sites will not be accepted. Surveyors should deploy microphones: (a) at least 10 feet (3 meters) in any direction from vegetation or other obstructions (Hayes 2000; Weller and Zabel 2002; Chenger and Tyburec 2014); (b) in areas without, or with minimal[50], vegetation within 100 feet (30 meters) of highly directional microphones or 33 feet (10 meters) from other microphones; (c) parallel to woodland edges; and (d) at least 49 feet (15 meters) from known or suitable roosts[51] (e.g., trees/snags, buildings, bridges, bat houses, cave or mine portal entrances).

[50] If necessary, surveyors can remove small amounts of vegetation (e.g., small limbs, saplings) from the estimated detection zone at a site, much like what is done while setting up mist-nets. Deployment of detectors/microphones in closed-canopy locations that typically are good for mist-netting are acceptable as long as the area sampled below the canopy does not restrict the ability of the equipment's detection zone to record high-quality calls (i.e., vegetation is outside of the detection zone).

[51] If the surveyor discovers a potential roost and wishes to document bat use, please refer to Appendix E for guidance on conducting emergence surveys and contact the USFWS FO(s).

Elevating a detector greater than 3 meters above ground level (AGL) vegetation may dramatically improve recording quality. Microphones can be attached horizontally to a pole to listen out into flight space, rather than just listening up from the ground. This will serve to increase the volume of airspace sampled and avoid the distortion effect of recording near the ground. However, the relationship between the zone of detection and the vegetation, not the placement of the detector is the most important consideration during site selection.

Surveyors should distribute acoustic sites throughout the project area or adjacent habitats. In most cases, acoustic sites should be at least 656 feet (200 meters) apart. If closer spacing is determined to be necessary or beneficial (e.g., multiple suitable habitats and acoustic sites immediately adjacent to each other), sufficient justification must be provided in the acoustic study plan and survey report submitted to USFWS FO(s).

Verification of Deployment Location

It is recommended to temporarily attach GPS units to each detector (according to manufacturer's instructions) to directly record accurate location coordinates for each acoustic site that is paired with the acoustic data files. Regardless of technique used, accurate GPS coordinates must be generated and reported for each acoustic detector location.

Verification of Proper Functioning

It is highly recommended that surveyors ensure acoustic detectors are functioning properly through a periodic verification of performance to factory specifications (a service currently offered or in development by several manufacturers). It may be possible that independent service bureaus would be willing to perform this service, providing that a standard test/adjustment procedure can be developed.

It is also recommended to ensure equipment is working during set-up in the field. This can be done simply by producing ultrasound (e.g., finger rubs, calibrator, or follow the equipment manufacturer's testing recommendations) in front of the microphone at survey start and survey finish. These tests document that the equipment was working when deployed and when picked up (and by assumption throughout the entire period). Detector field settings (e.g., sensitivity, frequency, etc.) should follow the recommendations provided by the manufacturer. Surveyors should also save files produced by detectors (e.g., log files, status files, sensor files) as an excellent way to provide documentation when equipment was functioning within the survey period. Many types of detectors allow for setting timers that initiate and end recording sessions. This saves battery life as well as reducing the number of extraneous noise files recorded. However, if the units are visited when the timer is on (i.e., unit is in standby mode), the surveyor cannot verify that the unit is functioning properly. This is particularly important in areas where no bat activity is recorded for the entire night or during the last portion of the night. In these cases, if the surveyor cannot demonstrate that the detector was indeed functioning properly throughout the survey period, then the site will need to be re-sampled, unless adequate justification can be provided to the USFWS FO(s).

Selection of acoustic sites is similarly important. Suitable set-up of the equipment should result in high-quality call sequences that are adequate for species identification. Nights of sampling at individual sites that produce no bat calls may need to be re-sampled unless adequate justification (e.g., areas with significant bat population declines due to WNS) can be provided to the USFWS FO(s). Modifications of the equipment (e.g., changing the orientation and/or microphone type) at the

same location on subsequent nights may improve quantity and quality of call sequences recorded, which can be determined through daily data downloads. If modifications of the equipment do not improve call identification, then the detectors will need to be moved to a new location.

Orientation

Detectors deployed with directional microphones should be aimed to sample the majority of the identified flight path/zone to maximize the number of call pulses recorded from individual bats. Omnidirectional microphones deployed on a pole in the center of the flight path/zone should be oriented horizontally. In some circumstances, it might be desirable to aim a directional microphone straight up in smaller forest openings. As always, the goal is to sample as large a volume of likely bat flight space as possible while minimizing clutter. Hemispherical microphones should be aimed vertically, creating a dome-like detection field. Hemispherical microphones are best suited for open areas where deploying at heights greater than 3 meters AGL is problematic because of the lack of structure to hide the microphone and prevent it from becoming a novel item of interest to bats. Vertical orientation, however, precludes the use of weatherproofing for protection of the microphone, since no currently-approved weatherproofing system will adequately protect the microphone of a detector aimed vertically. Once acoustic sites are identified, photographs documenting the orientation, detection zone (i.e., "what the detector is sampling"), and relative position of the microphone should be taken for later submittal to the USFWS FO(s) as part of the acoustic survey report (See Submission of Acoustic Survey Results for additional description).

Weather Conditions

If any of the following weather conditions exist at a survey site during acoustic sampling, note the time and duration of such conditions, and repeat the acoustic sampling effort for that night[52]: (a) temperatures fall below 50°F (10°C) during the first 5 hours of survey period; (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale) for 30 minutes or more during the first 5 hours of the survey period. At a minimum, nightly weather conditions for survey sites should be checked using the nearest NOAA National Weather Service station and summarized in the survey reports.

Weatherproofing

Most bat detectors are not weatherproof when delivered from the factory. Recording without after-market weatherproofing is preferred as the addition of these systems may result in some signal degradation. **The decision to weatherproof detectors or not should be determined nightly based on the likelihood of precipitation in the survey area.** If necessary, detectors should be placed in after-market weatherproof containers and an external microphone, attached by an extension cable should be deployed greater than 3 meters AGL.

For directional microphones, the use of a polyvinyl chloride (PVC) tube[53], generally in the form of a 45-degree elbow the same diameter as the microphone (Britzke et al. 2010) is acceptable, if the situation requires the use of after-market weatherproofing. The microphone should be placed facing

[52] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

[53] The PVC option has only been tested with AnaBat SD1/SD2 detectors and directional microphones. It may not perform as well with other detector microphone combinations.

the open end of the elbow and as close to the opening as is consistent with the aim of weatherproofing. The microphone should be pointing at an angle below horizontal so water will not collect in it. Corben & Livengood (2014) showed that the direction of greatest sensitivity of tubes like this varies greatly depending on details of the specific tube shape and the exact position of the microphone. Often the greatest sensitivity will be pointed up at a substantial angle (up to 45 degrees) above horizontal when the microphone itself is pointing 45 degrees below horizontal. Users should be aware of the characteristics of the setup they use so they can know what region is actually being sampled. Again, the preferred option for weatherproofing detectors is to detach the microphone from the detector so that the detector can be placed in a weatherproof container but the microphone (tethered by a cable) remains unobstructed.

Other after-market weatherproofing systems may become available and approved by the USFWS provided they show that call quality and the number of calls recorded are comparable to those without weatherproofing.

MINIMUM LEVEL OF EFFORT (applies to all Recovery Units/range-wide) (See Figures 1 and 2)

The level of acoustic survey effort required for a project will be dependent upon the overall acreage of suitable habitat that may be impacted by the action (directly or indirectly). To determine the acoustic survey effort, quantify the amount of suitable summer habitat within the project area. **NOTE**: for projects where impacts other than tree removal are likely (e.g., collision), ensure that presence/probable absence surveys are designed to cover all suitable habitat within the entire project area and NOT just the locations where tree removal is planned.

Linear projects: a minimum of 2 detector nights per km (0.6 miles) of suitable summer habitat (See Appendix F).

At least 1 detector location for at least 2 calendar nights (can sample the same location or move within the km site).

Non-linear projects: a minimum of 8 detector nights per 123 acres (0.5 km^2) of suitable summer habitat.

At least 2 detector locations per 123 acre "site" shall be sampled until at least 4 detector nights has been completed over the course of at least 2 calendar nights (may be consecutive).

For example:

- 4 detectors for 2 nights each (can sample the same location or move within the site)
- 2 detectors for 4 nights each (can sample the same location or move within the site)
- 1 detector for 8 nights (must sample at least 2 locations and move within the site – we recommend evenly distributing LOE among locations)

The acoustic sampling period for each site must begin at sunset[54] and ends at sunrise each night of sampling.

ANALYSIS OF RECORDED ECHOLOCATION CALLS

Step 5. Optional coarse screening - for high frequency (HF) or myotid calls (depending on available H/L frequency filters) or Proceed to Step 6.

a) If no positive detection of HF calls[55] (≥35 kHz) or myotid calls, no further summer surveys recommended.

b) If positive detection of HF or myotid calls, then
   i) proceed to Step 6 for further acoustic analysis; **OR**
   ii) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
   iii) assume presence and proceed to **Phase 3**.

Step 6. Conduct Automated Acoustic Analyses for each site that had HF or Myotid calls from Step 5 or ALL sites if Step 5 was not conducted.

Use **one or more** of the currently available 'approved' acoustic bat ID programs[56] (use most current approved software versions available and manufacturer's recommended settings for Indiana bat P/A surveys) as previously identified in your Phase 2 study plan. 'Candidate' programs are not yet approved by USFWS for stand-alone use for Indiana bat P/A surveys, but may be used in conjunction with one or more of the approved programs. Include your plans for which specific software program(s) you will use in your survey study plan and submit for USFWS FO(s) review prior to conducting surveys. Beginning with acoustic data from night one at each acoustic site, run each night's data for each site through your chosen ID program(s). Review results by site by night from each acoustic ID program used[57].

a) If Indiana bat presence is considered unlikely by the approved and candidate program(s) used in analysis, then no further summer surveys recommended.

b) If Indiana bat presence is considered likely at one or more sites on one or more nights by any approved or candidate program(s) used in analysis, then
   i) proceed to Step 7 for qualitative ID; **OR**
   ii) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
   iii) assume presence and proceed to **Phase 3**.

Step 7. Conduct Qualitative Analysis of Calls.

[54] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

[55] HF calls are defined as individual call pulses whose minimum frequency is ≥35 kHz.

[56] Approved and candidate programs are listed at http://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html

[57] The approved acoustic identification programs all have implemented a maximum likelihood estimator (MLE) at this time. If the analysis of collected calls at a given site on a given night results in the probable presence of Indiana bats with high levels of certainty ($P<0.05$), then select one of the options available in Step 6b.

At a minimum, for each detector site/night a program considered Indiana presence likely, review all files (including no IDs) from that site/night. Qualitative analysis[58] (i.e., manual vetting) must also include and present within a written report a comparison of the results of each acoustic ID program by site and night (see Reporting Requirements below).

a) If no visual confirmation of probable Indiana bats, then no further summer surveys recommended[59].

b) If visual confirmation of probable Indiana bats, then

i) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
ii) assume presence and proceed to **Phase 3**.

SUBMISSION OF ACOUSTIC SURVEY RESULTS

NOTE: All originally recorded (ZC or FS) data MUST be maintained for a period of 7 years and be made available to the USFWS FO(s), if requested. Failure to do so may result in invalidation of survey results.

Provide results of acoustic surveys to the appropriate USFWS FO(s) within 10 days of completing the survey unless otherwise agreed upon with the local USFWS FO(s)[60]. Each acoustic survey report should include the following[61] (also, see checklist at end of this appendix):

1. Copy of habitat assessment (if not previously provided)
2. Explanation of any modifications from original survey plan (e.g., altered site locations)[62]
3. Full names of all personnel conducting acoustic surveys, including those that selected acoustic sites and deployed detectors
4. Full name and resume of individual(s) conducting qualitative acoustic analyses (if applicable)

[58] Qualitative analysis of each acoustic site and night with probable detections of Indiana bats during Step 6 should include the entire night's high frequency call data, including "no ID" files, and not just those files making it through the acoustic analysis tools as probable Indiana bats in Step 6.
[59] If you identify any suspected mis-identifications from programs, the Service will share those results with the software manufacturer(s) and the USGS to assist with future improvements and testing of software.
[60] As discussed in the Introduction, we encourage coordination with USFWS FO(s) prior to implementation of any surveys to ensure that all parties agree upon the need for surveys, the methods proposed, and the decisions from various survey results.
[61] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using the standardized permit reporting spreadsheets available on the Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).
[62] If the USFWS previously agreed upon the study plan we need to understand whether the revised work still accomplished the agreed upon methods.

5. Description of acoustic monitoring sites, survey dates, duration of survey, weather conditions, and a summary of findings
6. Table with information on acoustic monitoring and resulting data, including but not limited to: detector GPS coordinates for each detector, survey dates, survey hours
7. Map identifying acoustic detector locations and a corresponding table including the GPS coordinates. Include arrow(s) showing direction(s) of microphone(s)
8. Photographs documenting the location of each detector, the orientation of the detector, and the intended sampling area. Please include detector and something for scale (e.g., vehicle, person) in photographs of acoustic sites
9. Description of acoustic detector and microphone brand(s) and model(s) used, microphone type, use of weatherproofing, acoustic monitoring equipment settings (e.g., sensitivity, audio division ratios), deployment data (i.e., deployment site, habitat, date, time started, time stopped, orientation), and call analysis methods used
10. A description of how proper functioning of bat detectors was verified
11. Discussion of what software program(s) was/were used (including settings)
12. Acoustic detector log files renamed by site identifier
13. Acoustic analysis software program output/summary results by site by night (i.e., number of calls detected, species composition, MLE results, settings files)
14. Discussion for any site/nights with zero bat calls (were additional nights added? was detector functioning? was placement appropriate?)
15. If manual vetting was used, discussion of how this was done (e.g., what keys were used?)
16. If manual vetting was used, detailed analysis and results of any qualitative acoustic analysis conducted on those projects where a program(s) considered Indiana bat presence likely, including justification for rejecting any program MLE results (if applicable). We recommend providing a table with each species ID from the program(s), suggested species ID from manual vetting, and rationale for any changes.
17. Any other information requested by the local USFWS FO(s) related to the project

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General Checklist for Acoustic Surveys of Indiana Bats

The following items should be documented and clearly presented within acoustic bat survey reports submitted to the Service

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ACOUSTIC SURVEY INFO

- ☐ Project Name
- ☐ Site ID No./Name
- ☐ State and County
- ☐ Site Lat./Long. Coordinates (e.g., decimal degrees, NAD83)
- ☐ Approx. accuracy of Lat./Long. Coordinates
- ☐ Survey Date(s)
- ☐ Person who Selected Acoustic Site(s)
- ☐ Person who Deployed Detector(s)
- ☐ Detector Brand & Model
- ☐ Microphone Brand & Model
- ☐ Microphone Type: Directional/Hemispherical/Omnidirectional
- ☐ Type of Weatherproofing (if any)
- ☐ Microphone Height above Ground-level Vegetation(m)
- ☐ Distance from Nearest Vegetation or other Obstruction (m)(apart from veg. on ground)
- ☐ Horizontal Orientation of Microphone (1-360°)
- ☐ Vertical Orientation of Microphone (assuming 0° is parallel with horizon)
- ☐ Photographs of Detector Set-up at each Site
- ☐ Detector Settings and/or Log Files (all settings used for each brand/model of detector. For example, sensitivity, gain, data division, 16k high filter, sample rate, min/max duration, min trigger freq., trigger level, etc.)
- ☐ Survey Start Time (military)
- ☐ Survey End Time (military)
- ☐ Methods used to Field-test proper Functioning of Detector
- ☐ Were calls collected in Full Spectrum or Zero Crossing?
- ☐ Habitat Type and/or Feature Surveyed
- ☐ Weather Conditions during Survey Period

ACOUSTIC ANALYSIS INFO

- ☐ Program used to convert Full Spectrum to Zero Cross (if applicable)?
- ☐ Filter(s) used (if any) and parameters used (e.g., CFRead, noise, bug, etc.)
- ☐ Name of Service-approved Bat ID Software Program(s) and Version(s) used and Candidate program(s)(if used)
- ☐ Program Settings (if applicable):
  - Min. # of pulses for species ID
  - Min. # of pulses per group ID
  - Min. discrim. prob. for species ID
  - Other relevant settings affecting ID
  - Suite of species/groups included in program analysis
- ☐ Table summarizing Number of Calls ID'd for each Species/Site/Night/Program (including MLE p-values)
- ☐ If Qualitative Analysis was conducted, include Number of Calls Confirmed through Qualitative ID for each Species/Site/Night
- ☐ Full Name of Person(s) who conducted Qualitative Analysis
- ☐ Additional Survey Reporting Requirements
- ☐ Acoustic Report Appendices:
  - data sheets and maps,
  - photographs of detector set-ups,
  - computer screen captures of representative bat species identified during acoustic analyses, and
  - resume(s) highlighting relevant qualifications of person(s) who conducted qualitative analysis (e.g., experience visually identifying *Myotis*, certificates of training, publications etc.)

APPENDIX D: PHASE 4 RADIO-TRACKING

PERSONNEL

Transmitter Attachment: A qualified biologist[63] who is experienced in handling Indiana bats and attaching radio transmitters must perform transmitter attachments, as further explained in the protocol below.

Tracking: Biological technicians and/or a qualified biologist who is experienced in tracking transmittered bats must be present and actively involved in all tracking activities for Indiana bats as further explained in the protocol below.

METHODS

If one or more Indiana bats are captured, the following radio-tracking protocols will be applicable:

1. Biologists should coordinate in advance with USFWS FO(s) regarding recommendations for the number and distribution of transmitters (e.g., prioritization of sex/age, maximum number per site) and whether foraging data would be beneficial to collect. Also, professional judgment should be used to determine whether attachment of transmitters could compromise the health of a bat. Since the maximum holding times for Indiana bats targeted for radio-tracking is 30 minutes[64], or as allowed in federal and state permits, surveyors should be prepared to place transmitters on bats immediately following their capture to minimize holding times.

2. The radio transmitter, adhesive, and any other markings (e.g., wing bands) should weigh less than 5% of pre-attachment body weight (Aldridge and Brigham 1988, American Society of Mammalogists 1998), the total weight of the package (transmitter and adhesive) may not exceed 6% of the bat's body weight, and must comply with any USFWS and state permits. In all cases, the lightest transmitters capable of the required task should be used, particularly with pregnant females and volant juveniles. With pregnant bats, biologists should always use the lightest transmitter possible but no more than 5% of their expected non-pregnant weight.

3. Proposed radio telemetry equipment (e.g., receivers, antennas, and transmitters) and frequencies should be coordinated with the appropriate state natural resource agency and USFWS FO(s).

4. The qualified biologist or biological technician(s) should track all radio-tagged bats captured to diurnal roosts in accordance with permit requirements. We generally recommend tracking until the transmitter fails, fall off, or cannot be located for at least 7 days and should conduct

[63] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[64] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes

a minimum of 2 evening emergence counts at each identified roost (See Appendix E for Emergence Survey Protocols). However, biologists are encouraged to continue radio-tracking efforts for the life of the transmitter. Biologists should contact the USFWS FO(s) immediately if they plan to cease tracking efforts before the 7-day tracking period ends. If landowner access is denied, approximate roost locations (i.e., coordinates) should be determined using triangulation.

5. Daily radio telemetry searches for roosts must be conducted during daylight hours and should be conducted until the bat(s) is located or for a minimum of 4 hours of ground or 1 hour of aerial-searching effort per tagged bat per day for 7 days. However, multiple bats captured at the same net location or nearby may be tracked simultaneously. Once a signal is detected, tracking should continue until the roost is located. At a minimum, biologists should document all ground and aerial-searching effort for all bats not recovered during radio-tracking for submittal with the survey report. For each roost identified during tracking, the biologist should complete a "USFWS Indiana Bat Roost Datasheet".

6. To minimize potential for disease transmission, any equipment that comes in contact with bats should be kept clean and disinfected, following approved protocols; this is particularly a concern relative to WNS. Protocols are posted at http://www.whitenosesyndrome.org/. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

SUBMISSION OF RADIO-TRACKING RESULTS

Phase 4 radio-tracking results should be included with the Phase 2 or 3 mist-netting report and submitted to the appropriate USFWS FO(s). Each report should include the following information related to radio-tracking efforts[65]:

1. Copy of prior phase reports (if not previously provided)
2. Explanation of any modifications from original survey plan (e.g., number of transmitters used, frequency of transmitters changed)[66]
3. Map and narrative detailing all ground and aerial searching effort for all bats not recovered during radio-tracking and relative to the negotiated or agreed effort as determined by the appropriate USFWS FO(s)
4. Map summarizing Indiana bat data collected from summer surveys for the proposed project (e.g., project area boundary and results from the site habitat assessment, acoustic survey, mist-net survey, radio-tracking, and emergence surveys)
5. Full names and permit numbers of personnel who attached transmitters to Indiana bats and full names of all personnel conducting radio-tracking efforts
6. Photographs of all roosts identified during radio-tracking
7. Legible copies of all original USFWS Indiana Bat Roost Datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted

[65] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using standardized permit reporting spreadsheets available on the Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

[66] If the USFWS previously agreed upon the study plan we need to understand whether the revised work still accomplished the agreed upon methods.

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USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name):_____ Date:_____

UTM: Zone_____ Easting _____ Northing_____ *OR*

LAT_____ LONG_____

Property Owner:_____ Phone#_____

State_____ County_____ Site #_____

Roost #_____ Roost Name:_____

Roost Tree Data

Species: _____ Live __ Snag __ Other __

(if other, explain) _____

DBH (in or cm)_____ Total Height (ft or m)_____

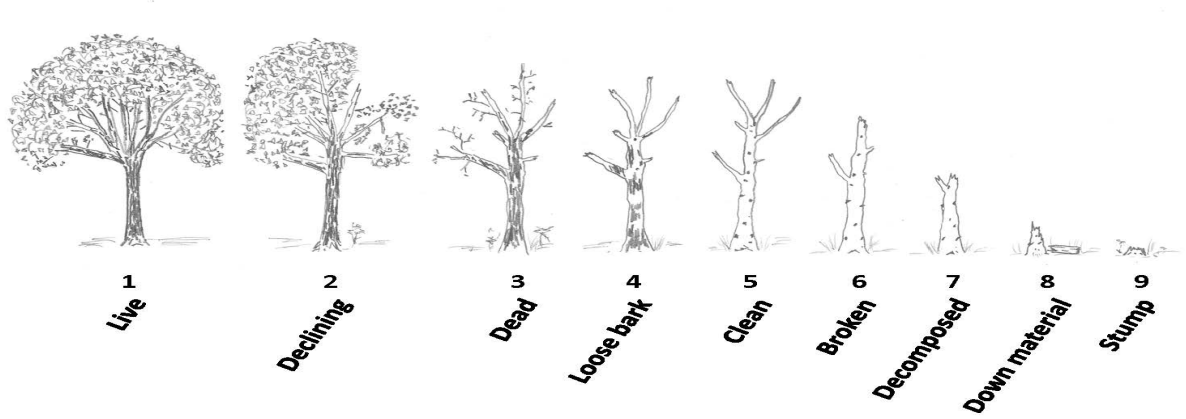
Height of roost area (if known)_____Dist. from capture site_____

Roost position aspect (deg)_____

Exfoliating bark on bole (%)_____ Describe: sloughing __ platy__ tight__

Cavities present? ____ If so, describe:_____

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



Roost tree or snag canopy position: Dominant __ Co-Dominant __ Suppressed __

Surrounding Habitat Condition

Canopy closure at roost (%) _____

Approximate woodlot size (ac or ha)_____ Distance to non-forest (ft or m)_____

Describe forest/woodlot current condition (mature, partially cut-over, burned, insect damage, etc.)
_____

_____

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Additional Comments_____

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APPENDIX E: PHASE 4 EMERGENCE SURVEYS

PERSONNEL

Qualified biologists[67], biological technicians, and any other individuals deemed qualified by a local USFWS FO may conduct emergence surveys for Indiana bats by following the protocols below.

EMERGENCE SURVEYS FOR KNOWN INDIANA BAT ROOSTS

The following protocols should begin as soon as feasible after identification of a diurnal roost (ideally that night):

1. Bat emergence surveys should begin one half hour before sunset[68] and continue until at least one hour after sunset or until it is otherwise too dark to see emerging bats. The surveyor(s) should be positioned so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. There should be at least one surveyor per roost. Surveyors must be close enough to the roost to observe all exiting bats but not close enough to influence emergence. That is, do not stand directly beneath the roost, do not make noise or carry on a conversation, and minimize use of lights (use a small flashlight or similar to record data, if necessary). Do not shine a light on the roost as this may prevent or delay bats from emerging. Use of an infra-red, night vision, or thermal-imaging video camera or spotting scope is encouraged but not required. Likewise, use of an ultrasonic bat detector may aid in identifying the exact timing of bats emerging and may be used to help differentiate between low- and high-frequency bats species, and therefore, is strongly recommended. If multiple roosts are known within a colony, then simultaneous emergence surveys are encouraged to estimate population size. [NOTE: If a roost cannot be adequately silhouetted, then the local USFWS FO(s) should be contacted to discuss alternative survey methods].

2. Bat activity is affected by weather; therefore emergence surveys should not be conducted when the following conditions exist: (a) temperatures that fall below 50°F (10°C); (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale).

3. Surveyors should use the attached (or similar) "Bat Emergence Survey Datasheet".

[67] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[68] Surveys may need to start a little earlier or later than one half hour before official sunset times (i.e., before "dusk") in some settings such as deep/dark forested valleys or ridge tops, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

4. Surveyors should also complete an "Indiana Bat Roost Datasheet" for each roost known to be used by one or more Indiana bats (see Appendix D for an example).

5. Completed datasheets should be included in reports prepared for the USFWS.

EMERGENCE SURVEYS FOR POTENTIAL INDIANA BAT ROOSTS

In some limited cases (e.g., individual hazard tree removal during the active season), surveyors may have the option of conducting emergence surveys for individual potential Indiana bat roosts to determine use prior to removal. The following protocol applies to these surveys:

1. Consult with the local USFWS FO(s) to determine whether a tree(s) that needs to be felled/ cleared may be potential roosting habitat for Indiana bats and whether conducting an emergence survey is an appropriate means of avoiding take of Indiana bats[69]. In general, the USFWS only approves of conducting emergence surveys as a means of avoiding direct take of bats for projects that only affect a very small number of potential roosts (e.g., less than or equal to 10)[70] in relatively small project areas. An online directory of USFWS offices is available at: http://www.fws.gov/offices/.

2. If the USFWS FO(s) approves/concurs with Step 1, then follow the emergence guidelines for Emergence Surveys for Known Indiana Bat Roosts (above) to determine if any bats are roosting in the tree(s).

3. At the conclusion of the emergence survey:

    a. If **no** bats were observed emerging from the potential roost(s), then it maybe felled immediately. If safety concerns dictate that a tree cannot be felled immediately (i.e., in the dark), then the tree(s) should be felled as soon as possible after sunrise on the following day. If a tree is not felled during the daytime immediately following an emergence survey, then the survey has to be repeated, because bats may switch roosts on a nightly basis. Immediately after the tree is felled, a visual inspection of the downed tree must be completed to ensure that no bats were present, injured, or killed. The USFWS FO(s) should be contacted immediately, if bats are discovered during this inspection.

    b. If **1 or more** bats (regardless of species, because species identification cannot reliably be made during visual emergence counts alone) are observed emerging from the roost, then it should **not** be felled, and the USFWS FO(s) should be contacted the next working day for further guidance.

[69] If a potential bat roost tree poses an imminent threat to human safety or property, then emergency consultation procedures should be followed as appropriate. (50 CFR §402.05). If a hazard tree does not pose an imminent threat, then the USFWS requests that it be felled during the bat's inactive season (i.e., generally from October – March, but contact the FO for specific dates for your area.) When possible, felling of potential roost/hazard trees should be avoided during the primary maternity period (June – July) to avoid potential adverse effects to non-volant pups.

[70] Areas containing >10 hazard trees will be assessed by the USFWS on a case-by-case basis with the project proponent.

SUBMISSION OF EMERGENCE SURVEY RESULTS

Emergence survey results should be included with the mist-netting survey report, unless the survey was completed as an evaluation of potential roosts, and should be submitted to the appropriate USFWS FO(s) for review. Each survey report should include the following information related to emergence survey efforts[71]:

1. Copy of prior phase reports (if not previously provided)
2. Explanation of any modifications from the Phase 4 emergence count study plan (e.g., number of potential roosts surveyed), if applicable
3. Summary of roost emergence data
4. Map identifying location of roost(s) identified during radio-tracking and/or emergence surveys for Indiana bat(s) including GPS coordinates
5. Full names of personnel present during emergence survey efforts and who conducted emergence surveys of roosts
6. Photographs of each identified roost
7. Copies of all "Emergence Survey" and "Indiana Bat Roost" datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted
9. Copy of the pre-approved site-specific written authorization from USFWS and/or state natural resource agency (if required)

[71] In 2016, the USFWS implemented a new standardized approach for reporting of bat survey data. In addition to a traditional written report, federal permit holders are now required to submit their survey data using standardized permit reporting spreadsheets available on the Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: _____ Surveyor(s) Full Name:_____

State: _____ County: _____ Project Name: _____

Site Name/#: _____ Roost Name/# _____ Bat #:_____

Lat/Long or UTM of Roost: _____

Description of Roost/Habitat Feature Surveyed: _____

_____

Bat Species Known to be using this Roost/Feature (if not known, leave blank):

_____

Other Suspected Bat Species (explain): _____

Weather Conditions during Survey (temperature, precipitation, wind speed):

_____

Survey Start Time: _____ Time of Sunset: _____ Survey End Time: _____

NOTE: Emergence surveys should begin ½ hour before sunset and continue until at least one hour after sunset or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes

Site Name/#: _____ Roost Name/#: _____

Time	Number of Bats Leaving Roost*	Comments / Notes
Total Number of Bats Observed Emerging from the Roost/Feature During the Survey:		

* If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

_____

_____

_____

APPENDIX F: LINEAR PROJECT GUIDANCE

For linear projects (e.g., pipelines and roadways), surveyors have the option to use either mist nets or acoustic detectors in any given 1-km segment of suitable habitat. A survey site may also cover other associated linear project facilities (e.g., access roads) that are located within a pre-determined distance of each segment. When possible, surveyors should seek out the best available survey sites located within the footprint of the project alignment, and directly adjacent to, or near, the alignment if no suitable sites are available within the footprint. Because the best survey sites for capturing/detecting bats may fall outside of a project footprint, the surveyor and project proponent should coordinate with the appropriate USFWS FO to establish a project-specific maximum distance from the centerline or project boundary prior to initiating surveys.

Tentative survey site locations along linear projects should be included in a proposed study plan to be reviewed and approved by the USFWS FO. Adequate survey effort should be conducted within each approximate 1-km segment that contains suitable forested habitat along the proposed workspace. It is not appropriate to cumulatively add up each habitat block crossed until 1km of habitat has been traversed. Segments along a linear project that do not contain suitable habitat should be skipped until the next patch of suitable habitat is encountered (Figure 3). Establishing exactly how many survey sites are needed for presence/absence surveys along a linear project often involves some give and take particularly in fragmented habitat areas (Figure 3, rows B and C). The final number of survey sites could be greater than the minimum number of sites prescribed in the protocol in order to adequately cover the areas of suitable habitat to be impacted. When available, habitat quality and quantity (e.g., size and location of suitable maternity roost trees) from on-the-ground habitat assessments can be used to fine tune and guide the placement of survey sites. In some marginal habitat areas, the quality and quantity of the existing habitat may be low enough to justify skipping some survey segments (e.g., Figure 3, Site 11). Likewise, some isolated woodlots, fencelines or individual trees may be considered too isolated and/or small to independently support bats and may be skipped if the USFWS FO concurs. Habitat suitability in fragmented areas should be assessed on a site-specific basis and consider habitat configuration and connectivity to other suitable habitat patches. In general, we recommend surveying a few more sites for a project than the absolute minimum required.

In instances where a mist netting survey has been proposed, but no suitable mist net sites can be found or accessed within a particular segment, biologists should contact the USFWS FO for further guidance or ideally agree in advance as to how such situations will be handled when encountered in the field (e.g., an acoustic survey may be substituted). Similarly, if an area of forest habitat that seemed suitable from aerial photography appears to be unsuitable or of particularly low quality upon field inspection, then you should coordinate with the USFWS FO to determine if an area may be exempted from surveys. To avoid problems, any significant departures from previously agreed to survey plans should be justified and coordinated with the USFWS FO prior to leaving the field.

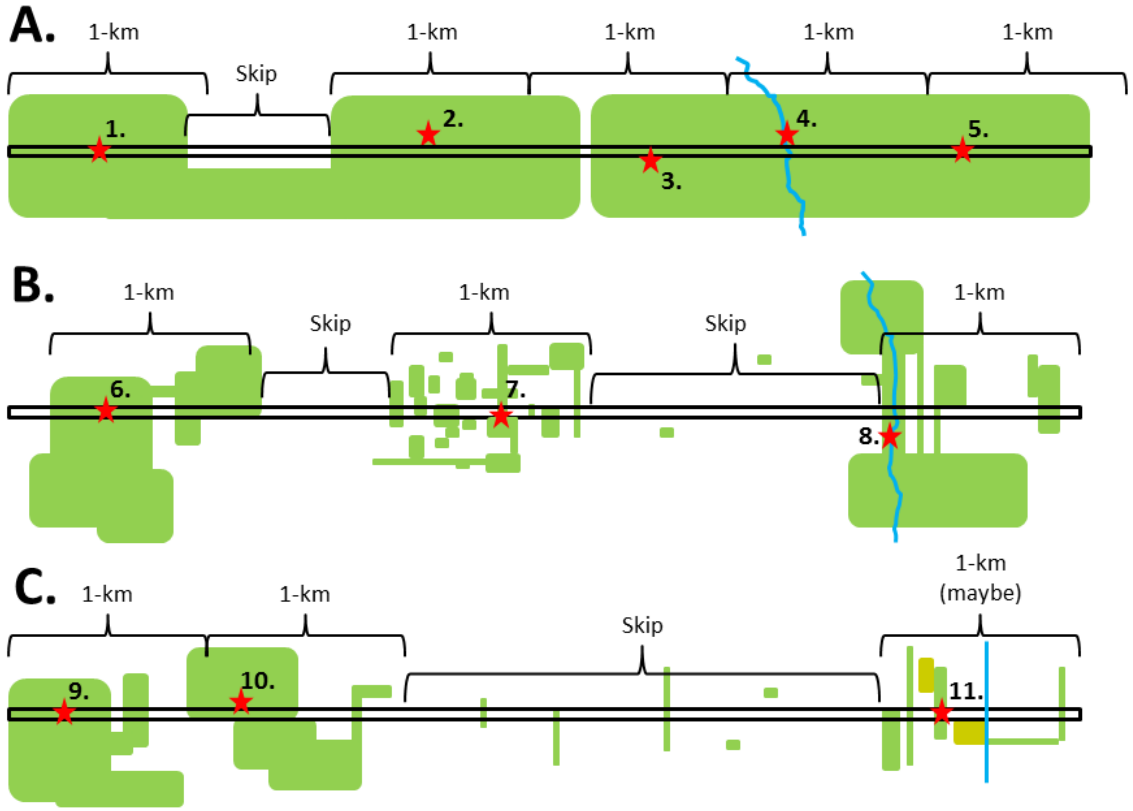

FIGURE 3. Conceptual linear project (black double lines) through relatively contiguous (A.) and fragmented (B. and C.) forested habitats (green patches) delineated into approximate 1-km survey sections. Numbered red stars represent suitable survey sites (1-11) on or near the project boundaries. Blue lines represent natural streams (A. and B.) and a ditch (C.). Yellow-green patches near Site 11 represent low-quality habitat.

APPENDIX G: THE OUTER–TIER GUIDANCE

Since early radio-tracking studies in Illinois, it has become standard practice for USFWS FOs to assume that an Indiana bat summer maternity colony will utilize suitable habitat within approximately 2.5 miles of its primary roost tree(s)/focal roosting area. However, if a reproductive adult female or juvenile Indiana bat is captured (or Indiana bats are acoustically detected), but not radio-tracked to a roost site, then FOs typically assign its capture site a 5-mile conservation buffer and assume that its roost tree is located somewhere within 2.5 miles of the capture site. This approach is further detailed in the Service's Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects[72]. **NOTE**: The same principles used for Indiana bat can be used for NLEB pertaining to NLEB capture/ detections having been assigned a 3-mile conservation buffer.

Because a 5-mile buffer encompasses four times more area than a 2.5-mile buffer (50,265 acres vs. 12,566 acres), it is reasonable to assume that only 25% of a 5-mile buffered area is actually occupied by the documented Indiana bat summer maternity colony at any given time and that 75% remains unoccupied or could be used by members of another as yet undocumented colony(s). Therefore, if a subsequently proposed project is either ≤123 acres in size or affects ≤1% of existing suitable summer habitat within a 5-mile buffer (whichever is greater), but is situated ≥2.5 miles from the original capture/detection site, then it will have a relatively low probability of being within the true maternity colony home range (assuming suitable habitat is more or less evenly distributed in all directions from the capture site)(See Figures 4 & 5). Allowing project proponents of such "outer tier" projects to conduct a summer P/A survey for Indiana bats using the standard survey level of effort (LOE) (as outlined in Appendix B and C) in such cases is reasonable and the additional survey data would 1) help refine the home range boundaries of the original colony, 2) confirm presence of additional colonies if present, 3) provide additional radio-tracking opportunities /roost tree locations, and 4) provide an option for project proponents to survey instead of always assuming presence. **NOTE**: A FO may decide not to approve an outer-tier survey under the following circumstances: (1) If available forest habitat with a 5-mile buffer is not more-or-less evenly distributed, but rather is highly clumped or restricted to a relatively narrow strip(s) (e.g., a riparian corridor); (2) <10% of a 5-mile buffer contains suitable summer habitat; or (3) other site-specific reasons.

If a project proponent of an "outer-tier" project coordinates with a USFWS FO upfront and conducts a valid summer mist-netting (Appendix B) or acoustic (Appendix C) survey using the appropriate LOE and does not capture/detect an Indiana bat(s), then no Indiana bat-related restrictions will be required for that specific project area. However, all restrictions/assumptions of Indiana bat presence outside of a completed outer-tier project survey area shall remain intact indefinitely within the 5-mile buffer zone or until additional negative survey data or discovery of roost trees indicate adjustments to a buffer are warranted by USFWS. Negative survey results from "outer-tier" projects are valid for 5 years for that particular project area. If an Indiana bat(s) is captured/detected/radio-tracked during the survey, then the project area will be presumed to be occupied, restrictions will remain in place, and the FO will reassess/adjust the original buffer(s) if warranted using the newly acquired bat location data.

[72] https://www.fws.gov/midwest/Endangered/mammals/inba/pdf/inbaS7and10WindGuidanceFinal26Oct2011.pdf

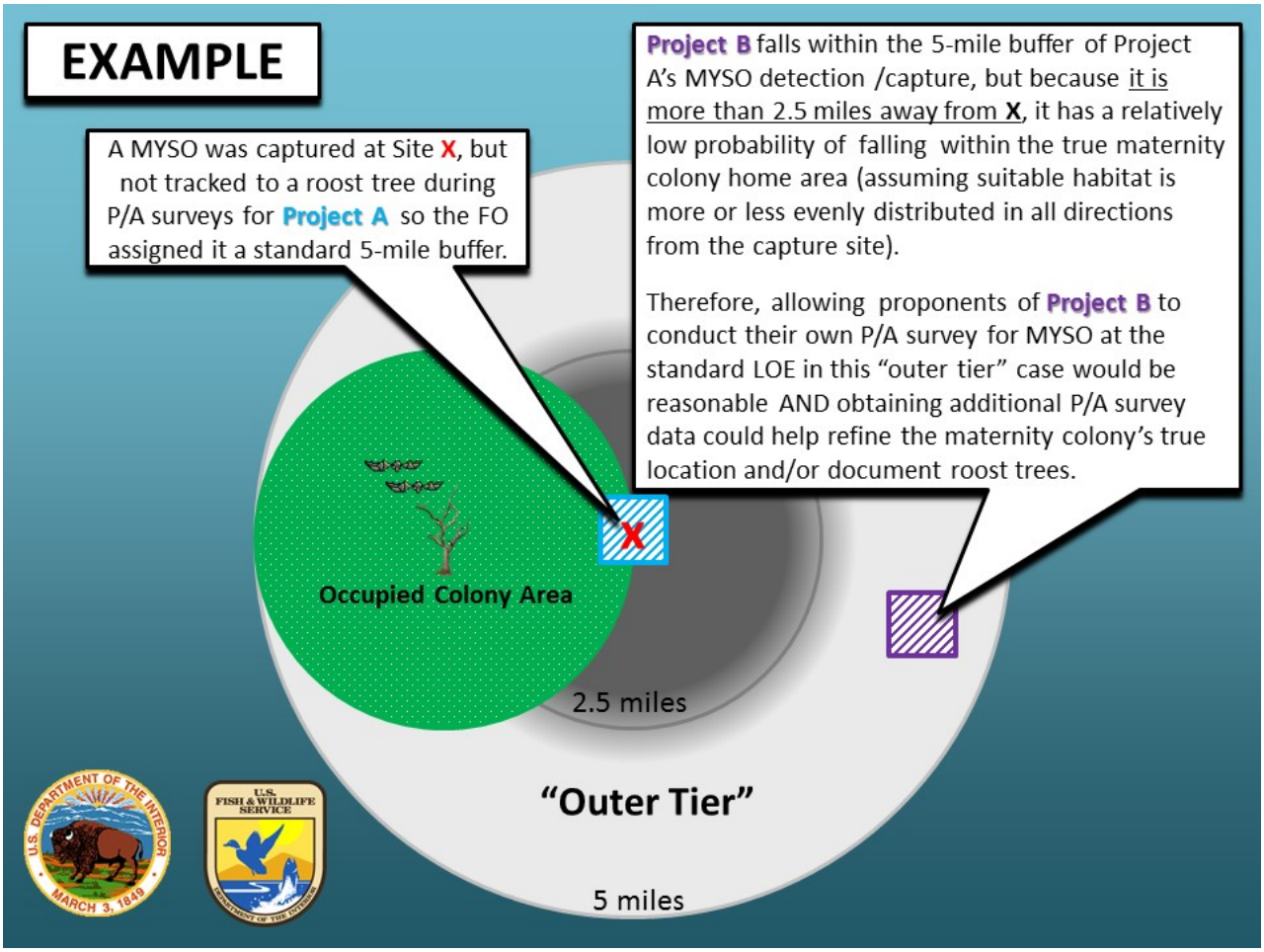

FIGURE 4. Graphical example depicting the proper application of the outer-tier guidance.

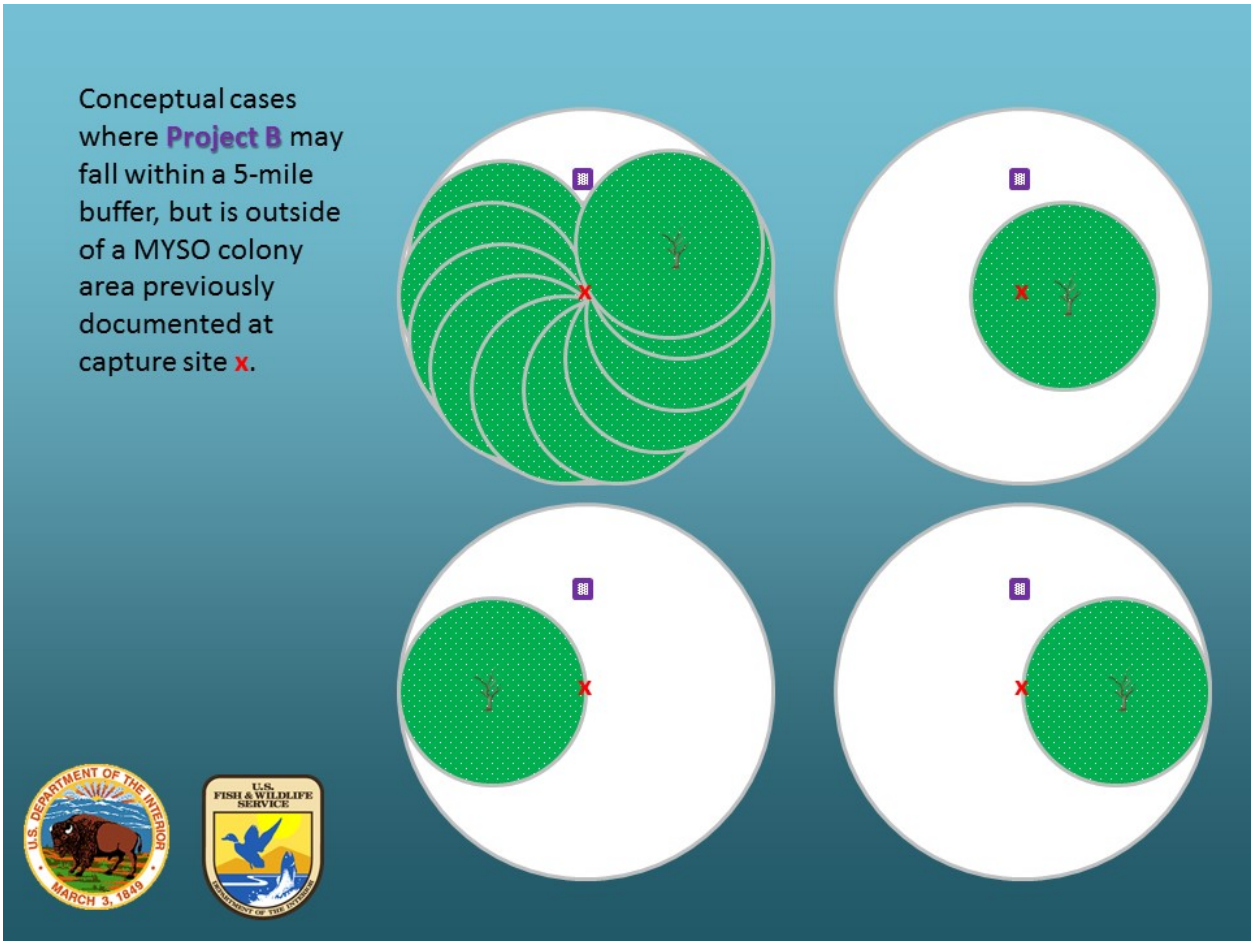

FIGURE 5. Hypothetical outer-tier scenarios where a proposed project area (depicted by a purple square) falls outside of the "true" Indiana bat maternity colony area(s) (depicted in green).

APPENDIX H: POTENTIAL HIBERNACULUM SURVEY GUIDANCE

Indiana bats have been documented using caves (and their associated sinkholes, fissures, and other karst features), as well as anthropogenic features such as mines and tunnels as winter hibernation habitat (i.e., hibernacula). Project proponents need to evaluate whether any potentially suitable Indiana bat hibernacula exist within a proposed project area. This knowledge will be derived from a variety of sources. The following phased process should be followed to determine presence or probable absence of Indiana bats in potential hibernaculum:

PHASE 1 – INITIAL PROJECT SCREENING

Step 1. Coordinate with the USFWS FO(s) and appropriate state natural resource agencies regarding existing federally listed bat hibernaculum or other occurrence information.

Prior to initiating P/A surveys (Phase 2) of potential Indiana bat hibernacula (as determined by the Phase 1 Habitat Assessment), the USFWS FO(s) and appropriate state natural resource agencies must be contacted to determine if any caves or other underground features have been previously documented as hibernacula or other habitat for federally listed bat species. Any proposed surveys of previously documented hibernacula must be coordinated directly with these agencies to ensure that adverse effects to listed species do not occur because of the survey.

Step 2. Desktop Analysis and Initial Field Reconnaissance.

After coordinating with the FO and appropriate state natural resource agency (when applicable), a desktop analysis and initial field reconnaissance should be completed by individuals with a natural resource degree or equivalent work experience and a solid understanding of karst topography and/or surface features associated with underground mines. These initial assessments can be completed at any time of year.

For all projects, a FO-approved field survey of all land within 0.5 miles of the edge of the project footprint (where access can be obtained) and documentation (e.g., a literature search, maps and information provided by local cave survey groups or grottos, review of aerial photography and topographical maps, previous mining records (if applicable), forest inventories, previous species survey reports, and the work of consultants or other designees) of all known caves and abandoned mines within 3 miles of the outside edge of the project footprint should be conducted. If caves or abandoned mines are found, further detail about the known or estimated underground extent of the cave/mine should be provided to the USFWS FO(s), including minimum and maximum depth of features and where those features are located on a map(s).

In general, underground openings can be deemed unsuitable as a hibernaculum and dismissed from further assessment and surveys if:

a) There is only one horizontal opening, and it is less than 6 inches (15.2 cm) in diameter;

b) Vertical shafts are < 1 foot (0.3 m) in diameter;

c) Passage continues < 50 feet (15.2 m) and terminates with no visible fissures that bats can access;

d) Openings are prone to flooding, collapsed shut and completely sealed, or otherwise are inaccessible to bats; and

e) Openings that have occurred recently (i.e., within the past 12 months) due to human activity or subsidence. (Include written documentation verifying this determination).

The results of initial field assessments should be submitted to the USFWS and State regulatory partners (when applicable) for review and approval prior to proceeding to Step 3. FO-approved results from Step 2 will remain valid for a minimum of five years. **NOTE**: longer time frames may not be appropriate due to cave/mine dynamics.

Step 3. Conduct a Phase 1 Habitat Assessment of Potentially Suitable Hibernacula.

If underground openings are documented during field surveys in Step 2 and cannot be dismissed during initial project screening above, then a qualified biologist[73] will need to conduct a Phase 1 Habitat Assessment to determine whether bats using a potentially suitable hibernaculum within a project area could be adversely affected by the proposed project as described below (see Phase 1 Habitat Assessment Sample Data Sheet).

Habitat assessments should include all entrances or openings that will be directly or indirectly impacted by the proposed project. This would include those caves (and their associated sinkholes, fissures, and other karst features), as well as anthropogenic features such as mines and tunnels that are within the project site or that are otherwise connected (i.e., by physical passageway, airflow or hydrologically) to any underground feature that will be directly or indirectly impacted by the proposed project.

The results of a Phase 1 Habitat Assessment should be submitted to the USFWS and State regulatory partners (when applicable) for review and approval prior to proceeding to Phase 2. FO-approved results from Step 3 will remain valid for a minimum of five years. **NOTE**: longer time frames may not be appropriate due to cave/mine dynamics.

PHASE 2 – PRESENCE/ABSENCE SURVEYS

Surveys to Confirm Use of Suitable Winter Habitat

If suitable winter habitat is discovered as a result of the Phase 1 Habitat Assessment above, do not alter, modify, or otherwise disturb entrances or internal passages of caves, mines, or other entrances to underground voids (potential hibernacula) within the action area before completing a Phase 2 survey. The survey protocols for determining occupancy are detailed below. Some

[73] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for Indiana and/or northern long-eared bats in the state/region in which they are surveying. Alternatively, in States within Region 5 of the USFWS, state agencies assess qualifications and provide authorization to net, handle, and conduct hibernaculum surveys of/for Indiana and/or northern long-eared bats in that State (authorization is only valid in the State that provides the authorization). Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

surveys may require modification (or clarification) of these guidelines; therefore, submittal of a study plan and coordination with the USFWS FO(s) and state natural resource agency is necessary prior to initiating suitable winter habitat/hibernacula surveys. Submit results of completed summer and/or winter surveys to the appropriate FO(s) prior to clearing or altering of identified bat habitat. The USFWS FO will review the results of P/A surveys conducted according to these guidelines for the purposes of determining whether Indiana bats are occupying hibernacula in the project area and whether they may be adversely affected by any proposed actions.

WINTER (INTERNAL), FALL, AND SPRING SURVEY PROTOCOLS FOR IDENTIFYING POTENTIAL INDIANA BAT HIBERNACULA

White-nose syndrome (WNS) is a devastating fungal disease that has killed unprecedented numbers of hibernating bats in eastern North America. WNS and/or *Pseudogymnoascus destructans* (Pd), the fungus causing the disease has been detected throughout the range of the Indiana bat. Users of this guidance must follow the recommendations provided in the most recent USFWS Cave Advisory[74] as they relate to reducing the potential for humans to disturb hibernating bats or inadvertently transporting Pd to uncontaminated bat habitats. All surveys conducted at caves/mines should be coordinated with the USFWS FO(s) and appropriate state natural resources agencies prior to initiation (see example USFWS Project Proposal Form).

Winter (Internal) Surveys

Working near and within abandoned mines and caves can be inherently dangerous due to a variety of potential hazards (e.g., ceiling collapse and presence of toxic gases)[75]. Therefore, surveyors must thoroughly assess their work sites for any known and potential health and safety hazards and must use appropriate personal protective equipment and take proper precautions to avoid and minimize identified risks. Only sites that are deemed safe should be entered at the surveyor's discretion.

Potential hibernacula that are deemed safe to enter should be entered and all of its accessible passages visually surveyed for the presence of Indiana bats during mid-winter (i.e., beginning January 1st and ending prior to March 1st of the same calendar year (also see Appendix 4 of the USFWS 2007 Indiana Bat Draft Recovery Plan: first revision). **NOTE:** The use of direct internal surveys is not adequate for northern long-eared bats due to the difficulty in visually detecting the species inside hibernacula (i.e., it typically roosts in deep cracks and crevices). Only properly trained and qualified individuals with the appropriate federal and/or state permits and equipment should attempt internal presence/absence surveys for the Indiana bat. If the qualified biologist, who completed the Phase 1 Habitat Assessment, does not have the necessary experience/permits to complete internal survey work, then this portion of the project should be subcontracted to another individual or group that does. If a site is unsafe or too difficult to enter or it is believed that significant portions of the underground system are inaccessible, it should be surveyed using the Fall or Spring emergence survey guidance to determine presence or probable absence of federally listed bat species, including the Indiana bat (also see Sample Data Sheet for Fall or Spring Surveys of Potential Hibernacula).

[74] https://www.whitenosesyndrome.org/sites/default/files/files/final-cave_access_advisory_2016_2.pdf.

[75] The Service highly recommends that surveyors seek counsel from an occupational health and safety professional(s) prior to working underground or under other potentially hazardous field conditions.

Fall or Spring Emergence Surveys

1A. Fall surveys of mine/cave entrances must be conducted between September 15 and October 31[76] and prior to any tree clearing by the project applicant. A minimum of one night of harp trap sampling per week for 6 weeks (i.e., 6 nights of sampling) is required at each suitable entrance as determined by the Phase 1 Habitat Assessment. Each night of sampling should be separated by at least one week of the survey window if weather conditions allow it. However, multiple nights of sampling per week can be accepted in the last two weeks of October if forecasted weather conditions require it, at least 3 nights of sampling were completed during the first 3 weeks of the survey period, and the modification is approved by the appropriate USFWS FO(s). Survey effort may be suspended if no bats (of any species) are captured after the first 2 nights of acceptable survey effort in the fall. Surveys of a potential hibernaculum are in addition to any summer P/A surveys that may be required for a proposed project.

OR

1B. Spring surveys of mine/cave entrances must be conducted between April 1 and April 21[77] and prior to any tree clearing by the project applicant. Conducting surveys during the spring emergence is typically more complex than conducting fall surveys due to a greater number of uncontrollable factors (e.g., weather related factors). Thus, a minimum of three nights of harp trap sampling per week for three weeks (i.e., 9 nights of sampling) is required at each suitable entrance as determined by the Phase 1 Habitat Assessment. Due to the need to monitor weather conditions closely, each proposed spring mine/cave survey must be coordinated with the USFWS FO(s) and appropriate state natural resource agencies prior to surveying to ensure that adequate survey results are achieved. Surveys of a potential hibernaculum are in addition to any summer P/A surveys that may be required for a proposed project.

2. Unless otherwise approved by the USFWS FO[78], the capture of an Indiana and/or northern long-eared bat during a fall or spring mine/cave survey requires that the applicant complete three additional nights of sampling per week for three consecutive weeks (9 additional nights LOE) in order to determine the relative significance of the mine(s) and/or cave(s) and their associated underground workings to the Indiana and/or northern long-eared bat. If the mine/cave survey season (i.e., September 15 to October 31 for fall sampling and April 1 to April 21 for spring sampling) ends prior to the completion of the required additional sampling, then sampling must be completed the following fall or spring.

3. Harp traps are the preferred method for sampling entrances as they are less stressful on captured bats. Mist nets can also be deployed along corridors immediately adjacent to the entrance to increase survey effectiveness. Mist nets may also be used at the entrance but only when the mine or cave configurations are not suitable to harp trapping. The use of mist nets must be approved by the USFWS FO(s) and appropriate state natural resource agency prior to

[76] Timing of fall surveys may need adjustment based on location and weather conditions leading up to the survey. Coordination with local USFWS FO(s) and State regulatory partners (when applicable) during development of the study plan/project proposal form is required.

[77] Timing of spring surveys may need adjustment based on location and weather conditions leading up to the survey. Coordination with local USFWS FO(s) and State regulatory partners (when applicable) during development of the study plan/project proposal form is required.

[78] Additional survey effort may not be recommended in cases where a project proponent agrees to modify their project to completely avoid adverse impacts to newly documented hibernacula or the survey was conducted solely to determine if abandoned mine openings can be closed or if bat-friendly gates need to be installed.

initiation of survey. Mist nets should be made of the finest, lowest visibility mesh commercially available. Currently, this is 2-ply, 50-denier nylon (denoted 50/2). The mesh should be approximately 1.5-inch in size. No other specific mist netting hardware is required.

4. Entrances must be entirely enclosed by the survey gear when harp trapping. If mist nets are used, entrances should not be entirely enclosed by the survey gear.

5. All entrances that are potentially inter-connected should be surveyed on the same night. In cases where one team of surveyors cannot feasibly sample all entrances in one night, a modified method could also be used. This method should only be used in situations where the entrances are known to be interconnected. In this modified method, half of the interconnected entrances are surveyed on the first night, and the other half of the entrances are completely blocked using bird-exclusion netting, plastic sheets or other impervious material. On the second night, survey efforts are reversed. Any materials used to block the entrances must be removed each night immediately after conducting the survey. No entrances should be left blocked over-night. Plastics or other materials used to block the entrances should be removed each night immediately after conducting the survey. Entrances that are not connected (e.g., as determined by existing mine maps) do not have to be surveyed simultaneously.

6. The sampling period should begin at sunset and continue for at least 5 hours each night. During this time, harp traps (most preferable method) and/ or mist nets (acceptable method, but less preferable from a bat-handling perspective) should be monitored for captured bats on 30- and 10-minute intervals, respectively, to minimize the number of bats that escape.

7. If captures increase during the survey or if 6 or more bats of any species were captured during the last hour of monitoring, the survey effort must continue until activity declines or fewer than 6 bats are captured per hour. A total of 30 (fall) or 45 (spring) hours of sampling should take place for a mine/cave survey to be approved.

8. Severe weather adversely affects the activity levels of bats. If any of the following weather conditions exist during the fall or spring mine/cave survey, the time and duration of such conditions must be noted on the data sheets and in the survey report, and the survey effort for that night must be repeated: (a) winds sufficiently strong and variable enough to move equipment (i.e., traps or nets) more than 50 percent of the time; and (b) precipitation, including rain and/or fog, that does not stop within 30 minutes or continues intermittently during the survey period; and (c) temperatures that are less than 50° F (10° C) for the first 2 hours, and that drop below 40° F (1.6° C) at any point during the survey.

9. All bats captured during fall or spring surveys must be temporarily marked with a FO-approved non-toxic material that will last for the remainder of the survey period in order to identify any recaptures during subsequent survey nights.

10. If Indiana and/or northern long-eared bats (or other federally listed species) are captured during fall or spring mine/cave surveys, notification to the local USFWS FO is required within 48 hours (or in accordance with permit conditions), and the sex and reproductive condition of the bat and GPS coordinates of the capture site should be provided.

11. A bat detector/roost logger should be on site to monitor general bat activity when trapping or netting. Bat passes should be monitored and tallied hourly. Bat tallies should be reported

along with the time sampled. Report the beginning time and number of bat passes in hour blocks. Analysis of recorded bat calls to attempt species identification should not be completed as these calls are not expected to be foraging calls.

12. Noise, the use of lights, or other potential disturbances should be kept to, at a minimum, no closer than 300 feet (91.4 m) of the sampling site.

13. At least one member of each survey crew must hold, and have in his or her possession, a valid endangered species collection permit issued by USFWS and/or[79] the appropriate state natural resource agency that allows the qualified biologist to collect bats, including federally listed species. All activities must be carried out with strict adherence to permit conditions and authorizations specified in your federal permit, as well as any State authorizations. A qualified biologist(s) must (1) select/approve harp trap/mist-net set-ups, (2) be physically present at each site throughout the survey period, and (3) confirm all bat species identifications. This biologist may oversee other biological technicians and manage set-ups in close proximity to one another as long as the trap/net-check timing (i.e., every 30 min. for harp traps and every 10 min. for mist-nets) can be maintained while walking between sites.

14. All survey efforts must follow the most recent USFWS decontamination protocols regarding WNS.

[79] Surveyors working in States within Region 5 of the USFWS only require a permit from the State where the survey is taking place.

Phase I Habitat Assessment Sample Data Sheet

Location _____

Observers (include permit numbers) _____

Latitude _____ **Longitude**[80] _____

Date _____ **Time** _____ **Temp (outside)** _____

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)				
Opening vertical or horizontal				
Opening Size: Height x Width (or Diameter)				
Internal Dimensions: Height x Width				
Slope (up or down from entrance)				
Entrance Stable?				
Direction of Airflow (In or out?)				
Amount of Airflow (e.g., none, slight, heavy)				
Internal air warmer or cooler than outside temp.?				
Evidence of collapse?				
Ceiling Condition				
Amount of water in opening				
Evidence of past flooding?				
Observed length of internal passage				
Distance to nearest water source				
% Canopy Cover at entrance				
Foraging Signs? (e.g., moth wings)				

Are any portals suspected or known to be connected? Which ones?

Any observable side passages?

Additional comments:

Entry of abandoned mine portals, quarries, or caves can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter into any cave, quarry, or mine portal.

[80] Provide coordinates for each opening.

Sample Data Sheet for Fall or Spring Surveys of a Potential Hibernaculum

DATE:	TEMPERATURE	Start:	End:
PRECIPITATION*:		WIND*:	
MOONLIGHT:	TIME	Start:	End:
PERSONNEL (include permit numbers):		LOCATION (lat/long):	

Time	Species	Age	Sex	Repro Cond.	RFA (mm)	Mass (g)	Flight Direction (in or out)	Notes and General Comments

***Precipitation and Wind should be measured hourly**

****Repro. Cond (Reproductive Condition): (P) pregnant; (L) lactating; (PL) post-lactating; (NR) non-reproductive, (TD) testes descended**

USFWS Potential Hibernaculum Project Proposal Form

CONTACT INFORMATION

Permittee Name(s): _____

State Permit # _____ Section 10 USFWS Permit # _____

Institution/Company Name (as on Permit): _____

Address: _____

City: _____ State: _____ Zip: _____

Email address: _____

Phone #: _____

PROPOSED PROJECT OR ACTIVITY INFORMATION

County: _____ Quad: _____

Project location: latitude: longitude:

(You must include an 8.5" x 11" topo or aerial map with project/activity location and proposed sites identified)

USFWS Project Number (if known): _____

Mining Project ☐ SMCRA Permit Number: _____

Transportation Project ☐ DOT Item Number: _____

Utility Project: _____

AML Project: _____

Other: _____

Acres of suitable Indiana bat habitat within project/activity area: _____

Is the project/activity linear? Yes: ☐ No: ☐

If yes, indicate length of suitable Indiana bat habitat in km (mi): _____

Are caves or portals present? Yes: ☐ No: ☐

METHODOLOGY & SURVEY EFFORT

Coordinates of cave/portal (if multiple, please provide locations on project map): latitude: _____ longitude: _____

Name of cave (if known): _____

Estimated Start Date of Fieldwork: _____

# of Acoustic Activity Nights: _____ Number of Mist Net/Harp Trap Nights: _____

Other _____

_____ _____

Signature **Date**

Appendix F
Informal Conference & Management Guidelines on the Northern Long-eared Bat (*Myotis septentrionalis*) for Ongoing Operations on Installation Management Command Installations

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

5600 American Boulevard West, Suite 990
Bloomington, Minnesota 55437-1458

IN REPLY REFER TO:

FWS/R3/ES

MAY 04 2015

Col. Robert Witting
Colonel, U.S. Army Commanding
U.S. Army Installation Management Command
U.S. Army Environmental Command
2450 Connell Road
Joint Base San Antonio Fort Sam Houston, TX 78234-7664

Re: Request for Concurrence on the Programmatic Informal Consultation on Impacts of Operations on Installation Management Command Installations on the Northern Long-eared Bat

Dear Col. Witting:

This responds to your April 24, 2015 request for our concurrence that select military mission operations of the Army's Installation Management Command (IMCOM), are not likely adversely affect the threatened northern long-eared bat (*Myotis septentrionalis*). Although you requested a conference report, the northern long-eared bat listing is effective as of today; therefore, the U.S. Fish and Wildlife Service (Service) is responding to your request under Section 7(a)(2) of the Endangered Species Act, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.; ESA).

As discussed in your letter, the U.S. Assistant Chief of Staff for Installation and staffs from the U.S. Army Environmental Command (USAEC), IMCOM, the U.S. Army National Guard and the Service have been coordinating on a programmatic informal consultation for select Army mission activities. This informal consultation includes conservation measures outlined in your April 24, 2015, Biological Evaluation (BE) entitled "Informal Conference & Management Guidelines on the Northern Long-eared Bat (*Myotis septentrionalis*) for Ongoing Operations on Installation Management Command Installations". The conservation measures will be incorporated into activities to avoid adverse effects to northern long-eared bats, thus achieving a "may affect, not likely to adversely affect" determination for Section 7 consultation for these projects. This programmatic informal consultation only addresses the consultation requirements for those projects that can implement the conservation measures and meet the project conditions and effect determinations described in the biological evaluation. The Service was a part of, and worked to help construct the biological evaluation, including all analysis and design of conservation measures. Therefore, based on the analysis in biological evaluation, we concur that all projects designed to fully meet the required terms

will only have effects on northern long-eared bat that are insignificant (unlikely to rise to the level of take), discountable (take is extremely unlikely to occur), or wholly beneficial.

Under the terms of this programmatic informal consultation, IMCOM is responsible for ensuring activities are within the scope of, and adhere to the criteria of the programmatic BE. Each IMCOM installation will screen applicable installation activities through an IMCOM/USFWS cooperatively generated checklist to ensure the activity is conducted as described in the BE. For each activity completed under the programmatic informal consultation, each installation will document their activities and compliance, and IMCOM will provide an annual report to the Service for all actions taken under this informal consultation.

The programmatic informal consultation agreement will be in effect for a period of three years, unless we receive information that indicates the consultation must be revised. To track and monitor the consultation, IMCOM and the Service will meet on an annual basis, or as needed, to: (1) discuss the annual report of covered projects, (2) evaluate and discuss the continued effectiveness of the programmatic consultation, and (3) update procedures, conservation measures, or project criteria, if necessary. If through this review process, IMCOM or the Service believes that this programmatic informal consultation is not being implemented as intended or is having unanticipated impacts on the species, they may request formal review and possible revision. IMCOM may also request revision if data endorses inclusion of new, or modification of established, measures in the BE that support a "may affect, not likely to adversely affect" determination.

We applaud your commitment to protect the northern long-eared bat and the collaborative approach of all of the participating divisions of the Army. With the completion of this programmatic informal consultation, we look forward to our continued collaboration on your conservation strategy and formal consultation approach for the northern long-eared bat. If the project description changes or new information reveals that the effects of the proposed action may affect listed species in a manner or to an extent not considered, further review pursuant to the ESA may be required. If you have any questions or need further information, please contact Karen Herrington of my staff at 850-348-6495.

Sincerely,

Lynn Lewis

Lynn Lewis
Assistant Regional Director, Midwest Region

cc: Paul Phifer, USFWS, ARD Ecological Services, Northeast Region
Leo Miranda, USFWS, ARD Ecological Services, Southeast Region
USFWS, Alabama Ecological Services Field Office, Daphne, AL
USFWS, Chesapeake Bay Ecological Services Field Office, Annapolis, MD
USFWS, Kansas Ecological Services Field Office, Manhattan, KS
USFWS, Kentucky Ecological Services Field Office, Frankfort, KY
USFWS, Michigan Ecological Services Field Office, East Lansing, MI

USFWS, Missouri Ecological Services Field Office, Columbia, MO
USFWS, New England Field Office, Concord, NH
USFWS, New Jersey Ecological Services Field Office, Pleasantville, NJ
USFWS, New York Ecological Services Field Office, Cortland, NY
USFWS, Pennsylvania Ecological Services Field Office, State College, PA
USFWS, Rock Island Ecological Services Field Office, Rock Island, IL
USFWS, Twin Cities Ecological Services Field Office, Bloomington, MN
USFWS, Virginia Ecological Services Field Office, Gloucester, VA

Informal Conference & Management Guidelines

on the

Northern Long-eared Bat (*Myotis septentrionalis*)

for

Ongoing Operations on Installation Management Command Installations

May 2015

Prepared By:
U.S. Army Environmental Command

Table of Contents

List of Tables:

I. General

A. *Purpose.* Pursuant to Section 7(a)(4) of the Endangered Species Act (ESA), federal action agencies are required to confer with the United States Fish and Wildlife Service (USFWS) if their proposed action is likely to jeopardize the continued existence of a listed species (50 CFR 402.10(a)). Action agencies may also confer with the USFWS if the proposed action may affect a proposed species or proposed critical habitat. Species listed as threatened or endangered under the ESA are afforded protection against "take". After the listing becomes effective, pursuant to Section 7(a)(2) of the ESA, federal action agencies are required to consult with the USFWS if their proposed action may affect the listed species (50 CFR 402.14(a)).

The intent of this informal conference and subsequent consultation is to evaluate military operations and sustainment/enhancement activities on Installation Management Command (IMCOM) installations and facilities that may affect, but are not likely to adversely affect (NLAA) the northern long-eared bat (*Myotis septentrionalis*; NLEB), a species to be listed as threatened under the ESA on 04 May 2015 (USFWS 2015). No additional species are addressed or covered within this action. IMCOM has determined effects and proposes conservation measures to avoid or minimize adverse effects to the NLEB. If USFWS concurs in the resulting conference report, this will be a programmatic informal conference and programmatic informal consultation. Any activities not included in this consultation will be subject to separate section 7(a)(2) consultation after the listing becomes effective.

This evaluation includes: 1) consultation requirements; 2) IMCOM structure; 3) distribution and status of the species; 4) description of Military Missions and Operations; 5) survey results; 6) proposed conservation measures to limit potential impacts from Military operations and activities; and 7) conclusions.

The resulting conference report will serve as guidelines that establish a programmatic baseline for managing the NLEB on applicable IMCOM installations and facilities to avoid likely future conflicts. It can be used in developing management and conservation goals and objectives for the NLEB as part of an installation's Integrated Natural Resource Management Plan (INRMP). An installation INRMP will supplement these guidelines with detailed measures to meet installation-specific NLEB conservation and unique military mission needs. The requirements established for the NLEB in the INRMPs will apply to all activities on the installation.

B. *Applicability.* The programmatic guidelines are applicable to IMCOM installations and areas of operations identified in this document. Some of these IMCOM installations have already completed an informal/formal conference/consultation with their local USFWS Field Office and will not be subject to this programmatic conference but instead retain the requirements within their specific document, unless the requirements are complimentary and/or the installation, in coordination with USFWS, chooses to adopt the conservation measures defined herein. The remaining IMCOM installations identified in this document with no prior USFWS coordination will be subject

to this programmatic conference and consultation. All IMCOM installations outside the known range of the NLEB are not considered in this programmatic document. The overarching intent is to facilitate IMCOM installations ability to utilize the most appropriate conservations measures in regards to NLEB though section 7conference/consultation.

C. *Timeline and Revision.* HQ IMCOM will revise these guidelines as necessary to be consistent with the listing rule of the NLEB, future Recovery Plans, or incorporation of the latest and best scientific data available. This informal conference will cover a period of three years but will be reviewed annually for applicability and continued concurrence between IMCOM & USFWS on its content. During the annual review if there is continued concurrence or if the document needs to be amended IMCOM and USFWS will coordinate according to the guidelines in the conference report. At any time, IMCOM or the USFWS may revoke or revise this programmatic consultation if it is determined that it is not being implemented as intended.

D. *Goal.* This documents intent is to provide programmatic coverage to all IMCOM installations for the training and land management activities and processes that are similar throughout. Additionally it is IMCOM's goal to implement management guidelines that will allow the accomplishment of military missions & sustainment while concurrently developing and implementing methods to assist in the conservation of the NLEB.

II. Additional Conference/Consultation

A. *Conference/Consultation Requirement.* In proposing actions that deviate from these guidelines that "may affect" the NLEB or for actions in which further consultation has been agreed to, IMCOM installations will comply with the conference/consultation requirements of section 7 of the ESA per the implementing regulations at 50 CFR part 402; and Army policies and guidance.

1. *Informal Conference/Consultation.* IMCOM recognizes that informal conference/consultation with the USFWS is critical to resolving potential problems and establishing the foundation to address issues in a proactive and positive manner. For any "may affect" determinations, IMCOM and IMCOM installations will seek to modify proposed actions and work with the USFWS to obtain concurrence on a "may affect, but not likely to adversely affect" (NLAA) determination. Issue resolution through informal conference/consultation is the preferred method.

2. *Formal Consultation.* If implementation of these guidelines is not possible or feasible for a proposed action and adverse affects cannot be avoided, the subject IMCOM installation will initiate formal Section 7 conference/consultation in accordance with the procedures in 50 CFR 402 and applicable Army policies and guidance. For formal consultations, the IMCOM installation will implement the reasonable and prudent measures (RPMs) identified in the Biological Opinion (BO) to ensure no impacts on mission implementation.

B. *Confirmation.* IMCOM will re-initiate consultation on these guidelines if (i) information arises indicating that implementation of the guidelines may not avoid adverse impacts on the NLEB for certain activities; (ii) data/new research endorses inclusion of new, or modification of established, measures in the guidelines that still support a NLAA determination; or (iii) a "take" occurs even though IMCOM is fully implementing the guidelines. IMCOM will notify USFWS within five business days if issues pertaining to (i) and/or (iii) arise, and work with the USFWS on addressing such issues through informal consultation. IMCOM will make the necessary changes to the guidelines, if any, and conduct the necessary internal staffing prior to submitting the revised document to USFWS for concurrence. During this period, the NLAA concurrence will still be valid for the conservation measures not subject to any scrutiny or concern.

C. *Programmatic Informal Consultation Process.* Each IMCOM installation will screen applicable installation activities through an IMCOM/USFWS cooperatively generated checklist to ensure the activity is conducted as described in this BE. For each activity completed under the programmatic informal consultation, each installation will document their activities and actions taken describing how compliance was maintained with the conservation guidelines within this document. IMCOM will collectively report annually to the USFWS on information collected in the annual Army Environmental Database Environmental Quality (AEDB-EQ) data call for actions taken in regards to NLEB at each installation. This informal conference will cover a period of three years but will be reviewed annually for applicability and continued concurrence between IMCOM & USFWS on its content. All other species that require Section 7 consultation or Migratory Bird Treaty Act compliance will be reported in separate documentation by the individual installation if applicable.

D. *Emergency Consultation*. Unpredictable catastrophes such as wildfires, tornados, or significant hurricane damage may present conditions that cannot be anticipated under these guidelines. In the case of a catastrophic event, IMCOM installations will implement these guidelines to the greatest extent possible, but imminent threat to life or property may take precedence. IMCOM installations will record impacts on NLEB habitat and any definitive impacts on bats resulting from the event, and document any actions that were necessary during the event such as creation of fire breaks, removal of hazardous trees, etc. The subject IMCOM installation(s) will initiate emergency consultation with their associated USFWS field office as soon as possible. IMCOM will reevaluate conservation and management requirements, if necessary, to better prepare for the conservation of the NLEB during such unanticipated events.

E. *Endangered Species Act 4(d) Rule*. With a 4(d) rule in place, any actions taken by an agency that are exempted in the 4(d) rule will not require an incidental take statement in a biological opinion. Therefore installations could drastically reduce the consultation timeframes and conservation measures required for forestry activities (including harvest & prescribed burning), prairie management, right of way expansion,

and other activities defined therein by conducting Section 7 Consultation only on activities contained within the 4d Rule.

F. *Other Listed Species*. Other ESA listed Threatened or Endangered species may occur on IMCOM installations listed in this BE. This BE only addresses the NLEB because consultation has already occurred for the other listed or, depending on the IMCOM installation, activities may have no effect on other listed species. Prior to implementing any Conservation Measure identified in this PBE, the IMCOM installation will address and assess impacts of such measures on applicable listed species. Conservation Measures and Reasonable and Prudent Measures of any relevant Biological Opinion(s) will continue to be implemented for listed species on sites subject to this consultation. If necessary, the IMCOM installation will informally consult with the USFWS to address a situation where implementation of a Conservation Measures may affect NLEB or other listed species.

III. Installation Management Command (Action Area).

Military installations particularly those managed by IMCOM have a demonstrated track record of sound natural resource stewardship and management. This demonstrated ability creates some of the most diverse natural resource areas supporting a multitude of rare and imperiled species while seamlessly blending that with the daily needs of advanced military training. It is the blending of these two seemingly contradictory things which continues to be the IMCOM goal as training capability is directly dependent on our ability to maintain the natural infrastructure of Army lands.

The primary purpose of IMCOM installations is to provide for the sustainment, enhancement, and readiness of the U.S. Military. Military training and enhancement activities are generally divided into the following categories: sustainment operations, engineering operations, air operations, water operations, field training operations, live munitions training, demolition, smokes/obscurants, and research, development, testing, and evaluation (RDTE). All of these activities occur in dispersed Training Areas; some of these activities occur in localized Training Areas year-round at all times of the day and night. Natural resource management activities also occur on most IMCOM installations which may include forest management, prairie management, wildlife management, recreation, erosion control, and other land management activities and uses as described in each installations INRMP.

The U.S. Army Command, IMCOM is a federal agency, and as such, must comply with Federal statutes and regulations. IMCOM supports active and reserve military installations worldwide. IMCOM is organized into four regions (Europe, Atlantic, Central, & Pacific), of which the Atlantic and Central Regions are within the range of the NLEB. There are 19 individual Army installations within the Atlantic Region and 6 installations within the Central Region that have the potential for NLEB's. Table 1 below lists each installation, its IMCOM Regions, the State in which it exists, and its approximate size. While there are approximately 809,000 million acres in total for these

installations only 453,000 of that is forested habitat which may or may not be suitable NLEB habitat.

Funding and policy guidance for natural resources management on installations are provided by IMCOM. IMCOM also provides natural resources technical support, and is responsible for tracking projects, quality assurance of compliance documents, and execution of funds. While IMCOM provides support across its installations, the individual installations are relatively autonomous in their completion of day-to-day management of the installation. Therefore some installations have conducted or are in the process of conducting individual Section 7 actions as it relates to their local situation and may not need the programmatic coverage provided by this document.

Table 1: IMCOM Installations Within the Range of the Northern Long-eared Bat.

IMCOM Region	Installation Name	State	Approx. Size (ac)	Approx. Forested (ac)	Indiana or Gray Bat	NLEB	Bat Surveys	Hibernacula <=5 miles	Consultation	WNS Decon
ATL	Aberdeen Proving Ground*	MD	72,500	18,000			scheduled FY15	No	No - poor habitat	NA
ATL	Carlisle Barracks*	PA	500	0						
CEN	Detroit Arsenal*	MI	341	0			None			
ATL (Reserve)	Devens Reserve Training Facility	MA	5,000	4,000	Verified absence	Historic presence	Occasional	No	No	NA
ATL	Fort AP Hill	VA	76,000	66,500	Out of Range	Historic presence	Occasional-in process	No	Informal	No
ATL	Fort Belvoir	VA	8,658	4,300	Indiana	Assumed	By project & Annual	No	Consultation in progress	Developing
ATL	Fort Campbell	KY	102,414	48,200	Indiana & Gray	Present	By project & Annual	Yes and on-site	Informal and Formal with INRMP	Yes
ATL	Fort Detrick*	MD	12,000	82			None	No Known	No	No
ATL	Fort Drum	NY	107,625	74,000	Indiana	Present	Annual	No	Informal and Formal BO	Yes
ATL	Fort George G. Meade	MD	5100	1,700	Out of Range	Assumed	None	No Known	Informal	N/A
ATL	Fort Hamilton*	NY	50	0			None			
ATL	Fort Knox	KY	109,000	81,000	Indiana	Present	Annual	Yes and on-site	Informal and Formal with INRMP	Yes
CEN	Fort Leavenworth	KS	5,600	3,500	Verified absence	Not Detected	Occasional	No Known	No	NA

IMCOM Region	Installation Name	State	Approx. Size (ac)	Approx. Forested (ac)	Indiana or Gray Bat	NLEB	Bat Surveys	Hibernacula <=5 miles	Consultation	WNS Decon
ATL	Fort Lee*	VA	5,376	2,300	Not Detected	Not Detected	Periodic (every 2-3 years)	No	No - poor habitat	Yes
CEN	Fort Leonard Wood	MO	61,000	44,500	Indiana & Gray	Present	Annual	Yes and on-site (Indiana)	Informal	
CEN (Reserve)	Fort McCoy	WI	60,000	45,400	Out of Range	Present	Periodic (every 2-3 years)	Yes	Informal	No
CEN	Fort Riley	KS	100,656	16,400	Out of Range	Verified absence	Annual	No	Informal	Yes
ATL	Joint Base Myer-Henderson Hall*	VA	270	0			None			
ATL	Natick Soldier System Center*	MA	124	0						
ATL	Picatinny Arsenal	NJ	6,400	4,000	Indiana	Present	Occasional	Yes	Informal	Yes
ATL	Redstone Arsenal	AL	38,000	23,900	Gray	Present	By project & Annual	Yes	Informal Consultation	Yes
CEN	Rock Island Arsenal	IL	946	200	Verified absence	Assumed	Periodic (every 2-3 years)	No	Informal Consultation	Developing
ATL	U.S. Army Adelphi	MD	200	120			scheduled FY15	No Known	No	Developing
ATL	U.S. Army Adelphi - Blossom Point*	MD	1,600	1,000			None	No	No - poor habitat	NA
ATL	West Point Military Reservation	NY	16,080	14,000	Possible Historic Presence	Present	Annual	Yes and on-site	Informal Consultation	Yes
Total			809,348	453,102						

* Indicates no habitat or highly unlikely to occur due to unsuitable habitat.

IV. Distribution and Status of the NLEB.

According to the NLEB final rule (USFWS 2015), the bat is known or believed to occur throughout or part of 37 States and the District of Columbia within the US. In Canada it is found from all Provinces from the Atlantic Coast westward to the southern Yukon Territory and eastern British Columbia. The northeast is considered to be the core range of the species and the area that has been hit hardest by white-nose syndrome. Based on hibernacula data, population numbers of NLEB have experienced a decline of approximately 99% in this core area (USFWS 2013). White-nose syndrome is the most severe and immediate threat to NLEB survival, and is the basis for the final listing of the species as threatened IAW ESA sections 3(6) and 4(a)(1) – Factor C: Disease or Predation. Currently, 12 IMCOM installations representing 9 States assume

NLEB presence or have recorded the NLEB potentially occurring on site (Table 1). A few other IMCOM installations have the potential for the NLEB to occur onsite, but surveys have not been completed to date. In general, the status of the species as a whole is declining and the status of the species on various installations ranges from declining in the east to stable in areas where effects of WNS have not yet occurred.

The active season of the NLEB is roughly April – October (USFWS 2015a). However, the spring staging and fall swarming periods can begin earlier in mid-March and extend to late November (USFWS 2014) (refer to Table 2). During the active season NLEBs roost singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees and snags, typically ≥3 inches diameter at breast height (DBH) in over 35 different tree species. They are also known to roost in sheds and barns, but the overwhelming majority of roosts are in trees (USFWS 2014). NLEBs have been known or suspected of occurring on some of the installations listed in Table 1. Tree species such as black and red oak, silver and sugar maples, hickories, American beech, short-leaf pine, hemlock, birch, spruce, etc. ≥3 inches DBH are known to occur on IMCOM installations throughout the range of NLEB. Summer roosting habitat is available and possibly used on these sites.

Table 2: Active Season Dates for the Northern Long-eared Bat based on Table 1 of the Northern Long-Eared Bat Conference Guidance (USFWS 2014). Individual IMCOM installations should confirm dates with their local USFWS Field Office.

State/Region	**Active Season**
Alabama	Apr 1-Nov 30
Illinois	Apr 1-Nov 15
Kansas	Apr 1-Nov 1
Kentucky	Apr 1-Nov 15
Massachusetts	Contact FO
Maryland	Contact FO
Michigan	Apr 1-Oct 1
Missouri	Apr 1-Nov 15
New Jersey	Apr 1-Nov 15
New York	Apr 1-Oct 30
Pennsylvania	Contact FO
Virginia	Apr 1-Nov 15
Wisconsin	Apr 1 - Oct 15

As described in the final rule (USFWS 2015), NLEBs predominantly overwinter in hibernacula that include caves and abandoned mines. The hibernacula are typically large, with large passages and entrances, relatively constant, cooler temperatures (0 to 9 °C (32 to 48 °F), and with high humidity to such a large degree that droplets of water are often observed on their fur. The NLEB has also been found to overwinter in structures resembling mines and caves such as abandoned railroad tunnels and hydro-electric dam facilities, to name a few. There are only a few known NLEB hibernacula on

or within five miles of the IMCOM installations. Through development of the IMCOM INRMPs and the Army ACUB program, IMCOM installations have a very good knowledge base on hibernacula occurring on the installation or in the local region. This document addresses potential impacts on or conservation of hibernacula and associated swarming and staging areas for known hibernacula on or within 5 miles of an IMCOM installation. More specific information on NLEB seasons by state is depicted in Table 2.

IMCOM installations, described in Table 1, have conducted both project-level and installation-wide bat surveys to support the military mission. Installations will continue to survey at the level necessary to meet their mission requirements and comply with ESA. Installations that have not surveyed will conduct NLEB surveys to determine presence/absence in suitable habitat as funding allows.

More detailed information on the life history and habitat requirements of the NLEB can be found in the 2015 final rule (USFWS 2015).

As used in this BE, known roost trees are defined as trees that NLEBs have been documented as using during the active season (approximately April–October). Once documented, a tree will be considered to be a ‘‘known roost’’ as long as the tree and surrounding habitat remain suitable for NLEB. However, a tree may be considered to be unoccupied if there is evidence that the roost is no longer in use by NLEB (USFWS 2015).

Known, occupied hibernacula are defined as locations where one or more northern long-eared bats have been detected during hibernation or at the entrance during fall swarming or spring emergence. Given the documented challenges of surveying for northern long-eared bats in the winter (use of cracks, crevices), any hibernacula with northern long-eared bats observed at least once, will continue to be considered ‘‘known hibernacula’’ as long as the hibernacula and its surrounding habitat remain suitable for northern long-eared bat. However, a hibernaculum may be considered to be unoccupied if there is evidence (*e.g.,* survey data) that it is no longer in use by following the USFWS Indiana Bat Hibernacula Survey protocols (USFWS 2015).

Refer to the Glossary, Section X, for additional definitions.

V. Activities That Will Not Affect NLEB.

All activities at installations outside the range of the NLEB will result in no effect to the species. Within the range, all activities that occur in unsuitable habitat will result in no effects to the species and do not require the implementation of any conservation measures. The Northern Long-eared Bat Interim Conference and Planning Guidance (USFWS 14) states, “Trees found in highly-developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable NLEB habitat.” Therefore, IMCOM considers that all sites within highly-developed urban areas that are not within 1000 feet of suitable forested/wooded habitat are excluded from these guidelines and

ESA conference/consultation requirements. Examples of highly-developed areas include but are not limited to: some cantonment areas, some housing areas, industrial areas, highly developed training sites, and developed testing facilities

IMCOM determines that all of the above proposed actions and sites will have "no effect" on the NLEB.

VI. Activities That May Affect NLEB.

For installations that contain habitat elements for the NLEB within its range, as identified in Table 1, IMCOM will adopt the below conservation practices, unless the installation has verified NLEB absence by utilizing the published USFWS Indiana bat (and NLEB) summer survey protocols.

A. Existing Military Training, Firing and Maneuver ranges: Military training activities are generally divided into the following categories: sustainment operations, engineering operations, air operations, water operations, field training operations (such as but not limited to: foot training, bivouacking, etc), live munitions training, demolition, smokes/obscurants, and research, development, testing, and evaluation (RDTE). All of these activities occur in dispersed Training Areas; some of these activities occur in localized Training Areas. Firing and maneuver ranges on IMCOM installations provide training and testing for the M16/M4 weapons family, M249 and M240 series machine guns, M9 and M1911 series pistols, M203 and MK19 grenade launchers, anti-tank weapons, helicopter gunnery, tank firing, 105 mm through 203 mm cannons, tracked and wheeled vehicles, live grenades, demolitions, and other military operations. The NLEB within these active ranges have been repeatedly exposed to loud noises associated with munitions, detonations, and training vehicles. Camp Atterbury (USFWS 2010), Fort Leonard Wood (USFWS 2010), and Fort Drum (USFS 2008) have assessed range and training noise impacts on Indiana bats (*Myotis sodalis*). Fort Leonard Wood monitored radio-telemetered Indiana bats and found that the bats did not avoid active ranges or alter foraging behavior during night-time maneuvers. A 2002 study on Camp Atterbury found that five of eleven Indiana bats tracked with radio transmitters periodically roosted in the impact area (Whitaker & Gummer 2002). Given these findings, along with the abundance and installation-wide distribution of the bats on the sites, they concluded, and USFWS concurred, that sound intensity and duration associated with past training events have not adversely affected Indiana bats due to the bats having become habituated to such stimuli. It is reasonable to believe that the NLEB have also become habituated to ongoing operational noise on existing IMCOM ranges.

Recent studies have indicated that anthropogenic noise can alter foraging behavior and success of bats, including some gleaning species like the NLEB (Bunkley et al., 2015; Schaub et al., 2008; Siemers and Schaub, 2011). Based on the potential that new sound stimuli may affect the NLEB by influencing foraging behavior and success, the relevant IMCOM installation will consult with the USFWS when new

activities are proposed that significantly differ in sound intensity, quantity/duration of noise events, from those described above.

Bats are vulnerable to mortality from vehicle strikes (Siebert and Connor, 1991; Glista and DeVault, 2008; Russell et al., 2009). Collisions with vehicles are documented for the endangered Indiana bat, as well as the NLEB (Russell et al., 2009). In this study, researchers monitored highway crossings of a roost of approximately 23,000 bats, mainly little brown bats (*Myotis lucifigus*). A total of 26,442 occurrences of bats crossing the highway during dusk (10 days) and dawn (six days) were recorded and 29 road-killed bats were found, one being an Indiana bat. In Glista and DeVault (2008), researchers surveyed 158.5 km of roads for mortality of vertebrates. A total of one road-killed bat (eastern red bat, *Lasiurus borealis*) was found during the road mortality detection surveys – travelling at speeds less than 40 km/h). Finally, Siebert and Connor recorded one road-killed bat during their 50 surveys of a 1.6km of highway (U.S. 33 NW of Athens, OH) spanning from June 1987 to August 1988. The Biological Opinion for Construction, Operation, And Maintenance of the U.S. 33 Nelsonville Bypass Road, OH (USFWS 2005), identified vehicle collision as an anticipated take of Indiana bat. Although we might expect bat mortality associated with vehicle collisions to diminish along with road size/traffic volume, the frequency at which bats attempt to cross roads, especially forest species like the NLEB, likely increases as road size and traffic decrease. Effects of vehicle collisions to bats are likely to be discountable regardless of road size, but should be considered that bats may respond differently to different types of roads. However, in contrast to the roads and maneuver sites on IMCOM installations, the stretches of road discussed above have a constant volume of traffic during times of bat activity, and vehicles are travelling at greater speeds than what typically occurs on IMCOM installations. The numbers and intensity of night time maneuvers and vehicle use on IMCOM installations, as well as operating speed of such vehicles, do not rise to the level associated with public highway use. Therefore, the likelihood of bat road mortality occurring during dusk to dawn on IMCOM installations is determined to be discountable.

In conclusion training activities at firing and maneuver ranges are not likely to adversely affect the NLEB.

B. Aircraft Operations. As with ranges, flight training has and continues to occur on multiple IMCOM installations within the range of the NLEB. Studies have shown that helicopters tend to elicit a heightened response compared to fixed-wing aircraft. Even though that may be the case, helicopter training on IMCOM installations usually occurs as hovering operations occurring over fields or other open areas, thus any impacts from noise or downdrafts would be temporary and minimal to roosting bats and trees. For ongoing night time operations, foraging bats will continue to be exposed to sound levels that have been shown not to alter foraging behavior (USFWS 2010). Given that NLEB forages in the canopy layer (USFWS 2013), collision during night time flight operations are very unlikely to occur. Based on the nature and implementation of air operations, and the assumed level of habituation to flight training stimuli, it is determined that sound generated by ongoing training activities at existing ranges is not likely to adversely

affect the NLEB. Similar conclusions were made at Fort Leonard Wood, (3D/I 1996), involving night-time maneuvers; air operations at Fort Drum, (USFWS 2009); and ongoing training activities at Camp Atterbury (USFWS 2010).

If there are any indications that flight training may be adversely impacting bats such as the observation of tree limbs and/or bark being blown off by helicopter downdraft, the applicable IMCOM installation will initiate consultation with their local USFWS field office. Consultation with the appropriate USFWS field office will also occur if flight training activities are introduced to new sites that have new impacts not discussed above, or if there is intensive low level hovering over forested areas during the active season (summer maternity season, and if applicable to the site, spring staging and fall swarming season), or if there is any other change to flight operations that may affect NLEB in a manner significantly different than those described above.

In conclusion, use of aircraft is not likely to adversely affect the NLEB.

C. Military Training Smoke and Obscurants: Smoke/obscurants are used to conceal military movements and help protect troops and equipment in combat conditions. They can be used throughout the Training Area as part of another military operation, or as part of an independent training scenario. Although they would be primarily used during the day, smoke/obscurants may be deployed at night. Training on some IMCOM installations may include, but is not limited to smokes and obscurants such as fog oil, colored smoke grenades, white phosphorous, and graphite smoke. The effects of these smokes and obscurants were assessed in the Fort Drum (USFS 2008;; Army 2014; USFWS 2009; USFWS 2013; USFWS 2015) and Camp Atterbury BAs and associated BOs (USFWS 2010). Research was cited indicating that prolonged dermal and respiratory exposures to these items, except for the graphite smoke, could have adverse effects on roosting and foraging Indiana bats. Given the similar roosting behavior and foraging locations of the NLEB, it is likely they will also be adversely affected by these smokes and obscurants. However, measures can be taken to avoid adverse effects of some smokes.

Camp Atterbury (USFWS 1998) conducted an ecological risk assessment (ERA) to assess which training materials and pesticides may cause adverse effects to Indiana bats. The ERA indicated that chemicals found in M18 colored smoke grenades may cause acute toxicological effects. They determined that Indiana bats roosting within 36 meters of the deployed grenades may inhale unsafe concentrations of M18 colored smoke during a one-minute period following release. To avoid the potential for adverse effects from colored smoke on NLEB, installations will not release M18 colored smoke grenades within 50 meters of forested suitable NLEB habitat during the active season if USFWS protocol surveys have not been completed. However, sites where surveys have been conducted and determined NLEB roost locations, M18 colored smoke grenades will not be used during the NLEB active season within 50 meters of known roost trees, which are described in Section IV of this document. Therefore, by implementing this measure, it is believed the effects of colored smoke on NLEB will be insignificant.

Citing data from a National Research Council's report on the toxicity of military smokes and obscurants, Fort Drum determined that based on the low toxicity on experimental animals, the use of graphite smoke may affect, but is not likely to adversely affect the known and undiscovered maternity colonies of Indiana bats. The USFWS concurred that any adverse effects associated with graphite smoke are discountable or insignificant (USFWS 2009).

In the 2012 Fort Drum BO (USFWS 2012), the USFWS included a table of a number of studies that provided estimates of fog oil concentrations from typical smoke screening operations. The highest level of fog oil recorded was 140 mg/m3, which was the upper level of a range for a 30 minute release that averaged a 51.8 mg/m3 concentration 200 meters from the source. A 120 min release recorded a maximum level of 105 and 102 mg/m3 at 200 and 100 meters, respectively, from the source of release. The COE Engineer Research and Development Center conducted a study to evaluate the health effects of fog oil aerosols in a surrogate species (Red-winged Blackbird) for the Red-cockaded Woodpecker (Driver et al. 2002). Based on the results of the study, they concluded that adult Red-winged Blackbirds can apparently sustain fog oil exposures of about 400 mg/m3 for 4 hours with no detectable adverse effects.

Table 3. 2012 Fort Drum BO of Estimates of Fog Oil Concentrations Resulting From Typical Smoke Screening Operations at Given Distances From the Source.

Study	Distance from source (meters)	Average (mg/m3)	Range (mg/m3)	Maximum (mg/m3)
Lilegren et al. 1988[A]	100	7.7		
	200	3.6		
	400	2.6		
Policastro et al. 1989[A]	25	116		
	100	8		
	200	3		
Driver et al. 1993[B] (30 min release)	100	64.3	27-120	
	200	51.8	7-140	
	400	27.9	1.8-93	
	1000	6.9	1.6-24	
Driver et al. 1993[B] (300 min release)	100	64		
	200	29		
	400	8.7		
	1000	1.6		
Getz et al. 1996 (120 min release)	100	64	25-102	
	200	56	8-105	
	500	46	1.3-90	
	1000	13	0.8-25	
U.S. Army 1997[B]	100	3.8		13.5
	250	3.5		12.7
	500	2.7		11.2
	1,000	1.2		4.3
Department of the Army 1997 (30 min release)	100		0-14	
	1000		0.1-1	

A- Results from studies conducted in the field
B- Results from modeling

Table is summarized from Getz et al. 1996 and ENSR 1999.

The Lethal Concentration (LC)50 of rats for inhalation of fog oil after 3.5 hours was 5,200 mg/m3. Less than 15% of the rats died at 4,000 mg/m3 (NRC 1999). Roosting NLEBs would most likely be exposed to fog oil levels well below those lethal to rats and having no detectable adverse effects on blackbirds. It would appear that release of fog oil at least 100 meter from any known or suspected roost sites would be sufficient to avoid impacts on NLEB. However, in a study conducted on Fort Leonard Wood, it was estimated that Indiana bats within 4,000 m of static smoke training and 7,000 m of mobile smoke training had the potential to inhale unsafe quantities of fog oil (USFWS 2009). To ensure that NLEB are not adversely affected by fog oil, IMCOM sites will not use fog oil during the NLEB active period, unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

White phosphorous (WP) ignites when it is exposed to air and may cause burns. Smoke typically lasts up to 15 minutes. Rats exposed to WP for 15 min/day, 5 days/week for 13 weeks at 1,740 mg/m3 (H_3PO_4) resulted in the death of 32% of the rats within 6 weeks. Rats produced clear signs of irritation when exposed to H_3PO_4 at a concentration of 525 mg/m3 for 60 minutes. Longer term exposure at concentrations of 884 mg/m3 (15 min per day, 5 days per week for 6 or 13 weeks), resulted in slight laryngitis and tracheitis. A similar exposure, but at higher concentrations (H_3PO_4 at 1,742 mg/m3), resulted in wheezing, dyspnea, moderate-to-severe laryngitis and tracheitis, and interstitial pneumonia. No such effects were reported for rats exposed for 15 min per day, 5 days per week for 13 weeks with H_3PO_4 at 280 mg/m3. Reproduction and development of rats showed that higher WP exposure (1,742 mg/m3 for 15 min/day, 5 days/week for 10 weeks) were associated with lower natal weights and had severe effects on survivability (NRC 1999).

It has been estimated that an exposure concentration of WP could reach 202 mg/m3 (H_3PO_4) 100 m downwind from deployment and about 1.4 mg/m3 (H_3PO_4) 5,000 m downwind. It was cited that the EPA does not expect community exposures to be severe at a distance of greater than 300 m; however, particularly susceptible individuals might experience respiratory irritation even at a distance of 5,000 m (NRC 1999).

To avoid the potential for adverse effects WP on NLEB, installations will not release WP within 200 meters of forested suitable NLEB habitat during the active season if USFWS protocol surveys have not been completed. However, sites where surveys have been conducted and determined NLEB roost locations, WP will not be used during the NLEB active season within 200 meters of known roost trees, which are described in Section IV of this document. Therefore, by implementing this measure, the anticipated level of WP at that distance should not expose NLEB to concentrations of H_3PO_4 that would be likely to adversely affect them.

For “other” smokes and obscurants, we cannot negate the potential for adverse affects on NLEB from exposure. Therefore, to avoid any potential for adverse affects, these items will not be employed during the NLEB active season. IMCOM installations will consult with the USFWS if any of these “other” smokes or obscurants are being

considered for release during the NLEB active season and there is scientific evidence to support that such substances can be released in a manner to avoid adverse effects or ensure such effects are insignificant or discountable.

Summary of Conservation Measures for Military Smoke & Obscurants:

1. M18 colored smoke grenades will not be used within 50m of forested suitable NLEB habitat during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

2. M18 colored smoke grenades will not be used within 50m of known roost trees during the active season (see Table 2) after USFWS protocol surveys have been completed or site specific consultation has been completed with the local USFWS Field Office.

3. Fog oil will not be released within forested suitable NLEB habitat during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

4. WP will not be released within 200 meters of forested suitable NLEB habitat during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

5. WP will not be used within 200m of known roost trees during the active season (see Table 2) after USFWS protocol surveys have been completed or site specific consultation has been completed with the local USFWS Field Office.

6. Other smoke/obscurants will not be employed during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

7. No smoke or obscurants will be released within 0.5 miles of known hibernacula outside of the active season as defined in Table 2.

In conclusion military smoke and obscurants may affect, but are not likely to adversely affect the NLEB by implementing the above conservation measures.

D. Construction: Construction projects can include new buildings, building additions, new or upgraded utilities, etc. As part of construction there may be multiple activities including tree removal, site preparation, equipment staging and maintenance areas, etc. On IMCOM installations where NLEB are known (or assumed – no P/A

surveys conducted to date but within range and suitable summer habitat) to roost, tree cutting and clearing for construction projects will occur during the NLEB inactive season (Table 2) or when verified absence has been determined utilizing the published USFWS protocols. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed in Section VI.G. below to determine if such removal can be done with insignificant or discountable effects on NLEB. Tree cutting and clearing may cause loss of habitat; however, inactive season tree removal effects would be discountable by following similar conservation measures to the Federal Highway Administration and Federal Railroad Administration's Range-wide Biological Assessment for Transportation Projects for Indiana Bat and NLEB (FHA 2015)

Other construction activities such as site grading, road construction, vertical and horizontal building, and other activities are likely to occur during the NLEB active season during day light hours. Noise and vibrations generated by heavy equipment within or directly adjacent to roosting trees could temporarily disturb roosting bats. For known roost sites, or areas of suitable habitat without verified absence, that are greater than 100m from the construction site, it is anticipated that the intensity of noise and vibration associated with the construction will diminish a sufficient amount to reduce the likelihood of disturbing bats that roost in these particular areas. Also High light levels may deter bats from areas as their nocturnal behavior may have evolved in response to predation risks (Speakman 1991, Sparks et al. 2005). By angling the light away from potential foraging and roosting areas, the area will be darker thus providing bats more protection from predators. By implementing 100 meter buffers around areas of suitable habitat without verified absence, IMCOM determines that such activities "may affect, but not likely to adversely affect" the NLEB in regards to disturbance activities related to construction. Additional coordination will occur for projects within 0.25 miles of known roosts.

Hibernacula may be affected by construction activities if the activity is conducted too close to or during the inactive season. Construction activities such as site grading, road construction, vertical and horizontal building, and other activities are likely to occur during the NLEB inactive season (Table 2) during day light hours. Noise and vibrations generated by heavy equipment within or directly adjacent to hibernacula could temporarily disturb roosting bats. Because all construction activities will occur >0.5 miles from hibernacula during the winter to be included as part of this informal consultation, no direct effects to NLEB will occur. Additional consultation is required for any construction activities <0.5 miles from hibernacula.

In addition, in areas where NLEBs are already subject to noise and vibrations associated with ongoing actions, construction activities occurring in such area would not likely have an adverse effect on NLEBs.

Additionally, site-specific consultation with the local USFWS field office will often be needed to adequately assess the potential direct and indirect effects associated with construction projects. However, across the range of the species no effects are anticipated if construction projects:

1) Are located entirely (including staging areas & construction footprint) beyond 100 m[1] of NLEB suitable summer habitat and 5 mi of hibernacula OR
2) Involve maintenance, alteration, or demolition of bridges/structures without any signs of bats as verified by a trained biologist, pest management specialist, or similar professional individual.

Some projects may occur near or within suitable NLEB habitat, but the project will result in no effects or discountable likelihood of effects even without the implementation of any avoidance or minimization measures, if the proposed project is based on the following:

1) Activities are completely within existing road surfaces (e.g., road line painting).
2) Activities are within existing ROWs or at existing facilities that contain suitable habitat but that do not remove or alter the habitat (e.g., mowing, brush removal).
3) Activities are wetland or stream protection associated with wetland mitigation without any tree removal.
4) Are located in areas with verified absence determined by USFWS protocol surveys[2]

Other projects may occur near or within NLEB suitable habitat which will require the implementation of conservation measures to avoid or minimize impacts to the point of insignificant/discountable for the projects to be included in this programmatic consultation. Construction projects that involve any of the features listed below are not likely to adversely affect NLEBs.

1) Structure Maintenance: during the active season (Table 2) that does not bother roosting bats in any way (e.g., activity away from roosts inside common rooms in structures, normal cleaning and routine maintenance).
2) Bridge Maintenance: during the active season (Table 2) that does not bother roosting bats in any way (e.g., road paving, wing-wall work, work above that does not drill down to the underside of the deck, some abutment, beam end, scour, or pier repair).
3) Structure or Bridge Maintenance: outside the active season that does not alter roosting potential for bats.
4) Tree Removal must occur outside the active season (Table 2) AND must not remove known roosts (as defined herein) AND
    - must be entirely within 100 feet of existing road surfaces in order to have no linear acreage limits; (this would include roads within cantonment , state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)

    OR

[1] Addresses potential for noise/disturbance adjacent to suitable habitat.
[2] See protocols for minimum number of years negative survey results are valid

- if located >100 feet of existing road surfaces, must be limited to no more than 10 acres per project (10 acres is 5% of a 200 acre home range)

The following additional conservation measures will be taken for all construction to further eliminate the potential to affect NLEB:

1. Roost Tree Protection. No known roost trees, as defined herein, will be felled, unless there is a human health and safety concern. If there is a need to remove a known roost tree, the installation will follow procedures listed in Section VI.G. below to determine if such removal can be done with insignificant or discountable effects on NLEB.

2. Construction activities outside of suitable habitat will not occur within 100 meters of any known roost trees without additional site-specific consultation.

3. Construction activities that remove suitable habitat within 0.25 miles of any known roost trees without additional site-specific consultation. Construction activities will also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas, and any other issue important NLEB.

4. Time of Year Restriction for Tree Falling. A time of year restriction for clearing trees (> 3 in DBH) has been established to protect known or potential roost trees during the active season (see Table 2), unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

5. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any construction activities for a given project. Flagging will be removed upon completion of the project.

6. Via Scope of Works, Contracts, Briefings, etc., all personnel responsible for construction activities will be informed about the need to follow design plans, stay within flagging, and minimize impacts to wildlife and other environmental concerns.

7. Outdoor Lighting Minimization. For all future projects, IMCOM will evaluate the use of outdoor lighting and seek to minimize light pollution by angling lights downward or via other light minimization measures.

8. Demolition. If the building has pre-existing known NLEB colonies, then the appropriate environmental personnel of the IMCOM installation must be contacted before demolition is to occur. If during the course of demolition, NLEB are discovered, then all work must cease and USFWS must be immediately contacted. If the structure is safe to leave as is, then it will be left

until after October 15, or until bats have stopped using the structure. If the structure is unsafe and poses a risk to human health and safety, IMCOM will attempt to exclude the bats immediately. If this is not possible, or NLEB are found to be using the structure during the maternity season when pups are not volant, IMCOM will contact USFWS to discuss the most appropriate next course of action.

9. Water Quality BMPs will be established for each construction site in accordance with the appropriate federal laws and state permits.

In conclusion construction & maintenance activities may affect, but are not likely to adversely affect the NLEB by implementing the above screening criteria and conservation measures.

E. Forest management: Forest management includes both even-aged (e.g., clearcutting or shelterwood) and uneven-aged (single tree or group selection) harvest methods to manage forests to support military training, timber production/health, and wildlife habitat creation/enhancement. Environmental conditions (e.g., wet or rocky soils), training requirements, and stand characteristics dictate harvest methods. Forest management practices such as timber harvest and silviculture are essential to maintaining diverse quality forested habitat for both the NLEB and military training. A number of forest management practices occur on military installation such as but not limited to: harvest, thinning, and/or planting operations. Operations that require tree removal have the potential to alter NLEB habitat. In the final listing rule USFWS anticipates that habitat modifications resulting from forest management and silviculture will not significantly affect the conservation of the northern long-eared bat. However, timber harvest operations performed during the species' active season may directly kill or injure individuals.

Removal of trees could have an indirect effect from loss of potential roosting and foraging areas. The degree of potential impact would be dependent on whether the removal is temporary (i.e., timber harvest, to include clearcuts) or permanent (construction). As stated in the proposed listing rule for NLEB (USFWS 2013), studies to date have found that NLEBs show a varied degree of sensitivity to timber harvesting practices and the amount of forest removal occurring varies by State.

The following additional conservation measures will be taken for all forest management activities to further eliminate the potential to affect NLEB:

1. Time of Year Restriction for Tree Falling. A time of year restriction for clearing trees (> 3 in DBH) has been established to protect known or potential roost trees during the active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office

2. Roost Tree Protection: No known roost trees, as defined herein will be felled, unless there is a human health and safety concern. If there is a need to

remove a known roost tree, the installation will follow procedures listed in Section VI.G. below to determine if such removal can be done with insignificant or discountable effects on NLEB. Clearcutting or similar harvest will not occur within 0.25 mi (250 m) and overstory roost tree removal within 100 meters of documented maternity roost trees without further consultation with the USFWS. Tree thinning/removal will also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas, and any other issue important to NLEB.

3. Forest Management will not be conducted within 0.5 miles from "known hibernacula" when bats are present during the inactive season. Forest management near hibernacula may affect swarming and staging areas through habitat loss around the hibernacula. Additional site-specific consultation will occur for forest management within 0.5 miles of hibernacula.

4. Tree Removal Acreage Limits:
   - if located >100 feet of existing road surfaces, must be limited to no more than 10 acres of clearcutting (or similar forest practice like seed tree or shelterwood harvest) per project (10 acres is 5% of a 200 acre home range). NOTE: There is no acreage limit for selective harvest practices conducted during winter, as roosting habitat will remain available.

   OR
   - must be entirely within 100 feet of existing road surfaces in order to have no acreage limits; (this would include roads within cantonment , state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)

5. Snag Retention. All snags will be left in silvicultural treatments unless there is a safety concern for the contractor or the military units training in the stands (e.g., maneuver corridors), or unless the treatment is a salvage harvest or clearcut. Snags should be distributed and retained throughout the landscape.

In conclusion forest management activities may affect, but are not likely to adversely affect the NLEB by implementing the above screening criteria and conservation measures.

F. Prescribed Burns: Prescribed fire is used to improve line-of-sight on ranges and observation points for direct and indirect firing, maintain grassland/open shrubland for open maneuver training, reduce fuel accumulation to minimize wildfire risk, and manage species habitat. It is also used as a tool to maintain ecological health of grassland and forested areas and regenerate oak ecosystems. The majority of natural and prescribed fires on IMCOM installations occur in impact or surface danger zone areas, due to live fire training and testing operations. The vegetation that occupy these areas are fire dependent. Other prescribed fires are generally conducted in grasslands

and forests, during the growing and dormant seasons, and all prescribed fires are implemented in accordance with the installation's Integrated Wildland Fire Management Program and State regulations.

Prescribed fire is gaining acceptance as a means of restoring and perpetuating oak (*Quercus*) dominated ecosystems in the eastern U.S. (Dickinson et al., 2010). As stated in the final listing rule (USFWS 2015), a U.S. Forest Service review of prescribed fire and its effects on bats generally found that fire had beneficial effects on bat habitat. Bats are resilient to fire and some species prefer burned areas for foraging and roosting (e.g. Boyles and Aubrey 2005, Loeb and Waldrop 2007). There is little scientific evidence to indicate that fire has adverse effects on NLEB. NLEB roost-switching frequency, distance between successive roosts, and duration of individual roost tree use were similar between fire and control treatment areas (Johnson et al. 2009). Following prescribed fires, NLEB benefit from increased abundance of insects and availability of roost sites (Lacki et al. 2009). During prescribed fire, NLEB have been shown to exit their roosts during the day and switch roosts as necessary to limit their exposure (Dickinson et al. 2009). In fact, most bats are quick and highly vagile so that escape and relocation to unburned areas easily can occur (Carter et al. 2009). However, neonatal bats that cannot fly would be at greater risk to smoke and fire effects than juveniles or adults. Although, exposure of tree roosting bats to carbon monoxide (CO) is unlikely to be a concern when fireline intensity is low (~1.5 m flame length) (Dickinson et al., 2010). In largely forested landscapes, there are infinite amounts of available roosts for alternate use (Carter et al. 2000). During the active season, bats frequently roost-switch but use torpor to conserve energy and extra arousals when bats are in deep torpor are a cause for concern. The maternity roosting season, from 01 June to 31 July when young pups are not Volant, and to a much lesser extent during the active season, is the only time NLEB might be directly affected by prescribed burns to elicit take. During all other times of the year research has shown that NLEB are not adversely affected by burns conducted under prescribed conditions.

Conservation Measures for Prescribed Burning:

1. Not within 0.5 miles from "known hibernacula" when bats are present during the inactive season (see Table 2 for active season).

2. Not within forested suitable NLEB habitat during the active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

3. Prescribed burns will be conducted under a site specific burn plan per the Installation Integrated Wildland Fire Management Plan which is integrated with the ecosystem management goals and objectives of a tripartite approved (IMCOM, State, and USFWS) Integrated Natural Resource Management Plan (INRMP).

4. Time of Day Restriction. Fore prescribed burns not within forested suitable NLEB habitat, whenever possible, all efforts will be made to have all flames extinguished and smoke generation minimized by sunset to reduce potential direct impacts to foraging bats during the active season (see Table 2

5. Containment Measures. For prescribed burns within 100 meters of forested suitable NLEB habitat, make use of naturally occurring firebreaks or, if necessary, establish wet lines to preclude fire from entering the adjacent NLEB habitat during the active season (see Table 2), unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

In conclusion prescribed burning activities may affect, but are not likely to adversely affect the NLEB by implementing the above conservation measures. Additionally prescribed burning is determined to provide an overall beneficial effect to overall habitat quality.

G. Specific Single, Group, or Hazard Tree Removal: Removal of single, multiple, or cluster of trees during the active season in suitable habitat, trees that do not pose a risk to human life or property will be analyzed for signs of bats being present (emergence surveys) prior to removal according to USFWS Indiana bat (and NLEB) summer survey protocols. If NLEB are roosting in such tree(s), the applicable IMCOM installation will consult with their local USFWS field office. If bat species are determined present and immediate removal of the tree(s) is necessary, the tree(s) will be removed in a manner that will minimize impacts on the bats such as first disturbing the tree(s) to cause them to abandon the roost. If there are hazard trees that are considered an imminent threat to human life or loss of property and need to be removed during the active season, the IMCOM installation will remove such trees and inform the USFWS field office of the action only if NLEB are present on the installation and the IMCOM installation will initiate emergency consultation per the procedures in accordance with 50 CFR 402.05.

H. Pesticide Use: All pesticides will be applied in accordance with their label and applicable laws and regulations. All pesticides are also applied in accordance with the installation INRMP and the Integrated Pest Management Plan (IPMP).IMCOM installations will regularly check Protection Bulletins on EPA's Endangered Species Protection Program (ESPP) website to determine whether pesticide use in a certain geographic area may affect NLEB. Limitations on pesticide use will be implemented as required to protect NLEBs in all areas. Application of pesticides in and around buildings or other structures are not likely to have any effect on NLEB. If NLEBs are found roosting in a building, then pesticides will be used sparingly and no foggers will be used in and around the occupied building.

To minimize the exposure of NLEB to pesticide and to keep in from drifting into known roost tree areas or water bodies the following conservation measures will be followed:

Conservation measures for Pesticide use:

1. Only pesticides registered by the EPA and State of use may be applied and only in accordance with their label.

2. Aerial application of pesticide will only occur outside the active season unless additional consultation with the USFWS is accomplished. Aerial applications will occur between the hours of sunrise and one hour before sunset. This will protect foraging bats in undiscovered foraging areas from direct exposure.

3. Whenever possible, herbicides that have low toxicity to mammals will be utilized with the tow behind power blowers. Herbicides that may be somewhat toxic to mammals will be mixed and applied at a rate that should minimize any potential exposure concerns.

4. Application of pesticides from ground mounted vehicles (i.e., ATVs, tractors) that spray chemicals directly onto the ground and do not result in broad dispersal will be conducted at least 100 ft (30 m) from known roost trees during the active season (coordinate with local USFWS field office).

5. Application of pesticides that result in broad dispersal (e.g., tow behind power blowers) will be conducted at least 250 ft (76 m) away from known roost trees during the active season (coordinate with local USFWS field office). Pesticides will not be applied between sunrise and one hour before sunset. Location-specific applications (i.e. hatchet or stem injections of trees, individual application to specific plants) may be used within 50 ft (15 m) of known roosts. This measure minimizes the risk of exposure to bats and potential effects from pesticides.

6. Pesticides applied from tow behind power blowers will use appropriate nozzles and drift control additives, and will be applied using low pressure to reduce drift and potential swirling motion from the blower. All efforts will be made to only spray 10 feet from ground level or below.

7. Pesticides will not be applied outdoors when the wind speed exceeds 8 mi/hr for all applications except power mist blowers. Pesticides applied via power mist blower will only be applied with wind speeds <5 mi/hr. This is to reduce the risk of pesticide drift, which could impact water quality or non-target areas. Care will be taken to make sure that any spray drift is kept away from non-target areas and individuals. Additionally, aerial application utilizing helicopters should employ large droplet technology through special nozzles on drop tubes to ensure the herbicide stays on target.

8. If a bat colony is found roosting in a building, then insecticides will be used sparingly and no foggers will be used. This will minimize impacts to roosting northern long-eared bats if they are found within a building.

In conclusion by implementing these conservation measures IMCOM believes the effects on NLEB will be insignificant.

I. Pest Control: IMCOM facilities may have pest control complaints, such as but not limited to bats, moles (order Insectivora), raccoons (*Procyon lotor*), squirrels (order Rodentia), skunks (order Carnivora), woodchucks (order Rodentia), insects, and other such species. Each issue is handled on a case-by-case basis depending on the pest species and the situation. When possible, wildlife will be deterred from areas by removing features that are attractive to the species (e.g. eliminating potential food/nesting sources, plugging openings into buildings, etc.). If deterrence efforts are ineffective, then it may be necessary to set live traps and relocate or euthanize animals, or use lethal control methods such as trapping, shooting, and/ or chemical control. All pest control efforts are performed in accordance with the installation INRMP and the IPMP.

Lethal traps are primarily used for rodents and moles. Adhesive traps are allowable for rodent and insect control in buildings, however, if placed incorrectly, they may inadvertently capture bats. Both adult and juvenile bats are susceptible to capture in glue traps which could result in injury or mortality. To prevent accidental capture of bats, no adhesive traps can be placed in such a manner that they could capture bats. Glue traps will not be placed in any crawl space or attic compartment within buildings or in areas where bats are known to occur. If bats are present within the building, then live traps for rodents will be used instead of glue traps.

If there are large scale infestations of rodents and moles, chemical means may be necessary to effectively manage the outbreak. Bait stations will not be placed where it may be accessible to children or pets and must be monitored to prevent access to non-target animals.

Conservation Measures for Pest Control:

1. No Lethal Control. No lethal control methods are permitted for bats unless there is a suspected human health risk for exposure to rabies or other disease. If individual bats are in buildings and there is no evidence of maternity use, then all efforts will be made to safely capture and release individual bats. Or, the bats will be excluded by establishing one-way valves over the roost's exit (if feasible).

2. Time of Year Restriction for Exclusion. The exclusion will only be done during times of the year when pups are not present or when they are volant (i.e., August - early May). The time of year restriction will minimize the risk of separating mothers from non-volant young, so it will prevent potential pup mortality during exclusion activities. Sealing cracks and crevices in buildings will also be done during the late fall through early spring. Sealing cracks and

crevices prevents bats from entering a building and reduces human/bat conflicts.

3. Adhesive Trap Restrictions. No adhesive traps used for rodents or insects will be placed in such a manner that they could capture bats—glue traps will not be placed in any crawl space or attic compartment within buildings or in areas where bats are known to occur.

4. Chemical Measures. Any use of chemical or insecticides will be utilized in accordance with section "H" above.

In conclusion by implementing these conservation measures IMCOM believes the effects on NLEB will be insignificant in regards to pest control management activities.

J. Recreational Activities: Recreational activities on IMCOM installations typically consist of hunting, fishing, trapping, hiking, mountain biking, camping, horseback riding, wildlife watching, and other consumptive and non-consumptive activities. These activities whether dispersed or concentrated are low impact activities that do not alter the landscape or generate a disturbance that would be considered to affect the NLEB. Continued use of IMCOM installations for these or similar activities is expected to continue without restriction, in accordance with the Sikes Act (16 U.S.C. 670, et seq.). However development of new areas for these activities that would be considered construction or habitat alteration "may affect"; therefore those projects would utilize the conservation measures identified earlier in this document for those actions.

Hunting activities have the potential to directly affect roosting NLEB if a hunter should place a stand in a NLEB roost. Hunters are unlikely to place tree stands in snags due to the instability of snags and the risk that the tree may fall. Thus, NLEB roosting in standing dead trees are not likely to be adversely affected by tree stands during the non-hibernation seasons. Tree stands may disturb roosting NLEB or damage roosts that are located within crevices of live trees or are in a dead tree limb of a live tree. Installment of a tree stand may cause NLEB to abandon the roost. Hunting primarily occurs in the fall-winter when NLEB are moving to the hibernacula or are already in the hibernacula, so NLEB are more likely to roost alone or in small groups within trees or are within the hibernacula. But since hunting typically occurs in seasons when NLEB are less likely to be present, the use of tree stands may affect but is not likely to adversely affect roosting NLEB.

Hunting activities also have the potential to directly affect roosting NLEB if a hunter should shoot at game flying through the air or in a tree and the shot hits a tree containing roosting NLEB. The likelihood of this happening is expected to be extremely rare, given the combination of occurrences that need to come together (i.e., the hunter being in a location suitable for NLEB to be roosting and game birds or waterfowl to be flying, the hunter shooting at the right angle into a tree to hit and kill a NLEB, etc.).

Additionally, most NLEB would presumably be within the hibernacula when the majority of hunting is conducted (October-February).

There is potential that individuals hunting game may shoot into a forested area which has NLEB roosts. Fired projectiles may strike a NLEB roost and remove bark from the tree, rendering the roost unsuitable for future use. Snags are ephemeral in nature and frequently slough bark. NLEB are known to frequently switch roosts assumed because of the fleeting nature of snags. Since strikes of snags are expected to occur infrequently, NLEB are unlikely to be adversely affected by hunting. Thus effects are discountable.

Skeet shooting could potentially result in injury or mortality of a foraging NLEB if skeet shooting was conducted in extreme early morning or at sunset when NLEB may be active. Skeet ranges located adjacent to suitable NLEB summer foraging habitat have a likelihood that a NLEB could be struck during skeet shooting but is highly improbable.

Legal use of Off Road Vehicles (ORV) should have no known indirect effects to NLEB as ORV's will remain on the road at all times and will not damage vegetation in the area. However, unauthorized ORV use off-trail may damage vegetation which can expose the soil to the elements and could lead to increased soil erosion. Soil erosion may lead to declines in water quality. Lower water quality may reduce aquatic insect availability, which are prey for NLEB. In addition, streams/wetlands may be converted overtime into mud pits that are unsuitable for drinking by NLEB. Given the amount of ample water and natural habitat available on IMCOM installations, it is unlikely that ORV use will adversely affect NLEB. Thus, effects are discountable.

Recreational activities that occur in the vicinity of hibernacula are pass through in nature except possibly for stationary hunting. Stationary hunting would only create a disturbance when a shot or shots were fired but no different than the single unlikely instance as with pass through hunting. Additionally as in section "A" noise activities associated with the firing of weapons has been shown to not adversely affect NLEB.

In conclusion, the majority of recreational activities with the exclusion of ORV use, hunting, and skeet shooting, are expected to have no known effects on NLEB. Given the conservation measures for each and remote nature of potential effects, recreational activities may affect but are not likely to adversely affect NLEB.

VII. Additional General Conservation Measures

This section identifies the Conservation Measures (CM) proposed throughout this document that are considered necessary to either avoid adverse affects or to ensure the expected effects are beneficial, insignificant or discountable. Additional CMs are also proposed to promote the conservation of the NLEB.

- IMCOM will use the most current National WNS Decontamination Protocols approved by USFWS for planned activities that involve close or direct contact with bats, their environments, and/or associated materials.
- IMCOM will explore cooperative management efforts with adjacent landowners, if such efforts would complement installation NLEB conservation initiatives and/or support mission implementation.
- IMCOM will explore cooperative NLEB management strategies, solutions, and efforts with other federal, state, and private organizations and landowners in the region.
- IMCOM will seek funding opportunities to conduct USFWS presence/absence surveys on individual installations subject to the availability of funds.
- IMCOM installations will continue to manage their ecosystems to support and enhance military training, testing, & readiness in accordance with their INRMP to retain habitat and biological diversity, and long term sustainability.
- IMCOM & the USFWS will develop a screening criteria check list so individual installations may quickly and categorically apply the above listed measures described in the programmatic process.
- IMCOM will centrally report activities taken by individual installations under this programmatic opinion annually to the USFWS from data gathered through the annual AEDB-EQ installation data call.

VIII Conclusions

A. Northern Long-Eared Bat. Based on IMCOM's intent to follow USFWS guidance on NLEB management, carry out actions as described in Section V, and to implement the conservation measures identified in Section VI, IMCOM has determined that implementation of actions IAW with this document **"may affect, but not likely to adversely affect"** the NLEB as a threatened species listed under the ESA.

B. Request of Conference Report. IMCOM requests that the USFWS review our findings and determinations stated herein and provide a conference report that reflects IMCOM's proposed conservation measures for reducing adverse effects. If necessary, the applicable IMCOM installation(s) will initiate site specific consultation with their USFWS Field Office on activities that are not included in this BE or if there is additional site specific information to suggest alternate conservation measures.

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X. Glossary

Action area - all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action.

Active season – the time period when bats are not in hibernation. This includes spring emergence, young rearing, and breeding (swarming) and is typically from April through October (specific dates are defined by geographical area see Table 2).

Critical habitat - (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of the ESA, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the ESA, upon a determination by the Secretary that such areas are essential for the conservation of the species (defined in Section 3 of the ESA).

Emergency - An emergency is a situation involving an act of God, disasters, casualties, national defense or security emergencies, etc., and includes response activities that must be taken to prevent imminent loss of human life or property.

Exfoliating bark - tree bark that peels away from a trunk or a branch of a tree; when a tree dies, plates of bark spring away from the bole of the tree. Some living trees, such as shagbark hickory and white oak, have bark that peels back from the living cambium.

Hibernaculum (plural **hibernacula)** - a site, usually a cave or mine, where any bat species hibernates during the winter (see suitable habitat).

Is likely to adversely affect – the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial.

Known hibernacula – a location where one or more northern long-eared bats have been detected during hibernation or at the entrance during fall swarming or spring emergence. Given the documented challenges of surveying for northern long-eared bats in the winter (use of cracks, crevices), any hibernacula with northern long-eared bats observed at least once, will continue to be considered ‘‘known hibernacula’’ as long as the hibernacula and its surrounding habitat remain suitable for northern long-eared bat. However, a hibernaculum may be considered to be unoccupied if there is evidence (*e.g.,* survey data) that it is no longer in use by northern long-eared bats (USFWS 2015).

Known roost tree – a tree that male or female NLEBs have been documented as using during the active season (approximately April–October). Once documented, a tree will

be considered to be a ‘‘known roost’’ as long as the tree and surrounding habitat remain suitable for NLEB. However, a tree may be considered to be unoccupied if there is evidence that the roost is no longer in use by NLEB (USFWS 2015).

May affect - the appropriate conclusion when a proposed action may pose any effects on listed species or designated critical habitat.

No effect - the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or designated critical habitat**.**

Not likely to adversely affect (NLAA) - the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. **Beneficial effects** are contemporaneous positive effects without any adverse effects to the species. **Insignificant effects** relate to the size of the impact and should never reach the scale where take occurs. **Discountable effects** are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

Snag - a standing dead (or mostly dead) tree, generally with <10 percent living canopy.

Staging - the departure of bats from hibernacula in the spring, including processes and behaviors that lead up to departure (see suitable habitat).

Suitable habitat - Summer and/or winter habitat that is appropriate for use by NLEB (may be known or unknown in terms of documented use). See most recent summer survey guidance)

- **Winter** (hibernacula) is restricted to underground caves and cave-like structures (e.g.,abandoned mines, railroad tunnels). These hibernacula typically have large passages with significant cracks and crevices for roosting; relatively constant, cooler temperatures (0-9 degrees C) and with high humidity and minimal air currents.

- **Summer** for NLEB consists of the variety of forested/wooded habitats where they roost, forage, and travel. This includes forested patches as well as linear features such as fencerows, riparian forests and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree and are less than 1000 feet from the next nearest suitable roost tree, woodlot, or wooded fencerow. May also include structures for roosting (e.g., barn).

- **Spring staging/fall swarming** for NLEBs consists of the variety of forested/wooded habitats where they roost, forage, and travel within 5 miles of a hibernaculum. This includes forested patches as well as linear features

such as fencerows, riparian forests and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree and are less than 1000 feet from the next nearest suitable roost tree, woodlot, or wooded fencerow.

Suitable roost tree - any tree in which bats roost when they emerge from the hibernacula. Females gather in maternity colonies and males may roost singly or in small groups. During summer NLEBs roost singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees and snags, typically ≥3 inches dbh.

Survey - a method of sampling, such as mist netting, that provides data concerning the presence/absence of bats at a site; also, the act of enumerating the bats hibernating in a cave or mine. NLEB summer survey guidance can be found at http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html

Swarming - A phenomenon in which, during late summer and autumn, numerous bats are observed entering and exiting entrances to caves and mines, but few, if any, of the bats may roost within the site during the day. Swarming probably is related to fall breeding activities and locating potential hibernation sites. (See suitable habitat).

Take - Take is defined in Section 3 of the ESA as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Torpor – a period of inactivity, with reduced body temperature and metabolism.

Volant - able to fly.

Verified absence - refers to known or suitable habitat determined to be unoccupied at the time of impact by utilizing USFWS approved protocols.

XI. Summary of IMCOM NLEB Programmatic Biological Evaluation Conservation Measures

A) Activities/Areas Not Subject to Conservation Measures:

- Any Activity that occurs outside the known range of the NLEB (see Section V for details)
- Any activity that occurs within the known range of the NLEB but does not contain suitable NLEB habitat. (see Section V for details)
- Any activity in a highly developed urban area that is <1000' from suitable NLEB habitat. (see Section V for details)
- Any area where NLEB absence has been verified by USFWS Protocol survey.
- Any activity that is conducted under a site specific consultation with the local USFWS Field Office.
- All military activities such as but not limited to: air operations, water operations, field training operations, live munitions training, demolition, and research, development, testing, and evaluation (RDTE). (see Section VI-A for details)
- All activities involving the use of aircraft such as but not limited to: fixed wing, rotary wing, drone, etc…(see Section VI-B for details)
- All categories of outdoor recreation such as but not limited to: hunting, fishing, trapping, hiking, mountain biking, camping, horseback riding, wildlife watching, and other consumptive/non-consumptive activities. (see Section VI-J for details)

B) Activities Subject to Conservation Measures:

- Military Training Smoke and Obscurants: (see Section VI-C for details)
  1. M18 colored smoke grenades will not be used within 50m of forested known/presumed occupied NLEB during the active season (see PBE Table 2 Below). Or within 50m of known roost trees during the active season if USFWS protocol surveys have been completed.
  2. Fog oil will not be released within forested known/presumed occupied habitat during the NLEB active season (see PBE Table 2 Below).
  3. WP will not be released within 200 meters of forested known/presumed occupied NLEB during the active season (see PBE Table 2 Below). Or within 200m of known roost trees during the active season if USFWS protocol surveys have been completed.
  4. Other smoke/obscurants will not be employed during the NLEB active season (see PBE Table 2 Below).
  5. No smoke or obscurants will be released within 0.5 miles of known hibernacula outside of the active season as defined in PBE Table 2 Below.

- Construction: (see Section VI-D for details)
  1. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed in that section below.
  2. Consult with USFWS for projects within 0.25 miles of known roost trees. Buffers may also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas.

3. Implement a 0.5 mile buffer around “known” hibernacula where additional consultation is required
4. Conduct structure, sign, utility, & bridge maintenance: during the active season that does not bother roosting bats in any way (e.g., activity away from roosts inside common rooms in structures, normal cleaning and routine maintenance)
5. Tree removal outside the active season (see PBE Table 2 Below), that is entirely within 100’of an existing road surface has no acreage limit. This would include roads within cantonment , state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)
6. Tree removal outside the active season (see PBE Table 2 Below), that is >100’ of an existing road surface has a 10 acre per project limit.
7. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any construction activities for a given project. Flagging will be removed upon completion of the project.
8. Via Scope of Works, Contracts, etc., all personnel responsible for construction activities will be informed about the need to follow design plans, stay within flagging, and minimize impacts to wildlife and other environmental concerns.
9. Outdoor Lighting Minimization. For all future projects, IMCOM will evaluate the use of outdoor lighting and seek to minimize light pollution by angling lights downward or via other light minimization measures.
10. Demolition. If the building has pre-existing known NLEB colonies, then the environmental contact of the IMCOM installation must be contacted before demolition is to occur. If during the course of demolition, NLEB are discovered, then all work must cease and USFWS must be immediately contacted. If the structure is safe to leave as is, then it will be left until after October 15, or until bats have stopped using the structure. If the structure is unsafe and poses a risk to human health and safety, IMCOM will attempt to exclude the bats immediately. If this is not possible, or NLEB are found to be using the structure during the maternity season when pups are not volant, IMCOM will contact USFWS to discuss the most appropriate next course of action.
11. Water Quality BMPs will be established for each construction site in accordance with the appropriate federal laws and state permits.

- <u>Forest management:</u> (see Section VI-E for details)
  1. IMCOM will screen projects that required tree removal for forest management activities the same as identified for construction.
  2. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed in that section below.
  3. Implement a 0.25-mile buffer around known roost trees where additional consultation is required for clearcutting or similar harvest. Buffers will be may also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas.

4. Implement a 0.5 mile buffer around “known” hibernacula where additional consultation is required.
5. Tree removal outside the active season (see PBE Table 2 Below), that is entirely within 100’of an existing road surface has no acreage limit. This would include roads within cantonment , state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)
6. Clearcutting or similar harvest outside the active season (see PBE Table 2 Below), that is >100’of an existing road surface has a 10 acre per project limit. No acreage limit on selective harvest.
7. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any forest management activities for a given project. Flagging will be removed upon completion of the project.
8. Snag Retention. All snags will be left in silvicultural treatments unless there is a safety concern for the contractor or the military units training in the stands (e.g., maneuver corridors), or unless the treatment is a salvage harvest or clearcut.

- Prescribed Burns: (see Section VI-F for details)
  1. Will not be conducted within 0.5 miles from “known hibernacula” when bats are present during the inactive season (see Table 2 for active season).
  2. Will not occur within forested suitable NLEB habitat during the active season (see PBE Table 2 Below).
  3. Prescribed burns will be conducted under a site specific burn plan per the Installation Integrated Wildland Fire Management Plan
  4. Whenever possible, all efforts will be made to have all flames extinguished and smoke generation minimized by sunset to reduce potential direct impacts to foraging bats during the active season (see PBE Table 2 Below)
  5. Make use of naturally occurring firebreaks or if necessary, establish wet lines 100m around forested known/presumed occupied NLEB habitat during the active season (see PBE Table 2 Below), to preclude fire from entering, to the maximum extent practicable.

- Specific Single, Group, or Hazard Tree Removal (see Section VI-G for details)
  1. Removal of single, multiple, or cluster of trees during the active season, in areas where there are known roost trees, trees that do not pose a risk to human life or property will be analyzed for signs of bats being present (emergence surveys) prior to removal according to USFWS Indiana bat (and NLEB) summer survey protocols.
  2. If known roost tree removal is determined to be necessary, the applicable IMCOM installation will consult with their local USFWS field office.
  3. If such tree removal is preferred immediately, the applicable IMCOM installation will consult with their local USFWS field office.
  4. If non-ESA bat species are determined present and immediate removal of the tree(s) is necessary, the tree(s) will be removed in a manner that will minimize

impacts on the bats such as first disturbing the tree(s) to cause them to abandon the roost.

5. If there are hazard trees that are considered an imminent threat to human life or loss of property occurring in suitable NLEB habitat and need to be removed during the active season, the IMCOM installation will remove such trees and inform the USFWS field office of the action only if NLEB are present on the IMCOM installation will initiate emergency consultation per the procedures in accordance with 50 CFR 402.05.

- Pesticide Use: (see Section VI-H for details)
  1. Only pesticides registered by the EPA and State of use may be applied and only in accordance with their label.
  2. Aerial applications will occur outside the active season (see PBE Table 2 Below) and between the hours of sunrise and one hour before sunset. When utilizing helicopters for application they should employ large droplet technology through special nozzles on drop tubes to ensure the herbicide stays on target.
  3. Whenever possible, herbicides that have low toxicity to mammals will be utilized with the tow behind power blowers. Herbicides that may be somewhat toxic to mammals will be mixed and applied at a rate that should minimize any potential exposure concerns.
  4. Application of pesticides from ground mounted vehicles (i.e., ATVs, tractors) that spray chemicals directly onto the ground and do not result in broad dispersal will be conducted at least 100 ft (30 m) from known roost trees during the active season (see PBE Table 2).
  5. Application of pesticides that result in broad dispersal (e.g., tow behind power blowers) will be conducted at least 250 ft (76 m) away from known roost trees during the active season (see PBE Table 2 Below) and will not be applied between sunrise and one hour before sunset.
  6. Location-specific applications (i.e. hatchet or stem injections of trees, individual application to specific plants) may be used within 50 ft (15 m) of known roosts.
  7. Pesticides applied from tow behind power blowers will use appropriate nozzles and drift control additives, and will be applied using low pressure to reduce drift and potential swirling motion from the blower. All efforts will be made to only spray 10 feet from ground level or below.
  8. Pesticides will not be applied outdoors when the wind speed exceeds 8 mi/hr for all applications except power mist blowers. Pesticides applied via power mist blower will only be applied with wind speeds <5 mi/hr.
  9. If a bat colony is found roosting in a building, then insecticides will be used sparingly and no foggers will be used. This will minimize impacts to roosting northern long-eared bats if they are found within a building.

- Pest Control: (see Section VI-I for details)
  1. No Lethal Control. No lethal control methods are permitted for bats unless there is a suspected human health risk for exposure to rabies or other

disease. If individual bats are in buildings and there is no evidence of maternity use, then all efforts will be made to safely capture and release individual bats. Or, the bats will be excluded by establishing one-way valves over the roost's exit (if feasible).

2. Exclusion will only be done during times of the year when pups are not present or when they are volant (i.e., August - early May). Sealing cracks and crevices in buildings will also be done during the late fall or early spring.
3. No adhesive traps used for rodents or insects will be placed in such a manner that they could capture bats—glue traps will not be placed in any crawl space or attic compartment within buildings or in areas where bats are known to occur.
4. Chemical Measures. Any use of insecticides will be utilized in accordance with the conservation measure associated with "Pesticide Use".

C) Additional General Conservation Measures.

1. IMCOM will use the most current National WNS Decontamination Protocols approved by USFWS for planned activities that involve close or direct contact with bats, their environments, and/or associated materials.
2. IMCOM will explore cooperative management efforts with adjacent landowners, if such efforts would complement installation NLEB conservation initiatives and/or support mission implementation.
3. IMCOM will explore cooperative NLEB management strategies, solutions, and efforts with other federal, state, and private organizations and landowners in the region.
4. IMCOM will seek funding opportunities to conduct USFWS presence/absence surveys on individual installations subject to the availability of funds.
5. IMCOM installations will continue to manage their ecosystems to support and enhance military training, testing, & readiness in accordance with their INRMP to retain habitat and biological diversity, and long term sustainability.
6. IMCOM & the USFWS will develop a screening criteria check list so individual installations may quickly and categorically apply the above listed measures described in the programmatic process.
7. IMCOM will centrally report activities taken by individual installations under this programmatic opinion annually to the USFWS from data gathered through the annual AEDB-EQ installation data call.

Appendix G
Fort Campbell Endangered Bat Brochure

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Endangered bats on Fort Campbell

The Indiana bat (*Myotis sodalis*) and the gray bat (*Myotis grisescens*) are present on Fort Campbell. Both species are listed as endangered by the U.S. Fish and Wildlife Service (USFWS). The Endangered Species Act requires protection of listed species and, in some cases, their habitat.

Fort Campbell actively participates in conservation of endangered bats and their habitat, and is supporting efforts to increase populations so these species may one day be removed from the Endangered Species List.

Why are these bats endangered?

Since the 1960's, the number of Indiana bats in the U.S. has declined 60 percent. Gray bats experienced similar population declines. Due to these significant losses, these species were among the first listed as endangered.

Natural causes such as flooding of caves and ceiling collapse have killed thousands of gray bats and Indiana bats. However, human disturbance of roost caves is one of the most significant factors in the decline of these species. Destruction of forest that provides summer maternity habitat has likely contributed to their decline as well. Better understanding of the species' habits, protection of caves, and other conservation efforts have helped stabilize numbers of gray bats, and may be slowing the decline of Indiana bats.

Indiana bat

The Indiana bat lives in the eastern U.S. including Kentucky and Tennessee.

Indiana bats have fur that is light to dark brown. An individual is about 2.5 to 4 inches long, and weighs about 0.2 ounces.

Indiana bat banded for identification

In summer, Indiana bats roost beneath loose tree bark or in tree cavities. Females gather in tree roosts to form maternity colonies where they give birth and raise their young. Males often roost alone in separate trees. Indiana bats roost during the day and emerge at night to feed. This species eats only insects, which are captured while flying over streams, ponds, and fields, or through forests.

In fall, Indiana bats migrate to caves where they hibernate for nearly six months during winter. This species may migrate more than 200 miles to find caves with suitable climatic conditions. Indiana bats that spend summers on Fort Campbell likely hibernate in caves in Kentucky, Tennessee, or southern Indiana.

Indiana bats were first observed on Fort Campbell in 1998. Special nets were used to capture four Indiana bats between 1998 and 2003. Results of studies conducted by the Fort Campbell Fish and Wildlife Program indicate male Indiana bats are on base during summer and fall. No females have been captured, and no tree roosts or winter caves used by Indiana bats have been found on Fort Campbell.

Gray bat

The gray bat lives in the southeastern U.S. where caves or mines occur, including throughout Kentucky and Tennessee. Caves in the Fort Campbell area provide summer and winter roost caves for gray bats.

Gray bats have fur that is typically dark gray. An individual is 3 to 4 inches long, and weighs about 0.3 to 0.4 ounces.


Gray bat

Gray bats live in caves year round, often spending the summer and winter in different caves. Only a few caves provide the right climatic conditions for gray bats. This species may migrate more than 300 miles between summer and winter caves. A few gray bats captured on Fort Campbell were found hibernating in a cave in Edmonson County, Kentucky, about 70 miles from the base.

Hundreds of gray bats have been found at Fort Campbell between April and September. Biologists attached miniature radiotransmitters to some gray bats captured on the base. Study results indicate gray bats come to Fort Campbell to feed. They roost in caves outside the base. Gray bats usually forage (feed) over streams, lakes, and ponds, eating insects that hatch and emerge from the water. Many streams on Fort Campbell provide suitable foraging habitat for gray bats.

Colonies of bats, such as the gray bats inhabiting Fort Campbell, consume thousands of insects each night, including mosquitoes, gnats, beetles, moths, and crop pests. Presence of insect-eating bats can help lessen demands for insecticides.

What is Fort Campbell doing to help endangered bats?

Since 1998, Fort Campbell has conducted annual surveys to understand when, where, and how many Indiana bats and gray bats are on base. To meet requirements of Army Regulation 200-3, Fort Campbell developed an Endangered Species Management Plan (ESMP). The ESMP contains conservation objectives designed to protect Indiana and gray bats and is the guide for Fort Campbell's Natural Resources Specialists as they actively manage forest and streams to conserve habitat for endangered bats.

The Fort Campbell Fish and Wildlife Program works in close coordination with the USFWS to implement the ESMP and to ensure that base activities, from training, new construction, and maintenance, to recreation and natural resources management, are in compliance with the Endangered Species Act. The Fish and Wildlife Program evaluates base activities for the potential to affect endangered bats. When necessary, Fish and Wildlife Program biologists coordinate with project proponents and the USFWS to minimize or avoid the impacts.

What can I do to help protect endangered bats?

Bats are abundant on Fort Campbell. Because bats are active at night, encounters with humans are rare. Bats seen during daytime may be sick or injured and should never be handled. If you see a bat outside or inside a building, do not touch it – contact the Fort Campbell Fish and Wildlife Program for assistance.

Protecting the environment, including the quality of streams and forests, is the best way to support conservation of endangered bats. Some guidelines are:

- Do not drive vehicles through streams; cross only at designated low water crossings
- Do not wash vehicles in streams
- Dispose of petroleum, oil, lubricants, and other wastes in designated receptacles
- Do not enter caves, which may be home to endangered bats
- Call the Forestry department before removing any trees 270-798-2616

For more information please contact the Endangered Species Coordinator at 270-798-9855.

FORT CAMPBELL

Indiana bat (*Myotis sodalis)*

Gray bat (*Myotis grisescens)*

A Sentry for Species in Peril

101st Airborne Division (Air Assault)
and Fort Campbell, Ky.

Appendix H
Fort Campbell White-Nose Syndrome Brochure

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What is White-Nose Syndrome?

White-Nose Syndrome is a fungal disease associated with North American hibernating bats. This deadly disease is caused by *Geomyces destructans*, a fungal pathogen associated with the loss of up to 99% of infected populations of bats. Since first documented in New York in 2006, the death toll for North American bats infected with this deadly fungus has now surpassed 5.5 million individuals.

How Can a Fungus Kill a Bat?

White-Nose Syndrome is a quite descriptive name for the disease as infection presents white fungal growth on the muzzles, ears, and wings of infected bats. The fungus will attack, grow, and eventually invade the bat's layers of skin. The fungus will then replace the hair follicles, and fill the sweat glands. The growth of this fungus on, and below the surface of the bat's skin causes irritation. Frequently infected individuals will wake and groom during hibernation, using critical energy reserves while attempting to clean the infected area.

The invasive fungus triggers a reaction in the immune system of the hibernating bats that further depletes energy reserves that are vital to winter-hibernating bats. Often infected bats will awake during winter months, in a vain search for food needed to replenish energy used to fight the disease. Unfortunately, insect populations are scarce during these winter months and many individuals starve to death.

WNS on Fort Campbell

In February 2012, Fort Campbell wildlife biologists along with officials from The Nature Conservancy surveyed Morgamie Cave, located on the Fort Campbell military installation. White fungal growth was observed on the muzzles, ears, wing membranes, and tail membranes of several hibernating tri-colored bats *(Perimyotis subflavus*). This is an indicative sign of White-Nose Syndrome. The bats were examined and collected by Cory Holliday, The Nature Conservancy. The collected bats were sent to USGS National Wildlife Health Center for diagnostic testing to screen for the fungus *Geomyces destructans*. The tissue samples tested positive and confirmed that WNS had spread to Fort Campbell.

Why Save the Bats?

Bats make up over 20% of the total mammalian diversity worldwide; it is of great importance to focus conservation efforts towards the prevention of the collapse of bat populations, communities, and associated ecosystems throughout North America.

Bats are one of the most significant predators of night-flying insects. Bats are important to farmers because they control crop-consuming insect populations. Without bats controlling crop-pests, farmers would have to increase their usage of harmful pesticides. Not only are these chemicals potentially harmful to the environment, but they are also expensive.

WNS cannot be transmitted from bat to human and does not harm us directly. However, many species of North American bats also feed on mosquitoes which are not only a nuisance, but also carry deadly disease such as malaria and West-Nile virus, which can be transmitted to humans.

What Can We Do to Help?

The Fort Campbell Fish and Wildlife Program works in close coordination with The U.S. Fish and Wildlife Service (USFWS) to implement WNS monitoring strategies for the bat populations occurring on the installation.

Several species of bats utilize Fort Campbell's rear area as a foraging habitat in the summer. Both the Indiana bat and the gray bat are federally endangered species that occur on Fort Campbell. These species, along with several others, are monitored closely by Fort Campbell wildlife biologists.

Cave access has been restricted to research purposes throughout the region in efforts to slow the spread of the fungus to non-infected sites. Many caves are located on private property so regulations are hard to implement. Fungal spores can be passed from cave gear/equipment to roosting bats, cave soils, water sources, and cave wall substrates where it can quickly spread throughout a hibernating bat population. It is very important for WNS researchers, bat biologists, and cavers to utilize strict decontamination procedures to decrease the chance of spreading the spores to other caves and hibernacula.

Bats need homes too, so build a bat box! Provide suitable habitat for bats on your property. More bats in your backyard means less pestilent insects next summer. The link below provides step-by-step instructions on how to build a bat box.

http://www.batconservation.org/drupal/free_plans

White-Nose Syndrome in Fort Campbell, KY

Grassland Management Plan
Fort Campbell Military Reservation, Kentucky and Tennessee

Fish and Wildlife Program
DPW, Environmental Division
Fort Campbell, Kentucky

May 2018

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Executive Summary

Fort Campbell is approximately 42,492 ha (~105,000 acres) military post located in southwestern Kentucky and north central Tennessee. Portions of Fort Campbell are considered part of the Big Barrens Region (BBR) of north central Tennessee and central Kentucky. Historically, these areas were developed due to Native American influences. Cultivation and other anthropogenic influences have limited the quantity and quality of these grassland ecotypes. However, the largest and most complete grassland and barren remnants of the BBR occur at Fort Campbell due to land use conversion in early 1942. Grasslands and barrens found at Fort Campbell are larger than any other in the southeastern United States.

Grasslands and barrens managed on Fort Campbell contain rare, threatened and endangered plant and animal species known only to occur in such large systems. Therefore, Fort Campbell Fish and Wildlife (FCFW) determined size and distribution of these grasslands and barrens on Fort Campbell and developed grassland management guidelines to preserve biological and cultural importance of these rare habitat types. These guidelines were designed to support unique plant and animal communities, as well as long-term military readiness for Fort Campbell soldiers.

Resource management strategies were identified and incorporated into an Integrated Natural Resources Management Plan (INRMP) in 1999 to fulfill requirements of the Sikes Act (16 USC 670) and Army Regulation 200-1, “Environmental Protection and Enhancement”. For management purposes these grasslands are placed into three very general groups: mixed grasslands, barrens, and native grasslands without canopy. Grassland management will operate under a two-stage strategy. This strategy was developed to minimize fiscal and staff resources required for grassland management, and allows positive and economical management steps. These two stages in our management approach to grasslands are: *Stage 1* - passive management; *Stage 2* – active management. The following plan is designed to be used as a guidance document to shape future management actions to meet multiple-use needs of these imperiled communities.

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Figures

1.0 Background

Resource management strategies were identified and integrated into an Integrated Natural Resources Management Plan (INRMP) in 1999 to fulfill requirements of the Sikes Act (16 USC 670) and Army Regulation 200-1, “Environmental Protection and Enhancement”. The INRMP provides integrated guidance on resource management issues facing Fort Campbell and is to be used as a planning level document. Several initiatives, planning level terrestrial surveys, mapping ecosystem community boundaries, and developing GIS management tools pertaining to grassland management were included in the document. Contract initiatives to meet those needs began in 1999 and continued into 2003. Following completion of planning level vegetation surveys and mapping, FCFW biologists began developing management goals and objectives to support military mission and protect, conserve and maintain native grassland communities. The following plan is designed to be used as a guide to set and implement management actions to meet multiple-use needs of these imperiled communities.

2.0 Site Description

Fort Campbell is a 42,492 ha (~105,000 acre) military post located in Montgomery and Stewart counties in Tennessee and Christian and Trigg counties in Kentucky (67% in Tennessee; Figure 1). Approximately 10,585 ha (26,156 acres) are designated small arms and artillery impact areas and are off-limits to all but select military personnel. Another 4,764 ha (11,772 acres) are devoted to cantonment areas, schools, shopping areas, recreation areas, and air fields. The remaining 27,171 ha (67,142 acres) are available for military training activities.

3.0. Grassland Biological Resources

3.1 Flora

Fort Campbell is part of the Western Mesophytic Forest Region (Braun 1950). This ecotonal region includes a variety of forest community types, depending upon specific site conditions. However, all are oak dominated except on more mesic slopes where such mesophytes as beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and tulip popular (*Liriodendron tulipifera*) become more prevalent. The region also includes barrens, upland wet woods, and alluvial forests (see Duncan and Ellis 1969; Chester and Ellis 1989; Chester 1988; Deslem 1988 for discussions of specific vegetation patterns). All of these features occur on Fort Campbell, but farming operations prior to 1940, and military usage since have altered all natural communities. In addition, there are plantations of loblolly pine (*Pinus taeda*), shortleaf pine (*Pinus echinata*), and black walnut (*Juglans nigra*).

Portions of Fort Campbell are considered part of the Big Barrens Region (BBR) of north central Tennessee and central Kentucky (Chester 1988). During European settlement in Kentucky and Tennessee (ca. 1780) the BBR consisted of areas with restricted tree growth due to a lack of surface streams, soil type, and frequent fire. Eventually, most barrens were rapidly converted into agriculture (Chester 1988). Historically, most of the BBR was developed under anthropogenic influences approximately 3,000 ybp (Baskin 1999). Cultivation and other influences have limited quantity and quality of these grassland ecotypes. Remaining barrens in the BBR are not generally maintained as barrens. However, the largest and most vegetatively complete barrens occur at Fort Campbell due to the land use conversion in early 1942. Many barrens that exist today are products of a military training regime that favored barren-like conditions. A variety of grassland management regimes (i.e. haying, mowing, and burning) in conjunction with soil and climatic

conditions have created a variety of grassland types which support distinct communities of plants and animals.

Plant communities of the BBR are historically and biologically important. Biologically, the BBR is dominated by tallgrass prairie species, primarily little bluestem (*Schizachyrium scoparium*) (Baskin 1994). Rare, complex communities exist on sites exhibiting historical conditions. These sites provide clues to past biological complexes and anthropogenic activities that were utilized to create these habitats, adding both cultural and biological significance to the area.

A floral inventory was conducted in 1992 (Johnson et al. 1992). The inventory recorded 89 plant families and 423 species (Appendix A). Chester (1997) completed a cursory floristic study of 22 barrens sites that identified 342 plant species (Appendix B) associated with barren or barren-like ecosystems. A survey of rare and endangered vascular plant species on Fort Campbell was conducted from 1993 to 1994 (Chester et al. 1995). Eighteen listed taxa, none of which are federally listed, were recorded from the inventory. Figure 2 identifies locations of rare, threatened, and endangered species on the installation.

A study initiated in 1999 described over 2,833 ha (7,000 acres) of barrens (Figure 3), a term commonly interchanged with savanna to describe communities that have an environment that in some way restricts the tree growth and formation of forest communities (Parsons 2001, 2002, 2003). Often, barrens are transitional zones between forest and grasslands. Historical records show that these plant community types were a major part of the middle eastern United States landscape but have mostly been lost due to agriculture and urban development during the past century and are now considered “imperiled ecosystems” (Anderson et al.1999).

3.1.1 Grassland Communities

Plant communities consisting of native warm season grasses, native forbs, and both annual and perennial woody and semi-woody plant species make up a significant component of the Pennyroyal Plain and BBR of Kentucky. Ecological conditions on Fort Campbell promote three forms of grassland communities, each having their own composition and structure of native grasses, forbs, and overstory species (woody and semi-woody plant species). These three communities have been classified as mixed grasslands, barrens, and native grasslands (without canopy).

3.1.1.1 Mixed Grasslands

Mixed grassland communities consist of native warm season grassland communities but maintain a non-native species presence such as tall fescue (*Schedonorus arundinaceus*), orchardgrass (*Dactylis glomerata*), timothy grass (*Phleum sp.)*, Bermuda grass (*Cynodon dactylon*), Johnsongrass (*Sorghum halepense*), sericia lespedeza (*Lespedeza cuneata*), shrub lespedeza (*Lespedeza bicolor*), and Japanese clover (*Kummerowia striata*) as a result of past land management practices. Some mixed grasslands on Fort Campbell have light to moderate overstory composition of tree species. These areas are maintained as forest communities, but their grass dominated understory should not be excluded in management decisions.

Although mixed grasslands do support military training and some wildlife use, they are not an ideal grassland community for all wildlife. Additionally, they offer no added benefit for military training than barrens and native grasslands. Some non-native species present in mixed grasslands inhibit certain types

of training, especially those that grow above 2 meters (ex. limit aircraft landing, ground maneuver, and cause visual obstruction). To have the most beneficial multiple-use of these areas (both ecologically and for military training purposes), mixed grasslands should be managed in a manner that limits or removes non-native species.

3.1.1.2 Barrens

The term barren is commonly interchanged with savanna to describe communities that have an environment that in some way restricts tree growth and successional trajectory towards closed canopy forest. Factors known to restrict the establishment of forest communities include fire, unstable eroding slopes, a fragipan, excessive soil drainage, or low soil water holding capacity. Often, barrens are described as transitional zones between forests and grasslands, and occur in many different locales and exhibit unique ecological features. Historical records show that barrens were a major part of the middle eastern United States landscape, but most have been lost to agriculture and urban development during the last century and are considered “imperiled ecosystems” (Anderson 1999).

As a result of this loss, many species of plants and animals that depend on grasslands have also been rapidly declining, and many of these “grassland species” are now listed as "rare" and are protected by Kentucky and Tennessee state endangered species acts. Many of these species are avian species, but include other many other floral and faunal species. Some grassland species including the loggerhead shrike and Henslow’s sparrow are drastic regional decline. See Appendix C for a list of grassland bird species.

Unlike mixed grasslands, barrens contain a complex plant composition consisting of native warm season grasses and annual and perennial forbs found only in such ecosystems. Non-native species (as mentioned in section 3.1.1.1) threaten these plant communities. Due to their imperiled status, management of these non-native species should be top priority to conserve remaining barrens on Fort Campbell. Specifically, control of shrub lespedeza, sericea lespedeza, and tall fescue are important due to their invasiveness in Fort Campbell’s barrens.

3.1.1.3 Native Grasslands

Grasslands dominated by native warm season grass species with little or no woody influence are rare to absent in most areas east of the Mississippi River. Past management actions that have limited woody growth have produced small scattered fields that are currently managed as native grass seed sources. Fields of this type are managed for their monocultural characteristics and are important areas for future grassland restoration and remediation. A Memorandum of Agreement with the state of Kentucky allows native seed harvest from selected fields on Fort Campbell. Collected seeds are utilized in state grassland restoration projects and a minimum of 10% are given back to Fort Campbell for grassland projects.

3.2 Fauna

Fort Campbell supports a diverse assemblage of animal life that is adapted to slight to moderate impacts most habitats receive from management actions and military training. Most are habitat generalist but all show an affinity to grassland ecotypes. Research indicates all species contain viable populations and current military activities have not adversely affected reservation populations or community structures (Zirkle 1997). Major groups of grassland species are listed in Appendix C.

Herptile surveys were carried out from June 1992 to November 1994. Overall, 162 collecting trips (43 in 1992, 45 in 1993, and 74 in 1994) were logged. Terrestrial habitats utilized drift fences, pit traps and drop boards. Fifty-one species of herptiles were recorded. These included 27 species of amphibians (14 salamanders and 13 frogs and toads) and 24 species of reptiles (4 turtles, 4 lizards, and 16 snakes). All are species previously reported from the Western Highland Rim (Redmond and Scott 1996, Scott 1967; Scott 1991; Snyder 1972). More recently, an additional snake species (*Regina septemvittata*) was detected in 2014.

Small mammal surveys were conducted from December 1992 through March 2002. Nineteen species of small mammals have been recorded from Fort Campbell since 1992. These include 6 species of insectivores (moles and shrews) and 13 species of omnivores (rodents) representing 4 families and 13 genera. All were previously recorded from the region and none were found to be outside their known geographical range.

Avian surveys have documented 239 species since 1992; 13 of these species (6 grassland breeding obligates and 7 grassland wintering obligates) are known obligates of grassland habitats. Recorded species require various vegetational stages and require intensive management to produce suitable habitat.

A survey of rare and endangered vertebrate species on Fort Campbell was conducted from 1993 to 1994 (Scott et al. 1995) resulting in 22 listed taxa (no federally listed species) were recorded (Figure 2). Federally endangered Indiana bats (*Myotis sodalis*) and gray bats (*Myotis grisescens*) were detected in 1998 mist netting efforts. Northern long-eared bat (*Myotis septentrionalis*), also present on Fort Campbell, were listed as federally threatened in 2015.

4.0 Fort Campbell Approach to Grassland Management

Since initiating the barrens inventory project in 1999, Fort Campbell biologists have worked to manage both native and non-native grassland landscapes. Guidelines have been developed to determine an ecological tier relevant to the biological diversity existing in each field (Parsons, 2000). While these guidelines emphasize grasslands' ecological values, biologists also work to conserve military values associated with grasslands and will continue to work closely with trainers to encourage environmentally sound training activities.

A decision model has been developed to address management responsibilities and actions (Figure 4). This model outlines a process to delineate and integrate multiple program management (e.g. ITAM, AG Outlease, FCFW) of these areas. The Fish and Wildlife program is the lead program in grassland management on Fort Campbell. Following initial review, FCFW may release fields to other stakeholder programs for additional management. Individual field management is responsibility of the field proponent with regard to environmental regulations.

4.1 Grassland Management Strategies

Grassland management will operate under a two-stage strategy. This strategy was developed to minimize fiscal and staff resources required for grassland management. The strategy allows FCFW to undertake positive management steps without needing to increase financial inputs. Two stages of management approach to grasslands are: *Stage 1* – passive management; *Stage 2* - active management.

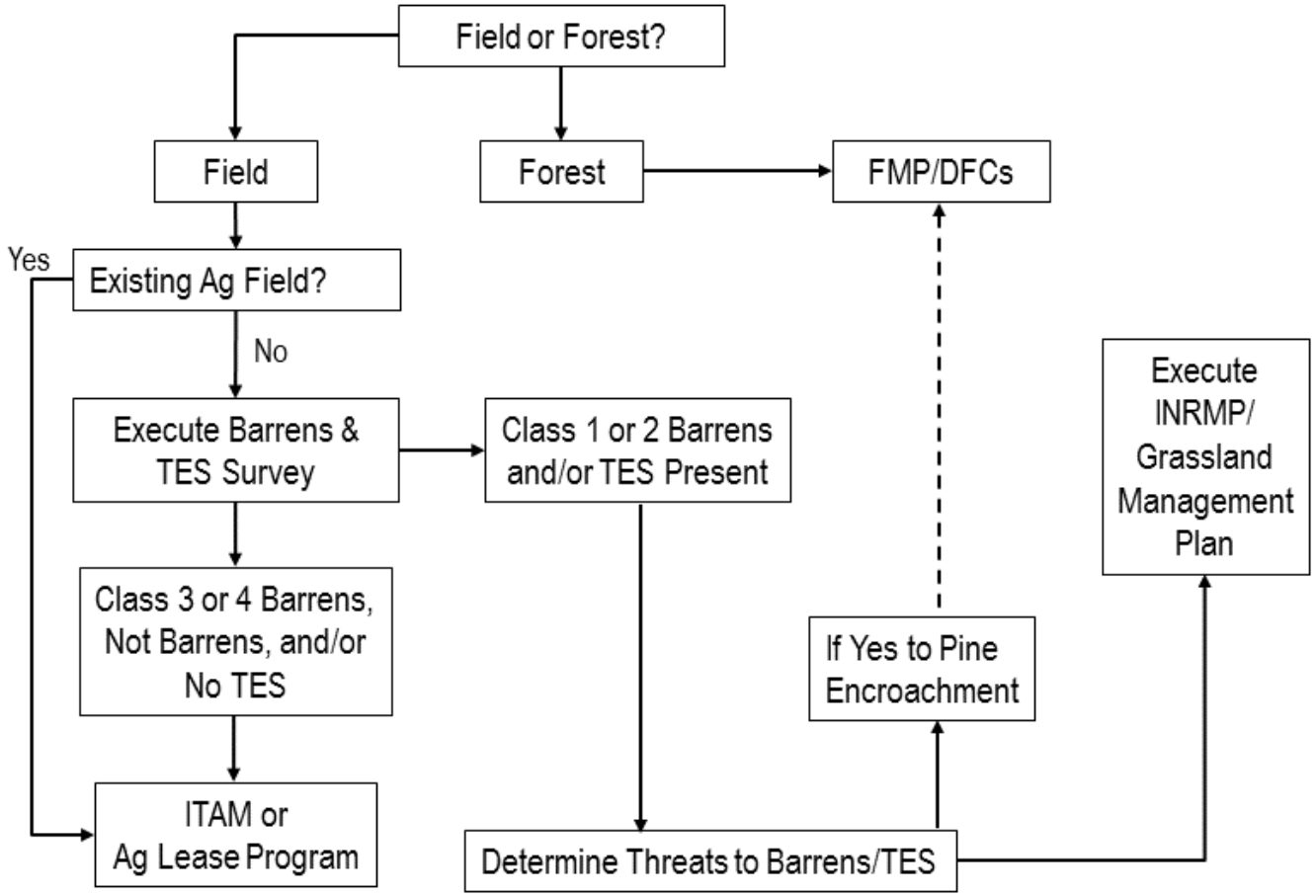

Figure 4. Grassland management decision model.

4.1.1 Stage 1- Passive Grassland Management

At first appearance, the combination of the word "passive" with "management" appears to be a contradiction in terms, and indeed it is in most areas of management. Passive suggests inaction, while management suggests structured, positive action. Positive steps that can be taken in managing some grassland areas is to cease current management practices, allow natural systems to re-establish with time, and monitor without intrusive action. Essentially, passive management is management through inaction.

Indiscriminate mowing, seeding of both native and non-native sources, and other unsympathetic management activities undertaken in open areas containing tall grass prairie species has detrimental effects on those grassland remnants. Allowing native seedbank regeneration and appropriate time for grassland succession without human interference is more likely to produce desired grassland habitats more so than “forcing” an outcome with active management. Furthermore, passive management allows for resources (staffing and financial) to be utilized elsewhere to achieve other program goals.

In most cases, active management should not be implemented prior to undertaking passive management. The passive management strategy on Fort Campbell largely revolves around newly created open areas (following military disturbance, clearing, and/or erosion control efforts). Once appropriate passive management action occurs, active management may then be used to maintain desirable conditions in mixed grasslands, barrens, and native grasslands.

4.1.2 Stage 2 - Active Grassland Management

Active grassland management revolves around the practical use of management tools to promote or conserve grassland structure and biodiversity. Tools should be employed following assessment a given open area. Techniques such as the use of selective herbicides, mechanical clearing and mowing, and prescribed fire are generally accepted and are easily managed. Military requirements actively support the use of active methods to meet multiple-use demands of grasslands. Integrated methods must be employed to meet biological and military objectives.

4.2 General Principles in Grassland Management on Fort Campbell

4.2.1 Grasslands Require Management

Grasslands in southwestern Kentucky and middle Tennessee are typically a result of human activities (e.g. farming, fire). Without frequent disturbance such as mowing, grubbing, disking, or fire grasslands will likely revert back to forests. Training requirements on Fort Campbell require a sizeable portion of open areas for airmobile operations. Woody vegetation above 21 inches is considered detrimental to military missions. Each grassland ecotype will be graded for ecological and military potential to ensure military needs are met. Fields that do not meet existing standards will be actively managed to meet military standards or converted to either agricultural fields or forest. Fields that meet the standard will be managed using a passive management approach.

4.2.2 Maintain Large Grasslands

Large tracts of contiguous grassland will support a greater diversity of grassland wildlife, especially birds and mammals. Some species (e.g. upland sandpiper and northern harrier) require large tracts of grassland;

typically a single pair needs more than 100 acres. Thus grasslands of 500 acres or more may be necessary to support populations of some species and military training. Very few of Fort Campbell's training areas contain extensive grasslands, therefore it is important that large grasslands be managed for grassland species. Although smaller grasslands (>25 acres) frequently support grassland nesting species, diversity decreases as grassland size decreases. Smaller grasslands that are near non-forested communities (e.g., cultivated lands) will often support grassland wildlife. Grasslands below 10 acres should be evaluated for wildlife habitat on a case by-case basis.

4.2.3 Minimize Fragmentation of Grasslands

Tree lines disrupt continuity of grasslands, reducing overall extent and quality of habitat for area dependent species. Woody borders and tree islands also attract nest predators and parasites such as cowbirds. Old fields, which typically have shrubs and small trees scattered throughout rather than concentrated as borders or islands, should be maintained since they may support greater plant species richness and small mammal abundance than native grasslands or hayfields.

Options are available for managing existing fragments. Conversion of forest fingers that bisect fields into oak-savanna may enhance existing field dynamics and increase use by some grassland species. Conversions to an oak-savanna habitat type may create larger grassland areas and reduce overall fragmentation of these communities allowing larger grasslands to support greater species diversity and ideal military training conditions.

4.2.4 Delay Cutting

Cutting grasslands during early growing season and during nesting season is detrimental to grassland wildlife, particularly birds. To reduce nest and fledgling mortality, cutting should be delayed until nesting activity has finished. Typically, mid-September has been given as a safe first cut date in the southeast United States. This date, however, does not consider late nesting birds, other wildlife, or the needs of plants and should not be relied upon. Species such as Henslow's sparrow, an endangered species in Kentucky and Tennessee, may continue to use fields into mid-September. Northern bobwhite (*Colinus virginianus*), a species of concern to Fort Campbell biologists, will nest early- to mid-September in grasslands during some years. Therefore, cutting fields prior to mid-September is not recommended. If grassland birds are the primary management concern for a field, grasslands should be checked for nesting birds and only cut when nesting is complete. If hay production is not an issue, grasslands can be left uncut until late in the year or even cut only once every two or three years. The latter would benefit small mammals but may allow woody plants to invade. If woody plants are an issue, grasslands should be cut annually on a rotational schedule.

4.2.5 Chemical Use – Selective Herbicides to Fight Invasive Species

Broad, non-selective application of pesticides can reduce insect and plant diversity in grasslands and thus should be avoided. Where control of invasive plants using herbicides is desirable, selective application (e.g. stem application), spot spraying, or use of selective herbicides across larger infestations versus non-selective herbicides should be used. Chemical management plans should be reviewed and/or supervised by a Fort Campbell biologist to ensure minimal ecological damage to grassland communities and that plans/actions remain in compliance with local and federal laws.

4.2.6 Protect Endangered Species Habitat

Signs are currently utilized in several fields containing grassland management concern species within the rear training areas. Signed fields are currently limited to plant species - earleaf foxglove (*Agalinus auriculata*). However, as avian habitat loss increases throughout the southeastern U.S., it is likely that federally managed grassland bird habitat will also be signed with limited activity during the nesting season.

4.2.7 Control Invasive Exotics

Grassland habitats on Fort Campbell are typically dominated by native tallgrass prairie species consisting of grasses and forbs. Non-native species can rapidly invade and colonize natural communities, thus degrading wildlife habitat and crowding out native species. Control of invasive species through either fire, mechanical, or chemical methods is critical for grassland habitat maintenance.

4.2.8 Use Ecologically Friendly Tools

Many tools, including mowing, disking, mulching, and burning, can help achieve grassland objectives. Depending on objectives and individual grassland features (e.g. soil types, rare species, military importance, etc.), not all tools are necessarily appropriate. Managers will need to consider available options and consult with installation biologists to determine the most appropriate tools and adopt techniques that benefit wildlife. Examples: When using fire, consider impacts on wildlife. Burning all of a habitat at one time can reduce amount of available habitat. Burning only a portion of a grassland will leave some habitat that can provide a refuge in which wildlife and plants can survive. These plants and animals will then be able to re-colonize the burned area. When mowing, grasslands should be cut in a series of parallel lines from the inside out if possible. Circular cuts that proceed from the perimeter to the center of the grassland should be avoided since this practice 'herds' small mammals towards the center where they may be killed by the mower. Mowing should be followed by strip or block disking to enhance habitat quality in subsequent months/years.

4.2.9 Maintain Biodiversity

Management of grasslands should strive to maintain biological diversity. While rare species are important and should be considered at all times, management of grasslands should also strive to maintain the greatest number and variety of plants and animals. For example, leaving unmowed strips and edges throughout the year will provide cover for small mammals and other edge species. Common grassland plants native to the BBR such as goldenrods, asters, ragweeds, and milkweeds should be encouraged since these species provide forage for many grassland animals. The timing and frequency of mowing or haying can influence plant species diversity and composition. Frequently mowed grasslands typically support fewer plant species and support less structural diversity than grasslands mowed infrequently. Likewise, rotational mowing will maintain plant diversity and structure, especially when followed by disking to promote forb growth.

5.0 Specific Management Guidelines by Grassland Type

5.1 Hay Fields (lands cut at least once annually for a hay crop)

Hay fields represent the most common type of grassland maintained by the Agricultural Outlease program. On Fort Campbell, fields managed for hay are typically dominated by dense, cool-season grasses and can include species such as tall fescue (*Schedonorus arundinaceus*), orchard grass (*Dactylis glomerata*), or timothy (*Phleum pretense*), and non-native clovers (*Trifolium ssp*). Typically these grasses are European in origin (e.g. orchard grass and timothy).

The major threat to grassland nesting birds using hay fields is the early cutting of fields before young birds have fledged. The options below minimize bird mortality while still allowing haying, and are listed in the order that provides the greatest reproductive success for grassland birds:

a. Approach 1: Cut only once annually and as late as possible, but before the first frost in order to get one crop of hay that can be sold as mulch. In addition, invasion of fields by woody plants is reduced to a minimum with annual cutting.

b. Approach 2: Cut after all ground-nesting birds have fledged their young. Mid-July will allow nesting species time to fledge their young, although late nesting or re-nesting birds may not have fledged young by this time. Fields may be cut earlier in the season if no nesting birds are present.

c. Approach 3a: Set aside 50% of the field around nests from cutting until mid-July, or until the field is clear of birds. The area to be set aside should be determined by the Agricultural Outlease manager and installation biologist. The unrestricted half can be cut anytime. Second cuttings could take place at the farmer's discretion on both the restricted and unrestricted halves.

d. Approach 3b: Set aside 25% of the field from cutting until mid-July or until bird nesting is complete and continue as described in Approach 3a.

e. Approach 4: In some cases (as with certain small fields), fields may not support species that are affected by early cutting and hay can be cut at any time. However, the fields should be monitored for grassland birds annually and managed accordingly if grassland birds are present. It is also important to note that several animals (e.g. deer, snakes, and wild turkey) may use the tall grass in these smaller fields for cover or food and will therefore be affected by early cutting.

5.2 Mowed Fields (non-agricultural grasslands being maintained by mowing)

Mowed fields provide similar wildlife benefits as hay fields do except hay production is no longer an issue. Thus, the need to cut these fields early and often is eliminated. Management will still be necessary to maintain grassland habitat and may include various options depending on the management goal. Mowing should be delayed until post-breeding season (Approach 1 & 2 for hay field management above). Management should also consider small mammals and rare plants.

Since mowing fields close to the ground can eliminate small mammals from fields, mower height should be adjusted to leave a minimum of 8-10 inches of grass standing to provide habitat for small mammals. Leaving fields un-mowed or cutting only a portion of fields on a rotating schedule to keep woody invaders in check will benefit wildlife by providing cover throughout the growing season. While fire can be useful for grassland management, potential ecological impacts need to be carefully considered before fire is used. Herbicides can have negative ecological impacts. Restricting herbicide use to spot applications (e.g. applying herbicide to individual cut stems to prevent re-sprouting), will allow more control of herbicide and

reduce overall amounts needed. Grassland-wide applications should be avoided. While frequent mowing throughout the growing season may reduce woody cover, it will likely impact wildlife and reduce plant diversity. Unless grassland conditions demand these more aggressive methods, they should be avoided.

5.3 Old Field (non-agricultural grasslands which are reverting to wooded habitat: shrubs and small trees are present)

Old field habitat (barren tier 3 and 4) is characterized by grassy openings with shrubs and small trees scattered throughout. This habitat is transitional and typically a result of forest succession on abandoned agricultural land. Old fields can provide many species with preferred habitat, including rare species of sparrows. Although forest clear cutting can also provide open, early successional habitat, clear cuts soon develop into dense young forest that is unsuitable for most species characteristic of old field habitat. In contrast, the more open habitat associated with old field succession persists much longer, providing habitat benefits for more years. Maintaining old field habitat requires some control of invading woody vegetation. Woody plant species invade fields that are infrequently cut, compromising grassland habitat and management. While species that prefer early successional habitat (e.g. field sparrow) will benefit from woody plants invading fields, woody plants generally compromise grassland habitat. Fields that are not well suited for grassland wildlife (e.g. small fields surrounded by forest) may provide greater benefits to wildlife if they are managed for early successional habitat. Managing for early successional habitat will typically require leaving fields uncut for several years to allow woody plants to colonize and then mowing around woody plants annually or mowing and or burning the fields on a rotational schedule. Early successional habitat could also be incorporated into larger fields to provide grassland habitat diversity. Areas within larger fields could be managed on a rotational schedule that allowed early successional plants to develop for a few years and then converted back to grassland, leaving another area to develop as early successional habitat. Small fields may also be allowed to revert to woodland where forest fragmentation is a concern.

5.4 Barrens/Savannah Grassland (barrens and grasslands with scattered woody vegetation)

These communities are distributed throughout Fort Campbell. This community is regionally rare and contains remnants of historical vegetational conditions prior to European settlement. Maintenance and restoration of these communities is critical for many state-listed rare species (e.g. short-eared owl, Henslow's sparrow, earleaf foxglove). These communities together once covered many thousands of acres and were maintained by fire, grazing ungulates, and anthropogenic activities. With the decline in large ungulate grazing many of these communities have reverted to shrublands or forest. Management of the remaining habitat is critical. Management will likely include one or more of the following tools: fire, mowing, and herbicides. Both mowing and fire have been used to restore or maintain BBR communities and are likely the most viable options. Frequent mowing, however, during the growing season reduces the plant diversity in these communities. Use of herbicides should be restricted to spot application of problematic species and should be used only in conjunction with other more viable tools (i.e. fire and mowing). Widespread application of herbicides should not be considered. Historically fire played an important role in maintaining these communities and in recent years fire has become the most cost effective management tool.

5.5 Row Crops (land being actively cultivated for row crops such as corn or beans)

These lands are commonly used for the production of agricultural commercial monocrops. Corn, soybeans and hay are the primary crops grown on Fort Campbell. These crops typically require tilling of the soil and application of chemicals (e.g. fertilizers, pesticides, herbicides, and fungicides). While row crops provide the least ecological value of all grassland types, they are important to Fort Campbell for resource management. Large native grass buffers should be developed adjacent to row crops to provide additional habitat and allow for a seed source when fields are fallow. To preserve their ecological values, however, high quality grasslands should not be converted to row crops. Where possible, existing cultivated lands should be considered for conversion to non-cultivated grasslands (e.g. hayfield, mowed field).

6.0 Management Tools

No one type of grassland management will meet the needs of all grassland species. For example, species such as the grasshopper sparrow require large areas of short, patchy grasses like those found around airports or in pastures, whereas bobolinks require taller grasses like those grown in hay fields. Likewise, frequently (3 times annually) mowed grasslands support fewer plant species and structural diversity than adjacent grasslands that are infrequently (1 time annually) mowed or burned.

6.1 Prescribed Fire

This section provides an overview of the use of fire in grassland management. It provides an essential element of grassland ecology while reducing adverse impacts from non-fire tolerant woody invasive species. Prescribed fire is the management tool of choice due to its ease and minimal costs. Minimal time and effort is required to develop and implement fire management prescriptions for fields on Fort Campbell.

6.1.1 Benefits of Prescribed Fire

Prescribed fire is not a "magic bullet" that alone will erase past management failures or make up for improper management in the future. However, prescribed fire can yield many benefits if it is used with other sound management practices. In grasslands, prescribed fire can increase grass quality, availability, reduce hazardous fuels, suppress unwanted plants, and improve wildlife habitat. Grass quality, and availability are improved because the fire removes dead plant material and improves access to new growth. If soil moisture is adequate, grass growth increases because baring and darkening the soil surface allows it to warm more quickly and stimulate earlier growth, and because competing weeds are suppressed.

6.1.2 When Not to Burn

Burning during the wrong environmental conditions is dangerous and can harm desirable plants. Plant growth may be reduced if soil moisture is low at the time of the fire. When soil moisture is low, the risk of soil erosion increases because ground cover is removed and plant re-growth is delayed. Burning when relative humidity is less than 25 percent, air temperature is above 80^{o}F, and wind speed is more than 15 mph causes intense, possibly dangerous fire behavior. Such fires can produce flame heights in excess of 50 feet and headfires can advance faster than the wind speed. On sites with low fine-fuel loads humidity higher than 60 percent, temperatures less than 40^{o}F, and winds less than 5 mph will result in patchy, incomplete burns that may fail to achieve management objectives. In most cases, fires should not be set unless winds are at least 5 mph from a consistent direction. This allows the fire to be controlled and

directed. Light and variable winds will cause the fire's direction to shift erratically, making control difficult. Improper fire timing can reduce plant productivity. If the goal is to increase warm-season tallgrass growth, the burn should be just before or during growth initiation, from mid-April to early May. Yields will be reduced if these grasses are burned when actively growing. If the burn is too early, cool-season grasses will increase and deplete soil water and nutrients before warm-season grasses begin growth.

6.1.3 Special Uses of Prescribed Fire

6.1.3.1 Eastern Red Cedar Management

Eastern red cedar trees are early successional invaders of grasslands. Encroachment by this species can be rapid and dramatically reduce biodiversity over time. The periodic use of prescribed fire is essential in eastern red cedar management, both to inexpensively reduce initial tree numbers and to prevent re-infestation. If eastern red cedar management is the primary objective, some variations in the usual practices may be desirable. For example, an earlier burn date, around April 1, may provide better control because eastern red cedar foliage is drier and more flammable before spring growth begins. Also, use of the warmest, driest conditions consistent with safety and fire control will improve effectiveness. This is especially important in early successional fields where fuel loads are low.

6.1.3.2 Sumac Management

Sumac invades many grasslands reducing forage production and accessibility under the dense sumac canopy. Fire alone is ineffective against sumac because, while the aerial stems may be top-killed, the plant will re-sprout from root buds. However, fire can reduce canopy height and reduce the intensity of herbicide application. In addition, fire will help rejuvenate warm-season grasses that have declined in vigor and productivity under the canopy.

6.1.3.3 Cool-Season Grasses

Most research and recommendations on prescribed fire relate to warm-season grasses. Much less is known about the use of fire on cool-season grasses. However, sound reasons exist to consider fire in this vegetation type. These may include many of the same objectives associated with burning warm-season grasses, such as woody plant control. One obvious difference between burning cool-season vs. warm-season grasses is fire date. Fires should be conducted just before or just as the grasses begin spring growth. For cool-season grasses this could be as much as six to eight weeks earlier than for warm-season grasses.

The situation is more complex when fire is considered on fallow agricultural fields that have both significant cool- and warm-season components. Fires conducted early will encourage the cool-season grasses at the expense of the warm-season grasses. Those conducted later will have the opposite effect. Total production also may be temporarily reduced if the warm-season component is too sparse or weakened to take immediate advantage of the reduction in competition. The use of fire on such mixed stands should be carefully considered.

6.1.3.4 Fire and Wildlife Habitat Management

Burning can benefit many wildlife species by increasing habitat diversity, and the nutritive quality, availability, and yield of browse, seeds, and forage. A common misconception is that many animals are killed by fire. Animals usually escape by running or flying away, going below ground, or moving to unburned islands of vegetation. The primary fire effect on wildlife is habitat alteration, not mortality.

If improvement or maintenance of wildlife habitat is the objective in using fire, some variations in practices recommended elsewhere in this publication may be in order. For example, many upland birds, including game birds, enter their peak nesting period in April-May. Fires conducted in early March will avoid most nest destruction. Also, habitat sites can be divided so that only a half or third is burned in a given year. This will provide a refuge for animals excluded from the burned area, and increase habitat diversity because burned and unburned areas will develop different canopy structures, litter accumulations, and to some extent, plant species.

6.2 Mechanical

Mechanical management is often thought as a tool that creates more problems than its worth. The majority of environmental issues occur due to management oversight or lack of direction in the field. It is a necessary tool required to reclaim grasslands that have reverted to a late successional stage.

6.2.1 Heavy Equipment (bull dozer, etc.)

Mechanical clearing of woody encroachment may be necessary to maintain grassland characteristics and support military training requirements. Areas designated for heavy mechanical clearing should be coordinated to ensure no loss of merchantable timber. Felled timber should be windrowed along the field border and burned. Areas cleared will be disked twice and placed in “passive” management. Each area should remain fallow for at least 3 years or until ample fine fuels are present to begin fire prescriptions.

6.2.2 Light Equipment (bushhog, mower, pasture aeriator, disking, etc.)

Use of light mechanical tools are necessary to maintain grasslands to support military desired conditions. Actions utilizing these tools are site specific and typically follow prescribe fire activity. Most work is completed with in-house equipment and focuses attention on invasive species removal. In absence of prescribed fire, disking may be used to set back successional trajectory and maintain grassland/forb mixed habitats.

6.2.3 Hand Tools

Removal of undesirable species by hand is time intensive and costly. However, it is more environmentally friendly than mechanical or chemical means. The large numbers of fields requiring this level of attention make this management action almost impractical except for small field management projects.

6.3 Chemical

Use of chemical means is the least preferred method of grassland management. The complexities found in grassland communities often provide critical management decisions on when to apply, what to apply, and

how to apply chemicals safety and effectively. Herbicides will be applied in accordance with the Integrated Pest Management Plan for control on invasive species.

6.3.1 Application

Broad application of non-selective herbicides can cause negative impacts to vegetational communities and impact many non-target species. However, use of chemicals to retard woody encroachment that may impede military training or as a means to manage extensive invasive species growth may be required. Chemical applications on Fort Campbell grasslands will be actively managed and most often will specifically target single species. Selective herbicides also allow for hand applications and spot treatments.

Many invasive species, specifically sericea lespedeza (*Lespedeza cuneata*) and bicolor lespedeza (*L. bicolor*), are not inhibited by fire and grow vigorously following fire prescriptions. Selective herbicide (Triclopyr - Garlon) applications for these species and non-selective (Glyphosate - Roundup or 2,4-D ester) may be used in pure stands. Application of herbicides, when warranted, will utilize State authorized chemical compounds as directed by the manufacturer.

6.4 Monitoring

Monitoring is just as important as the prescription itself. To actively manage field conditions, annual field inspections during the growing season (June-July) will be conducted. Field data will be collected using visual obstruction boards, belt transects, or any other scientifically valid method. Corrections to field prescriptions will be made and management actions will be projected for the following fiscal cycle.

7.0. Rare Species and Critical Habitat

Any grassland that is critical habitat for a rare species should not be altered until the endangered species biologists develops a suitable and agreeable management plan. Military trainers should consult the installation endangered species program for rare species locations and information. Grasslands that seem exceptionally well suited to endangered grassland plants and wildlife should be given consideration to making endangered species management a top priority. Fields of this nature should have conservation restrictions developed that prevent impacts and meet military training desires.

8.0 Invasive Exotic Species

Introduced species constitute approximately 4% of grassland flora on Fort Campbell. While most of these exotic plants are not problematic, some are highly invasive, crowding out native species, and threaten grassland habitat. Johnson grass (*Sorghum halepense*), Japanese honeysuckle (*Lonicera japonica*.), and non-native lespedezas (*Lespedeza spp)* are among the most serious invaders in grasslands. These species should be monitored and controlled where possible. Control and eradication of these species may include heavy and light mechanical, controlled burning and use of herbicides. Recommendations for specific species can be found within the installation's Integrated Pest Management Plan. Consideration should be given to controlling problematic species from adjacent forest edges and pine plantations to help prevent establishment in grasslands. All non-native loblolly pines (*Pinus taeda*) should be removed from grassland communities.

9.0 Field Management Prescriptions

Open area prescriptions provide the most comprehensive “active” management and are typically developed on a case-by-case basis. However, open areas on Fort Campbell can generally be classified into three major categories. Categories were delineated using woody encroachment, invasive species, and barren quality parameters. Category I fields require the most intense management, Category II fields moderate management, and Category III minimal management efforts. The intent of this document is to actively manage fields to meet desired military and biological conditions (Category III).

9.1 Category I

Category I fields are tier 2 barrens that are in the early stages of exhibiting tier 3 characteristics (severe woody encroachment, pines and hardwoods, displacing an area greater than 50%). Heavy infestations of an assortment of lespedezas (*Lespedeza spp.*), thistle (*Cirsium spp.*), and johnson grass (*Sorghum halepense*) also severely disrupt community viability and typically displace native species within a few years of un-checked growth. Habitats of this nature do not support a sound diversity foundation and result in poor biological reproductive capability. Fields with these characteristics are priority fields.

9.2 Category II

Category II fields are tier 2 barrens with moderate encroachment and invasive species. The habitats typically have moderate to heavy Lespedeza (*Lespedeza spp.*) or Sumac (*Rhus*) infestation. Infestations are localized and easily managed with spot chemical treatment. Light mechanical work following prescribed fire will help control the spread of invasives and allow spot chemical treatments. Fields with these characteristics can be subdivided into two management priority groups. Fields with endangered species are considered priority fields while fields lacking such species are not.

9.3 Category III

Category III fields are tier 1 or 2 barrens requiring minimal management. An active burn regime can thwart invasive species and maintain optimal habitat conditions. These areas currently support military operations and have viable community dynamics. Light mechanical work every 3-4 years can prevent woody encroachment.

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APPENDIX A - FLORAL LIST FOR FORT CAMPBELL, KENTUCKY

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Flora species identified at Fort Campbell in 1992.

Botanical Name	Common Name
ACANTHACEAE	ACANTHUS FAMILY
Justicia americana	water willow
Ruellia strepens var *strepens*	smooth wild petunia
ACERACEAE	MAPLE FAMILY
Acer negundo spp *negundo* var *negundo*	box-elder
Acer rubrum spp *rubrum* var *rubra*	red maple
Acer saccharinum	silver maple
Acer saccharum spp *floridanum*	sugar maple
AGAVACEAE	CENTURY PLANT FAMILY
Yucca flaccida yucca,	Spanish bayonet
ALISMATACEAE	WATER-PLANTAIN FAMILY
Alisma subcordatum	water-plantain
AMARANTHACEAE	AMARANTH FAMILY
Amaranthus retroflexus var *retroflexus*	green amaranth, pigweed
AMARYLLIDACEAE	AMARYLLIS FAMILY
Manfreda virginica	false aloe
Narcissus poeticus	poet's narcissus
ANACARDIACEAE	CASHEW FAMILY
Rhus copallina var *copallina*	winged sumac
Rhus glabra	smooth sumac
Toxicodendron radicans	poison ivy
ANNONACEAE	ANNONA FAMILY
Asimina triloba	pawpaw
APOCYNACEAE	DOGBANE FAMILY
Apocynum cannabinum	Indian hemp
Vinca minor	periwinkle
ARACEAE	ARUM FAMIL Y
Arisaema dracontium	green dragon
Arisaema triphyllum var *triphyllum*	small Jack-in-the-pulpit
ARALIACEAE	GINSENG FAMILY
Aralia spinosa	devil's walking stick
Panax quinquefolius	wild ginseng
ARISTOLOCHIACEAE	BIRTHWORT FAMILY
Asarum canadense var *acuminatum*	wild ginger
ASCLEPIADACEAE	MILKWEED FAMILY
Asclepias incarnata var *incarnata*	swamp-milkweed
Asclepias tuberosa spp *interior*	butterfly-weed
Asclepias viridiflora var *lanceolata*	green milkweed
Asplenium platyneuron var *platyneuron*	ebony-spleenwort
ASCLEPIADACEAE	MILKWEED FAMILY
Asplenium rhizophyllum	walking fern

Woodsia obtuse	common woodsia
Athyrium filix-femina var *angustum*	lady fern
Polystichum acrostichoides	Christmas fern
BALSAMINACEAE	TOUCH-ME-NOT FAMILY
Impatiens capensis	spotted touch-me-not
Impatiens pallida	pale touch-me-not
BERBERIDACEAE	BARBERRY FAMILY
Podophyluum peltatum	mayapple
BETULACEAE	BIRCH FAMILY
Alnus serrulata	common alder
Betula nigra	river birch
Carpinus caroliniana	American hornbeam
Ostrya virginiana	hop-hornbeam
BIGNONIACEAE	BIGNONIA FAMILY
Bignonia capreolata	cross-vine
Campsis radicans	trumpet-creeper
BORAGINACEAE	BORAGE FAMILY
Cynoglossum virginianum	wild comfrey
Lithospermum arvense	corn gromwell
Lithospermum canescens	hoary puccoon
Mertensia virginica	bluebells
Myosotis macrosperma	large-seeded scorpion grass
CAMPANULACEAE	BELLFLOWER FAMILY
Campanula americana	American bellflower
Lobelia puberula var meneolaya	downy lobelia
Lobelia puberula var puberula	downy lobelia
Lobelia spicata var spicata	spiked lobelia
Triodanis perfoliata	Venus' looking glass
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY
Lonicera japonica	Japanese honeysuckle
Lonicera sempervirens var sempervirens	trumpet-honeysuckle
Sambucus canadensis var canadensis	common elder
Symphoricarpos orbiculatus	coralberry
CARYOPHYLLACEAE	PINK FAMILY
Cerastium viscosum	sticky mouse-ear chickweed
Dianthus armeria	Deptford pink
Silene stellata	starry campion
Silene virginica	fire-pink
Stellaria media	common chickweed
Stellaria pubera	great chickweed
CELASTRACEAE	BITTERSWEET FAMILY
Euonymus biautschovicus	wahoo
Euonymus americanus	strawberry-bush
Euonymus atropurpureus	burning bush
CHENOPODIACEAE	GOOSEFOOT FAMILY
Chenopodium album var *lanceolatum*	pigweed

CISTACEAE	ROCK-ROSE FAMILY
Lechea tenuifolia var *tenuifolia*	narrow-leaved pinweed
COMMELINACEAE	SPIDERWORT FAMILY
Commelina communis var *ludens*	dayflower
Tradescantia subaspera harsh	spiderwort
COMPOSITAE	COMPOSITE FAMILY
Achillea millefolium	common yarrow
Ambrosia artemisiifolia var *artemisiifolia*	common ragweed
Ambrosia bidentata	twice-toothed ragweed
Ambrosia trifida	giant ragweed
Antennaria plantaginifolia	pussytoes
Aster dumosus var *dumosus*	bushy aster
Aster pilosus	pilose aster
Aster simplex	panicled aster
Aster solidagineus	white -topped aster
Astranthium integrifolium spp *integrifolium*	western daisy
Bidens polylepis var *polylepis*	scaled sticktights
Boltonia asteroides var *latisguama*	boltonia
Carduus nutans	musk-thistle
Cichorium intybus	common chickory
Cirsium discolor	two-colored thistle
Conoclinum coelestinum	mistflower
Conyza canadensis var *canadensis*	horseweed
Coreopsis major	large tickseed
Coreopsis tinctoria var *tinctoria*	tickseed
Eclipta alba	yerba-de-tajo
Elephantopus carolinianus	Carolina elephant's foot
Erechtites hieracifolia var *hieracifolia*	fireweed, pilewort
Erigeron annuus	daisy-fleabane
Erigeron philadelphicus	Philadephia fleabane
Erigeron strigosus var *beyrichii*	daisy fleabane
Eupatoriadelphus fistulosus	Joe-pye-weed
Eupatoriadelphus fistulosum	hollow Joe-pye-weed
Eupatorium hyssopifolium var *calcaratum*	hyssop-leaved thoroughwort
Eupatorium perfoliatium	perfoliate boneset
Eupatorium perfoliatium var *cuneatum*	perfoliate thoroughwort
Eupatorium rugosum	white snakeroot
Eupatorium serotinum var *serotinum*	large-flowering thoroughwort
Euthamia graminifolia	
Fleischmannia incarnata	
Gamochaeta purpurea	purple cudweed
Gnaphalium obtusifolium var *obtusifolium*	catfoot
Grindelia lanceolata	gumweed
Helenium amarum	slender-leaved sneezeweed
Helenium flexuosum	flexous sneezeweed
Helianthus hirsutus	hairy sunflower

Helianthus maximilianii	Maximilian's sunfloer
Helianthus microcephalus	small wood-sunflower
Helianthus mollis	soft sunflower
COMPOSITAE	COMPOSITE FAMILY
Helianthus occidentalis var *occidentalis*	western sunflower
Helianthus tuberosus	Jerusalem artichoke
Heterotheca camporum	camphorweed
Kringa biflora	two-flowered cynthia
Krigia virginica Virginia	dwarf dandelion
Lactuca floridana var *floridana*	Florida wild lettuce
Lactuca serriola var *serriola*	prickly lettuce
Leucanthemum vulgare	ox-eye daisy
Liatris squarrosa var *hirsuta*	spreading blazing star
Pyrrhopappus carolinianus	false dandelion
Rudbeckia hirta var *hirta*	black-eyed Susan
Rudbeckia triloba var *triloba*	lobed-leaved coneflower
Senecio glabellus	butterweed
Silphium laciniatum	compass plant
Silphium t. var *terebinthaceum*	prairie dock
Solidago altissima var *altissima*	tall goldenrod
Solidago caesia var *caesia*	blue-stem goldenrod
Solidago juncea	stiff goldenrod
Solidago nemoralis var *longipetiolata*	woodland goldenrod
Solidago ulmifolia var *ulmifolia*	elm-leaved goldenrod
Taraxacum officinale	common dandelion
Verbesina alternifolia	wing-stem
Verbesina virginica var *virginica*	tickweed
Vernonia altissim	ironweed
Vernonia gigantea spp *gigantean*	tall ironweed
Xanthium strumarium var *glabratum*	cocklebur
CONVOLVULACEAE	MORNING-GLORY FAMILY
Calystegia silvatica spp *fraterniflora*	bindweed
Cuscuta pentagona	prairie dodder
Ipomoea hederacea	ivy-like morning glory
Ipomea pandurata	morning glory
CORNACEAE	DOGWOOD FAMILY
Cornus florida	flowering dogwood
Nyssa sylvatica var *sylvatica*	black gum
CRASSULACEAE	STONECROP FAMILY
Penthorum sedoides	ditch-stonecrop
Sedum ternatum	stonecrop
CRUCIFERAE	MUSTARD FAMILY
Barbarea vulgaris	common winter-cress
Brassica napus	turnip
Capsella bursa-pastoris	shepherd's purse
Cardamine bulbosa	spring-cress

Cardamine concatenata	lacinate toothwort
Cardamine parviflora	small-flowered bitter cress
Iodanthus pinnatifidus	purple rocket
Lepidium virginicum var *robinsonii*	peppergrass
Lepidium virginicum var *virginicum*	peppergrass
Sisymbrium officinale	hedge mustard
Thlaspi arvense	field penny-cress
CYPERACEAE	SEDGE FAMILY
Carex albursina	sedge
Carex amphibola var *turgida*	ambiguous sedge
Carex annectens var *xanthocarpa*	connected sedge
Carex artitecta var *artitecta*	covered sedge
Carex blanda	charming sedge
Carex cephalophora	headed sedge
Carex flaccidula	sedge
Carex frankii	Frank's sedge
Carex hirsutella	sedge
Carex jamesii	James' sedge
Carex vulpinoidea	fox-tail sedge
Cyperus filiculmis	thread-like sedge
Cyperus lancastriensis	Lancaster's sedge
Cyperus pseudovegetus	green sedge
Eleocharis intermedia	spike-rush
Eleocharis obtusa var *obtusa*	blunt spike-rush
Eleocharis tenuis var *tenuis*	spike-rush
Rhynchospora coniculata var *coniculata*	horned-rush
CYPERACEAE	RUSH FAMILY
Scirpus atrovirens	dark-green bulrush
Scirpus cyperinus	red bulrush
Scirpus pendulus	line-scalled bulrush
DIOSCOREACEAE	YAM FAMILY
Dioscorea quaternata var *quaternata*	common yam
EBENACEAE	PERSIMMON FAMILY
Diospyros virginiana	common persimmon
ELAEGNACEAE	OLEASTER FAMILY
Elaeagnus umbellata	autumn olive
ERICACEAE	HEATH FAMILY
Chimaphila maculata var *maculata*	spotted wintergreen
Vaccinium arboretum	farkleberry
EUPHORBIACEAE	SPURGE FAMILY
Acalypha ostryifolia	three-seeded mercury
Croton monanthogynus	prairie-tea
Euphorbia corollata	flowering spurge
Euphorbia maculata	milk purslane
Euphorbia nutans	eyebane
FAGACEAE	BEECH FAMILY

Fagus grandifolia	American beech
Quercus alba	white oak
Quercus coccinea	scarlet oak
Quercus falcata var *falcata*	southern red oak
Quercus imbricaria	shingle oak
Quercus marilandica	black jack oak
Querucs muhlenbergii	chinkapin oak
Quercus palustris	pin oak
Quercus phellos	willow oak
Quercus shumardii var *shumardii*	Shumard's red oak
Quercus stellata var *stellata*	post oak
Quercus velutina	black oak
GENTIANACEAE	GENTIAN FAMILY
Sabatia angularis	rose-pink
GERANIACEAE	GERANIUM FAMILY
Geranium maculatum	wild geranium
GRAMINAE	GRASS FAMILY
Agrostis alba	red top
Alopecurus carolinianus	Carolina foxtail
Andropogon gerardii var *gerardii*	big bluestem
Andropogon virginicus	broomsedge
Aristida longispica var *longispica*	threeawn
Aristida oligantha	few-flowered needlegrass
Arundinaria gigantea	large cane
Bromus commutatus	racemose brome grass
Bromus purgens var *purgans*	woodland brome grass
Chasmanthium latifolium	wild oats, uniola
Cinna latifolia	wood reed-grass
Cynodon dactylon	Bermuda grass
Dichanthelium a. var *acuminatum*	panic grass
Dichanthelium boscii	Bosc's panic grass
Dichanthelium d. var *dichotomum*	small-fruited panic grass
Dichanthelium latifolium	panic grass
Dichanthelium laxiflorum	loose-flowered panic grass
Dichanthelium scoparium	broom-like panic grass
Dichanthelium s. var *isophyllum*	round-fruited panic grass
Dichanthelium s. var *sphaerocarpon*	round-fruited panic grass
Digitaria sanguinalis	hairy crab grass
Echinochloa crusgalli var *crusgalli*	barnyard grass
Eleusine indica	wiregrass
Elymus villosus var *villosus*	hairy wild rye
Eragrostis capillaris	lace grass
Eragrostis cilianensis	stink-love-grass
Eragrostis pectinacea	purple eragrostis
Eragrostis spectabilis	tumble grass
Erianthus alopecuroides	wooly beardgrass

Festuca arundinaceae	tall fescue
Festuca obtuse	fescue
Glyceria striata var *striata*	manna-grass
Hystrix patula	bottle-brush grass
Lolium perenne var *perenne*	common ryegrass
Panicum anceps var *anceps*	two-edged panic grass
Paspalum laeve var *circulare*	smooth knotgrass
Phleum pratense var *pratense*	common timothy
Poa annua var *annua*	low speargrass
Poa chapmaniana	bluegrass
Poa compressa	Canada bluegrass
Poa pratensis	Kentucky bluegrass
Poa sylvestris	bluegrass
Schizachyrium scoparium var *scoparium*	little bluestem
Setaria geniculata	bent bristly foxtail
Setaria glauca	foxtail
Setaria italica	German millet
Setaria viridis	green foxtail
Sorghastrum nutans	Indian grass
Sorghum halepense	Johnson grass
Sphenopholis nitida	shining wedge grass
Sphenopholis obtusata var *major*	blunt wedge grass
Tridens flavus var *flavus*	tall red-top
Tripsacum dactyloides var *occidentale*	gama grass
GUTTIFERAE	ST. JOHN'S WORT FAMILY
Hypericum gentianoides	orange-grass
Hypericum mutilum	slender St. John's-wort
Hypericum perforatum	common St. John's-wort
Hypericum prolificum	shrubby St. John's-wort
Hypericum punctatum	dotted St. John's-wort
HAMAMELIDACEAE	WITCH-HAZEL FAMILY
Liquidambar styraciflua	sweet gum
HIPPOCASTANACEAE	HORSE-CHESTNUT FAMILY
Aesculus glabra var *glabra*	Ohio buckeye
HYDROPHYLLACEAE	WATER-LEAF FAMILY
Phacelia bipinnatifida	scorpion weed
Phacelia ranunculacea	ranunculus-leaved phacelia
IRIDACEAE	IRIS FAMILY
Iris cristata	crested dwarf iris
Sisyrinchium angustifolium	narrow-leaf blue-eyed grass
JUGLANDACEAE	WALNUT FAMILY
Carya cordiformis	bitternut hickory
Carya ovata var *ovata*	shagbark hickory
Carya tomentosa	mockernut hickory
Juglans cinera	white walnut, butternut
Juglans nigra	black walnut

JUNCACEAE	RUSH FAMILY
Juncus biflorus	rush
Juncus debilis	weak rush
Juncus tenuis var *tenuis*	path rush
Luzula echinata	woodrush
LAMIACEAE	MINT FAMILY
Blephilia hirsuta	wood-mint
Collinsonia canadensis var *canadensis*	richweed
Cunila origanoides	dittany
Glecoma hederacea	gill-over-the-ground
Lamium purpureum	purple dead-nettle
Monarda fistulosa var *mollis*	wild bergamot
Prunella vulgaris ssp *vulgaris*	heal-all
Pycnanthemum incanum	mint
Pycanthemum pilosum	hairy mountain mint
Pycnanthemum tenuifolium	slender mountain mint
Scutellaria integrifolia var *integrifolia*	entire-leaved skullcap
Scutellaria ovata var *ovata*	heart-leaved skullcap
Scutellaria serrata	showy skullcap
Stachys tenuifolia	smooth hedge nettle
Teucrium canadense var *canadense*	American germander
LAURACEAE	LAUREL FAMILY
Lindera benzoin	spicebush
Sassafras albidum	white sassafras
LEGUMINOSAE	PEA FAMILY
Albizia julibrissin	mimosa
Amphicarpaea bracteata var *bracteata*	hog-peanut
Apios americana var *americana*	American potato bean
Cassia fasciculata var *puberula*	partridge-pea
Cassia nictitans	wild sensitive plant
Cercis canadensis var *canadensis*	redbud
Desmodium ciliare	ciliate tick clover
Desmodium glutinosum	glutinous tick clover
Desmodium pauciflorum	few-flowered tick seed
Desmodium rotundifolium	prostrate tick-trefoil
Gleditsia triacanthos	honey locust
Glycine max	soybean
Lespedeza cuneata	sericea lespedeza
Lespedeza hirta var *hirta*	hairy bush clover
Lespedeza procumbens	prostrate lespedeza
Lespedeza stipulacea	Korean clover
Lespedeza thunbergii	clover
Lespedeza virginica	Virginia lespedeza
Melilotus alba	white sweet-clover
Melilotus officinalis	yellow sweet-clover
Pueraria lobata	kudzu-vine

Robinia pseudoacacia var *pseudoacacia*	black locust
Stophostyles helvola	yellow wild bean
Stophostyles umbellata	pink wild bean
Tephrosia virginiana var *virginiana*	goat's-rue
Trifolium dubium	low hop clover
Trifolium pratense	red clover
LEGUMINOSAE	PEA FAMILY
Trofolium repens	white clover
Vicia cracca	tufted vetch
LILIACEAE	LILY FAMILY
Allium canadense var *canadense*	wild onion
Allium vineale	field-garlic
Camassia scilloides	eastern camas, wild hyacinth
Erythronium albidum var *albidum*	white dog's-tooth-violet
Hemerocallis fulva	common orange day-lily
Muscari botryoides	grape-hyacinth
Ornithogalum umbellatum	star-of-bethlehem
Polygonatum biflorum var *biflorum*	two-flowered Soloman's seal
Smilacina racemosa var *racemosa*	false spikenard
Smilax glauca	sawbrier
Smilax rotundifolia var *rotundifolia*	common greenbriar
Trillium grandiflorum	large-flowered trillium
Trillium recurvatum	prairie trillium
Trillium viride	trillium
Uvularia sessilifolia	wild-oats
LINACEAE	FLAX FAMILY
Linum virginianum	yellow-flax
LOGANIACEAE	LOGANIA FAMILY
Spigelia marilandica	Indian-pink
LYCOPODIACEAE	CLUBMOSS FAMILY
Lycopodium digitatum	ground cedar
MAGNOLIACEAE	MAGNOLIA FAMILY
Liridodendron tulipifera	yellow poplar
MALVACEAE	MALLOW FAMILY
Abutilon theophrasi	velvet-leaf
Hibiscus mocsheutos var *moscheutos*	swamp rose-mallow
MELASTOMATACEAE	MEADOW-BEAUTY FAMILY
Rhexia mariana var *mariana*	Maryland meadow beauty
Rhexia virginica	Virginia meadow beauty
MORACEAE	MULBERRY FAMILY
Maclura pomifera	osage orange
Morus rubra	red mulberry
OLEACEAE	OLIVE FAMILY
Fraxinus americana	white ash
Fraxinus pennsylvanica	green ash
ONAGRACEAE	EVENING-PRIMROSE FAMILY

Circaea lutetiana spp *canadensis*	enchanter's nightshade
Gaura biennis	biennal gaura
Ludwigia alternifolia	seedbox
Oenothera biennis	biennial evening primrose
Oenothera linifolia	evening primrose
OPHIOGLOSSACEAE	ADDER'S-TONGUE FAMILY
Botrychium dissectum	common grape fern
ORCHIDACEAE	ORCHID FAMILY
Corallorhiza wisteriana	Wister's coral-root
Cypripedium calceolus	yellow lady's slipper
Liparis lilifolia	wayblade
Platanthera peramoena	purple fingeless orchid
Spiranthes cernua	common ladies'-tresses
Tipularia discolor	cranefly orchis
OXALIDACEAE	WOOD-SORREL FAMILY
Oxalis corniculata var *corniculata*	creeping lady's-sorrel
Oxalis stricta	sourgrass
Oxalis violacea	violet wood-sorrel
PASSIFLORACEAE	PASSION-FLOWER FAMILY
Passiflora edulis	apricot-vine
PHRYMACEAE	LOPSEED FAMILY
Phryma leptostachya	lopseed
PHYTOLACCACEAE	POKEWEED FAMILY
Phytolacca americana	pokeweed
PINNACEAE	PINE FAMILY
Juniperus virginiana	red cedar
Pinus taeda	loblolly pine
Pinus virginiana	Virginia pine
PLANTAGINACEAE	PLANTAIN FAMILY
Plantago aristata	bracted plantain
Plantago lanceolata	ribgrass
Plantago rugelii	Rugel's plantain
Plantago virginica	hoary plantain
PLATANACEAE	SYCAMORE FAMILY
Platanus occidentalis	sycamore
POLEMONIACEAE	PHLOX FAMILY
Phlox divaricata var *divaricata*	blue phlox
Polemonium reptans var *reptans*	Greek valerian
POLYGALACEAE	MILKWORT FAMILY
Polygala incarnata	pink milkwort
Polygala sanguinea	field milkwort
Polygala verticillata var *verticillata*	whorled milkwort
POLYGONACEAE	BUCKWHEAT FAMILY
Fagopyrum sagittatum	buckwheat
Polygonum hydropiperoides	mild water-pepper
Polygonum punctatum var *leptostachyum*	water smartweed

Polygonum sagittatum	arrow-leaved tearthumb
Polygonum setaceum var *setaceum*	bristly smartweed
Polygonum virginianum	jumpseed
Rumex acetosella	sheep-sorrel
Rumex crispus	curly dock
Rumex obtusifolius var *obtusifolius*	bitter dock
POLYPODIACEAE	COMMON FERN FAMILY
Asplenium platyneuron var *platyneuron*	ebony-spleenwort
Asplenium rhizophyllum	walking fern
Athyrium filix-femina ssp *anugustum*	lady fern
Polystichium acrostichoides	Christmas fern
Woodsia obtusa	blunt-lobed woodsia
PORTULACEAE	PURSLANE FAMILY
Claytonia virginica	spring beauty
POTAMOGETONACEAE	PONDWEED FAMILY
Potamogeton nodosus	long-leaved pondweed
PRIMULACEAE	PRIMROSE FAMILY
Dodecatheon meadia var *meadia*	shooting-star
Lysimachia ciliata	fringed loosestrife
Samolus parviflorus	water-pimpernel
RANUNCULACEAE	BUTTERCUP FAMILY
Actaea pachypoda	white baneberry
Anemone virginiana	tall anemone
Clematis virginiana	virgin’s bower
Delphinium tricorne	dwarf larkspur
Ranunculus abortivus ssp *abortivus*	kidney leaf-buttercup
Ranunculus sardous	European crowfoot
Thalictrum thalictroides	rue-anemone
RHAMNACEAE	BUCKTHORN FAMILY
Ceanothus americanus var *pitcheri*	New Jersey tea
Rhamnus caroliniana	Carolina buckthorn
ROSACEAE	ROSE FAMILY
Agrimonia microcarpa	agrimony
Agrimonia rostellata	agrimony
Amelanchier arborea	serviceberry
Crataegus ssp.	hawthorn
Duchesnea indica	Indian strawberry
ROSACEAE	ROSE FAMILY
Frageria virginiana spp *virginiana*	wild strawberry
Geum canadense	Canada avens
Malus angustifolia	wild crab
Potentilla simplex var *argyrisma*	old field cinquefoil
Prunus americana	wild plum
Prunus hortulana	wild-goose plum
Prunus munsoniana	plum
Prunus serotina var *serotina*	black cherry

Rosa carolina	pasture rose
Rosa multiflora	multiflora rose
Rosa setigera var *setigera*	prairie rose
Rubus allegheniensis	blackberry
Rubus flagallaris	dewberry
Rubus occidentalis	raspberry
Rubus ostryifolius	MADDER FAMILY
Cephalanthus occidentalis	buttonbush
Diodia teres var *teres*	poor-Joe
Galium aparine	cleavers
Galium pilosum	hairy bedstraw
Houstonia caerulea var *caerulea*	bluets
Houstonia minima	star-violet
Houstonia purpurea var *purpurea*	purple bluets
SALICACEAE	WILLOW FAMILY
Populus alba	white poplar
Populus deltoides ssp *deltoides*	cottonwood
Salix caroliniana	Ward's willow
Salix nigra	black willow
SAXIFRAGACEAE	SAXIFRAGE FAMILY
Heuchera villosa	alumroot
Hydrangea arborescens ssp *discolor*	wild hydrangea
Saxifraga virginiensis var *virginiensis*	early saxifrage
SCROPHULARIACEAE	FIGWORT FAMILY
Agalinis gattingeri	figwort
Agalinis skinneriana	figwort
Agalinis viridis	figwort
Aurelolaria virginica	downy false foxglove
Buchnera americana	American blue-hearts
Lindernia dubia var *dubia*	false pimpernel
Mecardonia acuminata var *acuminata*	figwort
Mimulus alatus	winged monkey-flower
SCROPHULARIACEAE	FIGWORT FAMILY
Penstemon digitalis	foxglove beardtongue
Scrophularia marilandica	carpenter's square
Verbascum thapsus	common mullein
Veronica arvensis	common speedwell
Veronica peregrina	neckweed
SIMAROUBACEAE	QUASSIA FAMILY
Ailanthus altissima	tree-of-heaven
SOLANACEAE	NIGHTSHADE FAMILY
Physalis heterophylla var *heterophylla*	variable-leaved ground cherry
Solanum carolinense var *carolinense*	horse-nettle
TYPHACEAE	CAT-TAIL FAMILY
Typha latifolia	common cat-tail
ULMACEAE	ELM FAMILY

Celtis occidentalis	hackberry
Ulmus alata	winged elm
Ulmus americana	American elm
Ulmus rubra	slippery elm
UMBELLIFERAE	CARROT FAMILY
Chaerophyllum p. var *procumbens*	chervil
Chaerophyllum tainturieri var *tainturieri*	rough chervil
Cicuta maculata	water hemlock
Cryptotaenia canadensis	honewort
Daucus carota	wild carrot
Osmorhiza longistylis	anise-root
Sanicula canadensis	Canada black snakeroot
Zizia aurea	parsnip
URTICACEAE	NETTLE FAMILY
Boehmeria cylindrica var *cylindrica*	false nettle
Laportea canadensis	wood-nettle
Pilea pumila	clearweed
Urtica dioica	stinging nettle
VALERIANACEAE	VALERIAN FAMILY
Valeriana pauciflora	valerian
Valerianella radiata	corn-salad
Verbena hastata var *hastata*	blue vervain
Verbena simplex	narrow-leaved vervain
Verbena urticifolia var *urticifolia*	white vervain
VIOLACEAE	VIOLET FAMILY
Viola bicolor	violet
Viola papilionacea var *papilionacea*	meadow violet
Viola pensylvanica	smooth yellow violet
Viola sororia	meadow violet
Viola striata	cream violet
Viola triloba var *dilatata*	dilated three-lobed violet
VITACEAE	GRAPE FAMILY
Parthenocissus quinquefolia	Virginia creeper
Vitus aestivalis	summer grape
Vitus rotundifolia	muscadine grape
Vitis vulpina	winter grape

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APPENDIX B - FLORAL LIST FOR BARRENS OCCURRING ON FORT CAMPBELL, KENTUCKY.

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Plant species identified by E.W. Chester from 22 different barrens in 1993. Species are listed based on the number of sites they were recorded from in the 22 barrens.

Botanical Name	Common Name
Occurrence in 22 Barrens	
Acer rubrum	red maple
Achillea millefolium	yarrow
Agalinis tenuifolia	narrow-leaved foxglove
Allium vineale	wild garlic
Andropogon gyrans	Elliott's broom sedge
Andropogon ternarius	silver broom sedge
Apocynun cannabinun	indian hemp
Asclepias amplexicaulis	clasping-leaved milkweed
Asclepias tuberosa	butterfly weed
Aster dumosus	bushy aster
Aster pilosus	pilose aster
Carex complanata	sedge
Chamaecrista fasciculata	partridge pea
**Chrysanthemum leucanthemum*	ox-eye daisy
Coreopsis major	tickseed
Cornus florida	flowering dogwood
**Daucus carota*	wild carrot
Desmodium ciliare	ciliate tick-clover/beggars lice
Desmodium sessilifolium	sessile-leaved tick-clover
Diospyros virginiana	persimmon
Elymus virginicus	Virginia wild rye
Eragrostis spectabilis	tumble grass
Erianthus alopecuroides	plume grass
Erigeron strigosus	fleabane daisy
Eupatorium altissimum	tall thoroughwort
Eupatorium hyssopifolium	narrow-leaved thoroughwort
Eupatorium rotundifolium	round-leaved thoroughwort
Euphorbia corollata	flowering spurge
Fragaria virginiana	wild strawberry
Galium pilosum	hairy bedstraw
Gaura biennis	gaura
Gnaphalium obtusifolium	catfoot
Hedyotis purpurea	purple bluets
Helianthus hirsutus	hairy sunflower
Helianthus mollis	soft sunflower
Helianthus occidentalis	western sunflower
Lespedeza procumbens	trailing bush clover
Lespedeza virginica	Virginia/slender bush clover
Linum striatum	flax
**Lonicera japonica*	Japanese honeysuckle

Nyssa sylvatica	blackgum
Oxalis stricta	sourgrass
Potentilla simplex	five-finger
Prunus serotina	black cherry
Pycnanthemum pilosum	hairy mountain mint
Pycnanthemum tenuifolium	narrow-leaved mountain mint
Quercus falcata	southern red oak
Rhus copallina	winged sumac
Rosa carolina	Carolina rose
Rubus argutus	common blackberry
Rubus flagellaris	dewberry
Rudbeckia hirta	black-eyed Susan
Sassafras albidum	sassafras
Schizachyrium scoparium	little bluestem
Sericocarpus linifolius	white-topped aster
Setaria parviflora	bristly foxtail
Smilax glauca	sawbrier
Solidago juncea	early goldenrod
Solidago nemoralis	gray goldendrod
Sorghastrum nutans	Indian grass
Strophostyles umbellata	wild bean
Stylosanthes biflora	pencil flower
Tridens flavus	red top

Occurrence in 21 Barrens

Ambrosia bidentata	toothed ragweed
Diodia teres	poojoe
Lobelia puberula	downy lobelia
Sabatia angularis	meadow pink

Occurrence in 20 Barrens

Cirsium discolor	two-colored thistle
Desmodium paniculatum	panicled tick-clover/beggars lice
Euthamia graminifolia	grass-leaved goldenrod

Occurrence in 19 Barrens

Ambrosia artemisiifolia	common ragweed
Hypericum dummondii	nits-and-lice
Hypericum punctatum	dotted St. John's-wort
**Kummerowia stipulacea*	Korean lespedeza
Panicum anceps	panic grass
Polygala sanguinea	milkwort
**Prunella vulgaris*	heal-all
Solidago canadensis	Canada/tall goldenrod

Occurrence in 18 Barrens

Agalinis fasciculata	fascicled-leaved foxglove
Desmodium canescens	hoary tick-clover/beggars lice
Hypericum gentianoides	narrow-leaved
Prunus angustifolia	Chickasaw plum
Bidens polylepis	sticktights
Buchnera americana	American blue-hearts
Eragrostis capillaris	lace grass
Juncus biflorus	rush
**Melilotus alba*	white sweet clover
Panicum acuminatum	panic grass
Panicum dichotomum	panic grass
Plantago virginica	Virginia/hoary plantain
Polygala incarnata	pink milkwort

Occurrence in 17 Barrens

Scleria pauciflora	nutrush
Spiranthes lacera var. *gracilis*	Luer, ladies'-tresses
Triodanis perfoliata	Venus' looking glass
Verbena simplex	vervain
Vitis aestivalis	summer grape

Occurrence in 16 Barrens

Eupatorium serotinum	late-flowering thoroughwort
Helianthus angustifolius	narrow-leaved sunflower
Juncus brachycarpus	rush
**Lespedeza cuneata*	sericea lespedeza
Liatris spicata	spicate blazing star
Liatris squarrosa	spreading blazing star
Liatris squarrulosa	rough blazing star
Valerianella radiate	corn salad

Occurrence in 15 Barrens

Chamaecrista nictitans	small partridge pea
Hieracium gronovii	hawkweed
Juniperus virginiana	red cedar
Polygala verticillata var. *ambigua*	milkwort
Rosa setigera	prairie rose
Senacio anonymus	Small's groundsel
Sphenopholis obtusata	wedge grass

Occurrence in 14 Barrens

Oenothera biennis	evening primrose
Ulmus alata	winged elm

Occurrence in 13 Barrens

Antennaria plantaginifolia	pussy toes
Boltonia diffusa	boltonia
Toxicodendron radicans	poison ivy
Trichostema dichotomum	blue curls

Occurrence in 12 Barrens

Gnaphalium purpureum	purple catfoot
Juncus tenuis	path rush
**Lespedeza bicolor*	bicolor/bush lespedeza
Lespedeza hirta	hairy bush clover
Liquidambar styraciflua	sweetgum
Panicun depauperatum	panic grass
**Pinus taeda*	loblolly pine
**Plantago lanceolata*	lance-leaved plantain
Platanthera lacera	lacerate orchid

Occurrence in 11 Barrens

Anemone virginiana	thimbleweed
Lespedeza repens	creeping bush clover
Oenothera linifolia	narrow-leaved evening primrose
Scirpus atrovirens	bulrush
Scirpus pendulous	bulrush

Occurrence in 10 Barrens

Andropogon gerardii	big bluestem
Ipomoea pandurata	wild potato/morning-glory
Lobelia spicata	spicate lobelia
Ludwigia alternifolia	rattlebox
Myosotis verna	forget-me-not
Quercus velutina	black oak
Rhus glabra	smooth sumac
Vernonia gigantea	ironweed

Occurrence in 9 Barrens

Asclepias viridiflora	green milkweed
Coreopsis tripteris	tall tickseed
Eleocharis tenuis	spike rush
Lespedeza capitata	headed bush clover
Passiflora incarnate	maypops
Plantago aristata	aristate plaintain
Prenanthes barbata	white rattlesnake root
Pyrrhopappus carolinianus	false dandelion
Quercus imbricaria	shingle oak
Scleria triglomerata	nutrush
Ulmus rubra	red elm

Vitis vulpina	frost grape

Occurrence in 8 Barrens

Aristida longespica	needlegrass
Aristida oligantha	needlegrass
**Dianthus armeria*	Deptford pink
**Melilotus officinalis*	Yellow sweet clover
Monarda fistulosa	bee-balm
Physalis heterophylla	ground cherry
Scutellaria parvula	small skullcap
*Symphoricarpos or*biculatus	coralberry
Tomanthera auriculata	auriculate-leave false foxglove

Occurrence in 7 Barrens

Ambrosia trifida	giant ragweed
Campsis radicans	trumpet creeper
Chasmanthium latifolium	wild oats
Danthonia spicata	poverty grass
*Helenium flex*osum	sneezeweed
Quercus stellata	post oak
Silphium integrifolium	rosinweed
Tephrosia virginiana	goat's rue

Occurrence in 6 Barrens

Corylus americana	hazelnut
Geranium carolinianum	crane's bill
Gymnopogon ambiguous	beardgrass
Hypericum denticulatum	coppery St. John's wort
**Kummerowia striata*	Japanese lespedeza
Panicum scoparium	panic grass
Vulpia octoflora	eight-flowered fescue

Occurrence in 5 Barrens

Agrimonia parviflora	agrimony
Agrostis perennans	upland bent grass
Carya tomentosa	mockernut hickory
**Cerastium fontanum*	chickweed
Cuscuta campestris	dodder
Gleditsia triacanthos	honey locust
Krigia biflora	false dandelion
Kuhnia eupatorioides	boneset
Ornithogalum umbellatum	star-of-Bethlehem
Panicum capillare	panic grass
**Rosa multiflora*	multiflora rose
Salix humilis	prairie willow
Teucrium canadense	germander

Occurrence in 4 Barrens

Acalypha virginica	three-seeded mercury
Allium canadense	wild onion
Carex muhlenbergii	sedge
Carex vulpinoidea	sedge
Crataegus viridis	hawthorn
Erianthus giganteus	plume grass
Galactia volubilis	downy milk pea
Hypericum stragalum	St. Andrew's Cross
Krigia dandelion	potato dandelion
Manfreda virginica	agave
Oxalis violacea	violet wood sorrel
Paspalum laeve	smooth knotgrass
Quercus coccinea	scarlet oak
Salvia lyrata	lyre-leaved sage
Scutellaria incana	skullcap
Spiranthes vernalis	ladies' tresses
Viola sagittata	lobed violet

Occurrence in 3 Barrens

Acer saccharum	sugar maple
**Agrostis gigantea*	redtop
Andropogon virginicus	common broomsedge
Asclepias syriaca	common milkweed
Aster novae-angliae	New England aster
**Bromus commutatus*	brome grass
Ceanothus americanus	New Jersey tea
Clematis virginiana	virgin's bower
Conoclinum coelestinum	mist flower
Croton capitatus	wooly croton
Eupatorium fistulosum	Joe Pye weed
Fraxinus americana	American ash
Geum canadensis	avens
Helianthus microcephalus	small-flowered sunflower
Heliopsis helianthoides	sweet oxeye
Hieracium longipilum	lang-haired hawkweed
Lactuca canadensis	Canada lettuce
Leucospora multifida	conobea
Muhlenbergia glabriflora	smooth-flowered muhly
Penstemon hirsutus	beard-tongue
Platanus occidentalis	sycamore
**Poa pratensis*	bluegrass
Pycanthemum incanum	mountain mint
Quercus phellos	willow oak
Sisyrinchium albidum	blue-eyed grass

Smilax bona-nox	catbrier
Solidago ulmifolia	elm-leaved goldenrod
Spiraea tomentosa	hardhack
Trifolium compestre	hop clover
Tripsacum dactyloides	gama grass
Vaccinium arboretum	deerberry
Verbesina virginica	crownbeard

Occurrence in 2 Barrens

Aristida purpurascens	needlegrass
**Asparagus officinalis*	common asparagus
Callitriche terrestris	starwort
Cephalanthus occidentalis	buttonbush
Cercis canadensis	redbud
Croton monanthogynus	Mexican tea
Dioscorea villosa	wild yam
Eupatorium perfoliatum	perfoliate boneset
Hedyotis caerulea	bluets
Heuchera villosa	spider lily
Liriodendron tulipifera	tulip tree
Lysimachia lanceolata	loosestrife
Oenothera fruiticosa	sundrops
Panicum laxiflorum	panic grass
Passiflora lutea	small maypops
Phyllanthus caroliniense	phyllanthus
Platanthera peramoena	purple fringeless orchid
Porteranthus stipulatus	Indian physic
Quercus marilandica	blackjack oak
Quercus palustris	pin oak
Rhamnus caroliniana	Carolina buckthorn
Rhexia mariana	meadow beauty
Rhynchospora capitellata	headed rush
Rudbeckia triloba	trilobed black-eyed susan
Ruellia strepens	wild petunia
Silphium pinnatifidum	prairie dock
Solanum carolinense	Carolina nightshade
Sporobolus asper	dropseed
Strophostyles helvula	wild bean
Viola sororio	meadow violet

Occurrence in 1 Barren

Ageratina altissima	tall thoroughwort
Asclepias variegata	variegated milkweed
Aster paludosus spp. *hemisphericus*	aster
Aureolaria flava	foxglove
Baptisia alba	false indigo

Blephilia hirsuta	wood-mint
**Cardamine hirsuta*	bitter-cress
Carex bushii	sedge
Carex glaucodea	sedge
Carex squarrosa	sedge
Corya glabra	pignut hickory
Carya ovata	shagbark hickory
Celtis laevigata	hackberry
**Convolvulus arvensis*	bindweed
Crotalaria sagittalis	crotalaria
Cvperus bipartitus	nutsedge
Cyperus echinatus	nutsedge
Eupatorium album	thoroughwort
**Festuca pratensis*	fescue
Galium aparine	bedstraw
Galium tinctorium	swamp bedstraw
Helenium autumnale	autumnal sneezeweed
Helianthus maximilianii	Maximilian's sunflower
Helianthus strumosus	prairie golden aster
Hypericum hypericoides	St. John's wort
Hypericum mutilum	slender St. John's wort
Hypoxis hirsuta	yellow stargrass
**Iva annua*	marsh-elder
Juglans nigra	black walnut
Lechea mucronata	hairy pinweed
Lechea tenuifolia	narrow-leaved pinweed
Lepidiun virginicum	peppergrass
Lithospermum canescens	hoary puccoon
Lonicera sempervirens	trumpet honeysuckle
Luzula echinata	woodrush
Malus angustifolia	crabapple
Orbexilum onobrychis	scurf-pea
Orbexilum pedunculatum	Sampson's snake root
Panicum flexile	panic grass
Panicum polyanthes	panic grass
Panicum virgatum	switch grass
Parthenium integrifolium	quinine root
Paspalum floridanum	Florida knotgrass
Phytolacca americana	pokeweed
Platanthera ciliaris	yellow fringed orchis
Podophyllum peltatum	mayapple
Polygonatun biflorum	Solomon's seal
Populus grandidentata	big-tooth aspen
**Potentilla recta*	five finger
Quercus alba	white oak
Rhexia virginica	Virginia meadow beauty

Rhynchospora globularis	Small, rush
Rudbeckia subtomentosa	sweet coneflower
**Rumex acetosella*	sheep sorrell
Sambucus canadensis	elderbeny
Sanicula canadensis	snakeroot
Scutellaria integrifolia	skullcap
Senna marilandica	wild senna
**Seteria faberi*	foxtail grass
Silphium laciniatum	compass plant
Smilax rotundifolia	catbrier
Solidago rugosa	rugose goldenrod
**Sorghum halepense*	Johnson grass
Sporobolus vaginiflorus	poverty grass
Thalictrum revolutum	meadow rue
**Tragopogon dubius*	salsify
Verbena hastate	vervain
Verbena uticifolia	vervain
Verbesina alternifolia	Britton, yellow crownbeard
Verbesina helianthoides	crownbeard
Veronicastrum virginicum	Culver's root
Viola rafinesquii	field pansy
Yucca filamentosa	yucca

Species preceded by an asterix are considered invasive species.

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APPENDIX C - GRASSLAND VERTEBRATE SPECIES FOR FORT CAMPBELL, KENTUCKY

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Vertebrate species identified at Fort Campbell since 1992.

AMPHIBIANS

Pelobatidae - Spadefoot Toads	
Scaphiopus h. holbrooki	Eastern spadefoot toad
Bufonidae - "True" Toads	
Bufo a. americanus	Eastern American toad
Bufo woodhousei fowleri	Fowler's toad
Hylidae - Treefrogs	
Acris crepitans blanchardi	Blanchard's cricket frog
Hyla versicolor	gray treefrog
Pseudacris c. crucifer	Northern spring peeper
Pseudacris feriarum	upland chorus frog
Microhylidae - Narrowmouth Toads	
Gastrophryne carolinensis	Eastern narrowmouth toad
Ranidae - "True" Frogs	
Rana catesbeiana	bullfrog
Rana clamitans melanota	green frog
Rana palustris	pickerel frog
Rana sphenocephala	southern leopard frog

REPTILES

Emydidae - Emydid Turtles	
Terrapene c. carolina	Eastern box turtle
Iguanidae - Iguanid Lizards	
Sceloporus undulates hyacinthinus	Northern fence lizard
Scincidae - Skinks	
Eumeces faciatus	five-lined skink
Colubridae - Colubrid Snakes	
Coluber constrictor priapus	Southern black racer
Elaphe obsolete spiloides	gray rat snake
Heterodon platirhinos	Eastern hognose snake
Lampropeltis c. calligaster	prairie kingsnake
Lampropeltis getula nigra	black kingsnake
Lampropeltis t. triangulum	Eastern milk snake
Opheodrys aestivus	rough green snake
Storeria dekayi wrightorum	midland brown snake
Thamnophis s. sirtalis	Eastern garter snake

Viperidae - Pit Vipers

Agkistrodon c. contortrix	Southern copperhead
Agkistrodon contortrix mokasen	Northern copperhead

BIRDS

Podicipedidae - Grebes

Podilymbus podiceps	pied-billed grebe

Ardeidae - Herons

Florida caerulea	little blue heron

Anatidae - Swans, Geese, Ducks

Anas discors	blue-winged teal
Mergus serrator	red-breasted merganser

Gruiidae - Cranes

Grus canadensis	sandhill crane

Rallidae - Rails, Guillinules, Coots

Porzana carolina	Sora

Charadriidae - Plovers

Pluvialis dominica	American golden-plover

Scolopaciidae - Sandpipers

Bartramia longicauda	upland sandpiper
Capella gallinago	common snipe
Tringa solitaria	solitary sandpiper

Accipitridae - Kites, Hawks, Eagles

Buteo lagopus	rough-legged hawk
Circus cyaneus	Northern harrier
Ictinia mississippiensis	Mississippi kite

Falconidae - Falcons and Caracara

Falco columbarius	Merlin
Falco sparverius	American kestrel

Phasianidae - Grouse and Ptarmigans

Colinus virginianus	Northern bobwhite

Cuculidae - Cuckoos and Anis

Coccyzus erythropthalmus	black-billed cuckoo

Strigidae - Owls	
Asio flammeus	short-eared owl
Caprimulgidae - Nightjars	
Chordeiles minor	common nighthawk
Picidae - Woodpeckers	
Sphyrapicus varius	yellow-bellied sapsucker
Tyrannidae - Tyrant Flycatchers	
Contopus cooperi	olive-sided flycatcher
Tyrannus forficatus	scissor-tailed flycatcher
Tyrannus tyrannus	Eastern kingbird
Alaudidae - Larks	
Eremophila alpestris	horned lark
Sittidae - Nuthatches	
Sitta canadensis	red-breasted nuthatch
Troglodytidae - Wrens	
Cistothorus platensis	sedge wren
Muscicapidae - Thrushes	
Catharus guttatus	hermit thrush
Regulus calendula	ruby-crowned kinglet
Regulus satrapa	golden-crowned kinglet
Sialia sialis	Eastern bluebird
Motacilliadae - Wagtails and Pipits	
Anthus rubescens	American pipit
Laniidae - Shrikes	
Lanius ludovicianus	loggerhead shrike
Vireonidae - Vireos	
Vireo solitarius	solitary vireo
Emberizidae - Warblers, Sparrows	
Aimophila aestivalis	Bachman's sparrow
Ammodramus henslowii	Henslow's sparrow
Ammodramus savannarum	grasshopper sparrow
Chondestes grammacus	lark sparrow
Dendroica castanea	bay-breasted warbler
Dendroica magnolia	magnolia warbler
Dendroica palmarum	palm warbler
Dendroica petechia	yellow warbler

Dendroica pensylvanica	chestnut-sided warbler
Dendroica virens	black-throated green warbler
Dolichonyx oryzivorus	bobolink
Icterus galbula	Baltimore oriole
Junco hyemalis	dark-eyed junco
Melospiza georgiana	swamp sparrow
Melospiza melodia	song sparrow
Passerculus sandwichensis	savannah sparrow
Passerella iliaca	fox sparrow
Pooecetes gramineus	vesper sparrow
Spiza americana	Dickcissel
Spizella pusilla	field sparrow
Sturnella magna	Eastern meadowlark
Vermivora ruficapilla	Nashville warbler
Zonotrichia albicollis	white-throated sparrow
Zonotrichia leucophrys	white-crowned sparrow

MAMMALS

Soricidae - Shrews

Sorex cinereus	masked shrew
Sorex hoyi	pygmy shrew
Sorex longirostris	Southeastern shrew
Blarina carolinensis	Southern short-tailed shrew
Cryptotis parva	least shrew

Talpidae - Moles

Scalopus aquaticus	Eastern mole

Muridae - Mice and Rats

Oryzomys palustris	marsh rice rat
Reithrodontomys humulis	Eastern harvest mouse
Peromyscus leucopus	white-footed mouse
Peromyscus maniculatus	deer mouse
Sigmodon hispidus	hispid cotton rat
Microtus ochrogaster	prairie vole
Microtus pennsylvanicus	meadow vole
Microtus pinetorum	woodland vole
Synaptomys cooperi	Southern bog lemming
Mus musculus	house mouse

Dipodidae - Jumping Mice

Zapus hudsonius	meadow jumping mouse

Migratory Bird Management Strategy:
A conservation strategy for protecting and managing migratory birds on Fort Campbell, Kentucky

Directorate of Public Works
Environmental Division
Fish and Wildlife Program

January 2018

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Appendices

1.0 Introduction

Migratory birds are of great ecological and economic value and are an important international resource. Birding related expenditures generated over $82 billion dollars in total industry output and supported over 670,000 jobs in 2006. Birds are a key ecological component of the environment, and they also provide immense enjoyment to millions who study, watch, feed, or hunt them. Over 50 million Americans consider themselves bird watchers or enjoy watching birds on some level. Recognizing this importance, the United States has been an active participant in the internationally coordinated management and conservation of migratory birds. The Migratory Bird Treaty Act (16 U.S.C. 703-712) (MBTA) is the primary legislation in the United States established to conserve migratory birds. The MBTA was originally signed with Great Britain and was subsequently amended after treaties were signed with Mexico (1936, amended 1972, 1995), Japan (1972), and Russia (1976), and the amendment of the treaty with Canada (1999). The U.S. Fish and Wildlife Service (FWS) is responsible for administering and enforcing the statute. The MBTA imposes substantive obligations on the United States for the conservation of migratory birds and their habitats, including, but not limited to, the following conservation principles 1) to conserve and manage migratory birds internationally, 2) to sustain healthy migratory bird populations for consumptive and non-consumptive uses, 3) to provide for, maintain, and protect habitat necessary for the conservation of migratory birds, and 4) to restore depleted populations of migratory birds.

The DoD manages nearly 30 million acres of land. These land holdings support numerous rare and imperiled ecosystems that are utilized for training exercises. This land use classification prevents loss of habitat through development and enables DoD facilities to actively manage natural resources to prevent such loss. Fort Campbell has embraced the concept of ecosystem management through projects outlined in the Integrated Natural Resources Management Plan (INRMP). The post is a member of the DoD Partners In Flight initiative and committed to migratory bird management. Installation biologists have implemented projects designed to meet the intent of the MBTA and will ensure the covenants of the proposed rule are followed.

1.1 The Migratory Bird Treaty Act

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) as amended by: Chapter 634; June 20, 1936; 49 Stat. 1556; P.L. 86-732; September 8, 1960; 74 Stat. 866; P.L. 90-578; October 17, 1968; 82 Stat. 1118; P.L. 91-135; December 5, 1969; 83 Stat. 282; P.L. 93-300; June 1, 1974; 88 Stat. 190; P.L. 95-616; November 8, 1978; 92 Stat. 3111; P.L. 99-645; November 10, 1986; 100 Stat. 3590 and P.L. 105-312; October 30, 1998; 112 Stat. 2956. The Act provides for "the establishment of a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." (16 U.S.C. 703).

1.2 Executive Order 13186

Executive Order (EO) 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, was signed January 10, 2001. The EO required federal agencies to consider the effect of their actions on migratory

birds. Each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations are directed to develop and implement a Memorandum of Understanding (MOU) with the FWS that promotes the conservation of migratory bird populations. The MOU shall 1) support the conservation intent of the MBTA; 2) restore and enhance the habitat of migratory birds; 3) design migratory bird habitat and population conservation principles, measures, and practices, into Integrated Natural Resources Management Plans (INRMP); 4) ensure NEPA evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern; 5) consult with the FWS to minimize the intentional and unintentional take of species of concern. A draft version of the DoD MOU is found in Appendix A.

1.3 Proposed DoD Incidental Take Rule

The 2003 National Defense Authorization Act required the Secretary of the Interior to draft regulations authorizing incidental taking of migratory birds during military readiness activities. If the Department of Defense (DoD) determines that a proposed or an ongoing military readiness activity may result in a significant adverse effect on the sustainability of a population of a migratory bird species of concern, then they must confer and cooperate with the FWS to develop appropriate and reasonable-conservation measures to minimize or mitigate identified significant adverse effects. DoD activities other than military readiness activities are not exempt from 'take' and are required to obtain a 50 CFR 21.27 Special Purpose Permit for each action. These changes to the MBTA meet the intent of Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, and promote conservation of migratory bird populations as required by the original convention.

1.3.1 Military Readiness Activities

The Army is responsible for protecting the United States from external threats. To provide for national security, they engage in military readiness activities (MRA), which include all training and operations that relate to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Activities considered military readiness must: 1) must support realistic combat actions utilized on the battlefield, and 2) actions required to achieve individual combat skills (i.e. marksmanship, land navigation, etc). Descriptions of common MRA on Fort Campbell are found in Appendix B.

1.3.2 Non-military Readiness Activities

Non-military readiness activities (non-MRA) are important in supporting the training needs of the Army. Non-military readiness includes: 1) the routine operation of installation support functions; 2) the operation of industrial activities; or 3) the construction or demolition of facilities. Activities considered non-military readiness must support normal cantonment area functions, or support projects defined within the INRMP. Descriptions of common non-MRA on Fort Campbell are found in Appendix B.

1.4 Fort Campbell's Strategy Intent

The intent in developing a Migratory Bird Management Strategy is to ensure regulatory compliance with the MBTA, EO 13186, and the proposed DoD exemption from 'take' during military readiness activities. The strategy is the first step towards a MOU with the FWS pertaining to actions on Fort Campbell that are

likely to have adverse impacts to populations and associated habitats. Management plans for Birds of Conservation Concern (BCC) will be developed, coordinated through the FWS, and integrated into the INRMP. Plans shall synthesize and summarize current knowledge concerning the requirements of birds, specifically Birds of Conservation Concern (BCC) on Fort Campbell and provide recommendations for habitat protection, restoration, management, and monitoring to ensure long-term survival of birds and the ecosystems that support them.

2.0 Migratory Bird Species

Migratory birds, more specifically nearctic-neotropical migrants, are species that seasonally migrate. These species nest in the United States and Canada and migrate south to the tropical regions of Mexico, Central America, and South America. Migrants are especially vulnerable to habitat loss, modification, or degradation due to this behavior. Their migratory nature gives them international protection and conservation concern.

1048 species are protected under the MBTA (Appendix C). A subset of this group are considered birds of conservation concern (BCC) species because of 1) documented or apparent population declines, 2) small or restricted populations, or 3) dependence on restricted or vulnerable habitats. The North American Bird Conservation Initiative (NABCI) has adopted a regional approach, the Bird Conservation Regions (BCR), to facilitate landscape driven initiatives to prevent the decline of these species (Figure 1). The complete BCR list contains 272 species. Fort Campbell is part of the Central Hardwoods, BCR 24. Table 1 lists the 26 species for BCR 24. The major cause of population declines for these species in the southeastern United States is habitat degradation or loss. Habitat loss through land use conversions, development, and succession is a major factor in their declines. Climate change is also threatening to become a major impact on some bird populations.

2.1 Fort Campbell Birds of Conservation Concern (BCC)

Portions of Fort Campbell are considered part of the Big Barrens Region (BBR) of north central Tennessee and central Kentucky. Historically, these areas were developed under anthropogenic influences approximately 3,000 years before present. Cultivation and other anthropogenic influences have limited the quantity and quality of these grassland ecotypes. However, the largest and most vegetatively complete barrens occur on the post due to the land use conversion in early 1942. The barren-like grasslands are the largest expanse of this type of ecosystem in the southeastern United States. These areas are seasonally visited by BCC species.

Two hundred fourteen migratory bird species have been documented on Fort Campbell. Of these species, 22 are BCC species (Moss 2012). Habitat selection for BCC species is skewed toward open grassland areas with oak-hickory hardwoods a distant second.

3.0 Fort Campbell Strategy

3.1 Responsibilities

Fort Campbell, in accordance with the proposed MBTA rule and Section 315 of the Authorization Act will consult with the FWS to identify measures to minimize and mitigate adverse impacts of military readiness

Figure 1. Fort Campbell occurs in the North American Bird Conservation Initiative Bird Conservation Region (BCR) 24. BCR's are areas that encompass landscapes having similar bird communities, habitats, and resource issues.

activities and non-military readiness activities on migratory birds. Military readiness activities have been proposed for exemption for the MBTA as long as their actions do not severely affect a BCC bird's population. Informal consultations with the FWS will be completed for all non-military readiness activities affecting migratory birds. Provisions for migratory bird conservation will be detailed in the INRMP and shall include inventory, monitoring, avoidance, and habitat enhancement to minimize adverse impacts to migratory birds from testing and training activities. Compliance with these provisions will be maintained

through the NEPA process, INRMP annual review, and consultations with the FWS.

The Fort Campbell Fish and Wildlife program is the lead program in ensuring compliance with the MBTA, EO 13186, and the proposed DoD exemption from 'take' during MRA. The program will develop resource categories pertaining to BCC species and their associated populations, assist project proponents in the development of mitigation measures, and consult with the FWS on behalf of Fort Campbell.

3.2 Bird Conservation Planning

The Sikes Act requires the DoD to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the Act, Fort Campbell has prepared and implemented an INRMP. The INRMP contains projects that support wildlife habitat restoration, conservation, and on rare occasions preservation. The plan is mutually agreed upon by the FWS and Tennessee and Kentucky fish and wildlife agencies.

3.3 Implementation Strategies

The Fort Campbell strategy will achieve its intent by implementing actions in the following three areas: 1) population monitoring, assessment, and management, 2) habitat conservation, and 3) communication and consultation.

3.3.1 Population Monitoring, Assessment, and Management Information on the population status and trends of migratory birds is required to meet the mandates of the MBTA. Because most migratory birds range widely over their annual cycles, an accurate assessment of status, including distribution, abundance, and trends, requires long-term monitoring efforts. Monitoring is also needed to evaluate the effects of management, conservation, and military activities on bird demographics and distribution. To meet these needs, Fort Campbell will continue projects currently on-going and implement new projects when the need for data arises.

3.3.1.1 Bird Inventories. Fort Campbell conducts annual avian counts to develop species lists and distributions for all breeding birds including BCC. The action is an important factor in minimizing and mitigating takes of migratory birds by understanding when and where 'takes' are likely to occur. The project is developing a knowledgebase of migratory bird habits, including their migratory paths and stopovers as well as their feeding, breeding, wintering, and nesting habits.

Fort Campbell uses bird inventory and survey information in connection with the preparation of the INRMP. Bird data is also used when undertaking environmental analyses required under the NEPA.

3.3.1.2 BCC Assessments. Fort Campbell will develop assessment protocols for BCC birds (Table 1).

3.3.2 Habitat Conservation and Enhancement. Habitat conservation and enhancement generally involve improvements to existing habitat, the creation of new habitat for migratory birds, and enhancing degraded habitats. Improvements to existing habitat include wetland protection, maintenance and enhancement of forest buffers, elimination of feral animals that may be a threat to migratory birds, and elimination of invasive species that crowd out other species necessary to migratory bird survival.

Table 1. Birds of Conservation Concern (BCC) occurring on Fort Campbell.

Species Name	Common Name	Known to Breed on Fort Campbell
Aimophila aestivalis	Bachman's sparrow	Yes
Ammodramus henslowii	Henslow's sparrow	Yes
Ammodramus leconteii	Le Conte's sparrow	No
Asian flammeus	short-eared owl	No
Calcarius pictus	Smith's longspur	No
Caprimulugus voiciferus	Eastern whip-poor-will	Yes
Cistothorus platensis	sedge wren	Yes
Setophaga cerulea	cerulean warbler	No
Setophaga discolor	prairie warbler	Yes
Euphagus carolinus	rusty blackbird	No
Falco peregrines	peregrine falcon	No
Haliaeetus leucocephalus	bald eagle	Yes
Helmitheros vermivorus	worm-eating warbler	Yes
Hylocichla mustelina	wood thrush	Yes
Lanius ludovicianus	loggerhead shrike	No
Melenerpes erythrocephalus	red-headed woodpecker	Yes
Geothlypis formosa	Kentucky warbler	Yes
Thyromanes bewickii	Bewick's wren	No
Tringa solitaria	solitary sandpiper	No
Tryngites subruficollis	buff-breasted sandpiper	No
Vermivora cyanoptera	blue-winged warbler	Yes
Vireo bellii	Bell's vireo	Yes

3.3.2.1 Habitat Delineation. Habitat boundaries using geospatial tools will be completed to assist in NEPA analysis and to develop biologically-based sustainable management plans for birds of management concern.

3.3.2.2 Habitat Restoration or Enhancement. Habitat restoration and enhancement is a priority on Fort Campbell. Fort Campbell intends to restore, enhance and manage imperiled habitats for BCC birds on Fort Campbell. Conservation plans should contain designs for sustainable multi-species use of imperiled habitats on Fort Campbell.

3.3.3 Coordination and Consultation. Fort Campbell will coordinate and consult with the FWS obtain research and conservation technical assistance on migratory birds and their habitats and factors affecting them. Consultations with the FWS will occur for all actions that may adversely affect BCC.

3.4 Determination of Effect

Prior to formulation of mitigation recommendations, the impacts of the proposed project or action need to be analyzed and evaluated. Figure 2 outlines the MBTA evaluation process for Fort Campbell. Habitat evaluation procedures will be used as a basic tool for evaluating project impacts and as a basis for formulating subsequent recommendations. Where specific impact evaluation methods or mitigation technologies are not available, Fish and Wildlife biologists will apply their best professional judgment to develop mitigation recommendations.

Evaluations of MRA and non-MRA will be conducted concurrent with the activity to ensure no adverse impacts to BCC species.

3.4.1 Evaluation Criteria. Fish and Wildlife program biologists will utilize historical use data to evaluate potential effect of all non-MRA activities. Criteria will be biologically-based and used to evaluate the effect from an ecological viewpoint. General evaluation criteria for MRA and non-MRA are found in Appendix E.

3.5 Mitigation Measures

Mitigation measures apply to all MRA and non-MRA that have been determined to have adverse impacts on BCC species and their subsequent populations. Mitigation measure recommendations will be developed in coordination with installation biologists for all actions determined as an adverse impact to BCC species or populations. Development of measures will follow accepted USFWS mitigation procedures based upon a Resource Category (RC), a criteria that will be determined by the Fish and Wildlife program supported by scientifically defensible data.

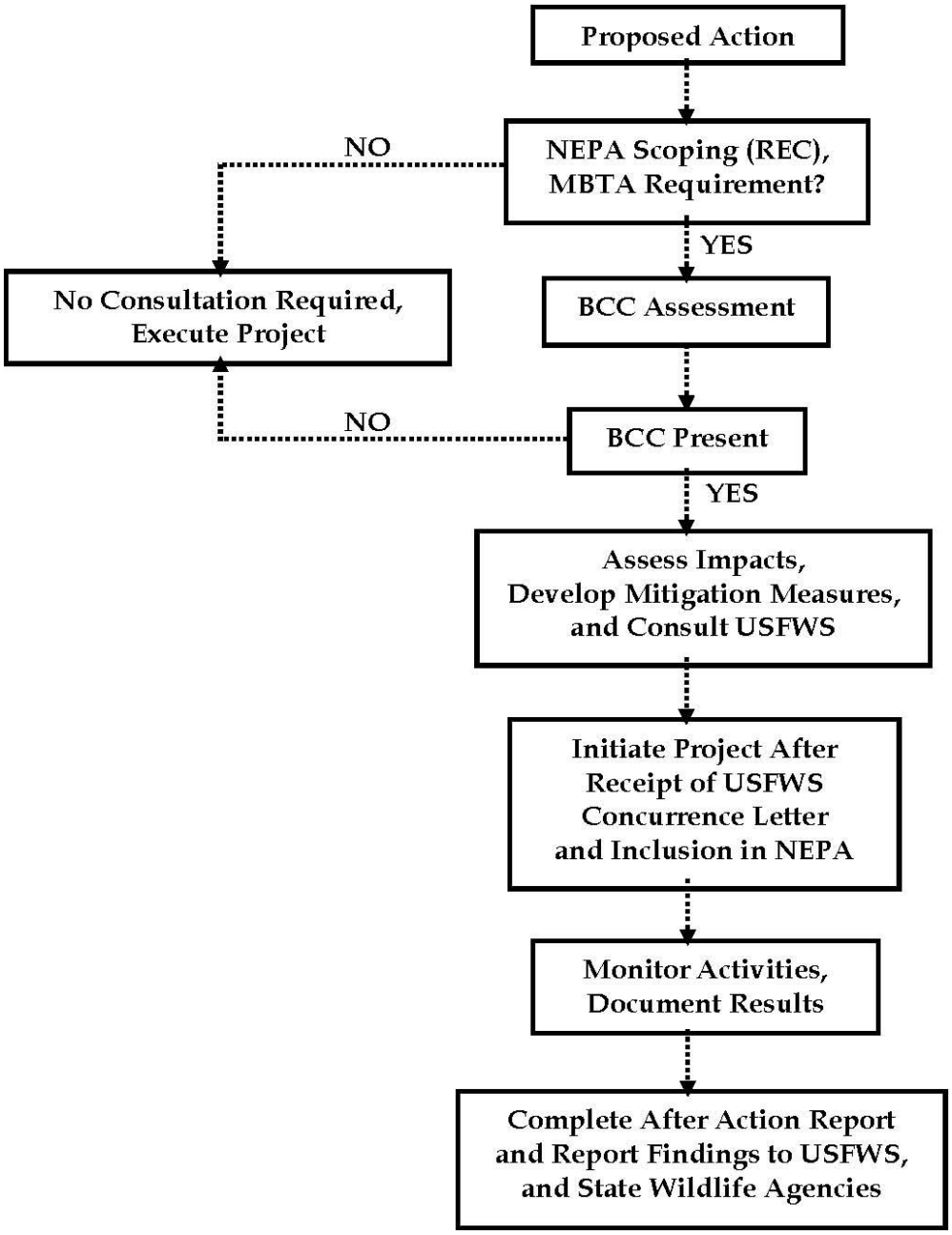
All RC determinations are to be fully supported by adequate technical rationale, demonstrate good professional judgment, and be consistent with other determinations. Simple identification of the RC of the habitat that may be impacted is not sufficient justification to support subsequent mitigation recommendations. The determination must be supported by descriptive scientific and technical information.

3.5.1 Resource Categories and Mitigation Objectives. The adopted mitigation procedure identifies four RCs, defines designation criteria, and establishes a mitigation objective for each.

3.5.1.1 RC 1. The designation criteria for habitat in RC 1 is "habitat to be impacted is of high value for BCC species and is unique and irreplaceable on an national basis or in the ecoregion section." The mitigation objective for habitat in RC 1 is "no loss of existing habitat value."

3.5.1.2 RC 2. The designation criteria for habitat in RC 2 is "habitat to be impacted is of high quality for BCC species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section." The mitigation objective for habitat in RC 2 is "no net loss of in-kind habitat value."

Figure 2. MBTA evaluation process for Fort Campbell. Specific guidelines pertaining to mitigation



3.5.1.3 RC 3. The designation criteria for RC 3 is "habitat to be impacted is of high to medium value for BCC species." The mitigation objective for habitat in RC 3 is "no net loss of habitat value while minimizing loss of in-kind habitat value."

3.5.1.4 RC 4. The designation criteria for RC 4 is "habitat to be impacted is of medium to low value for BCC species." The mitigation objectives for habitat in RC 4 is "minimize loss of habitat value."

3.5.2 Mitigation Means and Measures. Mitigation procedures provide five types of actions that can be incorporated into mitigation recommendations. These five types of actions are to be considered in the following order: avoid the impact; minimize the impact; rectify the impact; reduce or eliminate the impact over time; and finally, compensate for the impact. Measures are to be developed based upon site specific information. During consultations with the FWS, mitigation for non-MRA actions will be negotiated. The following mitigation guidelines are recommendations by the Fish and Wildlife program based upon RC.

3.5.2.1 RC 1. All loss of existing RC 1 habitat should be prevented, as these one-of-a-kind areas cannot be replaced. Insignificant changes that do not result in adverse impacts on habitat value may be acceptable provided they will have no significant cumulative impact.

3.5.2.2 RC 2. Develop ways to avoid or minimize losses. If losses are likely to occur, then develop measures to immediately rectify them or eliminate them over time. If impacts remain, then those losses should be compensated by replacement of the same kind of habitat value so that the total loss of such in-kind habitat value will be eliminated.

3.5.2.3 RC 3. Develop ways to avoid or minimize losses. If losses are likely to occur, then develop measures to immediately rectify them or reduce them over time. If impacts or losses remain, then those losses should be compensated by replacement of habitat value so that the total loss of habitat value will be eliminated. It is preferred to replace such losses in-kind.

3.5.2.4 RC 4. Develop ways to avoid or minimize losses. If losses are likely to occur, then develop ways to immediately rectify, reduce, or eliminate them over time. If losses remain, then compensate for the loss. Compensation should be dependent upon the significance of the potential loss.

3.6 Role of the NEPA

Fort Campbell will use the NEPA process to determine whether any ongoing or proposed military readiness activity is "likely to result in a significant adverse effect on the population of a migratory bird species of concern." NEPA analyses will be completed when the Army or Fort Campbell propose to undertake a new military readiness activity that may significantly affect the quality of the human environment; make a substantial change to an on-going military readiness activity that is relevant to environmental concerns; learn of significant new circumstances or information relevant to the environmental concerns bearing on an on-going military readiness activity; or prepare or revise an INRMP covering an area used for military readiness activities. If the NEPA process identifies any such significant adverse effects on migratory birds during the preparation of the analysis, Fort Campbell will confer and cooperate with the FWS to develop appropriate conservation measures to minimize or mitigate any such significant adverse effects.

4.0 Literature Cited

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Migratory Bird Treaty Act (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) as amended by: Chapter 634; June 20, 1936; 49 Stat. 1556; P.L. 86-732; September 8, 1960; 74 Stat. 866; P.L. 90-578; October 17, 1968; 82 Stat. 1118; P.L. 91-135;

December 5, 1969; 83 Stat. 282; P.L. 93-300; June 1, 1974; 88 Stat. 190; P.L. 95-616; November 8, 1978; 92 Stat. 3111; P.L. 99-645; November 10, 1986; 100 Stat. 3590 and P.L. 105-312; October 30, 1998; 112 Stat. 2956.

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U.S. North American Bird Conservation Initiative Committee. 2000b. Bird Conservation Region descriptions: A supplement to the North American Bird Conservation Initiative Bird Conservation Regions map. U.S. Fish and Wildlife Service, Arlington, Virginia. 38 pp.

50 CFR Part 21, Migratory Bird Permits; Take of Migratory Birds by Department of Defense

APPENDIX A

Memorandum of Understanding between the U.S. Department of Defense and the U.S. Fish and Wildlife Service to Promote the Conservation of Migratory Birds

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This Memorandum of Understanding (MOU) is entered into between the U.S. Department of Defense (DoD) and the U.S. Fish and Wildlife Service (FWS) (hereinafter "the Parties").

A. Purpose and Scope

Pursuant to Executive Order 13186 (January 17, 2001), *Responsibilities of Federal Agencies to Protect Migratory Birds*, this MOU outlines a collaborative approach to promote the conservation of migratory bird populations.

This MOU does not address military readiness activities, which are being addressed in a rulemaking in accordance with section 315 of the National Defense Authorization Act for Fiscal Year 2003 (Pub. L. 107-314, 116 Stat. 2458). This MOU specifically pertains to the following categories of DoD activities: 1) routine natural resource management activities, including habitat management, erosion control, forestry activities, agricultural outleasing, conservation law enforcement, invasive weed management, and prescribed burning; 2) routine installation support functions, such as administrative offices, military exchanges, commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, laundries, morale, welfare, and recreation activities, shops, and mess halls; 3) operation of industrial activities; and 4) construction or demolition of facilities relating to these routine operations.
This MOU identifies specific activities where cooperation between the Parties will contribute substantially to the conservation of migratory birds and their habitats.

B. Background

The Parties have a common interest in the conservation and management of America's natural resources. The Parties agree that migratory birds are important components of biological diversity, and that the conservation of migratory birds will both help sustain ecological systems and help meet the growing public demand for outdoor recreation, conservation education, wildlife viewing, and hunting opportunities. The Parties also agree that it is important to: 1) focus on bird populations, rather than on individuals; and 2) recognize that actions taken to benefit some migratory bird populations may adversely affect other migratory bird populations.

The DoD mission is to provide for the nation's defense. DoD's conservation program works to ensure continued access to land, air, and water resources for realistic military training and testing while ensuring that the natural and cultural resources entrusted to DoD's care are sustained in a healthy condition.
The DoD Partners in Flight (PIF) program offers a coordinated framework for incorporating bird habitat management efforts into installation Integrated Natural Resources Management Plans (INRMPs). DoD's strategy focuses on inventorying and long-term monitoring to determine changes in migratory bird populations on DoD installations. Effective on-the-ground management may then be applied to those areas identified as having the highest conservation value. DoD's PIF goal is to support the military's training and testing mission while being a vital and supportive partner in regional, national, and international bird conservation initiatives. DoD strives to implement cooperative projects and programs on military lands to benefit the health and well-being of birds and their habitats, whenever possible.

The mission of the FWS includes working with others to conserve, protect, manage, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The FWS is legally mandated to implement the conservation provisions of the Migratory Bird Treaty Act (MBTA), which include

responsibilities for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulation development and enforcement. The FWS also works to support the missions of other Federal agencies through its coordination and consultation processes.

Many FWS programs are involved in bird conservation activities, but four in particular are involved directly with this specific MOU:

(1) The Division of Migratory Bird Management serves as a focal point in the United States for policy development and strategic planning, program implementation, and evaluation of actions designed to conserve migratory birds and their habitats.
(2) The Division of Bird Habitat Conservation is instrumental in supporting habitat conservation partnerships through the development of Joint Ventures which serve as major vehicles for implementing the various bird conservation plans across the country.
(3) Ecological Services Field Offices across the country serve as the primary contacts for environmental reviews that will include, when requested, projects developed by local military installations and DoD regional offices involving migratory bird issues (and will include migratory bird management personnel when necessary).
(4) The Division of Law Enforcement is the principal FWS program that enforces the legal provisions of the MBTA and also oversees animal import and export activities at international ports of entry into the United States.

The Parties agree this MOU shall be implemented to the extent permitted by law and in harmony with agency missions, subject to the availability of appropriations and within Administration budgetary limits.

C. DoD Management Actions

Ecosystem Management. The goal of ecosystem management in DoD is to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Over the long term, that approach shall maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations.
Principles and Guidelines of Ecosystem Management. DoD implements ecosystem management through the following principles and guidelines:

1. Maintain and improve the sustainability and native biodiversity of ecosystems.
2. Administer with consideration of ecological units and timeframes.
3. Support sustainable human activities.
4. Develop a vision of ecosystem health.
5. Develop ecological priorities and reconcile conflicts.
6. Develop coordinated approaches to work toward ecosystem health to discuss issues and to work towards common goals.
7. Rely on the best science and data available.
8. Use benchmarks to monitor and evaluate outcomes.
9. Use adaptive management.

10. Implement through installation plans and programs.

Conservation Measures. Working with other Federal and State land management agencies, the DoD will develop conservation measures to avoid or minimize take of migratory bird populations and/or that will provide quality habitat to benefit migratory bird populations for the non-military readiness activities described in Section A, Purpose. DoD will identify management actions that potentially and significantly affect species of concern at the population level, and develop, in coordination with the FWS, conservation measures that are consistent with the agencies' missions and the Executive Order. These conservation measures will address, but are not limited to, the following:

Habitat protection, restoration, and enhancement. Military lands contain many important habitats for migratory birds. Some unique, sensitive, and/or declining habitat types that may require special management attention include:

a. Grasslands. Many native grassland communities require intensive management to maintain and restore vigor and species diversity and to provide habitat for migratory birds and other wildlife dependent on native grasslands. Grassland management and restoration tools include controlled burning, native species planting, and exotic plant removal. Many grasslands have evolved with a natural fire regime, and the military activities often emulate or sustain this fire regime.
b. Riparian and wetland habitats. Military lands contain riparian and wetland habitats that are critical for migratory birds. In accordance with management actions identified in INRMPs, DoD will take action to prevent the destruction or degradation of wetlands and riparian vegetation, and also restore those habitats, when feasible, where they have been degraded.
c. Coastal beach, salt marsh, and dune habitats. Military lands support some of the best remaining undisturbed coastal habitats. DoD will take action to protect, restore and prevent the destruction of coastal and island habitats that are important to breeding, migrating and wintering shorebirds, salt marsh land birds and colonial water birds.

Fire and fuels management practices. Fire plays an important role in shaping plant and animal communities, and is a valuable tool in restoring habitats altered by decades of fire suppression. Fire management may include fire suppression but it also involves fire prevention and fuels treatment, including prescribed burning, research, and monitoring, to protect communities and provide for healthy ecosystems. Fire management planning efforts should consider the effects of fire management strategies on the conservation of migratory bird species.

Invasive species management practices. Invasive and nuisance species are a threat to native habitats and wildlife species throughout the United States, including military lands. Efforts to control/contain these invasive species must take into account both the impacts from invasive species and the effects of the control efforts on migratory bird populations. Invasive and nuisance species that can threaten migratory birds and their habitats include, but are not limited to, exotic grasses, trees and weeds, terrestrial and aquatic insects and organisms, and stray and feral cats.

Communications towers, utilities and energy development. Increased communications demands, changes in technology and the development of alternative energy sources result in impacts on migratory birds. DoD will review guidelines published by FWS, and consult with FWS as needed, in considering the potential effects on migratory birds regarding proposals for silting communications towers on military lands.

Construction of new utility and energy systems and associated infrastructure should be designed to minimize impacts on migratory birds.

Recreation and public use. The demand for outdoor recreational opportunities on public lands is increasing. Impacts on migratory birds may occur both through direct and indirect disturbances by visitors and through agency activities associated with providing visitor services (e.g., facilities construction). DoD provides access to military lands for recreation and other public use, such as Watchable Wildlife and bird watching, where such access does not compromise security and safety concerns or impact migratory birds or other species or their habitats.

D. Responsibilities

1. Each of the Parties shall:
a. Emphasize an interdisciplinary, collaborative approach to migratory bird conservation in cooperation with other governments, State and Federal agencies, and non-federal partners within the framework of the NABCI Bird Conservation Regions (BCRs).
b. Strive to protect, restore, enhance, and manage habitat of migratory birds, and prevent or minimize the loss or degradation of habitats on DoD-managed lands by:

(1) Identifying management actions that adversely affect migratory bird populations, including breeding, migration, or wintering habitats, and developing and implementing, as appropriate, conservation measures that avoid or minimize these affects;
(2) Collaborating with partners to identify, conserve, and manage Important Bird Areas, Western Hemisphere Shorebird Reserve Network sites, and other significant bird sites that occur on DoD-managed lands;
(3) Preventing or abating the pollution or detrimental alteration of the habitats used by migratory birds whenever practicable;
(4) Developing and integrating information on migratory birds and their habitats into outreach and education materials and activities; and
(5) Controlling the introduction, establishment, and spread of non-native plants or animals that may be harmful to migratory bird populations, as required by Executive Order 13112 on Invasive Species.
c. Collaborate with willing landowners to prevent or minimize the loss or degradation of migratory bird habitats on lands beyond military installation boundaries, particularly in BCRs where DoD-managed lands are located. This includes:
(1) Participating in efforts to identify, protect, and conserve important migratory bird habitats or other significant bird conservation sites and ecological conditions that occur in landscapes or watersheds that might be substantially and adversely affected by activities on DoD lands;
(2) Developing and integrating information on migratory bird resources found on DoD lands into non-DoD outreach and education materials and activities; and
(3) Using the authority provided in 10 U.S.C. sec. 2684a to enter into agreements with other Federal agencies, States, political subdivisions, and private conservation entities to acquire real estate interests in the vicinity of a military installation to preserve habitat in a manner that will prevent incompatible land use that may restrict military operations.
d. Promote collaborative projects to include:
(1) Developing or using existing inventory and monitoring programs, at appropriate scales, with national or regional standardized protocols, to assess the status and trends of bird populations and habitats, including

migrating and wintering birds;
(2) Designing management studies and research projects using national or regional standardized protocols and programs, such as Monitoring Avian Productivity and Survivorship (MAPS) to identify the habitat conditions needed by applicable species of concern, to understand interrelationships of co-existing species, and to evaluate the effects of management activities on habitats and populations of migratory birds;
(3) Allowing access to military lands for conducting sampling or survey programs such as MAPS, Breeding Bird Survey (BBS), Breeding Biology Research and Monitoring Database (BBIRD), International Shorebird Survey (ISS), and breeding bird atlases;
(4) Sharing inventory, monitoring, research, and study data for breeding, migrating, and wintering populations and habitats in a timely fashion with national data repositories such as BBS, BBIRD, National Point Count Database, and MAPS; and
(5) Using existing partnerships and exploring opportunities for expanding and creating new partnerships that would facilitate collaborative funding for inventory, monitoring, management studies, and research.
e. Provide training to military natural resource personnel on bird population and habitat inventorying, monitoring methods, and management practices that avert detrimental affects and promote beneficial approaches to migratory bird conservation.
f. Participate as needed in the interagency Council for the Conservation of Migratory Birds to evaluate the implementation of this MOU.
g. Promote migratory bird conservation internationally, especially as it relates to wintering habitats of birds that breed on DoD lands. This includes assisting other nations, as appropriate, in sustaining migratory bird populations and habitats through technical cooperation, policy development, and disaster assistance, including conservation planning, project support, cooperative studies, education, and training.

2. The Department of Defense Shall:
a. Follow all migratory bird permitting requirements for activities subject to 50 CFR Parts 21.22 (banding or marking), 21.23 (scientific collecting), 21.26 (special Canada goose permit), 21.27 (special purposes), 21.28 (falconry), 21.30 (raptor propagation), or 21.41 (depredation). No permit is required to take birds in accordance with Parts 21.43 - 21.47 (depredation orders)

b. Promote the inclusion of comprehensive migratory bird management objectives into installation INRMPs. Comprehensive planning efforts for migratory birds include PIF Bird Conservation Plans, the North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan and North American Waterbird Conservation Plan, and the integration of these and other bird conservation planning efforts through the North American Bird Conservation Initiative (NABCI).
c. Avoid or minimize the unintentional take of migratory birds to the extent practicable.
d. Prior to starting any activity that is likely to affect populations of migratory birds, the responsible official as designated by the installation commander will first:

(1) Identify the migratory bird species likely to occur in the area of the proposed action and determine if any species of concern could be affected by the activity (see Species of Concern in Section F: Definitions);
(2) Assess and document, as appropriate, as part of compliance with the National Environmental Policy Act (NEPA), the expected impact of the proposed action on species of concern. Use best available demographic, population, or habitat association data in the assessment of impacts upon species of concern;
(3) Develop and strive to implement conservation measures for management actions or categories of actions to avoid or minimize unintentional take of migratory birds, with a primary focus on species of

concern (some of these actions are identified in Section C of this MOU);
(4) If a proposed action potentially will result in a significant negative impact on the sustainability of a migratory bird species population, such impact shall be clearly stated in the draft and/or final NEPA document, as appropriate, provided to the FWS Ecological Services Field Office. DoD will discuss any such action with the FWS to develop appropriate conservation measures to reduce or minimize significant negative effects to the extent reasonably practicable;
(5) Retain pertinent records of DoD actions and the conservation measures to be implemented, as appropriate, as part of the administrative record for the project when NEPA documentation is required;
(6) Within established authorities, and in conjunction with the adoption, amendment, or revision of DoD management plans (e.g., INRMPs) and guidance, strive to ensure that such plans and actions promote programs and recommendations of comprehensive planning efforts for migratory birds such as PIF Bird Conservation Plans, U.S. Shorebird Conservation Plan, North American Waterfowl Management Plan, North American Waterbird Conservation Plan, and the integration of those and other bird conservation planning efforts through the North American Bird Conservation Initiative (NABCI);
(7) Implement new and/or existing inventory and monitoring programs, at appropriate scales, with national standardized protocols, to evaluate the effectiveness of conservation measures to minimize or mitigate take of migratory birds;
(8) Prevent or abate, to the extent practicable and appropriate, the pollution or detrimental alteration of the environments used by migratory birds;
(9) Periodically evaluate and, if necessary, confer with FWS on revisions to the conservation measures taken under this MOU to avoid or minimize unintentional take of migratory birds; and
(10) Advise the public of the availability of this MOU through a notice published in the Federal Register.

3. The Fish and Wildlife Service Shall:
a. Work with the DoD to support the DoD military mission while providing recommendations that minimize adverse affects upon migratory birds;
b. Control, within the scope of its statutorily designated authorities, the import, export, and establishment in the wild of live exotic animals and plants that may be harmful to migratory bird resources;
c. Develop and maintain a Web page on permits that provides links to all offices responsible for issuing permits for intentional take of migratory birds;
d. Provide essential background information to the DoD to ensure sound management decisions. This may include migratory bird distributions, status, key habitats, conservation guidelines, and risk factors within each BCR. This includes updating the FWS *Birds of Conservation Concern* at regular intervals so it can be reliably referenced;
e. Work to identify special migratory bird habitats (migration corridors, stop-over habitats, ecological conditions important in nesting habitats, etc.) to aid in collaborative planning;
f. Work with the DoD in conjunction with other Federal and State agencies to develop reasonable and effective conservation measures for key management actions that affect migratory birds and their natural habitats;
g. Provide technical assistance on migratory bird species and their habitats at the request of the DoD;
h. Develop training on best management practices for migratory bird conservation in conjunction with the DoD and other Federal and State agencies;
i. Work with the DoD to incorporate in NEPA analysis conservation measures for minimizing unintentional take; and
j. Provide training on the implementation of this MOU and other migratory bird issues at future DoD Conservation Conferences and other appropriate venues.

E. Authorities

This MOU is entered under the provisions of the following laws and executive orders:

Alaska National Interest Lands Conservation Act of 1980 (16 USC 410hh-3233)
Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668-668d)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)
Fish and Wildlife Act of 1956 (16 U.S.C. 742 et seq.)
Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2911)
Fish and Wildlife Coordination Act (16 U.S.C. 661-667)
Migratory Bird Conservation Act (16 U.S.C. 715-715d, 715e, 715f-715r)
Migratory Bird Treaty Act (16 U.S.C. 703-711)
National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347)
Responsibilities of Federal Agencies to Protect Migratory Birds, Executive Order 13186, (66 FR 3853)
Sikes Act (16 USC 670a-670o)

F. Definitions

Action - a program, activity, project, official policy, rule, regulation or formal plan directly carried out by a Federal agency. See Management Action.
Breeding Biology Research and Monitoring Database (BBIRD) - national, cooperative program that uses standardized field methodologies for studies of nesting success and habitat requirements of breeding birds (http://pica.wru.umt.edu/BBIRD/).
Breeding Bird Survey (BBS) - a standardized international survey that provides information on population trends of breeding birds, through volunteer observations located along randomly selected roadside routes in the United States, Canada and Mexico (http://www.mbr-pwrc.usgs.gov/bbs/bbs.html).
Bird Conservation Region (BCR) - a geographic unit used to facilitate bird conservation actions under the North American Bird Conservation Initiative (http://www.manomet.org/USSCP/bcrmaps.html).
Birds of Conservation Concern - published by the FWS Division of Migratory Bird Management, refers to the list of migratory and non-migratory birds of the United States and its territories that are of conservation concern. The current version of the list *Birds of Conservation Concern 2002*, is available at http://migratorybirds.fws.gov/reports/bcc2002.pdf.
Comprehensive Planning Efforts for Migratory Birds - includes Partners in Flight, North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, Western Hemisphere Shorebird Reserve Network, North American Waterbird Conservation Plan, and the North American Bird Conservation Initiative.
Conservation Measure - an action undertaken to improve the conservation status of one or more species of migratory birds. Examples include surveys and inventories, monitoring, status assessments, land acquisition or protection, habitat restoration, population manipulation, research, and outreach.
Conservation Planning - strategic and tactical planning of agency activities for the long-term conservation of migratory birds and their habitats.
Council for the Conservation of Migratory Birds - an interagency council established by the Secretary of the Interior to oversee the implementation of the Executive Order.
Ecological Condition - the composition, structure, and processes of ecosystems over time and space. This includes the diversity of plant and animal communities, and the productive capacity of ecological systems and species diversity, ecosystem diversity, disturbance processes, soil productivity, water quality and

quantity, and air quality. Often referred to in terms of ecosystem health, which is the degree to which ecological factors and their interactions are reasonably complete and functioning for continued resilience, productivity, and renewal of the ecosystem.

Effect (adverse or beneficial) - effects and impacts, as used in this MOU are synonymous. Effects may be direct, indirect, or cumulative and in the MOU refer to effects from management actions or categories of management actions on migratory bird populations, habitats, ecological conditions and/or significant bird conservation sites.

Federal Agency - an executive department or agency of the U.S. government, including its employees while acting in their official capacity. It does not include non-Federal entities, regardless of Federal funding, involvement, or authorization.

Important Bird Areas (IBAs) - a network of sites that provide essential habitat for the long-term conservation of birds. In the United States, the IBA network is administered by the American Bird Conservancy and the National Audubon Society.

Integrated Natural Resource Management Plan (INRMP) - an integrated plan based, to the maximum extent practicable, on ecosystem management that shows the interrelationships of individual components of natural resources management (e.g., fish and wildlife, forestry, land management, and outdoor recreation) to mission requirements and other land use activities affecting an installation's natural resources.

Intentional Take - take that is the purpose of the activity in question.

Management Action - an activity by a government agency that could cause a positive or negative impact on migratory bird populations or habitats. Conservation measures to mitigate potential negative effects of actions may be required.

Migratory Bird - an individual of any species protected by the Migratory Bird Treaty Act; a list of migratory birds can be found in 50 CFR §10.13, Code of Federal Regulations (http://www.access.gpo.gov/nara/cfr/).

Military Readiness Activity - all training and operations of the Armed Forces that relate to combat, and realistic testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use.

Monitoring Avian Productivity and Survivorship (MAPS) - a program that uses the banding of birds during the breeding season to track the changes and patterns in the number of young produced and the survivorship of adults and young (http://www.birdpop.org/maps.htm).

National Environmental Policy Act (NEPA) - requires Federal agencies to prepare a detailed analysis of the environmental impacts of their proposal and alternatives, and to include public involvement in the decision making process for actions significantly affecting the quality of the human environment.

North American Waterbird Conservation Plan (NAWCP) - a coalition of Federal and State government agencies, non-governmental organizations, and private interests focusing on the conservation of waterbirds primarily marshbirds and colonial waterbirds (http://www.nawcp.org/).

North American Waterfowl Management Plan (NAWMP) - a coalition of Federal and State government agencies, non-governmental organizations, and private interests focusing on the conservation of waterfowl.

North American Bird Conservation Initiative (NABCI) - an initiative to align the avian conservation community to implement bird conservation through regionally-based, biologically driven, landscape-oriented partnerships across the North American continent. NABCI includes Federal agencies of Canada, Mexico and the United States, as well as most landbird, shorebird, waterbird, and waterfowl conservation initiatives (http://www.nabci-us.org).

Partners in Flight (PIF) - a coalition of more than 300 partners including Federal and State government agencies, non-governmental organizations, conservation groups, foundations, universities and industry focusing on the conservation of landbirds. The DoD was an original signatory to the PIF Federal

Agencies' MOA. (http://www.partnersinflight.org and http://www.dodpif.org).
Species of Concern - refers to those species listed in the periodic report *Birds of Conservation Concern* published by the FWS Division of Migratory Bird Management (http://migratorybirds.fws.gov/reports/bcc2002.pdf); priority migratory bird species documented in the comprehensive bird conservation plans (North American Waterbird Conservation Plan, United States Shorebird Conservation Plan, Partners in Flight Bird Conservation Plans); species or populations of waterfowl identified as high, or moderately high, continental priority in the North American Waterfowl Management Plan; listed threatened and endangered bird species in 50 CFR. 17.11; and MBTA listed game birds below desired population sizes (species list currently under development by FWS).

Take - as stated in 50 CFR § 10.12 to include pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.
Executive Order 13186 defines intentional and unintentional take.
Unintentional Take - take that results from, but is not the purpose of, the activity in question. Take of this type is sometimes referred to as incidental or indirect.

U.S. Shorebird Conservation Plan (USSCP) - an effort undertaken by a partnership of Federal and State government agencies, non-governmental organizations and private to ensure that stable and self-sustaining populations of all shorebird species are restored and protected (http://www.manomet.org/USSCP/index.htm).
Western Hemisphere Shorebird Reserve Network (WHSRN) - a coalition of private and public organizations in seven countries working together to study and conserve shorebirds through conservation, restoration, and management of critical shorebird habitats throughout the Americas (http://www.manomet.org /WHSRN/index.html).

G. It is Mutually Agreed and Understood That:

The MOU will not change or alter requirements associated with the Endangered Species Act.
This MOU does not alter the Parties' legal obligations under the MBTA, nor does it authorize take of migratory birds.

Ongoing DoD actions, for which a NEPA decision document was finalized prior to the date this MOU is signed or within 180 days thereafter will not be subject to the requirements of the MOU.

This instrument in no way restricts either Party from participating in similar activities with other public or private agencies, governments, organizations, or individuals. Any information furnished to the Parties under this instrument is subject to disclosure in accordance with the Freedom of Information Act (5 U.S.C. 552 et seq.).

This instrument in no way diminishes the respective Parties' requirements for conducting environmental impact analyses, including NEPA requirements.

An elevation process to resolve any dispute between the parties regarding a particular practice or activity is in place and consists of first attempting to resolve the dispute with the DoD military installation and the state FWS office. If there is no resolution at this level, either party can elevate the issue to the appropriate

officials at DoD Major Command and FWS Regional offices. In the event that there is no resolution by these offices, the dispute can be elevated by either party to the Washington office of each agency.
This instrument is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement, contribution of funds, or transfer of anything of value between the Parties will be handled in accordance with applicable laws, regulations, and procedures, including those for government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the Parties and shall be independently authorized by appropriate statutory authority.

Meetings will be scheduled periodically to review progress and identify opportunities for advancing the principles of this MOU.

This MOU is intended only to improve the internal management of the executive branch and does not create any right or benefit, substantive or procedural, separately enforceable at law or equity by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person. Modifications to the scope of the instrument shall be made by mutual consent of the parties, through the issuance of a written modification, signed and dated by all parties, prior to any changes being performed. Either Party may terminate this instrument, in whole or in part, at any time before the date of expiration by providing the other Party with a written statement to that effect.
The principal contacts for this instrument are as follows:

Brian Millsap, Chief
Division of Migratory Bird Management
US Fish and Wildlife Service
4401 N Fairfax Drive
MS4107
Arlington, VA 22203

L. Peter Boice, Conservation Team Leader
Office of the Secretary of Defense
1225 Jefferson Davis Drive
Suite 1500
Arlington, VA 22202-4336

This instrument is executed as of the last date signed below and expires no later than 5 years thereafter, at which time it is subject to review and renewal, or expiration.
The Parties hereto have executed this agreement as of the date shown below.

Director US Fish and Wildlife Service		Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), US Department of Defense	
Signature	Date	Signature	Date

APPENDIX B
Descriptions of Military Readiness and Non-Military Activities

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Fort Campbell and the 101st Airborne Division routinely carry out MRA and non-MRA within the rear training areas. MRA support unit combat preparedness while non-MRA support land conditions required for training.

MRA include all training and operations that relate to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Activities considered military readiness must: 1) must support realistic combat actions utilized on the battlefield, and 2) actions required to achieve individual combat skills (i.e. marksmanship, land navigation, etc).

Non-military readiness activities (non-MRA) are important in supporting the training needs of the Army. Non-military readiness includes: 1) the routine operation of installation support functions; 2) the operation of industrial activities; or 3) the construction or demolition of facilities. Activities considered non-military readiness must support normal cantonment area functions, or support projects defined within the INRMP.

1.0 Fort Campbell MRA

Each military unit conducts real world training mission according to their designated Mission Essential Task List (METL). The scope and nature of each unit's METL renders a complete task-by-task assessment unfeasible. MRA and non-MRA will be generally described within this appendix. MRA are generalized in the following groups: field maneuvers, range firing, aviation activities, vehicle operations, engineering and force protection activities, development and maintenance of TOC/LOG sites, and demolition training.

1.1 Field Maneuvers and Range Firing.

Field maneuvers are the training exercises conducted by military units (e.g., platoons, companies, brigades). Maneuvers include force-on-force exercises and situational training. Maneuvers may include field artillery fire support, close air support, and Army aviation integrated with the infantry and armor to attack or defend objectives. Field maneuvers may occur at any location within the rear training areas. Maneuver training areas primarily are used by small units or units having only wheeled vehicles. Tracked vehicles occasionally are used in some training areas.

Training at Fort Campbell also includes firing at designated ranges to familiarize/qualify individuals and/or units with various weapons. Range firing at Fort Campbell takes place on 51 ranges. Basic Weapons Marksmanship Ranges are used to train and qualify soldiers on rifles, pistols, sniper rifles, grenade launchers, sub-caliber light anti-armor weapons, shotguns, machine guns, and grenade launchers. Collective Live Fire Ranges are used for group training events, such as infantry squad and platoon battle courses, aerial gunnery ranges, and MOUT assault courses. Indirect Fire Facilities are ranges or firing points used for training and qualification on mortars, field artillery, or air defense artillery. Special Live Fire Ranges are used for training and qualification of demolitions, live hand grenades, and claymores. Mortars are fired from observation points. Aerial gunnery is practiced within the large western impact area.

1.2 Aviation Activities

Both fixed- and rotary-wing aircraft are in use at Fort Campbell. Airfield facilities are located at Campbell

Army Airfield (CAAF), Destiny Heliport, and Sabre Heliport. These are paved facilities with associated infrastructure (e.g., hangars, parking lots). Additionally, remote landing strips for rotary-wing aircraft are scattered throughout the installation. These include six Landing Zones (LZs), which are flat, cleared areas where rotary-winged aircraft land while picking up or discharging personnel or equipment. There are nine Drop Zones (DZs), which are flat cleared areas where personnel and equipment land following a parachute jump. All DZs and LZs are grass or bare ground, except Indian Mound LZ, which is paved.

Helicopter flight corridors run primarily along the perimeter of the installation, as well as through the installation running from east to west. Helicopter training activities include tactical terrain flight training, heliport gunnery training, heliport test flights, cross-country flight, touch-and-go operations, hovering, and sling load training. Helicopters fly throughout the rear (non cantonment) areas of the installation and often in adjacent areas outside the installation.

In addition to helicopters, aircraft in use at Fort Campbell include C-130 and C-17 fixed-wing cargo aircraft, and Hughes 500M rotary-winged aircraft. Fixed-wing aircraft depart primarily from the CAAF, and typically fly over the installation for airborne drops or practice touch-and-go landings at the airfield. Fixed-wing aircraft occasionally land and depart from Golden Eagle LZ.

1.3 VehicleOperation

Tracked and non-tracked vehicles are used to transport troops, individuals, and equipment. Vehicles are primarily driven on established paved, gravel, and dirt roads; under some circumstances vehicles are driven off established roads. The operation of tracked and wheeled vehicles support all field maneuver exercises described in Section 1.1.

1.4 Engineering and Force Protection Activities

Some training activities on Fort Campbell involve construction of berms, fighting positions, trenches, and similar structures to protect troops, supplies, and equipment. Berms are aboveground linear barricades designed to protect lines of troops from hostile observation and gunfire. Fighting positions are holes designed to contain and shield a small number of soldiers from hostile observation and assault. Trenches are below ground linear holes that shield lines of troops from hostile observation or gunfire. Berms are typically constructed in conjunction with trenches, as berms are formed using soil displaced by the digging of the trench. The size and location of force protection structures vary depending upon the activity being conducted.

1.5 Development and Maintenance of TOC/LOG Sites

Tactical Operation Centers/Logistic Sites (TOC/LOG sites) are unsheltered temporary encampments where units camp for the night during extended field maneuvers. TOC/LOG sites may be established anywhere throughout the training areas. The size and location of the site varies depending upon the unit and the purpose of the exercise.

1.6 Demolition Training

Demolition training and ordnance disposal takes place within areas designated as Special Live Fire

Ranges. These areas are used the train Explosive Ordinance soldiers in the demolition of mines, fuzes, firing devices, trip flares, and simulators.

2.0 Natural Resources Management

The natural resources management program oversees activities to manage natural resources on Fort Campbell. Natural resources are managed using an ecosystem-level approach, in which management focuses upon the sustainability and biological diversity of terrestrial and aquatic ecosystems rather than on individual species. Fort Campbell's management approach seeks to maintain and improve sustainability and native biodiversity of ecosystems, support sustainable human activities, develop a vision of ecosystem health, and use monitoring and adaptive management to improve management outcomes. The Natural Resources Management Program at Fort Campbell includes management of the following resource areas: 1) soil; 2) water resources; 3) aquatic and terrestrial habitat management; 4) rare, threatened, and endangered species; 5) pest management; 6) agricultural outleasing; and 7) new construction.

2.1 Soil Management

Soil conservation and management measures undertaken by Fort Campbell focus primarily upon preventing soil erosion and associated impacts to water quality and aquatic habitat. The Conservation Branch and ITAM program rigorously monitor erosion-prone areas, and implement rehabilitation measures to minimize erosion and sedimentation. Training areas, TOC/LOG sites, and firing points are routinely monitored (via the LCTA program) to identify damage to soil and vegetation, and soil compaction. Damaged areas are rehabilitated as soon as possible, and, if necessary, areas are closed for rehabilitation. Soil conservation measures designed to control erosion, sedimentation, and dust (e.g., check dams, wind breaks) are implemented when exposure of soils is necessary for training or non-training activities. At construction sites, erosion and sediment control measures such as gravel, fabrics, vegetative cover, and riprap are installed. Check dams and bank stabilization measures are employed to reduce erosion and sedimentation at wash-out sites. Ongoing projects to promote soil conservation include road shoulder repairs; upgrades to firebreaks and roads; erosion control measures; firebreak redesign, closure, and revegetation; development of sediment basins; and repair of training areas.

2.2 Water Resources Management

Fort Campbell manages water resources to protect and enhance the quality of surface water and groundwater on the installation. Since the development of the Watershed Management Plan in 2000, Fort Campbell has prioritized protection of water quality in streams to meet state and federal water quality standards. The Conservation Branch annually analyzes the quality of water in all bodies of water on the installation.

2.3 Habitat Management

Fort Campbell manages aquatic, riparian, wetland, and terrestrial habitat for the purpose of restoring and maintaining healthy ecosystems. Aquatic and riparian habitats are managed to protect water quality, maintain healthy communities of macroinvertebrates, and support fisheries. Within riparian buffer zones, timber harvest and creation of skid trails is prohibited. Prescribed fire is permitted in riparian areas only where recovery of habitat is needed due to natural or human-caused disturbance, or to enhance or

maintain riparian species. Tree canopy is maintained to the extent practicable over streams.
Fort Campbell takes a progressive approach toward protection, restoration, and creation of wetlands to improve the quantity and quality of wetlands on the installation. Results of a recent inventory indicate there are approximately 2,500 acres of wetlands on Fort Campbell.

Terrestrial habitat types on the installation include hardwood forest, pine plantation, grassland and barrens, and agricultural lands. Fort Campbell manages terrestrial habitat primarily to restore and maintain native habitat and to accommodate land use requirements of the military mission. The primary objective of terrestrial habitat management is to restore pre-settlement vegetation patterns, including restoring open areas in which shrubs and woody vegetation are now encroaching, increasing biodiversity of native species and eliminating non-natives, increasing the acreage of native prairie grasses, and thinning or removing pine plantations. To achieve this objective, the Conservation Branch has developed grassland management plan to promote growth and expansion of native warm season grasses in barrens communities. The Forestry program has developed the Forest Management Plan to meet training and natural resource objectives within the rear areas.

2.4 Rare, Threatened, and Endangered Species Management

The objective of rare, threatened, and endangered (RTE) management at Fort Campbell is to identify and conserve federal- and state-listed species on the installation in accordance with applicable federal and state laws and U.S. Army regulations and guidance. Fort Campbell strives to balance mission requirements with endangered species protection, cooperation with regulatory agencies, and conservation of biological diversity. Federally listed threatened and endangered species are managed in accordance with ESA, Endangered Species Recovery Plans, and Fort Campbell's Endangered Species Management Plan. All Army land uses, including military training and testing, timber harvest, recreation, agricultural outleasing, and cantonment area operation and maintenance and construction are subject to the requirements of ESA.

2.5 Agricultural Outlease

Fort Campbell has approximately 6,000 acres of land leased to local farmers for crop production. These areas are open fields or "old field" areas. Crops grown on Fort Campbell lands include corn, grain sorghum, soybeans and native cultivated grasses such as millet. Recurring and rotating leases operate on a 5-year cycle. Fields used for rotating leases may be uncultivated for several years between leases. Some tracts are designated as planned agricultural space to be leased within the next several years. Each leased tract of land has a tract management plan developed by the Agricultural Lease Manager, requiring that lessees comply with Fort Campbell land use regulations. This includes adhering to soil conservation plans, wildlife habitat improvement practices, and conducting application of lime, fertilizers, and chemicals in accordance with recognized and approved practices. Fort Campbell coordinates with the local USDA National Resource Conservation Service (NRCS) or Soil Conservation District to develop a soil conservation plan for each agricultural parcel based upon site-specific soil types, slope, and drainage patterns. Tract management plans include practices designed to minimize soil erosion including minimum or reduced tillage, contour farming, planting of cover crops, and maintenance of vegetated borders along waterways and field borders.

2.6 Pest Management

Fort Campbell uses pesticides and herbicides to control nuisance plant and animal species on the installation. Pest management is conducted primarily on the cantonment area (e.g., golf course, parade fields, cemeteries, lawns). Periodic maintenance, particularly weed and brush control, is conducted on semi-improved grounds (e.g., agricultural lease fields) inside and outside the cantonment area. Activities on unimproved grounds (e.g., forest land, impact areas) occur as needed to respond to unpredictable occurrence of insects, and other factors.

2.7 New Construction in the Rear Area

Fort Campbell plans and executes construction activities for Major Construction Actions or operations and maintenance each year. Major Construction Actions within the rear areas include expansion of training ranges and new construction of support facilities. Construction activities may include clearing vegetated areas, or building upon previously cleared areas. For each construction activity, the Environmental Division completes a comprehensive checklist to evaluate compliance with the National Environmental Policy Act. Unless the action is specifically excluded under AR 200-2, a record (REC), an Environmental Assessment, or Environmental Impact Statement is completed. During the NEPA analysis, the Environmental Division analyzes potential effects to the environment, including federally-listed species and their critical habitat.

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APPENDIX C
Birds Protected Under the Migratory Bird Treaty Act

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Family ANATIDAE (Swans, Geese, and Ducks)

Dendrocygna autumnalis, Black-bellied Whistling-Duck
Dendrocygna arborea, West Indian Whistling-Duck
Dendrocygna bicolor, Fulvous Whistling-Duck
Anser fabalis, Taiga Bean-Goose
Anser serrirostris, Tundra Bean-Goose
Anser albifrons, Greater White-fronted Goose
Anser erythropus, Lesser White-fronted Goose
Chen canagica, Emperor Goose
Chen caerulescens, Snow Goose
Chen rossii, Ross's Goose
Branta bernicla, Brant
Branta leucopsis, Barnacle Goose
Branta canadensis, Canada Goose (including *Branta hutchinsii,* Cackling Goose)
Branta sandvicensis, Hawaiian Goose
Cygnus buccinator, Trumpeter Swan
Cygnus columbianus, Tundra Swan
Cygnus cygnus, Whooper Swan
Cairina moschata, Muscovy Duck
Aix sponsa, Wood Duck
Anas strepera, Gadwall
Anas falcata, Falcated Duck
Anas penelope, Eurasian Wigeon
Anas americana, American Wigeon
Anas rubripes, American Black Duck
Anas platyrhynchos, Mallard
Anas fulvigula, Mottled Duck
Anas wyvilliana, Hawaiian Duck
Anas laysanensis, Laysan Duck
Anas poecilorhyncha, Spot-billed Duck
Anas superciliosa, Pacific Black Duck
Anas discors, Blue-winged Teal
Anas cyanoptera, Cinnamon Teal
Anas clypeata, Northern Shoveler
Anas bahamensis, White-cheeked Pintail
Anas acuta, Northern Pintail
Anas querquedula, Garganey
Anas formosa, Baikal Teal
Anas crecca, Green-winged Teal
Aythya valisineria, Canvasback
Aythya americana, Redhead
Aythya ferina, Common Pochard
Aythya baeri, Baer's Pochard
Aythya collaris, Ring-necked Duck
Aythya fuligula, Tufted Duck
Aythya marila, Greater Scaup

Aythya affinis, Lesser Scaup
Polysticta stelleri, Steller's Eider
Somateria fischeri, Spectacled Eider
Somateria spectabilis, King Eider
Somateria mollissima, Common Eider
Histrionicus histrionicus, Harlequin Duck
Melanitta perspicillata, Surf Scoter
Melanitta fusca, White-winged Scoter
Melanitta nigra, Black Scoter
Clangula hyemalis, Long-tailed Duck
Bucephala albeola, Bufflehead
Bucephala clangula, Common Goldeneye
Bucephala islandica, Barrow's Goldeneye
Mergellus albellus, Smew
Lophodytes cucullatus, Hooded Merganser
Mergus merganser, Common Merganser
Mergus serrator, Red-breasted Merganser
Nomonyx dominicus, Masked Duck
Oxyura jamaicensis, Ruddy Duck

Family GAVIIDAE (Loons)
Gavia stellata, Red-throated Loon
Gavia arctica, Arctic Loon
Gavia pacifica, Pacific Loon
Gavia immer, Common Loon
Gavia adamsii, Yellow-billed Loon

Family PODICIPEDIDAE (Grebes)
Tachybaptus dominicus, Least Grebe
Podilymbus podiceps, Pied-billed Grebe
Podiceps auritus, Horned Grebe
Podiceps grisegena, Red-necked Grebe
Podiceps nigricollis, Eared Grebe
Aechmophorus occidentalis, Western Grebe
Aechmophorus clarkii, Clark's Grebe

Family PHOENICOPTERIDAE (Flamingos)
Phoenicopterus ruber, Greater Flamingo

Family DIOMEDEIDAE (Albatrosses)
Thalassarche chlororhynchos, Yellow-nosed Albatross
Thalassarche cauta, Shy Albatross
Thalassarche melanophris, Black-browed Albatross
Phoebetria palpebrata, Light-mantled Albatross
Diomedea exulans, Wandering Albatross
Phoebastria immutabilis, Laysan Albatross

Phoebastria nigripes, Black-footed Albatross
Phoebastria albatrus, Short-tailed Albatross

Family PROCELLARIIDAE (Petrels, Shearwaters, and Allies)
Fulmarus glacialis, Northern Fulmar
Pterodroma macroptera, Great-winged Petrel
Pterodroma neglecta, Kermadec Petrel
Pterodroma arminjoniana, Herald Petrel
Pterodroma ultima, Murphy's Petrel
Pterodroma inexpectata, Mottled Petrel
Pterodroma cahow, Bermuda Petrel
Pterodroma hasitata, Black-capped Petrel
Pterodroma externa, Juan Fernandez Petrel
Pterodroma sandwichensis, Hawaiian Petrel
Pterodroma cervicalis, White-necked Petrel
Pterodroma hypoleuca, Bonin Petrel
Pterodroma nigripennis, Black-winged Petrel
Pterodroma cookii, Cook's Petrel
Pterodroma longirostris, Stejneger's Petrel
Pterodroma alba, Phoenix Petrel
Pterodroma leucoptera, Gould's Petrel
Pterodroma rostrata, Tahiti Petrel
Bulweria bulwerii, Bulwer's Petrel
Bulweria fallax, Jouanin's Petrel
Procellaria aequinoctialis, White-chinned Petrel
Calonectris leucomelas, Streaked Shearwater
Calonectris diomedea, Cory's Shearwater
Calonectris edwardsii, Cape Verde Shearwater
Puffinus creatopus, Pink-footed Shearwater
Puffinus carneipes, Flesh-footed Shearwater
Puffinus gravis, Greater Shearwater
Puffinus pacificus, Wedge-tailed Shearwater
Puffinus bulleri, Buller's Shearwater
Puffinus griseus, Sooty Shearwater
Puffinus tenuirostris, Short-tailed Shearwater
Puffinus nativitatis, Christmas Shearwater
Puffinus puffinus, Manx Shearwater
Puffinus auricularis, Townsend's Shearwater
Puffinus opisthomelas, Black-vented Shearwater
Puffinus lherminieri, Audubon's Shearwater
Puffinus assimilis, Little Shearwater

Family HYDROBATIDAE (Storm-Petrels)
Oceanites oceanicus, Wilson's Storm-Petrel
Pelagodroma marina, White-faced Storm-Petrel
Fregetta tropica, Black-bellied Storm-Petrel

Fregetta grallaria, White-bellied Storm-Petrel
Nesofregetta fuiginosa, Polynesian Storm-Petrel
Oceanodroma furcata, Fork-tailed Storm-Petrel
Oceanodroma hornbyi, Ringed Storm-Petrel
Oceanodroma leucorhoa, Leach's Storm-Petrel
Oceanodroma homochroa, Ashy Storm-Petrel
Oceanodroma castro, Band-rumped Storm-Petrel
Oceanodroma tethys, Wedge-rumped Storm-Petrel
Oceanodroma matsudairae, Matsudaira's Storm-Petrel
Oceanodroma melania, Black Storm-Petrel
Oceanodroma tristrami, Tristram's Storm-Petrel
Oceanodroma microsoma, Least Storm-Petrel

Family PHAETHONTIDAE (Tropicbirds)
Phaethon lepturus, White-tailed Tropicbird
Phaethon aethereus, Red-billed Tropicbird
Phaethon rubricauda, Red-tailed Tropicbird

Family CICONIIDAE (Storks)
Jabiru mycteria, Jabiru
Mycteria americana, Wood Stork

Family FREGATIDAE (Frigatebirds)
Fregata magnificens, Magnificent Frigatebird
Fregata minor, Great Frigatebird
Fregata ariel, Lesser Frigatebird

Family SULIDAE (Boobys)
Sula dactylatra, Masked Booby
Sula nebouxii, Blue-footed Booby
Sula leucogaster, Brown Booby
Sula sula, Red-footed Booby
Morus bassanus, Northern Gannet

Family PHALACROCORACIDAE (Cormorants)
Phalacrocorax melanoleucos, Little Pied Cormorant
Phalacrocorax penicillatus, Brandt's Cormorant
Phalacrocorax brasilianus, Neotropic Cormorant
Phalacrocorax auritus, Double-crested Cormorant
Phalacrocorax carbo, Great Cormorant
Phalacrocorax urile, Red-faced Cormorant
Phalacrocorax pelagicus, Pelagic Cormorant

Family ANHINGIDAE (Anhingas)
Anhinga anhinga, Anhinga

Family PELECANIDAE (Pelicans)
- *Pelecanus erythrorhynchos*, American White Pelican
- *Pelecanus occidentalis*, Brown Pelican

Family ARDEIDAE (Bitterns and Herons)
- *Botaurus lentiginosus*, American Bittern
- *Ixobrychus sinensis*, Yellow Bittern
- *Ixobrychus exilis*, Least Bittern
- *Ixobrychus eurhythmus*, Schrenck's Bittern
- *Ixobrychus flavicollis*, Black Bittern
- *Ardea herodias*, Great Blue Heron
- *Ardea cinerea*, Gray Heron
- *Ardea alba*, Great Egret
- *Mesophoyx intermedia*, Intermediate Egret
- *Egretta eulophotes*, Chinese Egret
- *Egretta garzetta*, Little Egret
- *Egretta sacra*, Pacific Reef-Egret
- *Egretta gularis*, Western Reef-Heron
- *Egretta thula*, Snowy Egret
- *Egretta caerulea*, Little Blue Heron
- *Egretta tricolor*, Tricolored Heron
- *Egretta rufescens*, Reddish Egret
- *Bubulcus ibis*, Cattle Egret
- *Ardeola bacchus*, Chinese Pond-Heron
- *Butorides virescens*, Green Heron
- *Nycticorax nycticorax*, Black-crowned Night-Heron
- *Nyctanassa violacea*, Yellow-crowned Night-Heron
- *Gorsachius goisagi*, Japanese Night-Heron
- *Gorsachius melanolophus*, Malayan Night-Heron

Family THRESKIORNITHIDAE (Ibises)
- *Eudocimus albus*, White Ibis
- *Eudocimus ruber*, Scarlet Ibis
- *Plegadis falcinellus*, Glossy Ibis
- *Plegadis chihi*, White-faced Ibis

Family PLATALEIDAE (Spoonbills)
- *Platalea ajaja*, Roseate Spoonbill

Family CATHARTIDAE (Vultures)
- *Coragyps atratus*, Black Vulture
- *Cathartes aura*, Turkey Vulture
- *Gymnogyps californianus*, California Condor

Family PANDIONIDAE (Ospreys)
- *Pandion haliaetus*, Osprey

Family ACCIPITRIDAE (Kites, Hawk, and Eagles)
- *Chondrohierax uncinatus*, Hook-billed Kite
- *Elanoides forficatus*, Swallow-tailed Kite
- *Elanus leucurus*, White-tailed Kite
- *Rostrhamus sociabilis*, Snail Kite
- *Ictinia mississippiensis*, Mississippi Kite
- *Milvus migrans*, Black Kite
- *Haliaeetus leucocephalus*, Bald Eagle
- *Haliaeetus albicilla*, White-tailed Eagle
- *Haliaeetus pelagicus*, Steller's Sea-Eagle
- *Circus cyaneus*, Northern Harrier
- *Accipiter soloensis*, Gray Frog-Hawk
- *Accipiter gularis*, Japanese Sparrowhawk
- *Accipiter striatus*, Sharp-shinned Hawk
- *Accipiter cooperii*, Cooper's Hawk
- *Accipiter gentilis*, Northern Goshawk
- *Geranospiza caerulescens*, Crane Hawk
- *Buteogallus anthracinus*, Common Black-Hawk
- *Parabuteo unicinctus*, Harris's Hawk
- *Buteo magnirostris*, Roadside Hawk
- *Buteo lineatus*, Red-shouldered Hawk
- *Buteo platypterus*, Broad-winged Hawk
- *Buteo nitidus*, Gray Hawk
- *Buteo brachyurus*, Short-tailed Hawk
- *Buteo swainsoni*, Swainson's Hawk
- *Buteo albicaudatus*, White-tailed Hawk
- *Buteo albonotatus*, Zone-tailed Hawk
- *Buteo solitarius*, Hawaiian Hawk
- *Buteo jamaicensis*, Red-tailed Hawk
- *Buteo regalis*, Ferruginous Hawk
- *Buteo lagopus*, Rough-legged Hawk
- *Aquila chrysaetos*, Golden Eagle

Family FALCONIDAE (Caracaras and Falcons)
- *Micrastur semitorquatus*, Collared Forest-Falcon
- *Caracara cheriway*, Crested Caracara
- *Falco tinnunculus*, Eurasian Kestrel
- *Falco sparverius*, American Kestrel
- *Falco vespertinus*, Red-footed Falcon
- *Falco columbarius*, Merlin
- *Falco subbuteo*, Eurasian Hobby
- *Falco femoralis*, Aplomado Falcon
- *Falco rusticolus*, Gyrfalcon
- *Falco peregrinus*, Peregrine Falcon
- *Falco mexicanus*, Prairie Falcon

Family RALLIDAE (Rails, Gallinules, and Coots)
- *Coturnicops noveboracensis*, Yellow Rail
- *Laterallus jamaicensis*, Black Rail
- *Gallirallus philippensis*, Buff-banded Rail
- *Gallirallus owstoni*, Guam Rail
- *Crex crex*, Corn Crake
- *Rallus longirostris*, Clapper Rail
- *Rallus elegans*, King Rail
- *Rallus limicola*, Virginia Rail
- *Porzana carolina*, Sora
- *Porzana tabuensis*, Spotless Crake
- *Porzana flaviventer*, Yellow-breasted Crake
- *Neocrex erythrops*, Paint-billed Crake
- *Pardirallus maculatus*, Spotted Rail
- *Porphyrio martinica*, Purple Gallinule
- *Porphyrio porphyrio*, Purple Swamphen
- *Porphyrio flavirostris*, Azure Gallinule
- *Gallinula galeata*, Common Gallinule
- *Fulica atra*, Eurasian Coot
- *Fulica alai*, Hawaiian Coot
- *Fulica americana*, American Coot
- *Fulica caribaea*, Caribbean Coot

Family HELIORNITHIDAE (Sungrebes)
- *Heliornis fulica*, Sungrebe

Family ARAMIDAE (Limpkins)
- *Aramus guarauna*, Limpkin

Family GRUIDAE (Cranes)
- *Grus canadensis*, Sandhill Crane
- *Grus grus*, Common Crane
- *Grus americana*, Whooping Crane

Family CHARADRIIDAE (Plovers and Lapwings)
- *Vanellus vanellus*, Northern Lapwing
- *Pluvialis squatarola*, Black-bellied Plover
- *Pluvialis apricaria*, European Golden-Plover
- *Pluvialis dominica*, American Golden-Plover
- *Pluvialis fulva*, Pacific Golden-Plover
- *Charadrius mongolus*, Lesser Sand-Plover
- *Charadrius leschenaultii*, Greater Sand-Plover
- *Charadrius collaris*, Collared Plover
- *Charadrius nivosus*, Snowy Plover
- *Charadrius wilsonia*, Wilson's Plover
- *Charadrius hiaticula*, Common Ringed Plover

Charadrius semipalmatus, Semipalmated Plover
Charadrius melodus, Piping Plover
Charadrius dubius, Little Ringed Plover
Charadrius vociferus, Killdeer
Charadrius montanus, Mountain Plover
Charadrius morinellus, Eurasian Dotterel

Family HAEMATOPODIDAE (Oystercatchers)
Haematopus ostralegus, Eurasian Oystercatcher
Haematopus palliatus, American Oystercatcher
Haematopus bachmani, Black Oystercatcher

Family RECURVIROSTRIDAE (Stilts and Avocets)
Himantopus himantopus, Black-winged Stilt
Himantopus mexicanus, Black-necked Stilt
Recurvirostra americana, American Avocet

Family JACANIDAE (Jacanas)
Jacana spinosa, Northern Jacana

Family SCOLOPACIDAE (Sandpipers, Phalaropes, and Allies)
Xenus cinereus, Terek Sandpiper
Actitis hypoleucos, Common Sandpiper
Actitis macularius, Spotted Sandpiper
Tringa ochropus, Green Sandpiper
Tringa solitaria, Solitary Sandpiper
Tringa brevipes, Gray-tailed Tattler
Tringa incana, Wandering Tattler
Tringa erythropus, Spotted Redshank
Tringa melanoleuca, Greater Yellowlegs
Tringa nebularia, Common Greenshank
Tringa guttifer, Nordmann's Greenshank
Tringa semipalmata, Willet
Tringa flavipes, Lesser Yellowlegs
Tringa stagnatilis, Marsh Sandpiper
Tringa glareola, Wood Sandpiper
Bartramia longicauda, Upland Sandpiper
Numenius minutus, Little Curlew
Numenius borealis, Eskimo Curlew
Numenius phaeopus, Whimbrel
Numenius tahitiensis, Bristle-thighed Curlew
Numenius madagascariensis, Far Eastern Curlew
Numenius arquata, Eurasian Curlew
Numenius americanus, Long-billed Curlew
Limosa limosa, Black-tailed Godwit
Limosa haemastica, Hudsonian Godwit

Limosa lapponica, Bar-tailed Godwit
Limosa fedoa, Marbled Godwit
Arenaria interpres, Ruddy Turnstone
Arenaria melanocephala, Black Turnstone
Aphriza virgata, Surfbird
Calidris tenuirostris, Great Knot
Calidris canutus, Red Knot
Calidris alba, Sanderling
Calidris pusilla, Semipalmated Sandpiper
Calidris mauri, Western Sandpiper
Calidris ruficollis, Red-necked Stint
Calidris minuta, Little Stint
Calidris temminckii, Temminck's Stint
Calidris subminuta, Long-toed Stint
Calidris minutilla, Least Sandpiper
Calidris fuscicollis, White-rumped Sandpiper
Calidris bairdii, Baird's Sandpiper
Calidris melanotos, Pectoral Sandpiper
Calidris acuminata, Sharp-tailed Sandpiper
Calidris maritima, Purple Sandpiper
Calidris ptilocnemis, Rock Sandpiper
Calidris alpina, Dunlin
Calidris ferruginea, Curlew Sandpiper
Calidris himantopus, Stilt Sandpiper
Eurynorhynchus pygmeus, Spoon-billed Sandpiper
Limicola falcinellus, Broad-billed Sandpiper
Tryngites subruficollis, Buff-breasted Sandpiper
Philomachus pugnax, Ruff
Limnodromus griseus, Short-billed Dowitcher
Limnodromus scolopaceus, Long-billed Dowitcher
Lymnocryptes minimus, Jack Snipe
Gallinago delicata, Wilson's Snipe
Gallinago gallinago, Common Snipe
Gallinago stenura, Pin-tailed Snipe
Gallinago megala, Swinhoe's Snipe
Scolopax rusticola, Eurasian Woodcock
Scolopax minor, American Woodcock
Phalaropus tricolor, Wilson's Phalarope
Phalaropus lobatus, Red-necked Phalarope
Phalaropus fulicarius, Red Phalarope

Family LARIDAE (Skuas, Gulls, Terns, and Skimmers)
Larus atricilla, Laughing Gull
Larus pipixcan, Franklin's Gull
Larus minutus, Little Gull
Larus ridibundus, Black-headed Gull

Larus philadelphia, Bonaparte's Gull
Larus heermanni, Heermann's Gull
Larus cirrocephalus, Gray-hooded Gull
Larus belcheri, Belcher's Gull
Larus crassirostris, Black-tailed Gull
Larus canus, Mew Gull
Larus delawarensis, Ring-billed Gull
Larus californicus, California Gull
Larus argentatus, Herring Gull
Larus michahellis, Yellow-legged Gull
Larus thayeri, Thayer's Gull
Larus glaucoides, Iceland Gull
Larus fuscus, Lesser Black-backed Gull
Larus schistisagus, Slaty-backed Gull
Larus livens, Yellow-footed Gull
Larus occidentalis, Western Gull
Larus glaucescens, Glaucous-winged Gull
Larus hyperboreus, Glaucous Gull
Larus marinus, Great Black-backed Gull
Larus dominicanus, Kelp Gull
Xema sabini, Sabine's Gull
Rissa tridactyla, Black-legged Kittiwake
Rissa brevirostris, Red-legged Kittiwake
Rhodostethia rosea, Ross's Gull
Pagophila eburnea, Ivory Gull
Anous stolidus, Brown Noddy
Anous minutus, Black Noddy
Procelsterna cerulea, Blue-gray Noddy
Gygis alba, White Tern
Onychoprion fuscatus, Sooty Tern
Onychoprion lunatus, Gray-backed Tern
Onychoprion anaethetus, Bridled Tern
Onychoprion aleuticus, Aleutian Tern
Sternula albifrons, Little Tern
Sternula antillarum, Least Tern
Phaetusa simplex, Large-billed Tern
Gelochelidon nilotica, Gull-billed Tern
Hydroprogne caspia, Caspian Tern
Chlidonias niger, Black Tern
Chlidonias leucopterus, White-winged Tern
Chlidonias hybridus, Whiskered Tern
Sterna dougallii, Roseate Tern
Sterna hirundo, Common Tern
Sterna paradisaea, Arctic Tern
Sterna forsteri, Forster's Tern
Sterna sumatrana, Black-naped Tern

Thalasseus maximus, Royal Tern
Thalasseus bergii, Great Crested Tern
Thalasseus sandvicensis, Sandwich Tern
Thalasseus elegans, Elegant Tern
Rynchops niger, Black Skimmer

Family STERCORARIIDAE (Skuas and Jaegers)
Stercorarius skua, Great Skua
Stercorarius maccormicki, South Polar Skua
Stercorarius pomarinus, Pomarine Jaeger
Stercorarius parasiticus, Parasitic Jaeger
Stercorarius longicaudus, Long-tailed Jaeger

Family ALCIDAE (Auks, Murres, and Puffins)
Alle alle, Dovekie
Uria aalge, Common Murre
Uria lomvia, Thick-billed Murre
Alca torda, Razorbill
Cepphus grylle, Black Guillemot
Cepphus columba, Pigeon Guillemot
Brachyramphus perdix, Long-billed Murrelet
Brachyramphus marmoratus, Marbled Murrelet
Brachyramphus brevirostris, Kittlitz's Murrelet
Synthliboramphus hypoleucus, Xantus's Murrelet
Synthliboramphus craveri, Craveri's Murrelet
Synthliboramphus antiquus, Ancient Murrelet
Ptychoramphus aleuticus, Cassin's Auklet
Aethia psittacula, Parakeet Auklet
Aethia pusilla, Least Auklet
Aethia pygmaea, Whiskered Auklet
Aethia cristatella, Crested Auklet
Cerorhinca monocerata, Rhinoceros Auklet
Fratercula arctica, Atlantic Puffin
Fratercula corniculata, Horned Puffin
Fratercula cirrhata, Tufted Puffin

Family COLUMBIDAE (Pigeons and Doves)
Patagioenas squamosa, Scaly-naped Pigeon
Patagioenas leucocephala, White-crowned Pigeon
Patagioenas flavirostris, Red-billed Pigeon
Patagioenas inornata, Plain Pigeon
Patagioenas fasciata, Band-tailed Pigeon
Streptopelia orientalis, Oriental Turtle-Dove
Zenaida asiatica, White-winged Dove
Zenaida aurita, Zenaida Dove
Zenaida macroura, Mourning Dove

Columbina inca, Inca Dove
Columbina passerina, Common Ground-Dove
Columbina talpacoti, Ruddy Ground-Dove
Leptotila verreauxi, White-tipped Dove
Geotrygon chrysia, Key West Quail-Dove
Geotrygon mystacea, Bridled Quail-Dove
Geotrygon montana, Ruddy Quail-Dove
Gallicolumba xanthonura, White-throated Ground-Dove
Gallicolumba stairi, Friendly Ground-Dove
Ptilinopus perousii, Many-colored Fruit-Dove
Ptilinopus roseicapilla, Mariana Fruit-Dove
Ptilinopus porphyraceus, Crimson-crowned Fruit-Dove
Ducula pacifica, Pacific Imperial-Pigeon

Family CUCULIDAE (Cuckoos, Roadrunners, and Allies)
Cuculus canorus, Common Cuckoo
Cuculus optatus, Oriental Cuckoo
Cuculus fugax, Hodgson's Hawk-Cuckoo
Coccyzus americanus, Yellow-billed Cuckoo
Coccyzus minor, Mangrove Cuckoo
Coccyzus erythropthalmus, Black-billed Cuckoo
Coccyzus vieilloti, Puerto Rican Lizard-Cuckoo
Geococcyx californianus, Greater Roadrunner
Crotophaga ani, Smooth-billed Ani
Crotophaga sulcirostris, Groove-billed Ani

Family TYTONIDAE (Barn Owls)
Tyto alba, Barn Owl

Family STRIGIDAE (Typical Owls)
Otus flammeolus, Flammulated Owl
Otus sunia, Oriental Scops-Owl
Megascops kennicottii, Western Screech-Owl
Megascops asio, Eastern Screech-Owl
Megascops trichopsis, Whiskered Screech-Owl
Megascops nudipes, Puerto Rican Screech-Owl
Bubo virginianus, Great Horned Owl
Bubo scandiacus, Snowy Owl
Surnia ulula, Northern Hawk Owl
Glaucidium gnoma, Northern Pygmy-Owl
Glaucidium brasilianum, Ferruginous Pygmy-Owl
Micrathene whitneyi, Elf Owl
Athene cunicularia, Burrowing Owl
Ciccaba virgata, Mottled Owl
Strix occidentalis, Spotted Owl
Strix varia, Barred Owl

Strix nebulosa, Great Gray Owl
Asio otus, Long-eared Owl
Asio stygius, Stygian Owl
Asio flammeus, Short-eared Owl
Aegolius funereus, Boreal Owl
Aegolius acadicus, Northern Saw-whet Owl

Family CAPRIMULGIDAE (Goatsuckers)
Chordeiles acutipennis, Lesser Nighthawk
Chordeiles minor, Common Nighthawk
Chordeiles gundlachii, Antillean Nighthawk
Nyctidromus albicollis, Common Pauraque
Phalaenoptilus nuttallii, Common Poorwill
Caprimulgus carolinensis, Chuck-will's-widow
Caprimulgus ridgwayi, Buff-collared Nightjar
Caprimulgus vociferus, Eastern Whip-poor-will
Caprimulgus noctitherus, Puerto Rican Nightjar
Caprimulgus indicus, Gray Nightjar

Family APODIDAE (Swifts)
Cypseloides niger, Black Swift
Streptoprocne zonaris, White-collared Swift
Chaetura pelagica, Chimney Swift
Chaetura vauxi, Vaux's Swift
Chaetura brachyura, Short-tailed Swift
Hirundapus caudacutus, White-throated Needletail
Aerodramus spodiopygius, White-rumped Swiftlet
Aerodramus bartschi, Mariana Swiftlet
Apus apus, Common Swift
Apus pacificus, Fork-tailed Swift
Apus melba, Alpine Swift
Aeronautes saxatalis, White-throated Swift
Tachornis phoenicobia, Antillean Palm-Swift

Family TROCHILIDAE (Hummingbirds)
Colibri thalassinus, Green Violet-ear
Anthracothorax prevostii, Green-breasted Mango
Anthracothorax dominicus, Antillean Mango
Anthracothorax viridis, Green Mango
Eulampis jugularis, Purple-throated Carib
Eulampis holosericeus, Green-throated Carib
Orthorhyncus cristatus, Antillean Crested Hummingbird
Chlorostilbon maugaeus, Puerto Rican Emerald
Cynanthus latirostris, Broad-billed Hummingbird
Hylocharis leucotis, White-eared Hummingbird
Hylocharis xantusii, Xantus's Hummingbird

Amazilia beryllina, Berylline Hummingbird
Amazilia yucatanensis, Buff-bellied Hummingbird
Amazilia rutila, Cinnamon Hummingbird
Amazilia violiceps, Violet-crowned Hummingbird
Lampornis clemenciae, Blue-throated Hummingbird
Eugenes fulgens, Magnificent Hummingbird
Heliomaster constantii, Plain-capped Starthroat
Calliphlox evelynae, Bahama Woodstar
Calothorax lucifer, Lucifer Hummingbird
Archilochus colubris, Ruby-throated Hummingbird
Archilochus alexandri, Black-chinned Hummingbird
Calypte anna, Anna's Hummingbird
Calypte costae, Costa's Hummingbird
Stellula calliope, Calliope Hummingbird
Atthis heloisa, Bumblebee Hummingbird
Selasphorus platycercus, Broad-tailed Hummingbird
Selasphorus rufus, Rufous Hummingbird
Selasphorus sasin, Allen's Hummingbird

Family TROGONIDAE (Trogons)
Trogon elegans, Elegant Trogon
Euptilotis neoxenus, Eared Quetzel

Family UPUPIDAE (Hoopoes)
Upupa epops, Eurasian Hoopoe

Family ALCEDINIDAE (Kingfishers)
Todirhamphus cinnamominus, Micronesian Kingfisher
Todirhamphus chloris, Collared Kingfisher
Megaceryle torquata, Ringed Kingfisher
Megaceryle alcyon, Belted Kingfisher
Chloroceryle americana, Green Kingfisher

Family PICIDAE (Woodpeckers and Allies)
Jynx torquilla, Eurasian Wryneck
Melanerpes lewis, Lewis's Woodpecker
Melanerpes portoricensis, Puerto Rican Woodpecker
Melanerpes erythrocephalus, Red-headed Woodpecker
Melanerpes formicivorus, Acorn Woodpecker
Melanerpes uropygialis, Gila Woodpecker
Melanerpes aurifrons, Golden-fronted Woodpecker
Melanerpes carolinus, Red-bellied Woodpecker
Sphyrapicus thyroideus, Williamson's Sapsucker
Sphyrapicus varius, Yellow-bellied Sapsucker
Sphyrapicus nuchalis, Red-naped Sapsucker
Sphyrapicus ruber, Red-breasted Sapsucker

Dendrocopos major, Great Spotted Woodpecker
Picoides scalaris, Ladder-backed Woodpecker
Picoides nuttallii, Nuttall's Woodpecker
Picoides pubescens, Downy Woodpecker
Picoides villosus, Hairy Woodpecker
Picoides arizonae, Arizona Woodpecker
Picoides borealis, Red-cockaded Woodpecker
Picoides albolarvatus, White-headed Woodpecker
Picoides dorsalis, American Three-toed Woodpecker
Picoides arcticus, Black-backed Woodpecker
Colaptes auratus, Northern Flicker
Colaptes chrysoides, Gilded Flicker
Dryocopus pileatus, Pileated Woodpecker
Campephilus principalis, Ivory-billed Woodpecker

Family TYRANNIDAE (Tyrant Flycatchers)
Camptostoma imberbe, Northern Beardless-Tyrannulet
Myiopagis viridicata, Greenish Elaenia
Elaenia martinica, Caribbean Elaenia
Mitrephanes phaeocercus, Tufted Flycatcher
Contopus cooperi, Olive-sided Flycatcher
Contopus pertinax, Greater Pewee
Contopus sordidulus, Western Wood-Pewee
Contopus virens, Eastern Wood-Pewee
Contopus caribaeus, Cuban Pewee
Contopus hispaniolensis, Hispaniolan Pewee
Contopus latirostris, Lesser Antillean Pewee
Empidonax flaviventris, Yellow-bellied Flycatcher
Empidonax virescens, Acadian Flycatcher
Empidonax alnorum, Alder Flycatcher
Empidonax traillii, Willow Flycatcher
Empidonax minimus, Least Flycatcher
Empidonax hammondii, Hammond's Flycatcher
Empidonax wrightii, Gray Flycatcher
Empidonax oberholseri, Dusky Flycatcher
Empidonax difficilis, Pacific-slope Flycatcher
Empidonax occidentalis, Cordilleran Flycatcher
Empidonax fulvifrons, Buff-breasted Flycatcher
Sayornis nigricans, Black Phoebe
Sayornis phoebe, Eastern Phoebe
Sayornis saya, Say's Phoebe
Pyrocephalus rubinus, Vermilion Flycatcher
Myiarchus tuberculifer, Dusky-capped Flycatcher
Myiarchus cinerascens, Ash-throated Flycatcher
Myiarchus nuttingi, Nutting's Flycatcher
Myiarchus crinitus, Great Crested Flycatcher

Myiarchus tyrannulus, Brown-crested Flycatcher
Myiarchus sagrae, La Sagra's Flycatcher
Myiarchus antillarum, Puerto Rican Flycatcher
Pitangus sulphuratus, Great Kiskadee
Myiozetetes similis, Social Flycatcher
Myiodynastes luteiventris, Sulphur-bellied Flycatcher
Legatus leucophalus, Piratic Flycatcher
Empidonomus varius, Variegated Flycatcher
Tyrannus melancholicus, Tropical Kingbird
Tyrannus couchii, Couch's Kingbird
Tyrannus vociferans, Cassin's Kingbird
Tyrannus crassirostris, Thick-billed Kingbird
Tyrannus verticalis, Western Kingbird
Tyrannus tyrannus, Eastern Kingbird
Tyrannus dominicensis, Gray Kingbird
Tyrannus caudifasciatus, Loggerhead Kingbird
Tyrannus forficatus, Scissor-tailed Flycatcher
Tyrannus savana, Fork-tailed Flycatcher

Family TITYRIDAE (Tityras)
Tityra semifasciata, Masked Tityra
Pachyramphus aglaiae, Rose-throated Becard

Family LANIIDAE (Shrikes)
Lanius cristatus, Brown Shrike
Lanius ludovicianus, Loggerhead Shrike
Lanius excubitor, Northern Shrike

Family VIREONIDAE (Vireos)
Vireo griseus, White-eyed Vireo
Vireo crassirostris, Thick-billed Vireo
Vireo latimeri, Puerto Rican Vireo
Vireo bellii, Bell's Vireo
Vireo atricapillus, Black-capped Vireo
Vireo vicinior, Gray Vireo
Vireo flavifrons, Yellow-throated Vireo
Vireo plumbeus, Plumbeous Vireo
Vireo cassinii, Cassin's Vireo
Vireo solitarius, Blue-headed Vireo
Vireo huttoni, Hutton's Vireo
Vireo gilvus, Warbling Vireo
Vireo philadelphicus, Philadelphia Vireo
Vireo olivaceus, Red-eyed Vireo
Vireo flavoviridis, Yellow-green Vireo
Vireo altiloquus, Black-whiskered Vireo
Vireo magister, Yucatan Vireo

Family CORVIDAE (Jays, Magpies, and Crows)
- *Perisoreus canadensis*, Gray Jay
- *Cyanocitta stelleri*, Steller's Jay
- *Cyanocitta cristata*, Blue Jay
- *Cyanocorax yncas*, Green Jay
- *Cyanocorax morio*, Brown Jay
- *Aphelocoma coerulescens*, Florida Scrub-Jay
- *Aphelocoma insularis*, Island Scrub-Jay
- *Aphelocoma californica*, Western Scrub-Jay
- *Aphelocoma ultramarina*, Transvolcanic Jay
- *Aphelocoma wollweberi*, Mexican Jay
- *Gymnorhinus cyanocephalus*, Pinyon Jay
- *Nucifraga columbiana*, Clark's Nutcracker
- *Pica hudsonia*, Black-billed Magpie
- *Pica nuttalli*, Yellow-billed Magpie
- *Corvus kubaryi*, Mariana Crow
- *Corvus brachyrhynchos*, American Crow
- *Corvus caurinus*, Northwestern Crow
- *Corvus leucognaphalus*, White-necked Crow
- *Corvus imparatus*, Tamaulipas Crow
- *Corvus ossifragus*, Fish Crow
- *Corvus hawaiiensis*, Hawaiian Crow
- *Corvus cryptoleucus*, Chihuahuan Raven
- *Corvus corax*, Common Raven

Family ALAUDIDAE (Larks)
- *Alauda arvensis*, Sky Lark
- *Eremophila alpestris*, Horned Lark

Family HIRUNDINIDAE (Swallows)
- *Progne subis*, Purple Martin
- *Progne cryptoleuca*, Cuban Martin
- *Progne dominicensis*, Caribbean Martin
- *Progne chalybea*, Gray-breasted Martin
- *Progne elegans*, Southern Martin
- *Progne tapera*, Brown-chested Martin
- *Tachycineta bicolor*, Tree Swallow
- *Tachycineta albilinea*, Mangrove Swallow
- *Tachycineta thalassina*, Violet-green Swallow
- *Tachycineta cyaneoviridis*, Bahama Swallow
- *Stelgidopteryx serripennis*, Northern Rough-winged Swallow
- *Riparia riparia*, Bank Swallow
- *Petrochelidon pyrrhonota*, Cliff Swallow
- *Petrochelidon fulva*, Cave Swallow
- *Hirundo rustica*, Barn Swallow
- *Delichon urbicum*, Common House-Martin

Family PARIDAE (Titmice and Chickadees)
- *Poecile carolinensis*, Carolina Chickadee
- *Poecile atricapillus*, Black-capped Chickadee
- *Poecile gambeli*, Mountain Chickadee
- *Poecile sclateri*, Mexican Chickadee
- *Poecile rufescens*, Chestnut-backed Chickadee
- *Poecile hudsonica*, Boreal Chickadee
- *Poecile cincta*, Gray-headed Chickadee
- *Baeolophus wollweberi*, Bridled Titmouse
- *Baeolophus inornatus*, Oak Titmouse
- *Baeolophus ridgwayi*, Juniper Titmouse
- *Baeolophus bicolor*, Tufted Titmouse
- *Baeolophus atricristatus*, Black-crested Titmouse

Family REMIZIDAE (Verdins)
- *Auriparus flaviceps*, Verdin

Family AEGITHALIDAE (Bushtits)
- *Psaltriparus minimus*, Bushtit

Family SITTIDAE (Nuthatches)
- *Sitta canadensis*, Red-breasted Nuthatch
- *Sitta carolinensis*, White-breasted Nuthatch
- *Sitta pygmaea*, Pygmy Nuthatch
- *Sitta pusilla*, Brown-headed Nuthatch

Family CERTHIIDAE (Creepers)
- *Certhia americana*, Brown Creeper

Family TROGLODYTIDAE (Wrens)
- *Campylorhynchus brunneicapillus*, Cactus Wren
- *Salpinctes obsoletus*, Rock Wren
- *Catherpes mexicanus*, Canyon Wren
- *Thryothorus ludovicianus*, Carolina Wren
- *Thryomanes bewickii*, Bewick's Wren
- *Troglodytes aedon*, House Wren
- *Troglodytes pacificus*, Pacific Wren
- *Troglodytes hiemalis*, Winter Wren
- *Cistothorus platensis*, Sedge Wren
- *Cistothorus palustris*, Marsh Wren

family POLIOPTILIDAE (Gnatcatchers)
- *Polioptila caerulea*, Blue-gray Gnatcatcher
- *Polioptila californica*, California Gnatcatcher
- *Polioptila melanura*, Black-tailed Gnatcatcher
- *Polioptila nigriceps*, Black-capped Gnatcatcher

Family CINCLIDAE (Dippers)
Cinclus mexicanus, American Dipper

Family REGULIDAE (Kinglets)
Regulus satrapa, Golden-crowned Kinglet
Regulus calendula, Ruby-crowned Kinglet

Family PHYLLOSCOPIDAE (Old World Warblers)
Phylloscopus trochilus, Willow Warbler
Phylloscopus sibilatrix, Wood Warbler
Phylloscopus fuscatus, Dusky Warbler
Phylloscopus inornatus, Yellow-browed Warbler
Phylloscopus borealis, Arctic Warbler

Family SYLVIIDAE (Whitethroats)
Sylvia curruca, Lesser Whitethroat

Family ACROCEPHALIDAE (Reed-Warblers)
Acrocephalus familiaris, Millerbird
Acrocephalus luscinia, Nightingale Reed-Warbler

Family MEGALURIDAE (Bush Warblers)
Locustella ochotensis, Middendorff's Grasshopper-Warbler
Locustella lanceolata, Lanceolated Warbler

Family MUSCICAPIDAE (Old World Flycatchers)
Muscicapa griseisticta, Gray-streaked Flycatcher
Muscicapa dauurica, Asian Brown Flycatcher
Muscicapa striata, Spotted Flycatcher
Muscicapa sibirica, Dark-sided Flycatcher
Copsychus malabaricus, White-rumped Shama
Luscinia sibilans, Rufous-tailed Robin
Luscinia calliope, Siberian Rubythroat
Luscinia svecica, Bluethroat
Luscinia cyane, Siberian Blue Robin
Tarsiger cyanurus, Red-flanked Bluetail
Ficedula narcissina, Narcissus Flycatcher
Ficedula mugimaki, Mugimaki Flycatcher
Ficedula albicilla, Taiga Flycatcher
Oenanthe oenanthe, Northern Wheatear
Saxicola torquatus, Stonechat

Family TURDIDAE (Thrushes)
Monticola solitarius, Blue Rock Thrush
Sialia sialis, Eastern Bluebird
Sialia mexicana, Western Bluebird

Sialia currucoides, Mountain Bluebird
Myadestes townsendi, Townsend's Solitaire
Myadestes myadestinus, Kamao
Myadestes lanaiensis, Olomao
Myadestes obscurus, Omao
Myadestes palmeri, Puaiohi
Catharus aurantiirostris, Orange-billed Nightingale-Thrush
Catharus mexicanus, Black-headed Nightingale-Thrush
Catharus fuscescens, Veery
Catharus minimus, Gray-cheeked Thrush
Catharus bicknelli, Bicknell's Thrush
Catharus ustulatus, Swainson's Thrush
Catharus guttatus, Hermit Thrush
Hylocichla mustelina, Wood Thrush
Turdus obscurus, Eyebrowed Thrush
Turdus naumanni, Dusky Thrush
Turdus pilaris, Fieldfare
Turdus grayi, Clay-colored Robin
Turdus assimilis, White-throated Robin
Turdus rufopalliatus, Rufous-backed Robin
Turdus migratorius, American Robin
Turdus plumbeus, Red-legged Thrush
Ixoreus naevius, Varied Thrush
Ridgwayia pinicola, Aztec Thrush

Family MIMIDAE (Mockingbirds, Thrashers, and Allies)
Dumetella carolinensis, Gray Catbird
Melanoptila glabrirostris, Black Catbird
Mimus polyglottos, Northern Mockingbird
Mimus gundlachii, Bahama Mockingbird
Oreoscoptes montanus, Sage Thrasher
Toxostoma rufum, Brown Thrasher
Toxostoma longirostre, Long-billed Thrasher
Toxostoma bendirei, Bendire's Thrasher
Toxostoma curvirostre, Curve-billed Thrasher
Toxostoma redivivum, California Thrasher
Toxostoma crissale, Crissal Thrasher
Toxostoma lecontei, Le Conte's Thrasher
Melanotis caerulescens, Blue Mockingbird
Margarops fuscatus, Pearly-eyed Thrasher

Family STURNIDAE (Starlings)
Sturnus philippensis, Chestnut-cheeked Starling
Sturnus cineraceus, White-cheeked Starling

Family PRUNELLIDAE (Accentors)

Prunella montanella, Siberian Accentor

Family MOTACILLIDAE (Wagtails and pipits)
Motacilla tschutschensis, Eastern Yellow Wagtail
Motacilla citreola, Citrine Wagtail
Motacilla cinerea, Gray Wagtail
Motacilla alba, White Wagtail
Anthus trivialis, Tree Pipit
Anthus hodgsoni, Olive-backed Pipit
Anthus gustavi, Pechora Pipit
Anthus cervinus, Red-throated Pipit
Anthus rubescens, American Pipit
Anthus spragueii, Sprague's Pipit

Family BOMBYCILLIDAE (Waxwings)
Bombycilla garrulus, Bohemian Waxwing
Bombycilla cedrorum, Cedar Waxwing

Family PTILOGONATIDAE (Silky-flycatchers)
Ptilogonys cinereus, Gray Silky-flycatcher
Phainopepla nitens, Phainopepla

Family PEUCEDRAMIDAE (Olive Warblers)
Peucedramus taeniatus, Olive Warbler

Family CALCARIIDAE (Longspurs)
Calcarius lapponicus, Lapland Longspur
Calcarius ornatus, Chestnut-collared Longspur
Calcarius pictus, Smith's Longspur
Calcarius mccownii, McCown's Longspur
Plectrophenax nivalis, Snow Bunting
Plectrophenax hyperboreus, McKay's Bunting

Family PARULIDAE (New World Warblers)
Seiurus aurocapilla, Ovenbird
Helmitheros vermivorum, Worm-eating Warbler
Parkesia motacilla, Louisiana Waterthrush
Parkesia noveboracensis, Northern Waterthrush
Vermivora bachmanii, Bachman's Warbler
Vermivora chrysoptera, Golden-winged Warbler
Vermivora pinus, Blue-winged Warbler
Mniotilta varia, Black-and-white Warbler
Protonotaria citrea, Prothonotary Warbler
Limnothlypis swainsonii, Swainson's Warbler
Parula superciliosa, Crescent-chested Warbler
Oreothlypis gutturalis, Flame-throated Warbler

Oreothlypis peregrina, Tennessee Warbler
Oreothlypis celata, Orange-crowned Warbler
Oreothlypis crissalis, Colima Warbler
Oreothlypis luciae, Lucy's Warbler
Oreothlypis ruficapilla, Nashville Warbler
Oreothlypis virginiae, Virginia's Warbler
Leucopeza semperi, Semper's Warbler
Oporornis agilis, Connecticut Warbler
Geothlypis poliocephala, Gray-crowned Yellowthroat
Geothlypis aequinoctialis, Masked Yellowthroat
Geothlypis tolmiei, MacGillivray's Warbler
Geothlypis philadelphia, Mourning Warbler
Geothlypis formosus, Kentucky Warbler
Geothlypis semiflava, Olive-crowned Yellowthroat
Geothlypis speciosa, Black-polled Yellowthroat
Geothlypis beldingi, Belding's Yellowthroat
Geothlypis rostrata, Bahama Yellowthroat
Geothlypis flavovelata, Altamira Yellowthroat
Geothlypis trichas, Common Yellowthroat
Geothlypis nelson, Hooded Yellowthroat
Catharopeza bishop, Whistling Warbler
Setophaga plumbea, Plumbeous Warbler
Setophaga angelae, Elfin-woods Warbler
Setophaga pharetra, Arrowhead Warbler
Setophaga citrina, Hooded Warbler
Setophaga ruticilla, American Redstart
Setophaga kirtlandii, Kirtland's Warbler
Setophaga tigrina, Cape May Warbler
Setophaga cerulea, Cerulean Warbler
Setophaga americana, Northern Parula
Setophaga pitiayumi, Tropical Parula
Setophaga magnolia, Magnolia Warbler
Setophaga castanea, Bay-breasted Warbler
Setophaga fusca, Blackburnian Warbler
Setophaga petechia, Yellow Warbler
Setophaga pensylvanica, Chestnut-sided Warbler
Setophaga striata, Blackpoll Warbler
Setophaga caerulescens, Black-throated Blue Warbler
Setophaga palmarum, Palm Warbler
Setophaga pityophila, Olive-capped Warbler
Setophaga pinus, Pine Warbler
Setophaga coronata, Yellow-rumped Warbler
Setophaga dominica, Yellow-throated Warbler
Setophaga flavescens, Bahama Warbler
Setophaga vitellina, Vitelline Warbler
Setophaga discolor, Prairie Warbler

Setophaga adelaidae, Adelaide's Warbler
Setophaga subita, Barbuda Warbler
Setophaga delicate, St. Lucia Warbler
Setophaga graciae, Grace's Warbler
Setophaga nigrescens, Black-throated Gray Warbler
Setophaga townsendi, Townsend's Warbler
Setophaga occidentalis, Hermit Warbler
Setophaga chrysoparia, Golden-cheeked Warbler
Setophaga virens, Black-throated Green Warbler
Myiothlypis fulvicauda, Buff-rumped Warbler
Basileuterus lachrymosa, Fan-tailed Warbler
Basileuterus rufifrons, Rufous-capped Warbler
Basileuterus melanogenys, Black-cheeked Warbler
Basileuterus ignotus, Pirre Warbler
Basileuterus belli, Golden-browed Warbler
Basileuterus culicivorus, Golden-crowned Warbler
Basileuterus tristriatus, Three-striped Warbler
Cardellina canadensis, Canada Warbler
Cardellina pusilla, Wilson's Warbler
Cardellina rubrifrons, Red-faced Warbler
Cardellina rubra, Red Warbler
Cardellina versicolor, Pink-headed Warbler
Myioborus pictus, Painted Redstart
Myioborus miniatus, Slate-throated Redstart
Myioborus torquatus, Collared Redstart
Zeledonia coronate, Wrenthrush
Icteria virens, Yellow-breasted Chat
Xenoligea Montana, White-winged Warbler
Microligea palustris, Green-tailed Warbler
Teretistris fernandinae, Yellow-headed Warbler
Teretistris fornsi, Oriente Warbler

Family THRAUPIDAE (Tanagers)
Nesospingus speculiferus, Puerto Rican Tanager
Piranga flava, Hepatic Tanager
Piranga rubra, Summer Tanager
Piranga olivacea, Scarlet Tanager
Piranga ludoviciana, Western Tanager
Piranga bidentata, Flame-colored Tanager
Spindalis zena, Western Spindalis
Spindalis portoricensis, Puerto Rican Spindalis
Euphonia musica, Antillean Euphonia

Family EMBERIZIDAE (Sparrows and Allies)
Sporophila torqueola, White-collared Seedeater
Tiaris olivacea, Yellow-faced Grassquit

Tiaris bicolor, Black-faced Grassquit
Loxigilla portoricensis, Puerto Rican Bullfinch
Arremonops rufivirgatus, Olive Sparrow
Pipilo chlorurus, Green-tailed Towhee
Pipilo maculatus, Spotted Towhee
Pipilo erythrophthalmus, Eastern Towhee
Pipilo fuscus, Canyon Towhee
Pipilo crissalis, California Towhee
Pipilo aberti, Abert's Towhee
Aimophila carpalis, Rufous-winged Sparrow
Aimophila cassinii, Cassin's Sparrow
Peucaea aestivalis, Bachman's Sparrow
Aimophila botterii, Botteri's Sparrow
Aimophila ruficeps, Rufous-crowned Sparrow
Aimophila quinquestriata, Five-striped Sparrow
Spizella arborea, American Tree Sparrow
Spizella passerina, Chipping Sparrow
Spizella pallida, Clay-colored Sparrow
Spizella breweri, Brewer's Sparrow
Spizella pusilla, Field Sparrow
Spizella wortheni, Worthen's Sparrow
Spizella atrogularis, Black-chinned Sparrow
Pooecetes gramineus, Vesper Sparrow
Chondestes grammacus, Lark Sparrow
Amphispiza bilineata, Black-throated Sparrow
Amphispiza belli, Sage Sparrow
Calamospiza melanocorys, Lark Bunting
Passerculus sandwichensis, Savannah Sparrow
Ammodramus savannarum, Grasshopper Sparrow
Ammodramus bairdii, Baird's Sparrow
Ammodramus henslowii, Henslow's Sparrow
Ammodramus leconteii, Le Conte's Sparrow
Ammodramus nelsoni, Nelson's Sharp-tailed Sparrow
Ammodramus caudacutus, Saltmarsh Sharp-tailed Sparrow
Ammodramus maritimus, Seaside Sparrow
Passerella iliaca, Fox Sparrow
Melospiza melodia, Song Sparrow
Melospiza lincolnii, Lincoln's Sparrow
Melospiza georgiana, Swamp Sparrow
Zonotrichia albicollis, White-throated Sparrow
Zonotrichia querula, Harris's Sparrow
Zonotrichia leucophrys, White-crowned Sparrow
Zonotrichia atricapilla, Golden-crowned Sparrow
Junco hyemalis, Dark-eyed Junco
Junco phaeonotus, Yellow-eyed Junco
Emberiza leucocephalos, Pine Bunting

Emberiza pusilla, Little Bunting
Emberiza rustica, Rustic Bunting
Emberiza elegans, Yellow-throated Bunting
Emberiza aureola, Yellow-breasted Bunting
Emberiza variabilis, Gray Bunting
Emberiza pallasi, Pallas's Bunting
Emberiza schoeniclus, Reed Bunting

Family CARDINALIDAE (Cardinals, Grosbeaks, and Allies)
Rhodothraupis celaeno, Crimson-collared Grosbeak
Cardinalis cardinalis, Northern Cardinal
Cardinalis sinuatus, Pyrrhuloxia
Pheucticus chrysopeplus, Yellow Grosbeak
Pheucticus ludovicianus, Rose-breasted Grosbeak
Pheucticus melanocephalus, Black-headed Grosbeak
Cyanocompsa parellina, Blue Bunting
Passerina caerulea, Blue Grosbeak
Passerina amoena, Lazuli Bunting
Passerina cyanea, Indigo Bunting
Passerina versicolor, Varied Bunting
Passerina ciris, Painted Bunting
Spiza americana, Dickcissel

Family ICTERIDAE (Blackbirds and Allies)
Dolichonyx oryzivorus, Bobolink
Agelaius phoeniceus, Red-winged Blackbird
Agelaius tricolor, Tricolored Blackbird
Agelaius humeralis, Tawny-shouldered Blackbird
Agelaius xanthomus, Yellow-shouldered Blackbird
Sturnella magna, Eastern Meadowlark
Sturnella neglecta, Western Meadowlark
Xanthocephalus xanthocephalus, Yellow-headed Blackbird
Euphagus carolinus, Rusty Blackbird
Euphagus cyanocephalus, Brewer's Blackbird
Quiscalus quiscula, Common Grackle
Quiscalus major, Boat-tailed Grackle
Quiscalus mexicanus, Great-tailed Grackle
Quiscalus niger, Greater Antillean Grackle
Molothrus bonariensis, Shiny Cowbird
Molothrus aeneus, Bronzed Cowbird
Molothrus ater, Brown-headed Cowbird
Icterus wagleri, Black-vented Oriole
Icterus dominicensis, Greater Antillean Oriole
Icterus spurius, Orchard Oriole
Icterus cucullatus, Hooded Oriole
Icterus pustulatus, Streak-backed Oriole

Icterus bullockii, Bullock's Oriole
Icterus gularis, Altamira Oriole
Icterus graduacauda, Audubon's Oriole
Icterus galbula, Baltimore Oriole
Icterus parisorum, Scott's Oriole

Family FRINGILLIDAE (Finches)
Fringilla coelebs, Common Chaffinch
Fringilla montifringilla, Brambling
Leucosticte tephrocotis, Gray-crowned Rosy-Finch
Leucosticte atrata, Black Rosy-Finch
Leucosticte australis, Brown-capped Rosy-Finch
Pinicola enucleator, Pine Grosbeak
Carpodacus erythrinus, Common Rosefinch
Carpodacus purpureus, Purple Finch
Carpodacus cassinii, Cassin's Finch
Carpodacus mexicanus, House Finch
Loxia curvirostra, Red Crossbill
Loxia leucoptera, White-winged Crossbill
Carduelis flammea, Common Redpoll
Carduelis hornemanni, Hoary Redpoll
Carduelis spinus, Eurasian Siskin
Carduelis pinus, Pine Siskin
Carduelis psaltria, Lesser Goldfinch
Carduelis lawrencei, Lawrence's Goldfinch
Carduelis tristis, American Goldfinch
Carduelis sinica, Oriental Greenfinch
Pyrrhula pyrrhula, Eurasian Bullfinch
Coccothraustes vespertinus, Evening Grosbeak
Coccothraustes coccothraustes, Hawfinch
Telespiza cantans, Laysan Finch
Telespiza ultima, Nihoa Finch
Psittirostra psittacea, Ou
Loxioides bailleui, Palila
Pseudonestor xanthophrys, Maui Parrotbill
Hemignathus virens, Hawaii Amakihi
Hemignathus flavus, Oahu Amakihi
Hemignathus kauaiensis, Kauai Amakihi
Hemignathus ellisianus, Greater Akialoa
Hemignathus lucidus, Nukupuu
Hemignathus munroi, Akiapolaau
Magumma parva, Anianiau
Oreomystis bairdi, Akikiki
Oreomystis mana, Hawaii Creeper
Paroreomyza maculata, Oahu Alauahio
Paroreomyza flammea, Kakawahie

Paroreomyza montana, Maui Alauahio
Loxops caeruleirostris, Akekee
Loxops coccineus, Akepa
Vestiaria coccinea, Iiwi
Palmeria dolei, Akohekohe
Himatione sanguinea, Apapane
Melamprosops phaeosoma, Poo-uli

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APPENDIX D
Breeding BCC Species Conservation Plans

Conservation Plans were developed for the 13 known breeding BCC species on Fort Campbell. Plans are general in nature and provide management guidelines to ensure long-term viability of each species. Species are listed in alphabetical order and are not ranked. The bald eagle is not included within this section due to a separate plan included within the INRMP for that species.

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Conservation Plan for the Bachman's Sparrow (*Aimophila aestivalis*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. A plain sparrow with a large bill and long, rounded, dark tail. Adults have brownish-gray upperparts tinged with reddish streaks and underparts are buffy with a whitish belly (NGS 1987). Crown is reddish-brown with a thin dark eye line extending back from eye, dull pale superciliary, and thin dark malar streak (Dunning 1993). Wings have a small patch of yellow in the bend (alula). Upper mandible is dark while the lower mandible is pale. Southern and eastern populations are grayer and darker. Three subspecies are recognized: *A. aestivalis aestivali* (Lichtenstein)*; A. aestivalis bachmani* (Audubon)*; A. aestivalis illinoensis* (Ridgway). *A. aestivalis bachmani* is the subspecies occurring on Fort Campbell ranging north and west of *aestivalis* to southern Mississippi and northern Kentucky. The sexes have similar appearances (Pyle et al. 1997). The sparrow is a secretive and shy bird with a pleasant song and is typically associated with open habitat and mature pine ecosystems.

1.2 Juveniles Juveniles have a distinct eye ring and are streaked with brown on the throat, breast, and sides (NGS 1987). Juveniles have whitish underparts becoming buffy on flanks and crissum; greater secondary coverts margined with rusty to form a slight wing bar (Wolf 1977).

1.3 Eggs. The eggs are ovate, white, slightly glossy, and unmarked (Haggerty 1986). Egg measurements average 19.8 x 15.6 mm.

1.4 Nests. Nest almost always built on ground, at base of overhanging grass clump, small shrub, or pine seedling (Gainer 1921). Occasionally nest is 2–4 cm above ground in large forb or grass (particularly broomsedge or wiregrass) clump (Dunning 1993). Typical nest is a cup, often domed. Nests made of grasses, forbs and rootlets, lined with fine grass and horse hair. Domed nests have grass arch over cup, usually woven into overhanging grass or other structure, making nests difficult to see. Fewer domed nests in northern part of range; e.g., only 2 of 26 (8%) Ohio nests domed (Brooks 1938).

1.5 Vocalizations. The primary song is considered one of the most beautiful sparrow songs of North America. Song consists of 1–2 clear, relatively long, whistled introductory notes, followed by a trill sounding like "Seeeeee Slip Slip Slip Slip Slip" (Weston 1968, Borror 1971, Peterson 1980).

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. Breeds in the Coastal plain and Piedmont of southern United States from extreme

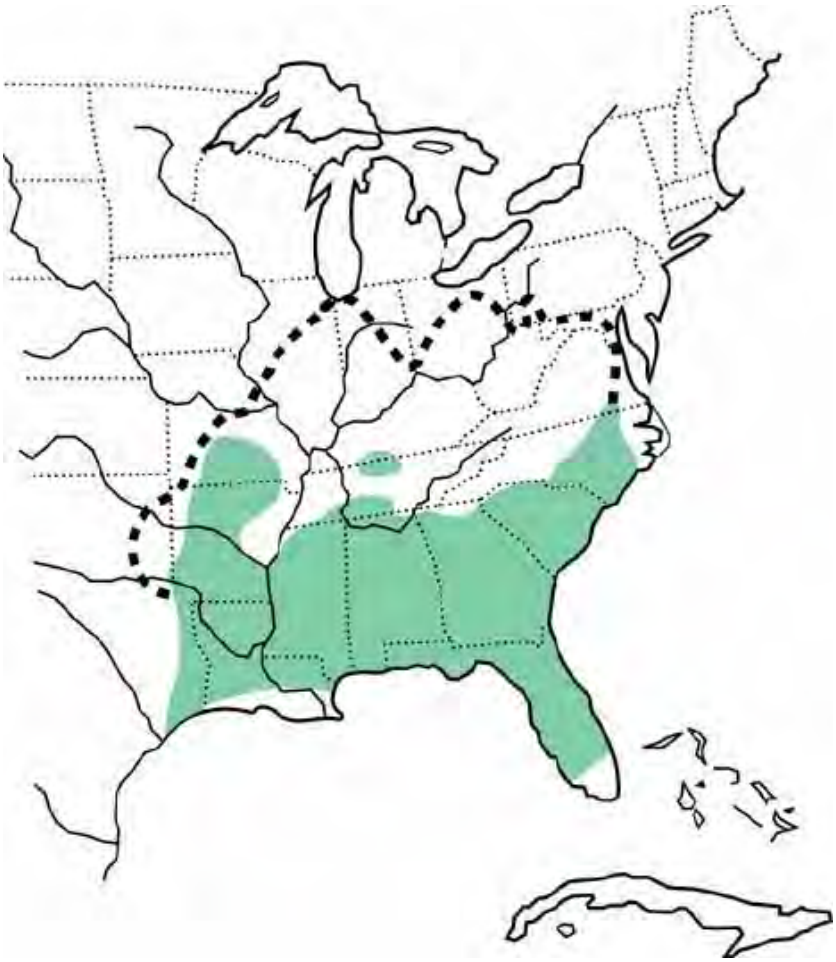

Figure 1. Breeding and Wintering range of the Bachman's sparrow.

southern Virginia south to central Florida and west to east Texas (Dunning 1993). Sparrows are locally distributed in many parts of range with occasional birds reported north to south-central Missouri, Kentucky, and Tennessee. Birds found in southern states are resident, while northern birds are migratory.
2.1.2 Non-breeding. Winters from east Texas, the Gulf Coast states and Atlantic coast (north to N. Carolina) south through remainder of breeding range (Dunning 1993). Casual elsewhere during winter in northern part of breeding range (American Ornithologists' Union 1983). Winter status and boundary of migratory population is uncertain due to the extremely secretive nature of this species in winter (Dunning 1993).

2.2 Habitat

2.2.1 Breeding. Breeding habitat is typically pine woodlands or open habitats with a dense ground layer of grasses and forbs, and an open understory with few dense shrubs (Hardin et al. 1982, Wan A. Kadir 1987, Dunning and Watts 1990). In South, usually breeds in mature pine stands where wiregrass (*Aristida* sp.) or broomsedge (*Andropogon* sp.) dominates ground cover (Dunning 1993). In areas lacking mature pine forest, majority of sparrows found in open habitats such as roadcuts, utility rights-of-way, and especially

clearcuts. Grassy breeding habitat also frequently associated with some form of disturbance (i.e. poor soils, fire), which limits woody growth (Dunning 1993).

2.2.2 Non-breeding. Winter habitat is similar to breeding habitat in southern part of range. Birds found in unusual habitats (e.g., Louisiana coastal cheniers) in fall and winter are presumably dispersers (Purrington 1981, Muth 1985, 1987).

2.3 Ecology

2.3.1 Reproduction. Sparrows attempt at least 2 clutches per season (Haggerty 1986). Only females collect nesting material and build nests; males follow females closely during nest building. Clutch size is from three to five eggs (Ehrlich et al. 1988). First broods are under construction from 15 Apr (Louisiana; Meanley 1959) to 25 May (Missouri; Hardin et al. 1982). Egg dates of probable second broods include "mid-May to late June" (Texas; Wolf 1977), 17 Jul (W. Virginia; Brooks 1938), 20 Jul (Tennessee; Gainer 1921), 27 Jul (Missouri; Hardin et al. 1982), 6 Aug (Ohio; Peterjohn 1989). Incubation period lasts from 12-14 days and only the female incubates the eggs and broods the young. Period from hatching to departure from nest: 9–10 d (Weston 1968, Haggerty 1986). Both parents feed nestlings usually by flying to open ground or shrub 0.5–3.0 m from nest and walking to nest. Females spend significantly more time at nest than males, but males make more trips to the nest early in the nestling period (Haggerty 1992). Young are fed grasshoppers, beetle larvae, spiders.

2.3.2 Territories. Territories established in the breeding season for both nesting and feeding. Method of establishing and maintaining territories is not well known; countersinging by males presumably plays a major role (Dunning 1993). There is no evidence of interspecific territoriality. Territory size averaged 2.49 ha based on entire breeding season (Haggerty 1986). Considerable overlap between large territories; intruders not always expelled, especially in nestling and fledgling periods (Haggerty 1986). Because breeding individuals will intrude into neighboring territories, breeding home ranges may be larger than defended territories. The average size of a territory ranges from 0.62 ha in Missouri (Hardin et al. 1982) to 5.1 ha in Florida (McKitrick 1979). Territory size inversely correlated with conspecific density in Arkansas (Haggerty 1986). Nine of 13 territories in Missouri on hillsides facing north, northwest, or west (Hardin et al. 1982). Very little data on site fidelity to breeding ground, however data indicates low fidelity. Three of 10 males and 2 of 7 females banded in 1983 by Haggerty (1988) returned in 1984, one male returned in 1985, but not 1984. None of 8 males and 9 females banded in 1984 returned in 1985. Returning birds may shift to different territories within a local area in subsequent breeding seasons. No information on fidelity to winter range.

2.3.3 Predators. No published accounts of adult mortality, but adults probably taken by hawks, mammals, and snakes. Nestlings and eggs eaten by snakes (especially *Elaphe* sp. and *Coluber* sp.); of 264 eggs monitored by Haggerty in 3 yr study, 31 (12%) eaten by snakes. Four of 8 W. Virginia nests destroyed; at least one by snakes (Brooks 1938).

2.3.4 Parasitism. Infrequent host of Brown-headed cowbird (*Molothrus ater*) possibly because of cryptic placement of domed nests, and secretive behavior of nesting adults. Three records of cowbird parasitism come from W. Virginia, Missouri, and Kentucky (Friedmann 1963). No parasitism reported in Tennessee (Nicholson 1997).

2.4 Species Status.

Widespread declines have led to a classification of Category 2 Candidate species under the Endangered Species Act by the U.S. Fish and Wildlife Service (USFWS). Southeast Region of the USFWS considers Bachman's sparrow a species of highest priority management concern (Hunter 1990). It has been on the National Audubon Society's Blue List every year the list has been compiled (Tate 1986). The sparrow is classified as Endangered in Indiana, Illinois, Missouri (Hand et al. 1989), Tennessee (Robinson 1990), and Virginia (Ridd 1991). Considered Extirpated in Ohio (Peterjohn 1989), Pennsylvania, and Maryland (LeGrand and Schneider 1992). Proposed status in Georgia is Rare, but not threatened. The Partners in Flight species assessment for the Central Hardwoods Bird Conservation Region recently raised the combined breeding score of the Bachman's sparrow from 17 to 20 – indicating a status of critical recovery (Rich et al. 2004, Panjabi et al. 2005).

2.4.1 Population Trends. The range of the Bachman's sparrow expanded tremendously between 1890 and 1915 (reaching northern limits of range in northern Illinois, central Ohio, southwestern Pennsylvania), peaking around 1920, and declined in the north since 1930 (Brooks 1938). Largest decline in Bachman's sparrow populations occurred from 1930's to 1960's, so analysis of BBS data unable to detect significant trends (Dunning 1993). Numbers increased dramatically in the South during the same time as the northern expansion. Population changes probably a response to changes in habitat availability associated with timber harvest in the South and farm abandonment in the North. Bachman's Sparrows probably expanded northward into degraded pastures and old fields of abandoned farms, and then declined as abandoned pastures and fields became unsuitable with forest succession (Brooks 1938, Haggerty 1986). Bachman's sparrows are currently rare or absent over most of their northern range and uncommon in most of the South.

Young pine plantations are suitable for about 4-7 years, but become unsuitable after this time period (Dunning 1993). Fire suppression policies during the last 3–4 decades in the South maintained the vast majority of southern timberlands with unsuitable under-story and ground cover conditions.

3.0 Species Conservation

The Bachman's sparrow is one of only a few birds that are completely endemic to America. Traditionally this resident species is associated with mature pine woods along the deep southeastern U.S. Although this species occurs in a wide variety of habitat types, this species has strict habitat requirements consisting of a high volume of grasses and forbs, and some scattered trees and shrubs with an open under-story on dry, upland sites (Dunning and Watts 1990). Regional populations appear to be primarily influenced by availability of suitable habitat and the ability to disperse within those patches. Thinning and frequent burning of pine stands simulates the habitat favored by the sparrow.

Very little research has been conducted on Bachman's sparrows probably due to the secretive nature of this species. Suggestions that interspecific aggression has limited populations has not been substantiated.

3.1 *Conservation Recommendations.* Prescribed burning, mowing, and timber thinning are important management tools for Bachman's sparrow populations to reduce woody vegetation and maintain open habitat. Conservation recommendations are based upon current scientific data and support habitat requirements on Fort Campbell. The recommendations are general in nature and will require specific

guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

3.1.1 Bachman's sparrows respond well to timber management of pine trees. Prescribe low basal area thinning when pine stands are due to be cut or provide low basal area re-plantings. Thinning of young trees to basal areas found in mature stands allows sparrows to use older stands.

3.1.2 Use techniques that do not disturb all ground vegetation when a pine or hardwood stand is harvested. Site preparation techniques that destroy most of the ground vegetation, such as windrowing and roller-chopping, may result in delayed colonization of site by sparrows (Dunning and Watts 1990).

3.1.3 Provide suitable habitat in and near areas previously occupied in previous years as this species appears to have low dispersal ability.

3.1.4 Provide suitable habitat patches across the landscape as isolated patches may serve to further accentuate the dispersal abilities of the sparrow. Computer simulations of sparrow population dynamics suggest that habitat patches that serve as stable sources of dispersers may be crucial to maintaining regional populations (Pulliam et al. 1992).

3.1.5 Do not burn, mow, or otherwise disturb an entire area in one breeding season because disturbance reduces available habitat for one or more growing seasons. In order to avoid destruction of nests, conduct management treatments before birds arrive in the spring (15 April) or after the young have fledged (15 September).

3.1.6 Use prescribed fire on a regular basis to maintain woody encroachment. Populations are positively affected by regular burning, which suppresses under-story growth and encourages establishment of grasses, especially *Andropogon* and *Aristida*. In Georgia and S. Carolina, three-year-burn schedules are preferable to longer burn rotations, as sparrow densities decrease 3 yr after last burn (Johnson and Landers 1982, Dunning and Watts 1990, Gobris 1992).

3.2 Management and Monitoring. Targeted surveys using playback over the last 10 years have yielded approximate counts of 20-25 breeding pairs per year on the base. The majority of the sightings have been located around the ranges and large impact zone on the northwestern part of the base (Kentucky).

3.2.1 Management Requirements:

3.2.1.1 *Burning.* Use of fire for habitat maintenance is very important for Bachman's sparrow populations. Populations are negatively affected by fire suppression, which increases shrubby understory and decreases ground vegetation. Fire prescriptions should include leaving unburned patches to leave residual cover for the following breeding season.

3.2.1.2 *Mowing.* Periodic mowing may be a viable option for controlling woody growth and maintaining grasslands suitable for use, provided that mowing is done well after the breeding season is concluded and young and adults have dispersed.

3.2.1.3 *Removal of Woody Species.* If allowed to progress to shrubland habitat, encroaching woody

species will eventually eliminate Bachman's sparrow habitat. It appears that barrens, fields with patchy shrubs, and fallow pastures are optimal habitats.

3.2.1.4 *Monitoring Requirements.* Annual monitoring of populations is recommended. Monitoring should include breeding habitat assessments, distribution, demographics, and long-term population trends.

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Conservation Plan for the Bell's Vireo (*Vireo bellii*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. A rather nondescript vireo with one or two faint pale wing bars on otherwise dark wings; dark tail; indistinct spectacles; overall color ranges from olive in the central U.S. to grayish in Southwest (NGS 1987, Peterson 1990).

1.2 Juveniles. Plumage of juveniles resembles that of adults in worn summer plumages with a brownish wash to the upperparts. Juveniles are whiter below with more distinctive wing bars (Pyle 1997).

1.3 Eggs. Oval to slightly pointed ovate averaging 12.8 x 17.5mm in size. Eggs are smooth and non-glossy with most exhibiting fine brown, black, or reddish-brown dots primarily on the larger end (Harrison 1978).

1.4 Nests. Nests constructed with grasses, bark, and other plant parts, along with spider webs and hair, to construct a nest loosely suspended from thin, forked branches; they line it with fine grasses and hairs. Most nests located 0.5 to 1.5 meters above ground, ranging from 0.2 to 8.0 meters (Thelander and Crabtree 1994).

1.5 Vocalizations. The song is loud, emphatic, and unmusical with an overall jerky, sputtering quality. Described as "cheedle-cheedle-cheedle-chee cheedle-cheedle-cheedle-chew" with a distinctive ascending or descending note (Pitelka and Koestner 1942, Nolan 1960, Barlow 1962).

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. From southern California, southern Nevada, southwestern Utah, Arizona, southern New Mexico, northeastern Colorado, Nebraska, South Dakota, western North Dakota, southeastern Minnesota, southern Wisconsin, northeastern Illinois, northwestern Indiana, and southwestern Michigan south to northern Baja California, southern Sonora, southern Durango, Zacatecas, southern Tamaulipas, southern Texas, north-central Louisiana, Arkansas, and southwestern Tennessee, southwestern Kentucky, southern Indiana, and western Ohio (Brown 1993, AOU 1998).

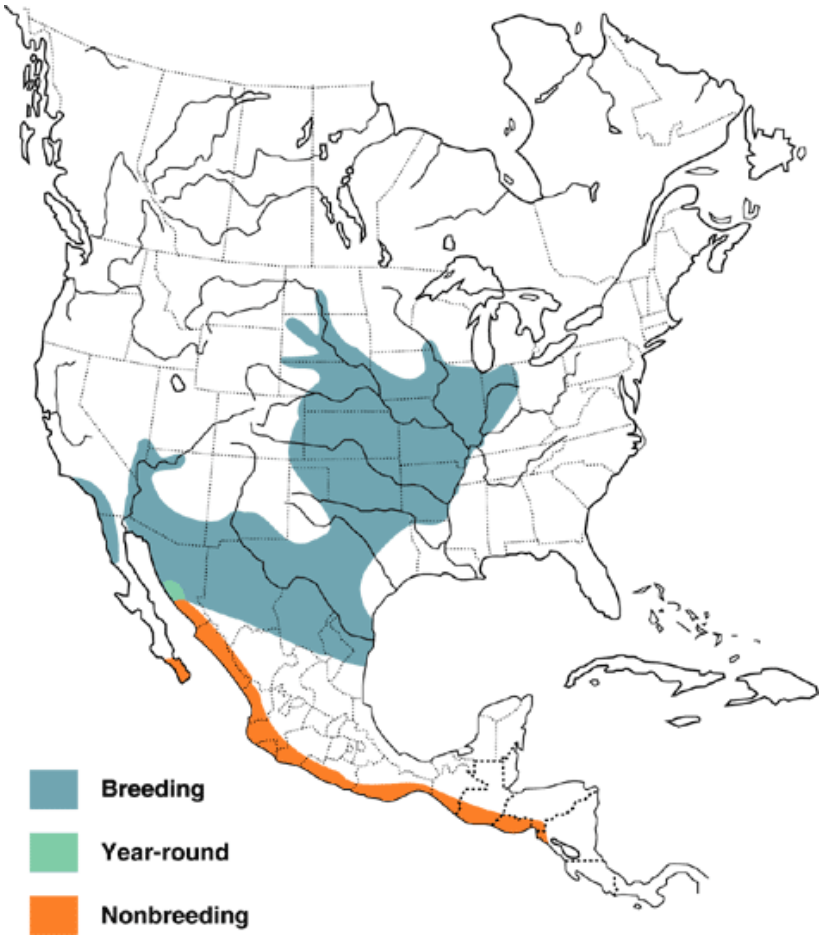

Figure 1. Breeding and Wintering range of the Bell's vireo.

2.1.2 Non-breeding. Southern Baja California and southern Sonora south to Honduras, primarily on Pacific slope; casually north to California, Arizona, Texas, Louisiana, and southern Florida, and south to Nicaragua (Brown 1993, AOU 1998).

2.2 Habitat

2.2.1 Breeding. The types of habitat used vary widely among the four subspecies (Ehrlich et al. 1992). Dense brush, willow thickets, mesquite, streamside thickets, and scrub oak, in arid regions often near water, also adjoining uplands (AOU 1998, Kus and Miner 1989). Nests in shrub or low tree usually in horizontal or down sloping twig fork, typically near edge of thicket. May nest in any successional stage with dense understory vegetation. Nesting success depends on an optimum microclimate, and adequate shade may be critical for successful nesting at low elevations. Tree canopies provide cooler environments for static temperature of the eggs while adults are foraging (Thelander and Crabtree 1994).

2.2.2 Non-breeding. In migration and winter, primarily in dense scrub (AOU 1998). West coast of Mexico and Honduras in thornscrub adjacent to watercourses, riparian gallery forests, tropical deciduous forest, and arid tropical scrub (Hutto 1989); rarely in interior subtropical scrub and tropical evergreen forest (Binford 1989).

2.3 Ecology

2.3.1 Reproduction. Clutch size is 3 to 5 (usually 4) and incubation lasts 14 days. Young are tended by both parents, leave nest at 10-12 days, and remain with adults for 25-30 days more. Breeding season begins early April in south to late May in north of range. Both parents incubate eggs and tend young (Harrison 1978). In Kansas, two broods per season possible, but most pairs rear only one (Barlow 1962). Usually returns to same nesting territory in successive years (Franzreb 1989). More than 60 percent of male and 30 percent of female returning birds utilize the previous year's territories (Greaves 1989). Nest site occasionally found in same shrub as in previous years (Greaves 1987).

2.3.2 Territories. Breeding territory maintained primarily by song, except during early stages of nesting when displays and physical contact more prevalent. Males patrol territories between intervals of sitting on eggs. Mated males on territory may direct threat displays toward intruding males throughout breeding season. Males establish breeding territories through disputes with neighboring males involving physical contact and high-intensity singing (Barlow 1962). In Kansas, territory size was 0.5 ± 0.4 ha (mean ± SD, range = 0.1–1.3 ha, *n* = 9; Barlow 1962); 0.2–1.6 ha in California (Gray and Greaves 1984); and 0.7 ± 0.3 ha (0.3–1.3 ha, *n* = 13) in California (Collins et al. 1989). Birds in California and Arizona appear to exhibit site fidelity as some return to nest in shrubs within 1 m of last years nests (Graves 1987).

2.3.3 Predators. Because often nests near the ground, brooding adults and young are commonly depredated by various mammals and reptiles, including domestic cat (*Felis domesticus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*), dusky-footed woodrat (*Neotoma fuscipes*), deer mouse (*Peromyscus maniculatus*), house mouse (*Mus musculus*), rat (*Rattus rattus*; Brown 1993, Bent 1950), and various snakes (Cink 1977, Nolan 1960). Suspected or confirmed avian predators include greater roadrunner (*Geococcyx californianus*), American crow (*Corvus brachyrhynchos*), and scrub jay (*Aphelocoma californica*; Collins et al. 1989).

2.3.4 Parasitism. Observed rates of brood parasitism by Brown-headed Cowbirds (*Molothrus ater*) vary geographically, ranging from 6 percent in Grand Canyon, Arizona, to 69 percent in Kansas. Elsewhere, nonparasitized nests successfully fledge more young than parasitized nests (Barlow 1962, Brown 1993). Birds forced into fragmented habitat or marginal nesting areas are more vulnerable to parasitism. There is reason to believe, however, that large vireo populations in suitable habitat can maintain themselves in the face of cowbird parasitism (Robinson et al. 1995).

2.4 Species Status. Has seriously declined in several portions of range, particularly in arid southwest where endangered. Vulnerable to loss and fragmentation of riparian and dense scrub habitats, and to brood parasitism by brown-headed cowbirds. These factors continue to threaten remaining breeding populations. Breeding habitat restoration and cowbird control has led to population recovery in limited areas.

2.4.1 Population Trends. North American Breeding Bird Survey (BBS) data (1966-1995) indicate significant survey wide declines averaging 3.2 percent per year (n = 238 survey routes), with steepest regional declines in the BBS Central region (-4.8 percent average per year; n = 173). Steepest declines by state evident with *V. b. bellii* in Oklahoma (-8.3 percent average per year; n = 35), and more recently in Nebraska (-7.7 percent per year; n = 12; 1980-1995; Sauer et al. 1996). Several populations have been reduced or extirpated (Brown 1993). The Least Bell's Vireo, *V. b. pusillus*, was designated "endangered" by the U.S. Fish and Wildlife Service and the State of California in 1986 when about 300 pairs were identified (USGS 1999, Brown 1993).

Has expanded range and increased in some areas. In one California population, brown-headed cowbird removal is credited with an increase from 19 to 122 breeding vireos over eight years (Robinson et al. 1995). A management program on Camp Pendleton, which included cowbird control, increased vireos from 15 territories in 1980 to 259 in 1991 (USGS 1999).

3.0 Species Conservation

Abundance appears to be a function primarily of availability of suitable nesting habitat and secondarily of rates of cowbird parasitism. Land use patterns, particularly along streams and rivers (riparian habitat), strongly influence abundance in breeding range. In southwest U.S., riparian habitat modifications—including agriculture, urbanization, firewood cutting, grazing, flood control projects, and reservoir construction—have reduced habitat for this species. Modifications that promote habitat patchiness apparently increase rates of cowbird parasitism and act to segregate remaining breeding vireos into disjunct subpopulations that are more susceptible to local extinction (Franzreb 1989). Overgrazing suppresses shrub growth and reduces available nest sites and vireo density (by 50% in Oklahoma; Overmire 1963).

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the Bell's vireo on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

1. Provide early to mid-successional habitat through use of prescribed fire and mechanical means. Leave scattered tree thickets in fields to provide a dense understory for nesting habitat.

2. Prevent riparian habitat removal and re-vegetate riparian areas that have become modified.

3. Never burn, mow, or otherwise disturb an entire area in one breeding season because disturbance reduces available habitat for one or two growing seasons. In order to avoid destruction of nests, conduct management treatments before birds arrive in the spring (15 April) or after the young have fledged (15 September).

4. Maintain native grasses and shrubs in fields and around field borders to discourage Brown-headed cowbird foraging areas.

5. Control Brown-headed cowbirds if parasitism rates become too high.

6. Efforts should be made to identify and prevent fragmentation of breeding habitats.

3.2 Management and Monitoring. No special management attention needed for apparently stable populations in eastern half of breeding range (Brown 1993), but those in central and western range would likely benefit from conservation of breeding habitat. Abundance is strongly influenced by land use patterns in breeding habitat, particularly in arid western regions where it is more limited by the quality and availability of riparian habitat than elsewhere. Removal of brown-headed cowbirds from breeding habitat during spring may be essential in some areas (Thelander and Crabtree 1994). Selective shooting and trapping of cowbirds, relocation of livestock facilities away from riparian areas, and reduction of grazing in riparian areas to maintain a dense understory are recommended, as well as revegetation of riparian areas to increase extent of nesting habitat and to deter cowbirds (Laymon 1987). Relocation or elimination of dairies, livestock feed lots, waste grain, bird feeders, and other cowbird attractants may reduce local parasitism rates. Periodic disturbance of riparian areas may be required to maintain the 5-10 year age structure of vegetation preferred for breeding. Scouring by flooding and river meandering rejuvenates gallery vegetation, an important factor in maintaining habitat (Franzreb 1990).

3.2.1 Management Requirements:

3.2.1.1 Mowing. Periodic mowing may be a viable option for maintaining habitat suitable for use, provided that mowing is done well after the breeding season is concluded and young and adults have dispersed.

3.2.1.2 Burning. Use of fire would help maintain the 5-10 year age structure and maintain the mid-successional habitat for breeding. Fire prescriptions should include leaving unburned thickets for breeding habitat. Prevent forest from succeeding to late seral stage, which would preclude any breeding activity.

3.2.1.4 Monitoring Requirements. Annual monitoring of populations is recommended. Monitoring should include breeding habitat assessments, distribution, demographics, and long-term population trends.

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Conservation Plan for the Blue-winged Warbler (*Vermivora pinus*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. Adult male has a bright-yellow crown and underparts, bold black eye-line, greenish-yellow back and nape, bluish-gray tail and wing, and 2 distinct, white wing-bars often tinged with yellow (Dunn and Garrett 1997). Female is similar to male, but slightly duller overall, with distinctly more olive crown and grayer eye-line. Wing-bars are often not as pronounced in females.

1.2 Juveniles. Juveniles are olive colored with an indistinct eye-line. Wing-bars are typically tinged with yellow (Pyle 1997).

1.3 Eggs. The eggs are white with fine, sparse spots of brown or gray, usually at the larger end (Harrison 1975). Average egg size (n=21) was 15.7 x 12.3 mm (Gill et al. 2001) and eggs are generally sub-elliptical in shape.

1.4 Nests. Nest sites are usually on or near the ground. Shape of the nest is round and sprawling, similar to Golden-wing warblers, but less bulky. Nests are narrow and deep, typically at the base of a grass clump or weed stems (Harrison 1975). The outer portion of the nest consists of dead leaves with some leaf tips hanging over the nest (Bent 1953). A nest cup consisting of coarse grasses, grapevine bark (Vitis spp.), bark strips of Viburnum spp., and dead leaves is woven into the outer portion. Inner lining consists of fine plant material (bark strips, grass stems) and occasionally horsehair (Gill et al. 2001).

1.5 Vocalizations. Vocalizations have been studied extensively (Gill et al. 2001). Primary song, which is mainly used in mate selection, is a harsh or wheezy “Beeee Buzzzz” (NGS 1987). A secondary song, primarily used for territorial defense, is described as a trill buzz (Kroodsma 1988). Other vocalizations include bill snapping during fights (Ficken and Ficken 1966).

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. Breeds north to southeastern Minnesota, central Wisconsin, central Lower Peninsula of Michigan, southern Ontario, north central New York State (south of Adirondack Mountains), central Vermont, central New Hampshire, and (recently) extreme southern Maine (Dunn and Garrett 1997). Breeds south of Minnesota through eastern and south central Iowa and Missouri (although very local in northwest) to extreme northeastern Oklahoma, northern Arkansas, and Tennessee. From Maine, breeds south along

Figure 1. Breeding and Wintering range of the Blue-winged warbler (Dunn and Garrett 1997).

Atlantic Coast to southern New Jersey, northernmost Delaware, northern Maryland, western Virginia,Tennessee, extreme southwestern North Carolina, northernmost Georgia, and northern half of Alabama. The breeding range has become highly fragmented; populations are largely absent from Mississippi lowlands of western Tennessee and western Kentucky, from mountains of eastern Tennessee, and eastern West Virginia, and very local in western Virginia. Also, missing in heavily agricultural portions of central Illinois, northern Indiana, western Ohio, and from portions of central Pennsylvania (Dunn and Garrett 1997).

2.1.2 Non-breeding. Winters from southeastern Mexico south along Atlantic slope of Mexico and Central America to central Panama. Winters south to northern Oaxaca and northern Chiapas, Mexico, and the northern halves of Guatemala, Honduras, and Nicaragua. Very uncommon to rare in Costa Rica (Stiles and Skutch 1989) and rare in lowlands and foothills of western and central Panama (Wetmore et al. 1984, Ridgely and Gwynne 1989). Rare in Greater Antilles, Bahamas, and Cayman Is. (Arendt 1992, Wunderle and Waide 1993, Raffaele et al. 1998); occasional to accidental vagrant in Lesser Antilles (Raffaele 1989, Evans 1990). Uncommon, new winter resident in Bermuda, where not recorded in winter prior to 1974–1975 (Amos 1991). Infrequent reports in North America from National Audubon Society Christmas Bird Counts (CBCs) over last 2 decades.

2.2 Habitat

2.2.1 Breeding. Breeding habitat usually consists of early to mid-succession habitat (Berger 1958, Confer and Knapp 1981, Will 1986, Buckelew and Hall 1994). Blue-winged warblers can be found in shrubby, second-growth, and open woods habitat. Most habitat descriptions refer to use of saplings or forest edge or forest clearings and dense shrub or dense thickets. In greater than 50 territories throughout New York, patches of dense, herbaceous growth and shrubs, with some forest cover observed in all territories measured. Breeding typically restricted to lower elevations (Gill et al. 2001). Blue-winged warblers preferred clearcuts with dense shrub cover (0.5-1.5m), smaller canopy height (<7m), and close to roads or power line right-of-ways in Connecticut (Zuckenberg 1998). Birds were not sensitive to the size of clearcut.

2.2.2 Non-breeding. During migration found in open woods and shrubby habitat similar to breeding grounds. Winter habitat includes low to mid-level elevation moist evergreen and semi-deciduous forest and edge (Howell and Webb 1995, Rappole 1995). In lowland and coastal Panama, winter habitat includes woodland and forest borders (Ridgely and Gwynne 1989). Winter habitat use in Honduras consists of second growth, scrub, forest edges, and occasionally open rain forest (Monroe 1968). In Costa Rica, wintering birds prefer second growth, semi-open forest, and hedgerows (Stiles and Skutch 1989). Blue-wings were found in dry, moist, and wet forests in the Yucatan Peninsula (Lynch 1989, 1992; Greenberg 1992).

2.3 Ecology

2.3.1 Reproduction. It is generally considered a single brooded species as no confirmed evidence of second broods. Nests are built almost entirely by females, although males have been documented assisting (Harrison 1975). Nest typically completed in 2-5 days (Will 1986). Clutch size is usually 4-5 eggs (Bent 1953, Harrison 1975). Egg-laying begins day after completion of nest. Only the female incubates during the 11-12 day incubation period (Harrison 1975, Will 1986). Most clutches are completed by late May or early June (Gill et al. 2001). Only the female broods throughout the 8-10 day nestling period (Will 1986). The male assists in the nestling feeding, especially during the first few days.

2.3.2 Territories. Occurs in loose colonies in tracts of 10 ha or more in the Northeast U.S. (Confer and Knapp 1981). Territory size averaged 1.1 ha (range 0.3–5.0 ha, n = 34) in northeast Ohio (Canterbury et al. 1995). Male responds strongly to presence and/or song of other species as well as playback of Blue-winged warbler song (Gill and Lanyon 1964; Crook 1984; Canterbury 1994). Tall trees and other edges provide territory boundaries and are reinforced by interactions with neighboring males (Canterbury 1996). Blue-winged warblers share overlapping territories with golden-winged warblers when the two species occur together and occasionally hybridize to form either the Brewster's or Lawrence's hybrids.

Breeding site fidelity rates included 31% (16 of 51 males) in south West Virginia (Gill et al. 2001), 40% (6 of 15 banded males) in central Michigan (Murray and Gill 1976), 44% (8 of 18 color-banded males) in north-central New York (Gill et al. 2001), and 59% (10 of 17 males) in central Michigan (Will 1986). Return rates for females appear to be lower, but their secretive behavior makes it harder to detect them. A return rate of 10% was documented for females in central Michigan (Will 1986), and a return rate of 14.3% (1 of 7) was found in south West Virginia (Gill et al. 2001).

2.3.3 Predators. Known predators on adults include Sharp-shinned hawk (Accipiter striatus) as well as

other raptors (Gill et al. 2001). Blue Jays (Cyanocitta cristata), American Crows (Corvus brachyrhynchos), and small mammals, especially eastern chipmunk (Tamias striatus), consume eggs and nestlings.
2.3.4 Parasitism. Brown-headed cowbird (Molothrus ater) is the only known brood parasite. Parasitism is common, however rates vary for different habitats. 8 of 12 (67%) nests were parasitized in highly fragmented habitats of urbanized landscapes in northeastern Ohio, but only 1 of 212 nests in intact habitats of south West Virginia (Canterbury et al. 1995). Cowbird parasitism reduces reproductive success and nestling growth rates, lengthens development period and increases juvenile mortality.

2.4 Species Status.

Blue-winged Warbler ranks as a Watch List Species in the Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004). This species also ranks at a moderate conservation priority in most states and physiographic areas throughout its range. States with higher conservation concern scores and greater population declines include Connecticut, New Jersey, Ohio, Kentucky, and Alabama.

2.4.1 Population Trends. Populations appear to be stable range-wide with the breeding range expanding to the north and eastward (Robbins et al. 1989). Abandoned farmland and forest clear-cuts have aided in the range expansion over the last century. From 1966 to 1993, Breeding Bird Survey (BBS) data shows a slight, insignificant increase overall of 0.21%/year (Peterjohn et al. 1994). However, certain populations have shown significant decreases during a similar time period. Alabama (-7.6%/yr), Connecticut (-2.8%/yr), Kentucky (-8.7%/yr), and New Jersey (-5.5%/yr) all had significant decreases between 1966 and 1996 (Sauer et al. 1997).

3.0 Species Conservation

Population declines have been attributed to the loss of early to mid-successional breeding habitats, either from encroaching urbanization or succession to shrublands and forests. As is the case with most declining migrants loss of breeding habitat is accelerating due to increasing human sprawl. For example, there are no Blue-wings on 9 former study sites in northeast Ohio due to new housing developments (Gill et al. 2001). Conversion of old fields for development and decreased abandonment of farmland has also reduced the early successional habitat. Habitat appears to be more stable on the wintering ground as tropical deforestation has not increased (Rappole and McDonald 1994).

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the Blue-winged warbler on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

3.1.1 Provide early to mid-successional habitat through use of prescribed fire and mechanical means. Leave scattered large trees to provide an shaded field habitat.

3.1.2 Never burn, mow, or otherwise disturb an entire area in one breeding season because disturbance reduces available habitat for one or two growing seasons. In order to avoid destruction of nests, conduct management treatments before birds arrive in the spring (15 April) or after the young have fledged (15 September).

3.1.3 Maintain native grasses and shrubs in fields and around field borders for breeding habitat. Removal of woody vegetation is needed when it becomes too thick.

3.1.4 Control Brown-headed cowbirds if parasitism rates become too high.

3.2 Management and Monitoring. Research on conservation of shrubland birds, however, is critically needed because of advancing succession and suburban sprawl.

3.2.1 Management Requirements:

3.2.1.1 Mowing. Periodic mowing may be a viable option for maintaining grasslands suitable for use, provided that mowing is done well after the breeding season is concluded and young and adults have dispersed.

3.2.1.2 Burning. Use of fire for habitat maintenance is required. Temperate grasslands require occasional fires to stimulate growth and retard woody invaders. Fire prescriptions should include unburned areas to leave residual cover for the following breeding season.

3.2.1.3 Removal of Woody Species. Shrubby second-growth vegetation is optimal breeding habitat for this species. However, if the vegetation is allowed to progress to a young forest, then this woody growth will eventually eliminate habitat. Grasslands, hayfields, and fallow pastures, with some invasion by woody species, provide good breeding habitat.

3.2.1.4 Monitoring Requirements. Annual monitoring of populations is recommended. Monitoring should include breeding and winter habitat assessments, distribution, demographics, and long-term population trends.

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Conservation Plan for the Henslow's Sparrow (*Ammodramus henslowii*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. Characterized by large flat head, large gray bill, and short tail. The head, nape, and most of the central crown stripe are olive-colored, with the wings extensively dark chestnut. The breast is finely streaked. When flushed, the bird flies low and jerkily, with a twisting motion of the tail. Otherwise, it is shy and secretive, with its presence most often revealed by its song (Peterson 1980, National Geographic Society 1987). The sexes have similar appearances. A cloacal protuberance (male) and brood patch (female) are reliable indicators of sex for living birds in the hand during the period from May through September (Pyle et al. 1987).

1.2 Juveniles. Juveniles are clay-colored above and streaked on the head and back with black. Below, a faint yellow with tinges of buff on the chin and throat. The sides of the throat are typically unstreaked although occasional streaking may occur (Roberts 1949).

1.3 Eggs. The eggs are approximately 18.3 x 14.4 mm in size (Graber 1968) and are white with spots or blotches of brown, mostly at the larger end.

1.4 Nests. Nests can be either open or domed and they are located from 0-50 cm above the litter (Hyde 1939, Robins 1971, Flanigan 1975). Those nests that are off the ground are attached to grass or forb stalks. Hyde (1939) describes a "typical" domed nest in southern Michigan as being located at the base of a clump of grass with dead grass from the clump forming an arched roof over the nest. The single entrance is located at an oblique angle on the side of the nest. Occasionally a nest is placed in a depression in the ground (Johnsgard 1979), but most are at least two cm above the substrate. The nest is loosely woven with dead grass and lined with finer grasses and hair.

1.5 Vocalizations. The song is distinctive and diagnostic: a short, quiet "see-lick," accented on the second syllable (Peterson 1980, National Geographic Society 1987). Sometimes sings on quiet nights. Given this bird's secretive nature, an ability to identify its song is essential for reliable census and survey work.

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

Figure 1. Breeding and Wintering range of the Henslow's sparrow.

2.1.1 Breeding. Locally from southeastern South Dakota (at least formerly), across the Great Lakes region of the eastern U.S. (southeastern Minnesota, north-central Wisconsin, northern Michigan) and southern Canada (southern Ontario, formerly southern Quebec) to New England (northern New York where now extirpated in most areas), south to central Kansas, northeastern Oklahoma, southwestern and central Missouri, southern Illinois, northern Kentucky, central West Virginia, eastern Virginia, and northern Tennessee, central and eastern North Carolina; formerly in eastern Texas.

2.1.2 Non-breeding. Coastal states from South Carolina south to Florida, west to Texas, casually north to Illinois, Indiana, New England, and Nova Scotia (Smith 1992, AOU 1998).

2.2 Habitat

2.2.1 Breeding. Open fields and meadows with grass interspersed with weeds or shrubby vegetation, especially in damp or low-lying areas, adjacent to salt marsh in some areas. Uses unmowed hayfields (abandoned if cut). Found in a variety of habitats that contain tall, dense grass and herbaceous vegetation

(Smith 1968, 1992). Graber (1968) found that their habitat was usually quite dense from 30-61 cm off the ground and reported them to be "adapted" to unmowed hayfields.

2.2.2 Non-breeding. In migration and winter also occurs in grassy areas adjacent to pine woods or second-growth woods. No detailed descriptions or studies of the habitat requirements of the winter range are available.

2.3 Ecology

2.3.1 Reproduction. Two broods of young per breeding season (Hyde 1939), perhaps three (Robins 1971), are raised. The female does most or all of the nest-building, taking five to six days to complete the process. Clutch size is from three to five eggs. First clutches are normally completed by 20-30 May in the central part of the range (Hyde 1939, Graber 1968). Second nests are initiated in July and August with some extending into September (Robins 1971). Only the female incubates the eggs and broods the young. The incubation period lasts about 11 days and the young stay in the nest nine to ten days. Females make most of the feeding trips during the first four or five days of the nestling period and about 50% of the trips during the latter half (Robins 1971). Young are tended by both parents, leave nest at 9-10 days.

2.3.2 Territories. Territory boundaries not well-defined (Ehrlich et al. 1992). Have been reported to nest in loose "colonies" with contiguous territories (Hyde 1939, Wiens 1969, Johnsgard 1979), although Robins (1971) found that most of the territories in his study area were separated by buffer zones where no breeding sparrows occurred. The average size of a territory ranges from 0.3 ha in southwestern Michigan (Robins 1971) to 0.6 ha near Madison, Wisconsin (Wiens 1969). Territory size has been reported to increase through the summer (Robins 1971, Johnsgard 1979), although this may reflect movements of adults in response to the wanderings of recently fledged young that still require parental care. Robins (1971) found that the average territory size was smallest and the population density highest in areas with the tallest and densest vegetation.

Conclusions regarding territory size and management strategies based on published information about territory size need to be interpreted with caution, since it is well known that territory size in many songbirds is closely related to the availability of food. When food is easily available, territory size tends to be smaller than when food is scarce. Likewise, although it is widely reported in the literature that Henslow's sparrows are colonial, it does not appear that they are more colonial than other sparrows. The fact that larger numbers tend to occur in more suitable habitat does not necessarily imply that this bird is colonial in the true sense of the word as it usually is applied to herons, gulls, terns, or colonially nesting swallows. The "clumping" may be a secondary effect of the clumped nature of suitable habitat in most situations.

No specific data are available on site fidelity but several authors have commented that local populations tend to be unstable from year to year (Hyde 1939, Wiens 1969, Robins 1971). On the other hand, birds are reported to have bred consistently in some undisturbed, protected areas, like Hayden Prairie in Iowa (Ennis 1959) and Goose Lake Prairie in Illinois (Birkenholz 1983).

2.3.3 Predators. Potentially important predators include mammals, snakes, and birds of prey.

2.3.4 Parasitism. There have been very few reports of nests being parasitized by the brown-headed cowbird (*Molothrus ater)* (Hyde 1939, Robins 1971). Since nests are very difficult to find, the available data probably are insufficient to support any final conclusions regarding the frequency or intensity of cowbird brood parasitism and its potential effects on populations.

2.4 Species Status. The species decline apparently is related to loss of habitat due to encroaching urbanization, successional change to shrubland or forest, and use for row-crop agriculture. The main threat is most likely the loss of breeding habitat as agricultural grasslands are developed or abandoned and revert to shrublands and forests (Smith 1992). In the Midwest a switch in agriculture methods from hay production and grazing to intensive production of specialized crops (soybeans, corn, etc.) has been a major factor in habitat loss (Illinois Natural History Survey 1983). In the East, increasing urbanization and encroachment of woody species have been major factors. Fragmentation of suitable habitat into small widely scattered plots is another serious threat. The sparrow is rarely encountered on grassland fragments less than 100 hectares (Herkert 1994). Normal annual population fluctuations can be more dramatic on smaller preserves, reducing local populations to levels where random events could lead to local extirpation.

2.4.1 Population Trends. One of the fastest declining songbirds in North America. In Illinois, may have declined 94 percent between 1957-1979 (Herkert 1994). Has declined significantly across range and can no longer be considered common anywhere. This decline is apparently due to the loss of suitable grassland nesting habitat (Smith 1992).

North American Breeding Bird Survey (BBS) data indicate a large and statistically significant decline survey-wide for the period 1966 - 1998 (-8.1% per year, P = 0.00, N = 146) (Sauer et al. 1999). The decline appears greatest in the central portion of the breeding range and in the northeastern U.S. (USFWS 1987, Sauer et al. 1999). Given its rarity, BBS trend can only be estimated for four individual states: Michigan, New York, Ohio, and Wisconsin. In Illinois, Spring Bird Count shows 7.1 percent average annual decline 1975-1995 (Herkert 1997). Only non-significant increase in Ohio (3.7 percent annual change; P = 0.61; n = 11). Christmas Bird Counts also show negative trend survey wide (-0.15 percent annual change; n = 98; Sauer et al. 1996).

3.0 Species Conservation

The species breeds in a variety of grassland habitats with tall, dense grass and herbaceous vegetation. Nests are typically constructed on or near to the ground and are comprised of woven grasses. Populations have declined throughout the range, but remain most abundant in the north and western portion of its range. Population declines have been attributed to the loss of grassland breeding habitats, either from encroaching urbanization or succession to shrublands and forests. Intensive production of row crops also reduces or eliminates the use of hay fields and grazing land. Fragmentation of grasslands into patches less than 30 ha in size may also preclude use. Therefore, a minimum area of 30 ha or more of contiguous grassland habitat should be preserved at any site. Breeding populations should be monitored annually in

localized areas that are inhabited. Management activities that enhance grassland productivity such as mowing and burning should be encouraged, but units subject to these management efforts should not be disturbed from mid-May through August. Management regimes that produce dense and moderately tall grassy vegetation (> 30 cm) from mid-May through mid-August should be considered. In general, mowing and/or burning may be needed to maintain habitat in the long term but may be detrimental to local populations in the short term. Woody species should be removed.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the Henslow's sparrow on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

1. Where possible, provide > 30 ha of contiguous grassland. If contiguous management units are not available, provide a complex of smaller units located near enough to one another to facilitate colonization from adjacent territories in available habitat. Grassland restoration areas should be > 50 ha and preferably > 100 ha in size.

2. Never burn, mow, or otherwise disturb an entire area in one breeding season because disturbance reduces available habitat for one or two growing seasons. In order to avoid destruction of nests, conduct management treatments before birds arrive in the spring (15 April) or after the young have fledged (15 September).

3. Provide dense and moderately tall (> 30 cm) grassy vegetation. Removal of woody vegetation is needed when it becomes taller than the fully grown herbaceous vegetation.

4. Prevent encroachment of woody vegetation with periodic prescribed fire. Use a rotational burning program in which 3-4 adjacent tracts of prairie are burned on a 2-3 yr cycle; incidental observations suggest that each patch should be 30 ha. Prescribed burns should be conducted in early spring (March to early April) or late fall (October and November). These intervals will allow vegetation to recover between disturbances to provide suitable habitat while keeping succession in check.

3.2 Management and Monitoring. Efforts should be made to identify and prevent fragmentation of breeding habitats. Samson (1980) estimated fields of 10-100 ha as the minimum area required to support a viable breeding population. The indications from recent work, that size is important in habitat choice, may be confounded by the fact that the bird is declining. During periods of decline, a species is less likely to saturate the available habitats and may occupy only the highest quality sites (O'Connor 1981), giving an inaccurate impression of the range of habitats it potentially may occupy at higher population densities. During the 2009 breeding season a complete survey of all fields with potential Henslow's sparrow habitat was conducted to get a better estimate of the population. A count of 288 Henslow's sparrows was recorded in on the base and entered into GIS.

3.2.1 Management Requirements:

3.2.1.1 Mowing. Periodic mowing may be a viable option for maintaining grasslands suitable for use, provided that mowing is done well after the breeding season is concluded and young and adults have dispersed.

3.2.1.2 Burning. Use of fire for habitat maintenance is required. Temperature grasslands require occasional fires to stimulate growth and retard woody invaders. Fire prescriptions should include unburned areas to leave residual cover for the following breeding season.

3.2.1.3 Removal of Woody Species. If allowed to progress to a shrubland seral stage, encroaching woody species will eventually eliminate habitat. It appears that grasslands, hayfields, and fallow pastures are optimal habitats, and that some invasion by woody species will be tolerated. Henslow's sparrows are believed to be disappearing because of conversion of old fields to forest. A reversal of this process may help the bird.

3.2.1.4 Monitoring Requirements. Annual monitoring of populations is recommended. Monitoring should include breeding and winter habitat assessments, distribution, demographics, and long-term population trends.

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Conservation Plan for the Kentucky Warbler (*Geothlypis formosa*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. A short-tailed, long-legged warbler. Bold yellow spectacles separate black crown from black on face and sides of neck; underparts are entirely yellow, upperparts bright olive. Sexes are similar, but black areas are duller or smaller on most females (Dunn and Garrett 1997, Sibley 2000). Lacks wing-bars and tail-spots. Adult plumages remain fairly constant throughout the year. Walks rapidly over ground overturning leaves with bill, searches under sticks and in crevices, leaps up to snatch insect or spider from overhanging leaf or branch (Terres 1980).

1.2 Juveniles. Juveniles are similar to adult females; the blackish coloration in the head pattern are mostly replaced by dark olive.

1.3 Eggs. The slightly glossy, smooth shell is short-oval to long-oval and white to creamy white in color, and blotched, dotted, or spotted with grays and browns, usually concentrated at the large end (Harrison 1978). The average size is 18.6 x 14.3 mm and the clutch size ranges from 3-6 (average 4).

1.4 Nests. Nests are built on or just above the ground at the base of a tree or shrub, or low in understory vegetation. They consist of a cup of grasses, plant fibers, and rootlets built on a bulky foundation of dead leaves 10-15 cm deep. Nests are lined with rootlets, weed stalks, and grasses (De Garis 1936). Nests are usually hidden by overhanging vegetation or fallen branches (Harrison 1978).

1.5 Vocalizations. Song is a series of rolling, rich quality musical notes: "churry churry churry" with each "churry" repeated about six times and low in pitch. Call note is a low, sharp "chuck" (NGS 1987).

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. Northern limits of the breeding range include southeastern Nebraska, east across central Iowa, southwestern Wisconsin, northeastern Illinois, central Indiana, north-central Ohio, southern Pennsylvania, northern New Jersey, and southeastern New York, to southwestern Connecticut, south to Texas, Gulf Coast to northwestern Florida, central Georgia, and South Carolina, and west to eastern Kansas and central Oklahoma (AOU 1983).

Figure 1. Breeding and Wintering range of the Kentucky warbler.

2.1.2 Non-breeding. Winters in tropical zones of southern Veracruz and Oaxaca, through Chiapas, the base of the Yucatan Peninsula, primarily on the Caribbean slope of northern Central America, throughout Costa Rica and Panama, and into northern Colombia and northwestern Venezuela (AOU 1983, McDonald 1998). Uncommon transient through the West Indies; some may overwinter on eastern and southern West Indies islands (McDonald 1998).

2.2 Habitat

2.2.1 Breeding. Breeds in humid deciduous forest (Hamel 1992), dense second growth, and swamps. Occurs in stands of various ages but is most common in medium-aged forests (Shugart et al. 1978). Prefers forests with a slightly open canopy, dense understory, and well-developed ground cover (Bushman and Therres 1988). Seldom found in conifers. In Virginia, McShea et al. (1995) found that forest type, streams, and low density of deer were significant variables in territory selection, but forest age (within a reasonable span of years) and the presence of a habitat boundary did not contribute significantly. Specifically, warblers selected cove hardwoods and avoided oak/hickory overstory.

2.2.2 Non-breeding. In migration, habitats include forest, woodland, scrub, and thickets. In winter, habitat includes the floor of rain forests; also second growth, forest edge, undergrowth (AOU 1983, Bushman and

Therres 1988). This species was found in wet forest (most commonly), moist forest (less commonly), and dry forest (rarely) on the Yucatan Peninsula (Lynch 1992); birds were also captured in mid-successional Acahual habitat. From studies in various Latin American countries, Robbins et al. (1992) concluded that wintering birds are ground foragers that require forest. Some birds were found in early successional habitats, but only an occasional bird was captured in pine woods or agricultural habitats. In Belize, found to prefer broadleaved forest edge and interior habitats (Petit et al. 1992).

2.3 Ecology

2.3.1 Reproduction. Breeding activity begins in early May after arriving back on their breeding ground. Female Kentucky warbler selects nest site and builds nest, while male defends territory. Nests are like those of the golden-winged warbler (*Vermivora chrysoptera*), but unlike many ground-nesting birds, the Kentucky warbler usually builds a nest slightly above ground level (Harrison 1975). Eggs are laid in May and June with the peak occurring in the second and third weeks of May (Nicholson 1997). The clutch size is 3-6 (usually 4-5) and females will incubate 12-13 days (Bent 1953). Tennessee clutches average 4.4 eggs (n = 48, s.d. = 0.82), which is very close to the range-wide average of 4.5 eggs (Nicholson 1997). Young are tended by both parents and leave the nest before they can fly at 8-10 days. Juveniles are fed by adults for up to 17 more days after fledging. Females have one brood typically, but sometimes two (Harrison 1975).

2.3.2 Territories. Territory sizes were found to differ significantly between forest tracts of different size by Wenny et al. (1993): territories averaged 0.8 ha in a large forest (> 800 ha) and 1.08 ha in two smaller fragments (300 ha). In Virginia, territory sizes ranged from about 0.8 to 2 ha; for nearly all territories considered individually, configuration (boundaries) and size remained nearly constant over the 14-year study. With few exceptions, the same male returned to and occupied a given territory for as long as he lived, although returning females did shift from year to year (McDonald, unpubl. data). Kentucky warblers were found to be territorial in winter (Stiles and Skutch 1989, Mabey and Morton 1992). Individuals commonly return to the same winter territory in successive years (Rappole and Warner 1980).

Gibbs and Faaborg (1990) found an average 2.2 males per 10 ha in larger forest tracts compared with 1.4 males per 10 ha in smaller fragments. Whitcomb et al. (1981) reported a territorial density of 36 males per sq km in Maryland. In Virginia, densities of 30-55 pairs were observed over the years 1988-1997 in the 1200 ha core area of suitable habitat at the study site (McDonald 1998). Winter density was up to 5.5 birds per 10 ha in Panama, around 30 per 10 ha in Veracruz, Mexico (Mabey and Morton 1992).

2.3.3 Predators. Predation on nests is probably more common than usually realized because the parents simply start re-nesting within a week unless the nest was destroyed very late in the season (McDonald, unpubl. data). Bent (1953) stated that snakes and other prowling predators have been known to rob nests. At McDonald's site in Virginia, about one-fourth of the nests were depredated before fledging. Indirect evidence, including disturbance of the nest cup, and the results of experiments at the same site on artificial nests, suggest that the major predators at this site are small mammals (e.g., eastern chipmunk (*Tamias striatus*) and medium-sized mammals (raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*), and opossum (*Didelphis virginiana*). It is not unlikely that snakes and corvids also prey on these nests (McDonald, unpubl. data). The only documented cases of predation on adults include a bizarre report of one being captured and consumed by a box turtle (*Terrapene carolina*) and McDonald's finding remains of a banded

female at her nest of four 7-day-old nestlings, also mostly consumed. A medium-sized mammalian predator, such as a raccoon or opossum, common at the Virginia site, were suspected in the latter predation event.

2.3.4 Parasitism. According to Bent (1953), the Kentucky warbler is a common victim of the brown-headed cowbird (*Molothrus ater*); in parts of Pennsylvania, historical records cite the warbler as the commonest victim of the cowbird. More recently, Robinson (1992) documented brood parasitism by cowbirds, although his data, as well as McDonald's in Virginia, indicate that ground-nesters appear to be less susceptible than shrub-nesting species. Of six nests in central Illinois, two were parasitized with an average 0.8 cowbird eggs per nest and an average 3.0 cowbird eggs per parasitized nest (Robinson 1992). In total, three warblers and one cowbird were raised; in no cases were warblers and cowbirds raised together at the Illinois site. At McDonald's Virginia site, the intensity of cowbird parasitism over 14 years has varied annually from 0% to about 15% of the known nests and fledged families. No correlates have been identified, however, to account for this variation (McDonald, unpubl. data). Unlike the Illinois study, in Virginia warblers and cowbirds were raised and fledged together successfully, with no species-specific survival differences.

A recent study conducted in 5 midwestern U.S. states concluded that Brown-headed Cowbird nest parasitism rates on Kentucky Warblers were so high in extensively fragmented forests that such forests were likely population sinks (Robinson et al. 1995). If this is true, then on a regional scale there must be enough recruitment of Kentucky Warbler young to maintain the apparently nondeclining adults censused annually in these areas.

2.4 Species Status. The Kentucky warbler was just added to the most recent Birds of Conservation Concern list for the Central Hardwoods Bird Conservation Region by the U.S. Fish and Wildlife Service (2008). This species has been hard-hit by losses of bottomland hardwood forests in the southeastern U.S. Major factors contributing to the losses include development, timber harvest, and agriculture. Recently, the loss of forest understory vegetation across large areas caused by browsing by an over-abundant White-tailed deer (*Odocoileus virginianus)* population has become a problem.

They are vulnerable to forest destruction on their tropical wintering grounds as well, in part because this species commonly inhabits interior mature forests (Wetmore et al. 1984). Most of its wintering range, Atlantic slope of Central America, is suffering from rapid deforestation. In addition, Kentucky warbler is territorial even in nonbreeding season, so only small numbers of individuals can coexist even in the most suitable habitat.

2.4.1 Population Trends. North American Breeding Bird Survey (BBS) data indicate a nonsignificant decline averaging 0.7% per year, 1966-1989 (Droege and Sauer 1990), a significant decline of 1.26% per year during 1966-1988, and a significant decline of 1.95% per year for 1978-1988; there was a significant population decline in central North America, 1966-1988, and a significant decline in eastern North America, 1978-1988 (Sauer and Droege 1992). A nonsignificant decline of 18% occurred between 1966 and 1993 and a significant decline of 20% occurred from 1984 to 1993 (Price et al. 1995). James et al. (1992) reanalyzed BBS data for the southeastern and south-central U.S. over the period 1966-1987 using an alternative analysis designed especially for BBS data. The Kentucky warbler, which was especially numerous in the Cumberland Plateau, shows a peak and then a decline. Elsewhere in the uplands this

species has been in general decline, most apparently so in the Ridge and Valley. Increases in the lowlands are offset by decreases in the highlands; as a result, the overall population in the region has been stable.

3.0 Species Conservation

The Kentucky warbler has been classified as a forest interior species, with its probability of occurrence increasing with the size of the woodland (Whitcomb et al. 1981, Robbins et al. 1989). Declines might be influenced by resources in winter or by forest fragmentation. Loss of forests (both on the wintering and breeding grounds) is the most immediate threat. Cowbird parasitism and predation may also contribute to declines.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the Kentucky warbler on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

3.2 Management and Monitoring.

3.2.1 Management Requirements:

1) Where possible, allow the growth of large contiguous tracts of deciduous forest. Forest restoration areas should be >300 ha and preferably >1000 ha in size. All forested stands should minimize forest roads and/or openings to reduce nest parasitism by the brown-headed cowbird.

2) Forest management practices that encourage a dense understory and well-developed ground cover should enhance forest stands for this species.

3) Timber harvesting techniques such as group selection, small or narrow clear-cuts, thinning of overmature trees, and selection-cutting are acceptable practices Because Kentucky Warblers are tolerant of openings in canopy. However, Kentucky warbler numbers actually declined after selective logging practices in Indiana (Adams and Barrett 1976).

4) Light timber stand improvement should also be acceptable to Kentucky Warblers.

5) Clear-cutting temporarily removes habitat for Kentucky Warbler, but regenerating forest may be reoccupied after 6–7 yr in Virginia (Conner and Adkisson 1975, McDonald 1998).

6) Monitoring Requirements. Annual monitoring of populations is recommended. Monitoring should include breeding habitat assessments, distribution, demographics, and long-term population trends. Detection of unmated males through unique singing behaviors they exhibit should be incorporated into monitoring programs. Presently no information exists on what proportion of the singing males in an area are unmated; estimates of breeding abundance may be inflated. It would also be useful to monitor vegetation changes at the survey sites.

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Conservation Plan for the Prairie Warbler (*Setophaga discolor*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. Small brightly colored wood warbler with a long narrow tail. Adults have a bright yellow supercilium and underparts with olive coloring on the upperparts and a chestnut streaked back (Dunn and Garrett 1997, Sibley 2000). Prairie warblers have a yellow patch under the eye, with a black line through the eye, bordered by a black strip below. The sides and neck have black streaks and the birds have 2 pale, yellow wing bars. Sexes are alike, but females are slightly duller in color. Warblers generally seen along lower branches and tops of brush and often twitches its tail (NGS 1987).

1.2 Juveniles. Juveniles have brownish upperparts and buffy wing bars (Pyle 1997). Immatures are yellowish below with slight black streaks on side and dark arc under eye (Sibley 2000).

1.3 Eggs. New eggs are translucent with a slight gray or off white color (Palmer 1962). Spots on eggs are brownish, chestnut-colored, or reddish with occasional wreathing close to the large end. Eggs are approximately 16.0 x 12.3 mm giving them a short oval shape (Nolan 1978).

1.4 Nests. Nests are usually placed in a shrub, sapling, or thicket between 1-10 feet up, occasionally up to 25 feet (Baicich and Harrison 1997). Nest is a compact cup with the rim slightly constricted. The nest is composed of plant fibers, small dead leaves, fine grasses, bud-scales, and plant down (Baicich and Harrison 1997). Nest materials are held together with spiders' webs and cup lined with hair and feathers.

1.5 Vocalizations. Song is a distinctive buzzy set of rising "zee" notes (Peterson 1980). Call notes, which are used by both sexes, are primarily single notes sounding like "chek" (Nolan et al. 1999). Occasionally call notes fuse into loud sputters, rattles, squawks, and twitters when the bird is surprised or very excited. "Tsip" is a common alarm note.

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. The northern limits of the breeding range include southernmost Maine; southern halves of New Hampshire, Vermont, and New York (locally); northwestern Pennsylvania; southern halves of Ohio and Indiana; southernmost Illinois; and southern half of Missouri (Dunn and Garrett 1997). Breeds south to northernmost Florida, southern Alabama, southern Mississippi, south-central Louisiana, and southeastern Texas. Breeds west to eastern Texas, eastern Oklahoma, and easternmost Kansas (extremely local).

Figure 1. Breeding and Wintering range of the Prairie warbler.

2.1.2 Non-breeding. Winters in Florida throughout most of the state except the panhandle east to the Atlantic coast (Stevenson and Anderson 1994), Bermuda (Amos 1991), Bahamas, Greater Antilles, Virgin Islands, and Cayman Islands (Raffaele et al. 1998). Also, winter sightings, although rare, are reported along the coasts of Georgia, South Carolina, and North Carolina (Dunn and Garrett 1997).

2.2 Habitat

2.2.1 Breeding. Breeds in various shrubby, second-growth habitats lacking closed canopies (Nicholson 1997, Nolan 1999). Typical habitats include southern pine (*Pinus*) forests with shrub layer present; dunes along Atlantic Coast and Great Lakes; mangroves of varying density; barrens (pines and scrub oak [*Quercus*], often sandy and maintained by fire); abandoned fields or pastures with shrubby growth; regenerating forest; abandoned orchards; field edges (Nolan 1978).

2.2.2 Non-breeding. Winters in early second-growth to mature forest edge (Wunderle and Wade 1993); pines, semiarid vegetation (Terborgh and Faaborg 1980); scrub, broadleaf evergreens (i.e., coppice; Emlen 1977, Rappole et al. 1983); mangroves; gardens; coffee fincas (Lack and Lack 1972); low, open-canopy,

second-growth forests with dense understory (Stacier 1992). Prairie warblers are rare or absent in mountains on the wintering ground (Lack and Lack 1972).

2.3 Ecology

2.3.1 Reproduction. Pairs form in late April to early May after arriving back on their breeding ground. Female Prairie warbler selects nest site and builds nest. The average first nest initiation dates fall between 30 Apr–12 May (*n* = 9 yr, ≥5 females studied; Nolan 1978). Female builds nest in a small tree or shrub typically in 3-5 days. Nest is placed in an upright fork of a branch, against the trunk at the base of a twig, or on a horizontal or diagonal branch (Nicholson 1997). Tree species used to support Prairie warbler nests in Tennessee include elm, oak, red cedar, pine, red maple, and blackberry (Nicholson 1997). Clutches typically average 4 eggs (range 3-5; Nolan 1978) with egg laying peaking in mid-May in Tennessee (Nicholson 1997). The female incubates the eggs for 12 days and nestlings are tended for another 9-10 days before fledging. Both adults feed the nestlings. This warbler is primarily single brooded, however some second broods have been reported.

2.3.2 Territories. All territory data based upon Nolan (1978). Male Prairie warblers defended territories based upon vegetation age and structure. In Indiana on adjacent tracts, territories in younger successional habitat averaged 1.62 ha ± 0.72 SD (0.5–3.5 ha, n = 111) while territories in older habitat (more and larger trees) averaged 1.47 ha ± 0.47 SD (0.4–2.4 ha, n = 60). Mean annual territory size in Indiana varied inversely with population density. Territories in the literature have been reported as small as 0.47 ha (85 pairs/40 ha tract) in Maryland and 0.24 ha on island in Georgia. Territories of young males were smaller. Territory sizes were correlated with shape in Indiana: thinner territories were larger and more rounded ones were smaller. Territories were larger when next to unsuitable habitat. Winter territoriality is inconclusive and needs further study (Stacier 1992).

Males show considerably more site fidelity than females, though males often wander well beyond their territory boundaries (Nolan 1978). Site-faithful males and females tend to be consistent and arrive relatively early or relatively late each year (Nolan 1978). In winter in Puerto Rico, September-March, individuals showed strong site fidelity within and between seasons (40% returned the next winter; Stacier 1992).

2.3.3 Predators. The most common predators of eggs and nestlings were snakes and chipmunks (Nolan 1978). Predation on adults during the breeding season appears to be rare in Indiana with females only occasionally killed on the nest by Red-winged Blackbirds (*Agelaius phoeniceus*) and rats (*Rattus* sp.; Prather and Cruz 1995). Nolan (1978) estimated the reduction of annual production by nest predation in Indiana was about 40%; by cowbirds, about 13%. Annual adult mortality was 35% in Indiana population.

2.3.4 Parasitism. Nests are parasitized by Brown-headed Cowbirds (*Molothrus ater)* throughout most of its breeding range (Nolan 1978). There appears to be a positive correlation between parasitism rates and nest heights. Cowbirds occasionally remove or break host eggs. Prairie warbler hatching success is not affected by parasitism (Nolan 1978).

2.4 Species Status. Severe declines recently have resulted in the Prairie warbler being included on the Partners in Flight Watchlist and the Audubon Watch list. The relatively restricted geographic area of the breeding and wintering range and the high likelihood of threats to the habitats they occupy are major factors in the listing. The subspecies, *Dendroica discolor paludicola*, is listed as a species of special

concern in Florida where it inhabits mangroves. Habitat loss and fragmentation are the two major threats to this species. Prairie Warbler is among a suite of bird species of shrubby habitats that have shown some of the greatest declines of any habitat group. Destruction of mangrove forests for development in Florida is contributing to the decline there as well as encouraging increased parasitism from Brown-headed Cowbird, and to a lesser extent, Shiny Cowbird. Habitat loss in the wintering range due to cutting wood, development, and agriculture may also be tied to this species' decline. Since the Prairie Warbler has a rather limited winter range, destruction that occurs there could devastate some local populations.

2.4.1 Population Trends. This species often cited as an example of alarming decline among Neotropical migrants. North American Breeding Bird Survey (BBS) data indicates a significant population decline of 44% in North America between 1966 and 1993; nonsignificant decline of 5% occurred between 1984 and 1993 (Price et al. 1995, Askins 1993). Rangewide, 11 physiographic regions showed decreases (4 nonsignificant) and 2 showed increases (both nonsignificant). Regions with largest estimated decreases (%/yr): Cumberland Plateau (–4.6), Ridge and Valley (southern Appalachians; –6.1), Ozark-Ouachita Plateau (–4.6). In the southeastern and south-central U.S., declines have occurred in the uplands but not in the lowlands (BBS data, 1966-1987, James et al. 1992). Spring surveys in Tennessee showed a 5.44% annual decline between 1960-1992, over which time agricultural or vacant land decreased by 44,841 ha and developed land increased by 33,370 ha (M. Baltz, unpubl. data).

Population declines noted within at least some of the winter range: Jamaica (Arendt 1992) and dry forest of Puerto Rico (1975–1990; Faaborg and Arendt 1992). Observation may represent local shifts in habitat use rather than true population declines. Before European settlement, the species was rare or absent from much of its present range (Nolan 1978). Populations spread as forests were opened and agricultural fields abandoned, creating more early-successional habitat. Population densities apparently peaked between the late-19th- to the mid-20th-century (Bent 1953, Nolan 1978).

3.0 Species Conservation

Declines might be influenced by resources in winter or by a decrease in old field habitat. Loss of breeding habitat, in space and time, is the most immediate threat. A net loss of early-successional habitats across the range, as forests matured and land was converted to residential or industrial, and in conjunction with fire suppression, is the cause of habitat loss in space. The period of time that a regenerating habitat is suitable has been decreased by increased mowing or broadcast spraying of herbicides, which maintains too early a seral stage, and also by reforestation, which speeds succession beyond the stage of suitability. Cowbird parasitism and predation may also contribute to declines.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the Prairie warbler on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

3.2 Management and Monitoring.

3.2.1 Management Requirements:

3.2.1.1 Provide a shifting mosaic of seral stages to allow for different amounts of early successional

habitats, especially shrub layer.

3.2.1.2 Maintain the early successional habitats with regular burning or mowing. If mowing management is used, leave islands of shrubs and small trees in fields.

3.2.1.3 If areas of hardwood or mixed-wood forests are to be logged, patches should be clearcut at different times to create a mixture of different woody vegetation stages, ensuring a stable supply of suitable habitat (relatively dense, low vegetation and little or no tree canopy).

3.2.1.4 Maintain open corridors (e.g., powerlines) by selective basal spraying of herbicides to remove trees, thus creating a relatively stable shrubland (Niering and Goodwin 1974, Askins 1994) for this and other early-successional species.

3.2.2 Monitoring Requirements. Annual monitoring of populations is recommended. Monitoring should include breeding habitat assessments, distribution, demographics, and long-term population trends. Detection of unmated males through unique singing behaviors they exhibit should be incorporated into monitoring programs. Presently no information exists on what proportion of the singing males in an area are unmated; estimates of breeding abundance may be inflated. It would also be useful to monitor vegetation changes at the survey sites.

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Conservation Plan for the Red-headed Woodpecker (*Melanerpes erythrocephalus*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. Male and female red-headed woodpeckers look alike. The entire head, neck, throat and upper breast are bright red. The wings and tail are bluish-black, and there are large square areas of white on the rear part of their wings and upper rump. The white on the wings makes them especially noticeable during flight.

This woodpecker is relatively small compared to others in its family. Red-headed woodpeckers can range from 21 to 25 cm in length and have a wingspan of 33 to 37 cm. The bill is long and chisel shaped, which is important for drilling into trees. The average red-headed woodpecker weighs approximately 70 grams.

1.2 Juveniles. Immature birds also possess the white patches on their wings. However, immature red-headed woodpeckers have a buffy-brown head and neck, which becomes red after the first molt.

1.3 Eggs. Four to six (usually 5) white eggs are laid in April, but will lay a replacement clutch through September if the nest is depredated or the eggs are otherwise inviable.

1.4 Nests. Nest sites range from natural holes, to under roofs of buildings, to fence posts, or utility poles. Preferred nest sites are in dead trees. Both the male and female excavate the nest, though the male does most of the drilling. The cavity is 20 to 60 cm deep and approximately 4 to 5 cm in diameter (Smith, Withgott, and Rodewald, 2000).

1.5 Vocalizations. Red-headed woodpeckers communicate using a wide array of calls and drumming. Both vocalizations and drumming seem to be used in a variety of social situations, including territorial encounters, courtship, copulation and communication between a mated pair. For example, mutual tapping (male tapping on the inside of the nest cavity while female taps on the outside) may play an important role in courtship. The call of the red-headed woodpecker is a repeated “qweer” (Smith, Withgott, and Rodewald, 2000).

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.
2.1.1 Breeding. The Red-headed Woodpecker is patchily distributed from the Rocky Mountains east to the Atlantic coast in the United States, and from southern Ontario in Canada south to Texas, the Gulf Coast and Florida. Click on the map on the left to see the breeding range as determined by the Breeding Bird Survey (BBS).

Figure 1. Breeding and Wintering range of the Red-headed Woodpecker.

2.1.2 Non-breeding. Northern populations of this species usually migrate to the southern states; the others are year-round residents. There is no record of this bird occurring south of the United States. Click on the map on the left to see the winter range as determined by the Christmas Bird Count (CBC).

2.2 Habitat

2.2.1 Breeding. Red-headed woodpeckers prefer open woodlands and forest edges and clearings. They are often found in deciduous woodlands, river bottoms, open woods, orchards, parks, open country, savannas and grasslands with scattered trees. They generally prefer habitat with few tall, large-diameter trees (Smith, Withgott, and Rodewald, 2000).

2.2.2 Non-breeding. The winter habitat of this species is similar to the breeding habitat; red-headed woodpeckers spend the winter in mature forests containing large, old trees. Their winter distribution within the range is thought to be primarily dependent on the abundance of food, particularly acorns (Smith, Withgott, and Rodewald, 2000).

2.3 Ecology

2.3.1 Reproduction. Red-headed woodpeckers are thought to be monogamous, though polygyny may occur. There is little information available about formation or duration of pair bonds in this species, though some pairs are known to have mated together over several seasons.
The eggs are laid between April and July, with clutch sizes of 3 to 10 eggs, most commonly 5 eggs. Incubation begins after the last egg is laid, and lasts 12 to 14 days. Both parents incubate, with males incubating at night. The chicks are altricial when they hatch; they are naked and their eyes don't open for 12 to 13 days. The young are fed and brooded by both parents and leave the nest at 24 to 31 days old. The chicks are strong fliers and able to catch their own food soon after fledging. Chicks that remain near the nest after several weeks are chased away by the parents. The chicks will be able to breed the next summer.

Red-headed woodpeckers have one or two broods a year. Pairs may start a second nesting attempt while still feeding the first brood. Though the second brood can be raised in the same nest, a new nest cavity is usually found (Smith, Withgott, and Rodewald, 2000). Male and female red-headed woodpeckers share most of the parental responsibilities, including nest construction, incubation, feeding, brooding and otherwise caring for the young.

2.3.2 Migration. A broad migration band from the Caribbean basin occurs from Texas to Florida. Peak migrations on the Gulf Coast occur during first three weeks of April. Arrives in Tennessee from late April to early May.

2.3.3 Predators. Red-headed woodpeckers adults are vulnerable to predation by raptors, including Cooper's hawks, and peregrine falcons, eastern screech-owls and red foxes. Eggs and chicks are predated by snakes, including black rat snakes and mammals, including raccoons and flying squirrels (Smith, Withgott, and Rodewald, 2000).

2.3.4 Parasitism. The species is parasitized by the brown-headed cowbird (*Molothrus ater*) and European starlings (*Sturnus vulgaris*). Up to 75% of nests are parasitized in some areas.

2.4 Species Status. The species decline apparently is related to loss of habitat due to encroaching urbanization, fragmented or loss of forest habitat. The main threat is the loss of breeding habitat as forests are fragmented or removed. Dependence on large forests for nesting may make this species highly vulnerable to population decreases. Considered "highly vulnerable" to population decline because of anthropogenic alteration of tropical, broadleaved forests (Petit et al. 1993). Normal annual population fluctuations can be more dramatic on smaller preserves, reducing local populations to levels where random events could lead to local extirpation.

Principle management concern is that large tracts (300-1000 ha) of unfragmented suitable habitat are required for nesting and must be protected. Primary habitat requirements on the breeding grounds are mature deciduous forest, understory patches of dense shrubs (e.g., mountain laurel), and a topography of moderate to steep slopes. Winter habitat requirements are less well known but believed to be dependent primarily on mature moist to wet broad-leaved forests. Specific habitat requirements during migration are not known.

2.4.1 Population Trends. Populations have always seemed to fluctuate from abundant to on the verge of extinction. Periods of abundance have coincided with the decline of chestnuts and elms, perhaps because of increased nesting trees. Periods of decline coincided with the decline of beech trees and Rocky Mountain grasshoppers in central US. Range has contracted to the southern limits of Ontario and appears to be decreasing in abundance across entire range. The Breeding Bird Survey indicates a significant population decline of 2.5% per year from 1966-2000 and by 4.6% per year over the last 20 years (1980-2000). This has amounted to a 50% population reduction since 1966. The Christmas Bird Count indicates a similar population decline, with both a decrease in the number of individuals recorded and the number of individuals observed per party hour. Local population increases have been associated with increasing beaver populations and the creation of flooded forests with lots of snags for nesting.

3.0 Species Conservation

Red-headed woodpeckers were once very common throughout eastern North America, but have been decreasing in abundance. In the 1890's, the introduction of European starlings (*Sturnus vulgaris*) had a significant negative impact on red-headed woodpeckers. The starlings compete with these woodpeckers for their nesting holes, frequently driving them from their homes. Also contributing to the decline of red-headed woodpeckers is the increased removal of dead trees containing potential nest sites. The increased use of automobiles has also led to declining numbers of red-headed woodpeckers, which are often struck by cars when swooping for prey. In order to conserve red-headed woodpeckers, their habitat needs to be protected and European starling populations must be controlled.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the worm-eating warbler on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

1. Where possible, allow the growth of large contiguous tracts of deciduous forest. Ample snags should remain following forest harvest activities.

3.2 Management and Monitoring. Further studies are required to assess effects of various logging practices on both wintering and breeding grounds. However, this warbler probably is tolerant of many different forest management and logging practices; selective logging and thinning "overmature" trees may create favorable conditions; may nest in clearcut areas as young as 7 years old where several hardwoods have been left standing in the clearcuts (see Bushman and Therres 1988). The species is inconspicuous and easily overlooked during surveys.

3.2.1 Management Requirements:

3.2.1.1 Establish population metrics and develop list of activities that may influence, both beneficial and adverse, the Fort Campbell population.

3.2.1.2 Assist in the develop forest desired future conditions to support worm-eating warbler breeding habitat.

3.2.1.3 Annual monitoring of populations is recommended. Monitoring should include breeding and winter

habitat assessments, distribution, demographics, and long-term population trends.

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Conservation Plan for the Sedge Wren (*Cistothorus platensis*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. Sedge wrens are small birds with short bills and relatively short tails. Adults are sandy buff to cinnamon overall with an orange-buff rump and pale buffy chest. The back is boldly streaked, the crown is streaked, and the wings and tail are barred (Sibley 2000). Sexes have similar plumages, and males are about a gram heavier than females (Taylor et al. 1983).

The "mouse-like," inconspicuous foraging behavior (Howell 1932, Walkinshaw 1935) suggests that these birds forage mainly at ground level, probably for insects hiding in moist soil and among bases of sedges and grasses. Information on their diet is limited, but mainly eats insects and spiders (Terres 1980).

1.2 Juveniles. Similar to adults except that the streaking on the head and neck is less conspicuous, and the juvenal plumage is darker above and more buffy on the throat and abdomen (Forbush 1929, Walkinshaw 1935).

1.3 Eggs. Ovate or pointed-ovate averaging 16 x 12 mm (Bent 1948). Eggs are white and unmarked, and smooth and moderately glossy (Harrison 1978).

1.4 Nests. Sedge wrens build well-hidden, rounded balls made of woven, fine grasses and culms of sedges, and are often built near the ground (< 0.5 m) and attached to live stems of grasses and sedges (Walkinshaw 1935, Tordoff and Young 1951, Harrison 1978). Typically they have a single side-entrance.

1.5 Vocalizations. The song of males is a dry, staccato chattering: "chap chap chap chapper-rrrrr" (Peterson 1980). Among individuals, the song's introduction is stereotyped, whereas the trill is highly variable (Kroodsma and Verner 1978). The call note is "churr churr," "chap churr," or "chap" (Bent 1948, Peterson 1980). The frequently sing at night (Vickery 1983).

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. The breeding range extends from eastern Alberta east across southern Canada to (formerly) central Maine and New Brunswick, south to eastern Arkansas, southern Illinois, central Kentucky, western West Virginia, and southeastern Virginia, west to Dakotas and Kansas (AOU 1983). Most common

Figure 1. Breeding and Wintering range of the Sedge wren.

in Minnesota, Wisconsin, north-central Michigan, southern and central Manitoba, and the Lake of the Woods area of northwestern Ontario (Jalava 1993).

2.1.2 Non-breeding. Sedge wrens winter from Tennessee and Maryland south to southeastern New Mexico and southeastern U.S. (AOU 1983); the most concentrated populations occur along the Gulf Coast of Texas and in Louisiana; other areas of abundance include the North Carolina coast, lowlands around Pensacola, the Pecos River area in western Texas, and the Green Swamp near Wilmington, North Carolina (Root 1988).

2.2 Habitat

2.2.1 Breeding. Grasslands and savanna, especially where wet or boggy; sedge marshes; moist meadows with scattered low bushes; upland margins of ponds and marshes; coastal brackish marshes of cordgrass, herbs, and low shrubs; locally in dry cultivated grain fields (AOU 1983). Avoids cattail marshes. Sings from exposed perch, otherwise creeps and hops on or near ground in tall sedgy grass or wet tangles at the bases of shrubs (Hilty and Brown 1986). Nests low in tall dense growths of sedges or grasses, or similar herbage, very near ground, or over shallow water (Harrison 1978).

Nesting areas may change opportunistically from year to year as conditions change. Several nests are built within a single breeding territory each season. Nesting takes place among dense, tall growths of sedges and grasses in wet meadows, hayfields, retired croplands, and upland margins of ponds and marshes. It also occurs in coastal, brackish marshes. Scattered shrubs and an absence of standing water are also typical features of nesting habitats. They are highly sensitive to habitat conditions and will abandon sites rendered too dry by drainage or drought or too wet by flooding. They will also abandon sites if shrubs become too prevalent. Opportunistic breeders and may re-nest at different locations during the same breeding season. Usually do not occupy the same site for more than one to three years.

2.2.2 Non-breeding. Little information is available on wintering habitats. Presumed similar to breeding habitat, but in migration and winter also in brushy grasslands (AOU 1983). Brackish and freshwater sedge meadows and marshes are used, as are old fields and prairies with dense, matted grass or weeds (Howell 1932). Drier portions of salt marshes may be used during migration (Forbush 1929, Palmer 1949).

2.3 Ecology

2.3.1 Reproduction. Male Sedge wrens build multiple, domed nests that figure prominently in courtship, and may also serve as dormitories and decoys for predators (Verner 1965, Picman and Picman 1980, Burns 1982). In Minnesota, males built an average of 7.4 complete nests and 0.8 incomplete nests on each territory (Burns 1982). Nests used for incubating eggs are built closer to the ground than dummy nests (Walkinshaw 1935) and have a substantial inner lining of grass, sedge, and feathers added by the female (Burns 1982).

Females begin laying one egg daily about the third day of nest lining (Burns 1982), and initiate incubation before the clutch is complete. Usually 7 eggs are laid per clutch (range is 2 to 8), although clutches laid later in the season may be smaller than earlier clutches (Bent 1948, Harrison 1978, Burns 1982). Clutch size 4 in Costa Rica (Stiles and Skutch 1989). Incubation is by the female only and lasts about 14 days (Burns 1982).

Females in some populations are double-brooded (Walkinshaw 1935, Burns 1982), but are single-brooded in others (Crawford 1977). Males may be serially or simultaneously polygynous and females may be serially polyandrous (Crawford 1977, Burns 1982). Mates of monogamous males had higher reproductive success than both primary and secondary females mated with polygynous males, whereas polygynous males had higher reproductive success than monogamous males (Burns 1982).

2.3.2 Territories. Upon arrival at nesting areas, males establish territories that are used for courtship, nesting, and foraging (Burns 1982). Territory boundaries are fluid throughout the nesting season, and males may shift their activity and defend new areas as the season progresses. Males defend territories and attract mates by singing vigorously throughout the breeding season, as much as 22 h/day and at rates of up to 12-15 songs/min (Walkinshaw 1935, Kroodsma and Verner 1978). This combination of song components may permit mixing of highly dispersive populations (Kroodsma and Verner 1978) and may represent an evolutionary compromise between species identification and sexual selection among individuals. Because local dialects would be swamped in such highly mobile populations, neighboring males do not share song-type repertoires nor do they counter-sing by matching song-types (cf. marsh wren).

2.3.3 Predators. Identity of nest predators poorly known due to their domed nest and nesting secrecy (Herkert et al. 2001).

2.3.4 Parasitism. Not known to occur, probably because entrance to nest is usually too small (1.5–2.5 cm) for a Brown-headed cowbird (*Molothrus ater*) to enter. However, on 30 Jun 1996 a Sedge wren was observed feeding a large cowbird fledgling at Lonetree Wildlife Management Area (Wells Co.), ND (Herkert et al. 2001).

2.4 Species Status. Considered a Species of Special Concern by the National Audubon Society from 1982 to 1986 owing to reports of depressed populations in midwestern prairie region, ne. Maritimes, Hudson-Delaware region, and Ontario (Tate 1986). In 1987 and again in 1995, USFWS (1987, 1995) identified the Sedge Wren as a Migratory Nongame Bird of Management Concern in the U.S. owing to its dependence on vulnerable or restricted habitats. Species also considered Endangered, Threatened, or of Special Concern in at least 9 states in the midwestern and northeastern U.S. (Vickery 1992, Herkert et al. 1996).

2.4.1 Population Trends. BBS data indicate that Sedge wren population trends were generally positive in North America from 1966 to 1996, mostly as a result of relatively recent population increases in the Great Plains (Peterjohn and Sauer 1999). Increases in Sedge wren populations in the Great Plains were most evident during the 1990's, apparently the result of both creation of new grassland habitat through the Conservation Reserve Program and increased annual precipitation in the region (Peterjohn and Sauer 1999). Increased precipitation improved wetland conditions in the Great Plains region during the 1990s (USFWS 1997) and expanded the extent of damp grasslands suitable for Sedge Wren breeding (Peterjohn and Sauer 1999). In areas where Sedge wren populations have declined (especially in the eastern U.S.), habitat loss appears to have been the most important factor contributing to population declines (Gibbs and Melvin 1992, Peterjohn and Sauer 1999). BBS trends should be viewed with some caution, however, since this species' erratic occurrence and fluctuating numbers make estimating population trends difficult (Peterjohn and Rice 1991, Bedell 1996, Peterjohn and Sauer 1999).

Regional population trends indicate a stable population in the Northeast, although existing surveys may under sample populations because territory establishment and nesting often do not occur until July (Gibbs and Melvin 1992).

3.0 Species Conservation

Protection of wetlands, especially sedge meadow and other wet-meadow habitats, is the most important conservation measure that could/should be taken to protect this species. Protection of existing sedge meadows may be particularly important, since this habitat typically supports high densities of Sedge Wrens, is vulnerable to urban and agricultural development (Tiner 1984), and has poor recovery potential after degradation (Reuter 1986). Although not intended to specifically benefit Sedge Wrens, habitat-establishment programs in both the U.S. (Conservation Reserve Program) and Canada (North American Waterfowl Management Plan) have apparently benefited the species by providing new habitats to colonize (e.g., Johnson and Schwartz 1993, Best et al. 1997, Prescott and Murphy 1999). Establishment of new grassland habitat through the Conservation Reserve Program may have contributed to recent population increases in some regions.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the Sedge wren on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

1. Provide early successional habitat, especially sedge marshes, wetlands, and drainage ditches, through use of prescribed fire and mechanical means.
2. Prevent riparian habitat removal and re-vegetate riparian areas that have become modified.
3. Never burn, mow, or otherwise disturb an entire area in one breeding season because disturbance reduces available habitat for one or two growing seasons. In order to avoid destruction of fall nests, conduct management treatments either before birds arrive in the spring (15 April) or after the young have fledged (31 October).
4. Work with Agricultural Lease Program Manager to set aside wet meadow habitat on edges of leased agricultural fields.
5. Efforts should be made to prevent loss or fragmentation of wetland habitat.

3.2 Management and Monitoring. Most common form of habitat degradation for Sedge Wrens appears to be loss and draining of wetlands and wet-grass habitats (e.g., Bull 1964, Robbins 1991, Sydlik 1991, Jackson et al. 1996, Walsh et al. 1999); draining of wetlands and subsequent conversion to agriculture land undoubtedly brings local population declines. About 1.9 million ha of palustrine emergent wetlands, which include wet meadows important to nesting Sedge Wrens, were lost in U.S. between mid-1950s and mid-1970s (Tiner 1984). Wetlands preferred by Sedge Wrens, such as sedge/grass meadows with moist or saturated soils, are the most easily drained and filled and have been the type of wetland most frequently destroyed by agriculture and urbanization (Tiner 1984).

3.2.1 Management Requirements:

3.2.1.1 Mowing. Periodic mowing may be a viable option for maintaining habitat suitable for use, provided that mowing is done well after the breeding season is concluded and young and adults have dispersed.

3.2.1.2 Burning. Fire can be used to stop encroachment of woody plants at nesting areas and to regenerate stands of tall grasses and sedges that provide needed cover. Prescribed burning should be

restricted to the non-breeding season (after October). Habitat blocks should be managed in rotation to ensure annual availability of nesting habitat.

3.2.1.3 Removal of Woody Species. If allowed to progress to a shrubland seral stage, encroaching woody species will eventually eliminate habitat. It appears that grasslands, hayfields, wet fields, and fallow pastures are optimal habitats, and that some invasion by woody species will be tolerated. However, Sedge wrens would definitely be impacted by the loss of wetlands or sedge/grass fields to forest.

3.2.1.4 Monitoring Requirements. Monitoring programs should extend through late summer and fall in order to accurately survey sedge wrens. Although habitat loss seems to be a major factor in population declines, many authors have noted that populations seem well below the level that available habitats could support (Palmer 1949, Laughlin and Kibbe 1985, Andrle and Carroll 1988). Thus, although regional populations may now be stationary (as indicated by Breeding Bird Survey trends), individuals may be too sparsely distributed to effect any substantive or rapid population recovery. Preservation and maintenance of complexes of breeding habitat is needed; habitat management across wide geographic areas may be necessary to significantly enhance regional populations (Gibbs and Melvin 1992). Annual monitoring of populations is recommended. Monitoring should include breeding habitat assessments, fall breeding monitoring, distribution, demographics, and long-term population trends.

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Conservation Plan for the Eastern Whip-Poor-Will *(Caprimulgus vociferus)*

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. Eastern Whip-poor-wills are mottled grayish-brown birds with long rounded tails and rounded wings. The males have black throats separated from the breast by a necklace of white. They show white outer tail feathers. The females have a thinner and buffier necklace and lack the white on the tail.

1.2 Juveniles. Young birds generally resemble adults

1.3 Eggs. Two white eggs are laid in May or June.

1.4 Nests. Female selects site, usually a shallow depression among on dead leaves, often in younger growth near a woodland edge on the ground. No structured nest is constructed.

1.5 Vocalizations. The Eastern Whip-poor-will sings its name, WHIP-poor- WEEA. Eastern birds are rising last note and have first and last syllables accented. Western birds sing it lower and more burry or trilled, and only the last note is accented.

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. Known to breed in southern California, southern Nevada, northern Arizona, central New Mexico, and western Texas south to Honduras; and from north-central Saskatchewan east across southern Canada to Nova Scotia, south (east of Great Plains) to northeastern Texas, Arkansas, northern Mississippi, north-central Alabama, South Carolina, east-central North Carolina, and Virginia (AOU 1998).

2.1.2 Non-breeding. Winters in northern Mexico (Sonora eastward), southern Texas, Gulf Coast, and east-central South Carolina south to Costa Rica, casually to southern California, western Panama, and Cuba (AOU 1998).

2.2 Habitat

2.2.1 Breeding. Forest and open woodland, both arid and humid, from lowland moist and deciduous forest to montane forest and pine-oak association (AOU 1983). In open woodlands with well spaced trees and a low canopy. Uncommon in mature forest; prefers even-aged successional habitats from regeneration to pole-stage stands (Bushman and Therres 1988). Rests on ground or on branch, in thicket at forest edge, in

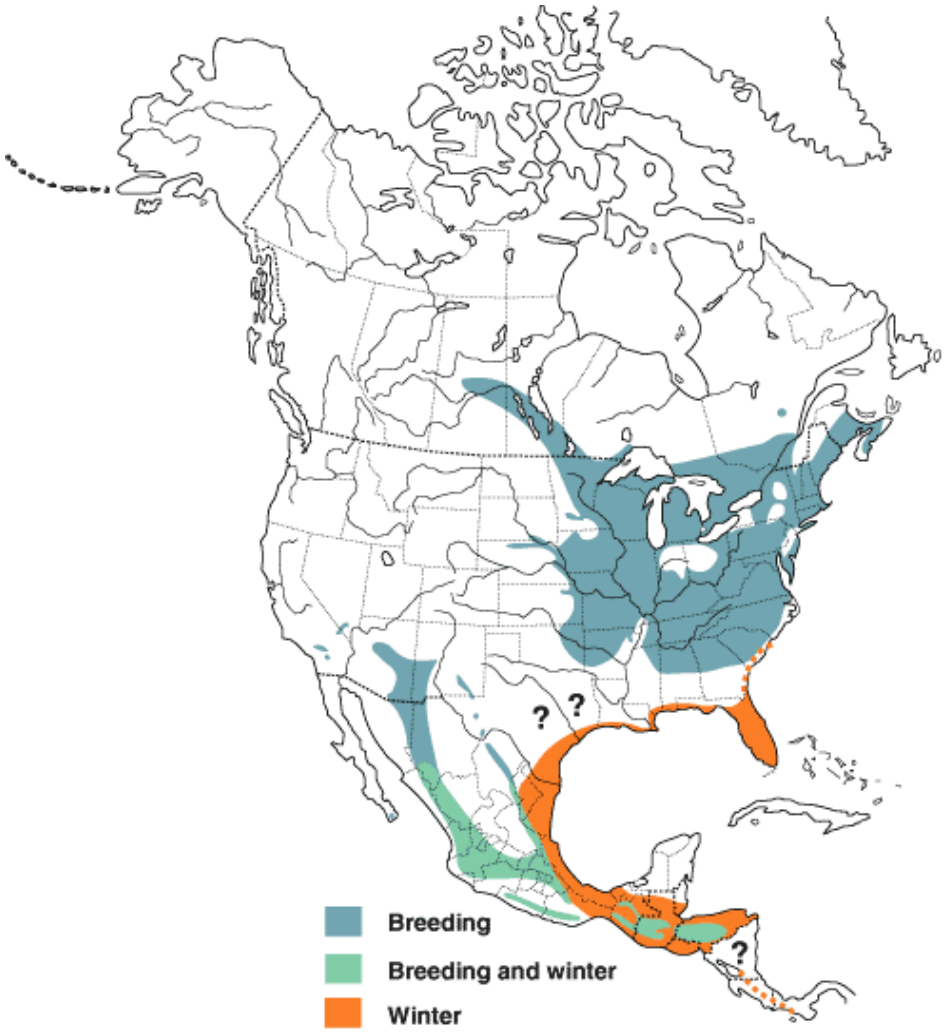

Figure 1. Breeding and Wintering range of the Eastern Whip-poor-will.

hedgerow or gallery forest (Stiles and Skutch 1989). Lays eggs on ground in open site under trees or under bush, usually on a bed of dead leaves (Harrison 1978) at woods edge or in open woodland. Breeds primarily in montane habitats in tropics (AOU 1983). of skeletonized leaves and lined with sporophyte stems of hairy cap moss (*Polytrichum* sp.).

2.2.2 Non-breeding. In migration, occurs in various forests especially in open woodlands with well-spaced trees.

2.3 Ecology

2.3.1 Reproduction. Eggs laid mostly May-June in north. Clutch size two. Incubation 17-20 days, by female (male possibly helps). Hatching often occurs during early stages of a waxing moon. Young tended mainly by female, male brings food. Young first fly at about 20 days. Elaborate courtship displays lead up to

mating. A Eastern Whip-poor-will female may alight near a calling male, who then walks toward her with an undulating gait, head raised with each step and then lowered. Reaching her, he circles as she bobs, one or both birds calling continuously. Or he may approach her from alternating sides, touching her bill as she trembles.

Due to the Eastern Whip-poor-will's reliance on moonlight, its breeding cycle is synchronized with the lunar cycle. Eastern Whip-poor-wills lay their eggs so that they hatch as the moon is waxing. In this way, they have the advantage of maximum moonlight while feeding their growing young. No nest is prepared for the pair's clutch of one or two eggs. Instead the Eastern Whip-poor-wills' eggs are laid on a bed of leaves. In the East, the eggs often rest near a log in a small clearing or at the edge of woods. In the West, the female often lays her eggs under a rocky overhang on a slope or in a wooded ravine. During the day, the female incubates the eggs. At night, both parents share the incubation duties.

When the Eastern Whip-poor-wills' eggs hatch, both parents feed the young regurgitated food. Soon the chicks are able to hop along the ground away from the nest, but they are still brooded by their parents. They rely on the parents' cryptic-coloring to hide them, but when that fails, the young may scatter and freeze while the parent performs a distraction display.

2.3.2 Predators. Potentially important predators include mammals, snakes, and birds of prey.

2.4 Species Status. Breeds in open coniferous and mixed woodlands in much of the eastern U.S. and montane woodlands in the southwest. Western population believed by some to be separate species but no studies currently available. In New Mexico, closely associated with hillsides in mid-elevation forests from 1828-2438 meters which roughly corresponds to the range of Ponderosa Pine (Chihuahua Pine in the very southwestern portion of the state). Possibly expanding it's range. Often found in riparian uplands, but this may not be a requirement for nesting habitat. BBS shows declines in Illinois and southern New England. Threats include breeding and winter habitat loss, possible pesticide exposure, but no data is available to verify this. Need more research on habitat use and requirements, status, and nesting success.

2.4.1 Population Trends. North American Breeding Bird Survey (BBS) shows a survey-wide decline of –1.7% per year (P = 0.00, N = 473) from 1966-1998 (Sauer et al. 1999). BBS, however, may not be an accurate indicator of population trend for this species. Declines have been reported from several areas; may be related to habitat fragmentation and loss and perhaps to increased nest predation (Ehrlich et al. 1992).

3.0 Species Conservation

This species has been declining in areas, probably due to land use changes. It is common within appropriate habitat, however, and is not yet listed as requiring special conservation attention in any portion of its southeastern range. Data is lacking because of the difficulty in censusing this bird.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the worm-eating warbler on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

- Where possible, allow the growth of large contiguous tracts of deciduous forest.
- Forest restoration areas should be >300 ha and preferably >1000 ha in size.
- All forested stands should be devoid of forest roads and/or openings to prevent nest parasitism by the brown-headed cowbird.

3.2 Management and Monitoring. Further studies are required to assess effects of various logging practices on both wintering and breeding grounds. However, this species probably is tolerant of many different forest management and logging practices; selective logging and thinning "overmature" trees may create favorable conditions.

3.2.1 Management Requirements:

3.2.1.1 Establish population metrics and develop list of activities that may influence, both beneficial and adverse, the Fort Campbell population.

3.2.1.2 Annual monitoring of populations is recommended. Monitoring should include breeding and winter habitat assessments, distribution, demographics, and long-term population trends. Focused nightbird surveys should be implemented.

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Conservation Plan for the Wood Thrush (*Hylocichla mustelina*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. Smaller than American Robin (*Turdus migratorius*) and plumper than the other brown thrushes (Gray-cheeked Thrush [C*atharus minimus*], Bicknell's Thrush [*Catharus bicknelli*], Swainson's Thrush [C*atharus ustulatus*], Hermit Thrush [C*atharus guttatus*], and Veery [C*atharus fuscescens*]). Distinguished by the deepening redness about the head and the larger, more numerous round spots on the breast. Nest is similar to that of robin but is smaller and invariably has leaves in foundation and rootlets instead of grass in lining. Length 20 cm. Sexes similar. Reddish-brown above, brightest on crown and nape; rump and tail brownish-olive. Bold white eye ring conspicuous on streaked face. Whitish below, with large dark spots on throat, breast, and sides.

1.2 Juveniles. Young birds generally resemble adults but may have tertials lightly tipped with rusty brown (Ridgway 1902, Dwight 1975). Juveniles are brown above and buffy below. The stripes on the head are brownish rather than black.

1.3 Eggs. Eggs are smaller and generally more pointed at one end than are robin eggs; also slightly paler than robin eggs (Harrison 1975). Average size 25.4 x 18.6 mm; typically oval; shell is smooth, has slight gloss; pale blue or bluish green and unmarked.

1.4 Nests. Firm, compact cup of grasses, bark, moss, paper, mixed with leaf mold, mud; molded by contours of female's body; lined with rootlets. Outside diameter 10.2-14 cm, height 5.1-14.6 cm; inside diameter 7 x 8.3 cm, depth 3.2-5.1 cm.

1.5 Vocalizations. Loud, liquid song of three- to five-note phrases, most notes differing in pitch, each phrase usually ending with a complex trill. Calls include a rapid "pit pit pit" (NGS 1987).

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. Southeastern North Dakota and central Minnesota across the northern U.S. and adjacent southern Canada to Nova Scotia; south to eastern Texas, the Gulf Coast, and northern Florida; and west to eastern South Dakota, central Nebraska, central Kansas, and eastern Oklahoma. Casual breeder to southern Manitoba, southwestern North Dakota, and central South Dakota (AOU 1983).

Figure 1. Breeding and Wintering range of the Wood Thrush.

2.1.2 Non-breeding. Southern Texas south through eastern Mexico and Middle America to Panama and northwestern Colombia (AOU 1983).

2.2 Habitat

2.2.1 Breeding. Deciduous or mixed forests with a dense tree canopy and a fairly well-developed deciduous understory, especially where moist (Bertin 1977, Roth 1987, Roth et al. 1996). Bottomlands and other rich hardwood forests are prime habitats. Also frequents pine forests with a deciduous understory and well-wooded residential areas (Hamel et al. 1982). Thickets and early successional woodland generally do not provide suitable habitat (Bertin 1977). Bertin (1977) found wood thrushes to require one or more trees at least 12 m tall, possibly for song perches, whereas Morse (1971) reported nesting in stands of young white pine with a canopy under 9 m in height. Nests usually are placed in a crotch or are saddled on a branch of a shrub, sapling, or large tree.

2.2.2 Non-breeding. In migration and winter, habitats include forest and woodland of various types from humid lowland to arid or humid montane forest, also scrub and thickets; primarily undisturbed to moderately disturbed wet primary forest; may wander into riparian forest and various stages of second growth (Rappole et al. 1989, Winker et al. 1990). Were recorded exclusively in forest in Atlantic lowlands of Costa Rica (Hagan and Johnston 1992). Winker et al. (1990) studied within-forest preferences of birds wintering in southern Veracruz and found that areas with gaps were preferred in this lowland rainforest; areas with heavy ground cover were also favored.

2.3 Ecology

2.3.1 Reproduction. Nesting occurs in late spring and early summer. In Delaware, nesting peaks occurred in the last week of May and in the second week of July (Longcore and Jones 1969). Nest site selection and building is by the female alone; complete in about five days. No evidence birds ever use nest a second time. Clutch size is 2-5 (usually 3-4). Individual females typically produce two broods per year. Incubation, by female, lasts 12-14 days. Male usually guards nest when female absent. Young are tended by both parents, leave nest at 12-13 days. Pair remains together for second nesting (Harrison 1975). There is some evidence of occasional polygyny (Johnson et al. 1991).

In Delaware, of 142 "nesting attempts," 38% were successful and 58% of nests were destroyed by predators. The greatest nest success was associated with late season nests, spicebush and black gum vegetation, and with lower nest height (below 8.5 ft); 33% of eggs hatched, and 65% of hatched birds survived to leave the nest (Longcore and Jones 1969). In Maryland, Whitcomb et al. (1981) reported that thrushes produced two broods per year and had a reproductive success of 7.60. In Pennsylvania, nesting failure was caused by predation more than 95% of the time (Hoover 1992); 78% of nest depredation was attributed to small mammal/snake/avian nest predators and 22% to large mammal nest predators. Much work on reproductive success in wood thrushes has also been done by Hoover (1992) in relation to forest fragmentation.

Long-term population dynamics in a 15-ha woodlot were studied in Delaware by Roth and Johnson (1993). A sustained episode of reduced production per female and of an increased percentage of adults failing to produce any young coincided with a 4% annual decline in abundance between 1978 and 1987. When failure rate later dropped, return rate and abundance subsequently increased. Roth and Johnson (1993) concluded that a period of elevated, predation-caused failure prompted greater emigration by an ever-younger, less-site-faithful population.

2.3.2 Territories. Freemark and Merriam (1986) listed the territory size as less than 2 ha. In wintering areas in southern Veracruz, some individuals were territorial and highly sedentary, often remained within 150 m of capture point for entire winter; other birds wandered (Rappole et al. 1989, Winker et al. 1990). Some birds return to same wintering areas in successive years (Rappole et al. 1989).

2.3.3 Migration. A broad migration band from the Caribbean basin occurs from Texas to Florida. Peak migrations on the Gulf Coast occur during first three weeks of April. Arrives in Tennessee from late April to early May.

2.3.4 Predators. Potentially important predators include mammals, snakes, and birds of prey.

2.3.5 Parasitism. The species is parasitized by the brown-headed cowbird (*Molothrus ater*). Up to 75% of nests are parasitized in some areas.

2.4 Species Status. Common throughout much of the eastern U.S. and most often found in deciduous or mixed forests with a fairly well-developed deciduous understory, especially where moist. Closed canopies are required. BBS data show this species to be most common in West Virginia, New Hampshire, and Maryland, with the Cumberland Plateau of the Appalachian Mountains being the most heavily populated Physiographic Region. Analyses of population trends show declines on regional and global scales. These declines are apparently due to loss and fragmentation of habitat, which has caused increased rates of nest predation and brood parasitism. In some areas of the Midwest, for example, thrushes are producing more cowbirds than thrushes, and avian nest predators such as grackles and crows are a serious threat. Tropical deforestation may also be a major threat to this species. Management recommendations are that forests be left unfragmented and low-volume selective cutting be used as an alternative to clear cutting where possible. Management needs include determination of key vegetation types associated with nesting success and a better understanding of minimum patch size requirements for source populations. Long-term monitoring of breeding productivity should be conducted wherever possible.

2.4.1 Population Trends. Published information on densities from breeding bird censuses in the southeastern U.S. between 1947 and 1979 were summarized by Hamel et al (1982): mean (standard error) density is listed as 14.2 (1.0) pairs per 40 ha with a density range of 1-41 pairs per 40 ha. In bottomland hardwood forests along the Roanoke River in eastern North Carolina, R. Sallabanks (unpubl. data) found thrushes to be most abundant in wide patches of levee forest where an average 1.14 singing males were detected per unlimited radius 10-min point count. Holmes and Sherry (1988) reported a mean (standard error) abundance in Hubbard Brook Experimental Forest, New Hampshire, of 4.64 (2.83) adult birds per 10 ha over the period 1969-1986 over which time the population showed a highly significant decline at Hubbard Brook (a similar pattern to that reflected for the state of New Hampshire population by BBS data). Whitcomb et al.(1981) found 125 males per sq km in an area in Maryland.

North American Breeding Bird Survey (BBS) data indicate a significant population decrease in eastern North America, 1966-1989 and 1978-1988, and a significant decrease in central North America, 19661988; overall, the decline in North America was about 2-4% (Droege and Sauer 1990, Sauer and Droege 1992). BBS data indicate a significant 39% decline in North America from 1966 to 1993, and a nonsignificant 4% increase from 1984 to 1993 (Price et al. 1995).

For the period 1982-1991, BBS data indicate significant population increases in three states (Florida, Louisiana, and Minnesota), significant population decreases in 13 states or provinces (Delaware, Indiana, Maine, Maryland, Massachusetts, New Hampshire, New York, North Carolina, Ohio, Oklahoma, Ontario, Tennessee, and Virginia), and nonsignificant changes in the remaining 21 states or provinces where data have been collected (Alaska, Arkansas, Connecticut, Georgia, Illinois, Iowa, Kentucky, Michigan, Mississippi, Missouri, Nebraska, New Jersey, Nova Scotia, Pennsylvania, Quebec, Rhode Island, South Carolina, Texas, Vermont, West Virginia, and Wisconsin). Other statistically significant changes are decreases in 11 physiographic areas (Lower Coastal Plain, Northern Piedmont, Southern Piedmont, Southern New England, Lexington Plain, Great Lakes Plain, St. Lawrence Plain, Cumberland Plateau, Allegheny Plain, Adirondack Mountains, and Central New England) and significant declines in the Eastern Region, the U.S. population, and the Continental population as a whole. Where the species is most often detected on BBS routes (Cumberland Plateau) there are signs of decline, both over the short-term (1978-

1987) and over the long-term (1966-1987). Signs of decline are widespread regardless of detection rate.

Witham and Hunter (1992) studied population trends of Neotropical migrant landbirds in northern coastal New England. Wood thrush showed declines in all analyses, but most significantly for the period 1983-1988 (percent change per year = -7.30). Numbers have been counted in migration at Long Point, Ontario, Canada, since 1961. The thrush declined over each decade (1961-1970, 1970-1979, and 1979-1988), most alarmingly in the 1979-1988 period, with a highly significant 15% per year decrease; the net change over the entire 30-year period is also significant and negative (-6% per year) (Hussell et al. 1992). Numbers were found to decline between 1985 and 1989 in small forest fragments in Illinois of 14, 25, and 65 ha in size (Robinson 1992). At Hubbard Brook Experimental Forest, New Hampshire, during the period 1969-1986, the population showed a highly significant decline similar to that reflected by statewide BBS data (Holmes and Sherry 1988).

2.4.2 Threats. Habitat degradation and fragmentation are commonly cited as the biggest threats. With loss of habitat and increased conversion to agriculture and pine plantations, both brood parasitism and nest predation increase. The Brown-headed Cowbird (*Molothrus ater*) is by far the most serious threat, causing significant population declines throughout much of the range. Despite the fact that cowbirds are such a problem, control of cowbird numbers rarely has been attempted. Rate and impact of cowbird parasitism is highest in the Midwest, lowest in the Northeast (Hoover and Brittingham 1993). Data were collected from fragmented forests in Illinois by Robinson (1992), where thrushes suffered extraordinarily high rates of brood parasitism. Of 19 nests found, all were parasitized with an average of 1.2 host eggs per nest, and an average of 4.6 cowbird eggs per parasitized nest; thrushes raised far more cowbirds than they did wood thrushes. Of 15 thrush nests found during the incubation period, only a single thrush fledgling was produced. One nest had 12 cowbird eggs in it. Similar results have been found for the Shawnee National Forest of southern Illinois, although parasitism rates are somewhat lower--89% of 83 nests contained an average 3.2 cowbird eggs per parasitized nest (Robinson and Wilcove 1994).

On four separate occasions, Hoover (1992) witnessed common grackles (Q*uiscalus quiscula*) preying on all of the eggs in four different nests (blue jay [C*yanocitta cristata*] and American crow [C*orvus brachyrhynchos*] were likely to be other avian nest predators). Brood parasitism by cowbirds was less prevalent in Hoover's (1992) study, 18% and 6% of all nests being parasitized in 1990 and 1991, respectively. Nest records for 896 nests (Cornell Laboratory of Ornithology) indicated that rates of brood parasitism differed significantly among the Midwest (42.1%), the mid-Atlantic (26.5%), and the Northeast (14.7%) regions of the U.S. Because of the high abundance of cowbirds, high percentages of nests parasitized, and high numbers of cowbird eggs per parasitized nest, the effects of cowbird parasitism are particularly detrimental to populations in the Midwest.

Another possible threat includes loss of forest undergrowth due to overgrazing by high deer populations. On the other hand, dense herbaceous growth resulting from waste-water irrigation is detrimental (Rollfinke et al. 1990). Loss of tropical forests also may contribute significantly to regional declines in temperate North America.

3.0 Species Conservation

The key habitat requirement is a moist woodland understory of deciduous shrubs or saplings; bottomland and other rich hardwood forests are prime examples. Pine forests with a deciduous understory are also

used, as are well-wooded residential areas. These habitat types should be a part of any preserve design considerations. As important as habitat type is preserve size. Nest predation and cowbird parasitism rates are higher in small woodlots and along the edges of larger tracts than in the interior of large tracts. Data from fragmented forests in the Midwest show that reproductive rates probably were well below levels necessary to compensate for adult mortality (Robinson and Wilcove 1994). Fragmented forests may therefore be population sinks with populations sustained by immigration from larger, unfragmented forest tracts. These data emphasize the importance of protecting large, unfragmented forests for breeding habitat.

Research on the effects of forest patch size on nesting success has direct implications for preserve design considerations. Hoover (1992) studied thrushes during 1990 and 1991 on 11 tracts of forest ranging in size from 9.2 ha to greater than 500 ha. Nesting success was significantly different between small and large forests (43% and 76%, respectively). Nest survival from 1990-1991 was positively correlated with forest area, forest core area, and percent forest within a 2-km radius of each study site. Nest depredation was significantly different between small and large forests (56% and 19%, respectively) and was the primary cause of nesting failure. Visitation by mammalian nest predators to scent-sign-posts was significantly different between small and large forests (41% and 14%, respectively), and relative abundance of avian nest predators was significantly higher on the small forests than on the large. Brood parasitism by cowbirds was also significantly different between small and large forests (13% and 4%, respectively) although had little influence on nesting success. Interestingly, Hoover (1992) found thrushes to be common on smaller tracts of forest, but that such birds had lower reproductive success because of high rates of nest depredation.

Large areas of forest are most favorable for breeding, though minimum patch size requirements are unclear. In Pennsylvania, nesting success was 86% in contiguous forest (10,000 ha), 72% in forest fragments larger than 100 ha, and 43% in small fragments of less than 80 ha; these differences were related to increased predation in the smaller forest tracts; cowbird parasitism had little influence on nesting success (Hoover et al. 1995). Whitcomb et al. (1981) reported that thrushes were present in small forest fragments (1-14 ha), but were almost twice as common if woodlots were larger than 70 ha. Thrushes were found by Galli et al. (1976) and Lynch (1987) to be more abundant in larger forest patches compared with smaller ones. In general, it appears that forest patches exceeding 100 ha are best suited for successful nesting because rates of nest predation and sometimes cowbird brood parasitism are lower. Thrushes require only small territories (< 1 ha) and seem to be able to maintain stable populations on small, isolated forest fragments in some cases (e.g., a 15-ha woodlot (Roth and Johnson 1993)). Some woodlots as small as 5 ha may be acceptable (Pinkowski 1991). These results warn of the dangers of assuming that small fragments are acceptable just because they contain many birds; instead, we must determine reproductive success in addition to abundance relationships before we make accurate conclusions about habitat quality. Hoover (1992) concluded that to reverse decreasing population trends, land-use practices that maximize forest area and forest core area are needed.

The effects of silvicultural practices such as clearcutting and selective logging on migratory songbirds may depend upon the landscape context (Robinson and Wilcove 1994). Preliminary evidence from the fragmented Shawnee National Forest of southern Illinois suggests that selective logging can have relatively little impact on thrushes. Robinson and Wilcove (1994) tentatively proposed that low-volume selective logging be used as an alternative to clearcutting. Logging roads should be closed and revegetated soon after harvest, and rotation times should be lengthened to permit regeneration of large, old trees.

The importance of protecting large, unfragmented forests for breeding habitat cannot be overstated. Where possible, forest preserves should be on the order of 10,000+ ha because cowbirds routinely commute up to seven kilometers between feeding and breeding sites. Fragmented forests might benefit from consolidation of ownership and forest regrowth within the largest tracts. Where necessary, cowbird control might be tried within the core of the largest tracts.

Vegetation patterns associated with successful reproduction need to be identified; then appropriate management plans can be devised. Thrushes are classified as closed-canopy obligate species and will tolerate uneven-age management forest stands (Crawford et al. 1981); single-tree selection (removal of mature trees as scattered individuals throughout the stand) and thinning understory trees that compete for root space will create favorable conditions for this species. Light diameter-limit cutting that removes only the best trees from the stand would be tolerated. Any intermediate or harvest cutting that opens the canopy will probably be detrimental.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the worm-eating warbler on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

1. Where possible, allow the growth of large contiguous tracts of deciduous forest. Forest restoration areas should be >300 ha and preferably >1000 ha in size. All forested stands should be devoid of forest roads and/or openings to prevent nest parasitism by the brown-headed cowbird.

3.2 Management and Monitoring. Further studies are required to assess effects of various logging practices on both wintering and breeding grounds. Minimum area requirements for source populations seem to be the least understood aspect of management. Vegetation characteristics associated with nest-site selection and reproductive success also need to be quantified. Also, the role of tropical deforestation in the decline of regional thrush populations must be better understood; habitat fragmentation on temperate breeding grounds cannot alone explain these declines.

3.2.1 Management Requirements:

3.2.1.1 Establish population metrics and develop list of activities that may influence, both beneficial and adverse, the Fort Campbell population.

3.2.1.2 Annual surveys of suitable habitat and known populations using point count censusing techniques is the best way to monitor this species. Long-term studies are preferred.

3.2.1.3 Annual monitoring of populations is recommended. Monitoring should include breeding and winter habitat assessments, distribution, demographics, and long-term population trends.

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Conservation Plan for the Worm-eating Warbler (*Helmitheros vermivorus*)

Conservation Plans (CP) are prepared to provide Fort Campbell land managers with current management information on birds of conservation concern (BCC) species. These species are designated by the USFWS due to continuous declines in population and/or habitat loss. CPs organize and summarize data from research actions and managers actively working with the species and are included in the installation Integrated Natural Resource Management Plan. Information provided is intended to support conservation efforts on the installation and meet the intent of EO13186, the Migratory Bird Treaty Act, and the Department of Defense proposed exemption rule.

1.0 General Description

1.1 Adults. The species is characterized as a stocky, short-tailed, and long-billed warbler. Overall body plumage is grayish olive-green above, paler on abdomen, turning rich creamy buff on breast, throat and cheek. Two broad but strongly contrasted lateral crown stripes and a post-ocular stripe of blackish mouse-gray are separated by the same buff of the throat and cheek. Sexes are indistinguishable, although males tend to be larger than females. Body length 11-12 cm (Ridgway 1902), wing length 66-75 mm, tarsus length 17.8-19.3 mm (Patton and Hanners, unpub. data).

1.2 Juveniles. Young birds generally resemble adults but may have tertials lightly tipped with rusty brown (Ridgway 1902, Dwight 1975). Juveniles are brown above and buffy below. The stripes on the head are brownish rather than black.

1.3 Eggs. Four to six (usually 5) white to flesh pink eggs, 17.4 mm by 13.6 mm, are speckled with shades of brown and drab, sparingly or profusely, often with markings wreathed about large end (Bent 1953). Some eggs are immaculate. Eggs are laid in May, but will lay a replacement clutch through June if the nest is depredated or the eggs are otherwise inviable. Replacement clutches usually contain 4 eggs.

1.4 Nests. Female selects site, on the ground, often near a stream or wetland. The nest, placed on a hillside or bank of ravine, is usually well hidden under a drift of dead leaves at base of a sapling, against roots of shrubs and trees, beside a rocky ledge or outcrop, or in dense low shrubs such as huckleberry and blueberry.

The female forms a cup of skeletonized, pliable leaves; she may even dampen her breast feathers to moisten the leaves to shape the cup. The lining of a fresh cup is usually burnt-orange to red in color, imparted by moss stems; after 2-3 weeks they darken to mahogany. Additional lining materials include white-tailed deer and horse hair, pine needles, fine grass, and stems of maple leaves.

1.5 Vocalizations. The primary song is a simple, dry, high-pitched trill lasting about 2 seconds and is similar to the song of a Chipping Sparrow, but usually shorter and less musical. The flight song, described as more musical than primary song and somewhat varied, is uncommon and usually given below the subcanopy during agonistic encounters. Only the male is known to sing.

Two types of calls regularly heard, *chip* and *tseet* . A soft chip may be communication between two birds, while a sharp, loud chip is given when a bird is particularly agitated, such as when predator is near nest. A *tseet* is frequently given between members of pair and particularly by birds involved in nesting activities.

2.0 Natural History

2.1 Range Maps. Species breeding and wintering ranges are shown in Figure 1.

2.1.1 Breeding. Found discontinuously across the southeastern United States; primarily in the Appalachian and adjacent states, from northeastern Kansas and southeastern Nebraska east to southern New England, south to northeastern Texas, southern Gulf Coast states, northwestern Florida, northern Georgia and South Carolina (AOU 1983). Expanding its distribution on the Atlantic and Gulf coastal plains.

2.1.2 Non-breeding. Winters in southern Mexico (Oaxaca, Chiapas, Veracruz, and Yucatan Peninsula) and south along the Caribbean slope (uncommon on Pacific slope) of Middle America to central Panama. Uncommon resident on Puerto Rico and St. John Island, rare on the other Virgin Islands (AOU 1983).

2.2 Habitat

2.2.1 Breeding. Well-drained upland deciduous forests with understory patches of mountain laurel or other shrubs, drier portions of stream swamps with an understory of mountain laurel, deciduous woods near streams; almost always associated with hillsides (Gale 1995, Bushman and Therres 1988). Coastal plain habitats in Maryland include well-drained oak and oak-hickory forests, flatland white oak forests along river terraces, and drier islands of nontidal forested wetlands (Stasz 1996). Dense patches of shrubs or saplings may be an important component of territories (Patton and Hanners, unpub. data; Bushman and Therres 1988). Most abundant in mature woods but also may be common in young and medium-aged stands (see Bushman and Therres 1988). Nests on the ground, usually on hillsides, in cryptic nests among dead leaves, usually against roots or stems of shrubs or saplings, in a slight cavity (Harrison 1978), or up against rock outcrops. Nests are constructed of skeletonized leaves and lined with sporophyte stems of hairy cap moss (*Polytrichum* sp.).

2.2.2 Non-breeding. In migration, occurs in various forest, woodland, scrub, and thicket situations, but specific habitat requirements are not known. In winter, inhabits undergrowth shrub and subcanopy layers of forests. Wunderle and Waide (1993) reported that worm-eating warblers are forest specialists but use a variety of forest types in the Caribbean, including "montane pine and broadleaf forest, wet limestone and dry forest, and dry scrub and residential habitats in the Bahamas." On the Caribbean slope of Central America, habitats include scrub and broadleaf and gallery forests (Rappole et al. 1983).

2.3 Ecology

2.3.1 Reproduction. Eggs are laid in May, will lay replacement clutches through June. In the middle Atlantic region, nests from mid-May to mid-July (Bushman and Therres 1988). In Connecticut, extreme egg dates for first or subsequent clutches range from 13 May to 21 June, with nestlings last observed on 11 July (Patton and Hanners, unpub. data). Clutch size is 5-6 for first clutches; replacement clutch size is usually 4. Single-brooded. Incubation lasts 13 days, by females only. Young are brooded by the female and fed by both parents. Mean nestling duration is 8.5 days but young may fledge as early as day 5 if disturbed (Patton and Hanners, unpub. data).

2.3.2 Territories. In Missouri, density was 2.13 males per 10 ha in continuous forest (Wenny et al. 1993). In Connecticut, density ranged from 4.46 males per 10 ha at a 300-ha TNC preserve to 0.26 per 10 ha at a

Figure 1. Breeding and Wintering range of the Worm-eating Warbler.

wooded 56-ha site (Gale et al. 1997). Territorial in winter in Mexico (Rappole and Warner 1980); may forage in mixed-species flocks with resident, tropical forest birds (Greenberg 1987).

2.3.3 Migration. A broad migration band from the Caribbean basin occurs from Texas to Florida. Peak migrations on the Gulf Coast occur during first three weeks of April. Arrives in Tennessee from late April to early May.

2.3.4 Predators. Potentially important predators include mammals, snakes, and birds of prey.

2.3.5 Parasitism. The species is parasitized by the brown-headed cowbird (*Molothrus ater*). Up to 75% of nests are parasitized in some areas.

2.4 Species Status. The species decline apparently is related to loss of habitat due to encroaching urbanization, fragmented or loss of forest habitat. The main threat is the loss of breeding habitat as forests are fragmented or removed. Dependence on large forests for nesting may make this species highly

vulnerable to population decreases. Considered "highly vulnerable" to population decline because of anthropogenic alteration of tropical, broadleaved forests (Petit et al. 1993). Normal annual population fluctuations can be more dramatic on smaller preserves, reducing local populations to levels where random events could lead to local extirpation.

Principle management concern is that large tracts (300-1000 ha) of unfragmented suitable habitat are required for nesting and must be protected. Primary habitat requirements on the breeding grounds are mature deciduous forest, understory patches of dense shrubs (e.g., mountain laurel), and a topography of moderate to steep slopes. Winter habitat requirements are less well known but believed to be dependent primarily on mature moist to wet broad-leaved forests. Specific habitat requirements during migration are not known.

2.4.1 Population Trends. North American Breeding Bird Survey (BBS) data indicate a significant population decrease in eastern North America, 1978-1988 (Sauer and Droege 1992); no significant change, 1966-1989 (Droege and Sauer 1990); nonsignificant increase of 7% from 1966 to 1993, nonsignificant decline of 4% from 1984 to 1993 (Price et al. 1995). In the Northeast, long-term population trends have declined the most in regions where the greatest proportion of the population occurs (West Virginia, Kentucky, Tennessee). Species has shown increases in southern New England. Estimated population trends for this species based on BBS data are suspect because sample sizes are small in most areas (Rosenberg and Wells 1995).

3.0 Species Conservation

This species requires large forest tracts for successful reproduction. Large contiguous areas with a minimum of nonforested edge produce the highest densities of breeding individuals (Gale et al. 1997) and increase reproductive success by decreasing cowbird parasitism and nest predation (Robinson et al. 1995). Several studies suggest that viable populations occur in forest tracts of 300 ha or more (Robbins et al. 1989, Wenny et al. 1993, Robinson et al. 1995). Reported as rare or absent in forest tracts smaller than about 20-70 ha in Maryland (see Bushman and Therres 1988). In Illinois, occurred in a forest tract of 65 ha but not in tracts of 25 ha or 14 ha (Robinson 1992). In Missouri, bred in a large continuous forest tract but not in two similar but smaller (300 ha) isolated sites (Wenny et al. 1993). In Connecticut, may nest in tracts as small as 20 ha but density is very low (Gale et al. 1997). It is unknown whether individuals nesting at small sites contribute offspring to future generations.

Robinson et al. (1995) suggested that a good regional conservation strategy for worm-eating warblers and other migrant songbirds is to identify, maintain, and restore the large tracts that are most likely to be population sources. Fragmentation of large forests into smaller ones may result in loss of local populations that will need to be replenished from birds from large, unfragmented forests.

3.1 Conservation Recommendations. Conservation recommendations are based upon current scientific data and support habitat requirements by the worm-eating warbler on Fort Campbell. The recommendations are general in nature and will require specific guidelines after delineation and assessment of all habitats on the installation. Recommendations are listed below:

1. Where possible, allow the growth of large contiguous tracts of deciduous forest. Forest restoration areas should be >300 ha and preferably >1000 ha in size. All forested stands should be devoid of forest roads

and/or openings to prevent nest parasitism by the brown-headed cowbird.

3.2 Management and Monitoring. Further studies are required to assess effects of various logging practices on both wintering and breeding grounds. However, this warbler probably is tolerant of many different forest management and logging practices; selective logging and thinning "overmature" trees may create favorable conditions; may nest in clearcut areas as young as 7 years old where several hardwoods have been left standing in the clearcuts (see Bushman and Therres 1988). The species is inconspicuous and easily overlooked during surveys.

3.2.1 Management Requirements:

3.2.1.1 Establish population metrics and develop list of activities that may influence, both beneficial and adverse, the Fort Campbell population.

3.2.1.2 Assist in the develop forest desired future conditions to support worm-eating warbler breeding habitat.

3.2.1.3 Annual monitoring of populations is recommended. Monitoring should include breeding and winter habitat assessments, distribution, demographics, and long-term population trends.

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APPENDIX E
General Evaluation Criteria for MRA and non-MRA

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Site specific determinations of effect will be completed using scientifically defensible methods. Biological and ecological impacts to species, populations, and their associated habitats will be evaluated before, during, and after to develop an understanding of impacts associated with MRA and non-MRA. General evaluation criteria are listed according to resource area. The list is not all inclusive.

1.0 Biological

1.1 Species Specific

Avian presence/absence # BCC species Species requirements Bird behavior (nesting, resting, pre-nesting, etc.) Territory (ies) size and location # nests observed

1.2 Population Level

birds on FTC # birds in the activity footprint 5 yr. population average Field threshold # (no more than 10% loss from the 5 yr. average) # birds displaced by activity % loss in reproductive capacity benefits/impacts to population

2.0 Ecological

total acreage % suitable habitat current habitat conditions anticipated cumulative impacts benefits/impacts to habitat

Fort Campbell
Watershed Management Plan

Prepared by:
Directorate of Public Works
Environmental Division
Fish and Wildlife Program

May 2018

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Executive Summary

Based on the Tennessee and Kentucky 2016 303(d) lists seven streams on Fort Campbell are listed as impaired with the majority have lost biological integrity due to hydro-modification, habitat alterations and siltation. The fundamental goal of the watershed management plan is to delist all Fort Campbell streams from the 303(d) list and keep the remainder of the streams from being listed. This will require a unified, watershed management approach and cooperation between all watershed members. This plan identifies strategies to help meet goals to delist Fort Campbell 303(d) streams and keep the remainder of the streams supporting their classified uses.

Due to the dated records and/or lack of data, this plan recommends the following:

- Execute the five year watershed management cycle per the 2014-18 Watershed Management Plan
- Establish baseline data for all streams & impervious surface acreage
- Develop TMDLs
- Develop a priority list for stream repair and specific watershed action plans
- Implement the watershed stakeholders group
- Update plan upon completion of first five goals, develop stream repair/maintenance timeline

As Fort Campbell continues to develop, it is imperative that a comprehensive management approach be implemented to protect water quality and the biological integrity of the stream systems. Therefore, this plan recommends the following to prevent future degradation:

- Better construction design to imitate natural flow regimes as well as incorporate green spaces into overall master plan and into individual construction sites
- Stream bank protection to include maintenance and development of wide native riparian buffers and debris clearing from bridges
- This plan recommends developing strategies to increase watershed stewardship
- Watershed outreach and education for schools/community programs/home school associations

Lastly, the need for on-going, adaptive management and plans to monitor the success of the proposed techniques and overall condition of the watershed will warrant:

- Stream and watershed physicochemical monitoring
- In stream habitat evaluation
- Metadata modeling to determine water quality and stream health

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1.0 Watershed Overview

The quality of our waters is a reflection of the quality of our land and our land use practices. Alan Levere stated, "A river is the report card of its watershed". Approximately 78 percent of Fort Campbell's streams are listed as impaired. A watershed is an area that drains water, sediment and dissolved materials to a common outlet at some point along a stream channel. The watershed management approach serves as an organizational framework for systematic assessment of the installation's water quality and plays a role in protecting both ground and surface water systems. By viewing and accessing the entire drainage area or watershed as a whole, the installation is better able to address water quality issues in a comprehensive manner. This unified approach affords a more in-depth study as well as unified corrective actions of/for watersheds and the land practices that affect the streams contained therein and therefore the water quality. Watershed management, sometimes referred to as ecosystem management, is a key component of installation sustainability (future productivity).

Sustainability involves balancing land use and resource protection within carrying capacity of the watershed to avoid a loss of training acreage and decreased tactical maneuverability, to avoid increased/natural resource maintenance cost and increased safety hazards.

As the division grows development will expand increasing the potential for greater impacts on natural resources vital to the continued mission that Fort Campbell has implemented. This expansion will increase impervious surfaces, which will impact stream quality by creating greater flows of rainfall to be directly deposited into surrounding streams. As natural vegetation is replaced with impervious surfaces and more drainage ditches are developed to carry water away from urban areas, more of a stream's annual flow is delivered as storm water runoff rather than base flow (channel flow due to ground water or soil moisture). A study from biology researchers at Baylor University and the University of Maryland-Baltimore (2011) found that there are consistent and widespread declines in stream biodiversity at lower levels of urban development more damaging than what was previously believed. The study found that aquatic life actually shows significant loss of biodiversity with less than two percent of developed land in a watershed. This is much less than what a decade-old analysis widely cited by environmental policymakers suggests that it takes up to 15 percent of solid surfaces like roads or parking lots, or 20 to 30 percent developed land in a given area before local water systems no longer sustain normal aquatic life (King et al. 2011). Depending upon the amount of impervious surface, the annual volume of storm water runoff can increase up to 16 times compared to natural areas (EPA, 2008 Web Academy). Therefore, when it rains, storm water moves rapidly over smooth impervious surfaces and through anthropogenic ditches entering streams quicker, altering stream flow and flood pulse.

In other words, the increased runoff leads to unstable stream beds, banks and erosion. Flow alteration is a change to the flow that leads to a loss of instream habitat that aquatic communities rely upon to maintain a diverse and functioning food web. Increased water velocities may cause extreme down-cutting of stream and river channels, aggradations, and degradation of stream beds with an increase of sediment transported downstream. Since impervious cover prevents rainfall from infiltrating the soil, less flow is available to recharge ground water aquifers and drinking water supplies. Therefore, during extended periods of no rainfall, base flow levels are often reduced and stream channels are dry.

Typically, watersheds for streams with large amounts of impervious surfaces have faster and greater runoff

compared to those with more natural areas. As development increases and the natural vegetation is removed, the stream processes of flooding, erosion/deposition, import and export of organic matter/sediment, stream corridor habitat diversity and water quality characteristics are significantly impacted.

2.0 Installation Physiographic Features

2.1 Watershed Land Use

Fort Campbell is located on approximately 104,400 acres in Montgomery and Stewart counties in Tennessee and Trigg and Christian counties in Kentucky (Figure 1). Approximately twelve percent of the installation is developed while 88 percent is an undeveloped rear area for military training (Table 1). This plan addresses all 104,400 acres.

The rear area contains approximately 26,000 acres of ranges and impact areas, 65,800 acres of light maneuver area and the 2,602 acre Clarksville Base. Minus roads, cleared areas, and structures associated with ranges, heliports, storage, support facilities, the majority of the rear area is natural habitat, including forests, fields/barrens, fields leased for agriculture, streams, lakes and wetlands. Approximately 9,270 acres of the installation consists of the cantonment, which is the main post or developed area consisting of residential housing, commercial, institutional (hospitals, schools), administrative, maintenance, airfield and recreational facilities to include the golf course. Vegetation in the cantonment area consists of ornamental grasses and shrubs and trees, many of which are non-native species.

The rear area contains the Impact Area (21,800 acres) and the Small Arms Impact Area (4,240 acres). These two areas are off limits to personnel due to hazards associated with unexploded ordinances. Aerial photography is used to assess area conditions since these areas cannot be actively managed due to the abundance of unexploded ordinance.

The land surrounding Fort Campbell is primarily agricultural; however, commercial and industrial properties are present in Oak Grove and Hopkinsville, Kentucky and Clarksville, Tennessee. The area adjacent east of the cantonment consists of commercial properties.

2.2 Topography

The installation is located within northwestern Tennessee and southwestern Kentucky. Topography is primarily gently rolling with the exception of the relatively flat area along the eastern border and approximately 5,000 acres of highly dissected hills along the western border. The installation is approximately 163.1 square miles. Fort Campbell is located approximately 500 feet above sea level. It is characterized by hot, humid summers and cool winters. The average mean temperature is 69.7 degrees Fahrenheit. The average yearly rainfall is 50.18 inches. Spring months are the wettest, with March, April and May delivering an average of 5 inches of precipitation. Summer rainfall typically comes in the form of scattered convection showers. The mean annual maximum rainfall in 1 hour is 1 inch. The mean annual maximum rainfall in 24 hours is 3 inches.

Elevations range from 397 feet above sea level south of the cantonment area, where Little West Fork Creek exits the installation, to 718 feet above sea level in the Saline Creek area of the western portion

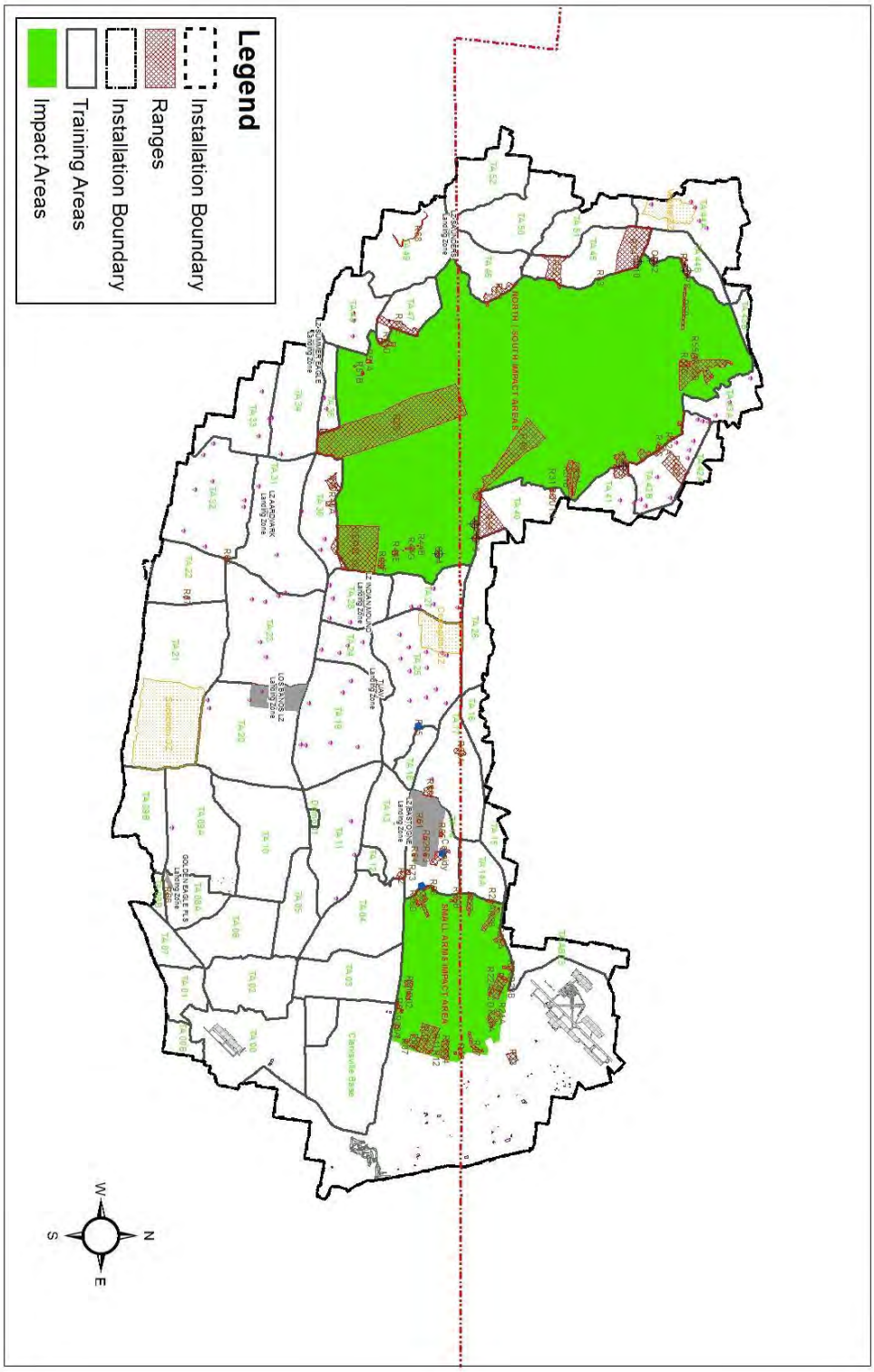

Figure 1. Fort Campbell Military Installation Map.

Table 1. Fort Campbell Land Use Categories

Fort Campbell Land Use Categories

Category	Description	Acreage	Dominate Landscape Feature	Percentage of Impervious surface
Built-up Area	Cantonment Area	9,276	Developed	23%
	Old Clarksville Base	2,602	Developed	10%
	Woodlawn Landfill and Solid Waste Management Units	724	Developed	>1%
Ranges and Impact Area	Small Arms Impact Area	4,241	Forested	Not calculated
	Impact Area	21,761	Forested	Not calculated
Training and Maneuver Areas	Portion of rear area designated for light maneuvers	65,794	Forested	Not calculated
Total		104,400		34%

of the installation. Slopes range from 2 percent to 70 percent in the steeper stream valleys. Most of the lower lands contain collapsed basins and sinkholes, the majority without water. The natural vegetation consists of oak-hickory forest with mosaics of bluestem prairie. The barrens of Kentucky that extended south into Stewart, Montgomery and Robertson counties were once some of the largest natural grasslands in Tennessee (Baskin, J.M et al 1994).

2.3 Geology

The installation is located within the Western Pennyroyal Karst ecoregion of the Western Highland Rim surrounding Nashville. This ecoregion consists of irregular plains/barrens, scattered with small sinkholes, depressions and dendritic systems associated with karst topography. The soils are formed from a thick loess mantle over residuum of Mississippian-age (320 to 345 million years ago) limestone. Beneath the Mississippian residuum are the older primarily limestone Warsaw Limestone, Fort Payne Chert, and

Chattanooga Shale Older units of Devonian, Silurian, and Ordovician ages are exposed along some of the more deeply incised streams (Tetra Tech, 1999).
As evidenced by the numerous sinkholes, the limestone formations are subject to solution weathering. The north and northeast sections of the installation are in a karst area. This area is characterized by thin mantles, sinks and fractured and solution-weathered limestone (Tetra Tech, 1999).

2.4 Soils

Greater than 50 percent of the soils on the installation are highly erodible and have a moderate to severe erosion potential. There are 23 soil mapping units that occur on Fort Campbell. Dickson silt loam is the most common and occurs on approximately 28 percent or 29,232 acres. This soil is found on the upland training areas located in the middle and southern portions of the installation. The second most common type of soil is Hammack (Bewleyville) silt loam and covers 14,105 acres. Sengtown gravelly silt loam covers the bottomland areas. Sengtown is found adjacent to streams and covers 10,931 acres. Together these three soil units make up over 52 percent of the mapping units. All are highly erodible. Minimizing soil erosion and the impacts to streams and other water bodies are top priorities for the installation. There are three hydric soil types and 15 soil types classified as prime farmland on the installation per the USDA. (BHE 2008a) There are roughly 6,000 acres in agricultural lease.

2.5 Hydrology

The major uses of water on Fort Campbell are water supply, recreation, training and aquatic habitat. Fort Campbell water sources consist of groundwater, surface water and wetlands. There are approximately 453 miles of streams, 720 acres of wetlands and 4 small man-made lakes located within 3 watersheds (Little West Fork, Saline Creek and Little River) (Figure 2). All watersheds on the installation eventually drain to the Cumberland River, a tributary of the Ohio River, which drains to the Mississippi River and ultimately to the Gulf of Mexico. The watersheds on the installation, with the exception of Saline Creek, drain to the Red River or the Little River. The Red River is a major stream of north-central Tennessee and south-central Kentucky and is a main contributory of the Cumberland River. Little West Fork, Fletcher's Fork, Jordan Creek, and Noah's Spring Branch watersheds drain to the Red River. The Little River drains to Lake Barkley. Casey Creek and Skinner Creek drain to the Little River. Saline Creek watershed drains directly to Lake Barkley (Cumberland River Impoundment). Major streams on Fort Campbell are perennial. Per the 22 March 2004 Hydraulic Classification of Waterways at Fort Campbell, Kentucky and Tennessee, there are approximately 46 miles of perennial streams, 100 miles of intermittent streams and 106 miles of wet weather conveyances.

2.6 Groundwater

Fort Campbell has two confirmed aquifers that deliver water to the surrounding streams on base. One is a shallow aquifer that is recharged by sinkholes occurring in the karst landscape under the installation and the other is a deeper aquifer that is charged by Boiling, Quarles, and Blue Springs. There are numerous natural springs which supply water to many of the streams on Fort Campbell. To date, 27 springs (Figure 2) have been documented on the installation and archived into ArcGIS for future reference and updates. The primary source of drinking water used at Fort Campbell originates from Boiling Spring, which receives groundwater from the Boiling Spring groundwater basin. This basin covers

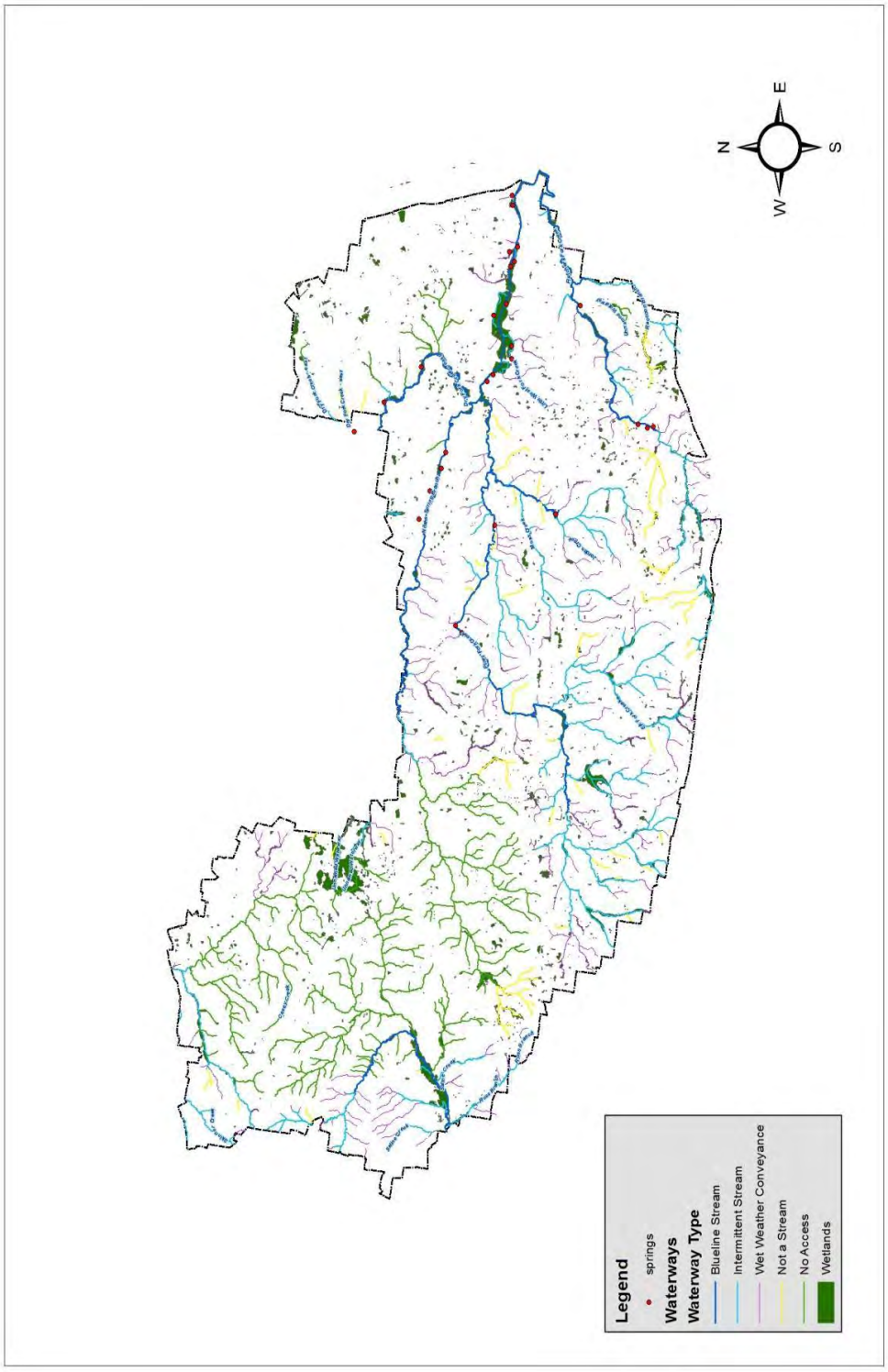

Figure 2. Streams, Sinks, and Impoundments of Fort Campbell.

30 square miles on Fort Campbell, and underlies much of the surface drainage of Piney Fork. In addition to water that originates directly above its groundwater basin, Boiling Spring receives some stream flow from adjacent areas, including Noah Spring Branch and Dry Fork East Creek. Tracer studies indicate that Boiling Spring has no traditional recharge directly through sinkholes (USACE 1994).

Regardless of origin, all the water that discharges from Boiling Spring flows down the potentiometric gradient through the bedrock aquifer in the Boiling Spring groundwater basin (USGS 1996).

To protect groundwater quality, Fort Campbell maintains 100-foot vegetated buffers around karst features to minimize run-off into groundwater via these features. Within the 100-foot buffers, Fort Campbell prohibits commercial timber harvest, development of skid trails, haul roads, and fire control lines, and creation of forest openings. If a cave entrance occurs within a prescribed burn area, the Fish and Wildlife Program must review proposed activities to determine the potential for effects to rare, threatened, or endangered species. In addition, application of pesticides, fertilizers, and other chemicals, as well as refueling and other potentially polluting activities are limited near karst features. Erosion control and spill prevention and control techniques in karst areas are developed in Fort Campbell's Compliance Program.

2.7 Surface Water

The surface water systems on Fort Campbell include approximately 700 watercourses, totaling about 453 stream miles (BHE 2004b). Approximately 160 miles of streams are within impact areas, and 293 miles are outside impact areas. The installation is divided into nine sub-watersheds, which are the primary management units in the Watershed Management Plan. Dry Fork East, Piney Fork, Jordan, Fletcher's Fork, and Noah's Spring Branch creeks drain to the Little West Fork Creek, which drains to the Red River, a tributary to the Cumberland in Clarksville. Saline Creek drains to the Cumberland River, which flows approximately 9 miles south and 5 miles west of the installation. Casey Creek and its tributaries, including Skinner Creek, drain into the Little River in Kentucky, which then flows into Lake Barkley northwest of Fort Campbell. The Cumberland River flows into the Ohio and Mississippi Rivers and ultimately into the Gulf of Mexico. Surface water on the installation also drains into the groundwater system via sinkholes and disappearing streams.

In 2003, Fort Campbell conducted a comprehensive inspection of streams to characterize perennial and intermittent streams, and wet weather conveyances in the training and maneuver area (BHE 2004b). The nine sub-watersheds and associated streams are described below. Four small man-made lakes also are present on Fort Campbell. Generally, high water occurs during the months of December through April, gradually receding to the low water period, August through October. Disappearing streams are more likely to occur during drought conditions in late summer and early fall when the water table typically drops due to infrequent rain.

2.8 Impoundments

There are three man-made lakes on Fort Campbell. They are used for recreation and training. Lake Kyle: a 75 acre lake located in a maneuver area, (TA 31) located in the southwestern corner of the installation. The lake was formed with an earthen dam with a concrete spillway. This lake is often used for training

and recreation. Per historical photograph review, the lake was constructed in the 1940s. Prior to construction the lake area was farmland. Per, Byrnes, 1992, the lake depth is approximately 10 feet with significant sediment deposition. In 1999, triploid grass carp were released into Lake Kyle to manage submerged aquatic vegetation. Projects are being executed now to reinforce the toe of the dam, increase spawning bed areas, repair boat ramps, and add fishing structures to the fishery.

Joe Swing Quarry: a 5.2 acre quarry located near the golf course.

Impoundment at TA 8: a 4 acre impoundment created to be a basin for fields north and west. However, surface flow does not reach impoundment nor is the outflow structure connected. There are additional ponds and wetland of various sizes throughout the installation.

3.0 Watershed Characteristics

Fort Campbell lies within the Red River basin, USGS Hydrologic Unit Code (HUC) designation 05130206 and the Lower Cumberland basin, HUC designation 05130205. The installation is located within three drainage areas or watersheds (Figure 3), which are further divided into nine sub-watersheds. The nine sub-watersheds (Figure 4) are the manageable units on the installation.

The watershed USGS HUC designations are supplied in Table 2. Seven streams on Fort Campbell are listed as impaired per the state 303(d) listing by Tennessee and Kentucky Environmental Divisions (2014). See Table 3 Sub-watersheds and associated stream characteristics on Fort Campbell.

3.1 Little West Fork Creek Watershed

There are five streams (five sub-watersheds) and their tributaries that drain into Little West Fork Creek: Fletcher's Fork, Noah's Spring Branch, Jordan Creek, Dry Fork East, and Piney Fork Creek. This watershed is composed of approximately 297 stream miles and covers approximately 124 square miles or 79,324 acres that drain roughly 66 percent of the surface runoff from the installation. Stream flow within this watershed drains in an easterly direction toward a confluence with the Red River. Per Tetra Tech, 1991, the streambed gradient is gentle with banks consisting primarily of silt or cherty silt and is moderately steep, with 35–50 percent slopes. The mean annual discharge is 24,235 gallons per minute (gpm) and supports Fort Campbell's drinking water supply. Little West Fork watershed is divided for management purposes into six sub-watersheds, Dry Fork Creek East, Noah's Spring Branch, Piney Fork Creek, Jordan Creek, Fletcher's Fork Creek and Little West Fork Creek.

Dry Fork Creek East: This sub-watershed covers approximately 12,158 acres or 19 square miles of training area, existing impact area and developed areas that include Campbell Army Airfield (CAAF) and the northern portions of the cantonment. Approximately 10 percent of this sub-watershed is forested. The headwaters of Dry Fork Creek originate off the installation in agricultural fields north and west. The sub-watershed contains approximately 6 miles of perennial streams and 1 mile of intermittent stream. Dry Fork Creek East designations are: Warm water habitat (WAH), primary contact recreation (PCR), secondary contact recreation (SCR), Drinking water supply (DWS). Dry Fork Creek East, segment 5.8-6.6 does not support WAH due to sedimentation/siltation.

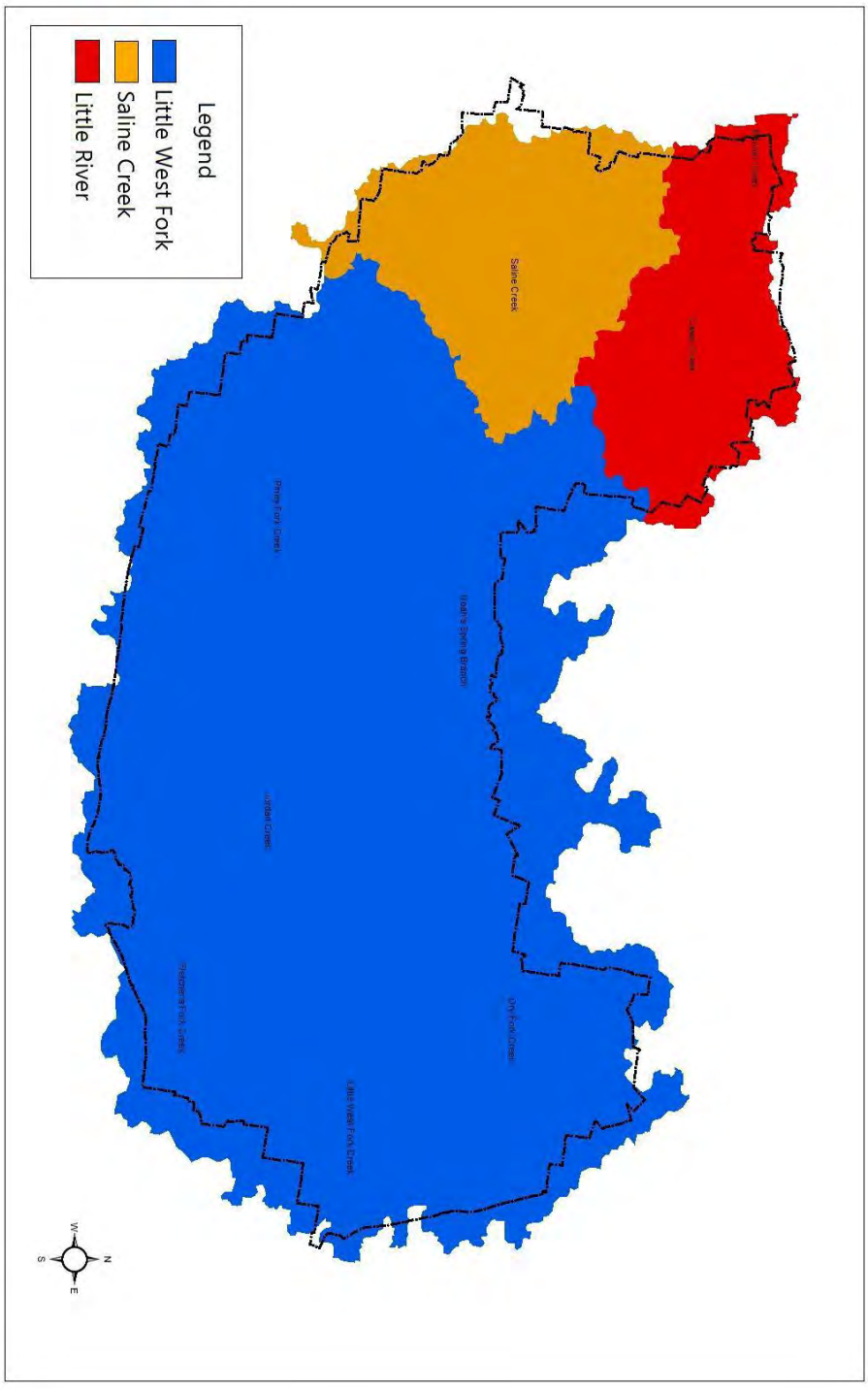

Figure 3. Major Watersheds contained within Fort Campbell Military Instillation.

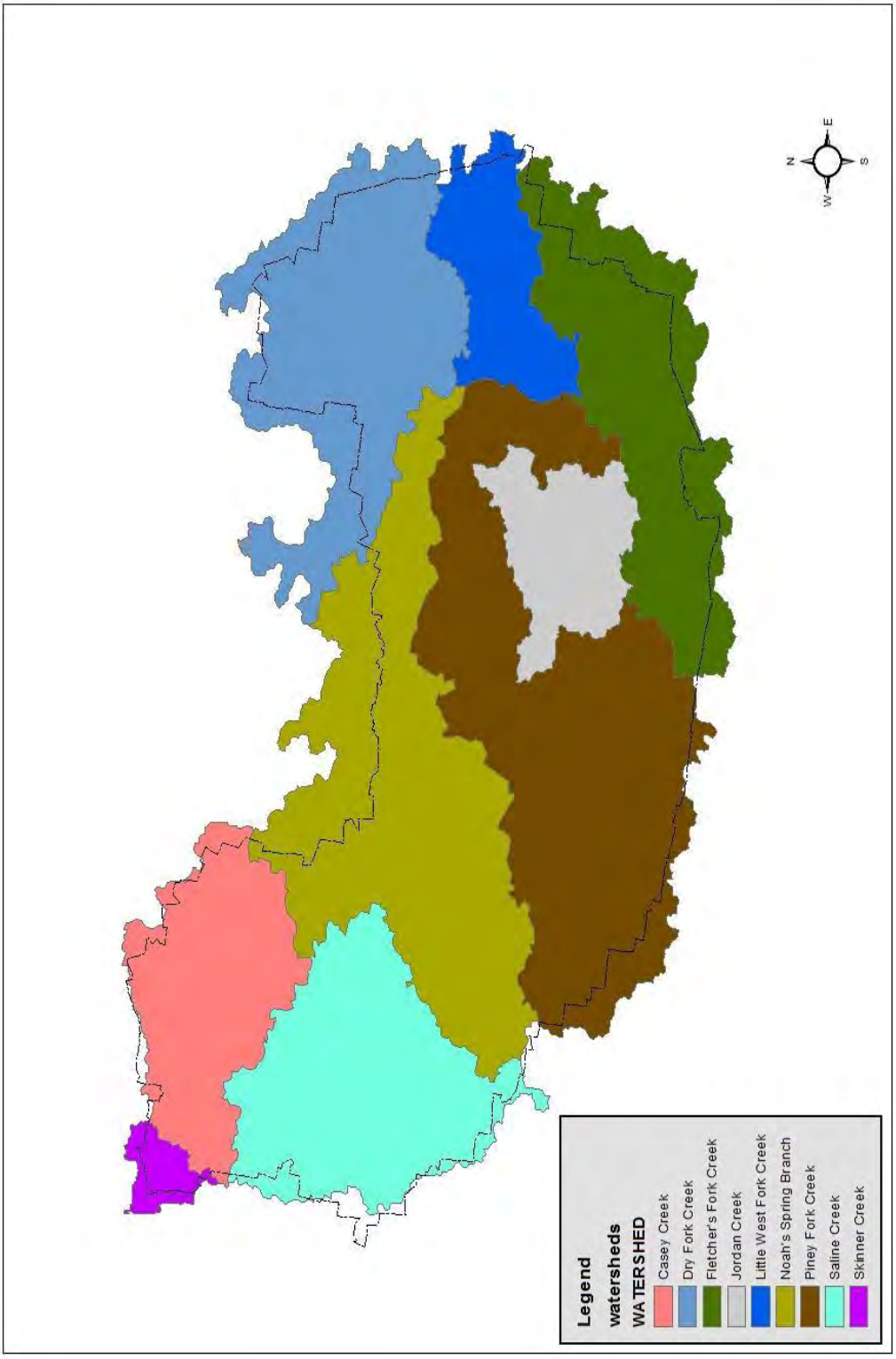

Figure 4. Sub-watersheds contained within Fort Campbell Military Instillation.

Table 2. Watershed HUC Designations. 12 digit designations are included; otherwise the 8 digit HUC is used.

Sub-watershed HUC Designations		
Sub-watershed Name	12 digit HUC Designation	Segment Length (miles)
Little West Fork Creek	051302060705/03	16.5
Piney Fork Creek	051302060702	102
Fletcher's Fork Creek	051302060704	38
Jordan Creek	05130206	28
Noah's Spring Branch	051302060701	69
Dry Fork Creek East	05130206	15
Saline Creek	05130205	78
Casey Creek	05130205	44
Skinner Creek	05130205	3

Noah's Spring Branch: This sub-watershed covers approximately 18,734 acres of training and impact area, approximately 39 square miles. Approximately 27 percent of the area is forested. The headwaters of Noah's Spring Branch originate entirely on the installation. Dry Fork Creek East drains to Noah's Spring Branch. Noah's Spring Branch also receives input from several tributaries originating off the installation. Portions of the sub-watershed lie within the Impact Area and are inaccessible. Noah's Spring Branch joins Piney Fork Creek to form Little West Fork Creek. Per the INRMP (2014-2018), of the accessible area, the sub-watershed contains approximately 26 miles of classified streams, 9 miles perennial, 3 miles intermittent and 14 wet weather conveyances. Noah's Spring Branch designated uses are: fish and aquatic life (FAL), recreation (REC), livestock, wildlife watering (LWW), and irrigation (IRR). Per the 2014 303(d) list, 2.8 miles of Noah's Spring Branch are under a category 5 impairment within unknown toxicity.

Piney Fork Creek: This sub-watershed covers approximately 25,327 acres of training area, approximately 40 square miles. Approximately 27 percent of the sub-watershed is forested. Per the INRMP (2014-2018) roughly 1 mile of Piney Fork Creek headwaters originate off the installation. Piney Fork Creek exhibits interstitial flow approximately 0.5 mile upstream of the confluence with Jordan Creek to its mouth at Little West Fork Creek and upstream of Elk Fork Creek. There are about 102 miles of classified streams, 13 perennial, 47 intermittent and 42 miles classified as wet weather conveyance. Piney Fork Creek designated uses are: FAL, REC, LWW and IRR. Per the 2004 303(d) list Piney Fork Creek is listed as impaired (loss of biological integrity) due to siltation and habitat modifications. However, the 2008 303(d) delisted stating the previous impacts were due to periodic dryness rather than pollution but data collected by CB employees has shown an abundance of siltation and habitat degradation.

Jordan Creek: This is the only sub-watershed located entirely within the installation. It drains approximately 6,263 acres or 9.7 miles. Approximately 79 percent of the sub-watershed is forested. Of the

Table 3. Characteristics of nine sub-watersheds and associated streams on Fort Campbell.

Subwatershed	Watershed Area (acres)	Length of Stream on Fort Campbell (miles)				Designated Uses[a]	Fully Supporting of Designated Uses?[b]
		Perennial Stream	Intermittent Stream	Wet Weather Conveyance	Total		
Little West Fork Creek	6,124	6	2	8.5	16.5	IWS, FAL, REC, LWW, IRR	No
Dry Fork East Creek	12,158	6	3	6	15	FAL, IWW, REC, IRR	No
Piney Fork Creek	25,327	13	47	42	102	FAL, REC, LWW, IRR	No
Jordan Creek	6,263	2.5	12	13.5	28	FAL, REC, LWW, IRR	Yes
Fletchers Fork	10,718	9	15	14	38	FAL, REC, LWW, IRR	No
Noahs Spring Branch	18,734	9	14	46	69	FAL, REC, LWW, IRR	Yes
Saline Creek	13,944	7	27	44	78	IWW, FAL, REC, LWW, IRR	Yes
Casey Creek	10,380	0	11	33	44	CAH, PCR, SCR	No
Skinner Creek	748	0	2.5	0.5	3	CAH, PCR, SCR	No

[a] Source: TDEC 2004a and 401 KAR 5:026. IWS – Industrial Water Supply; FAL – Fish and Aquatic Life; REC-Recreation; LWW – Livestock and Wildlife Watering; IRR – Irrigation; CAH – Cold Water Aquatic Habitat; PCR – Primary Contact Recreation; SCR – Secondary Contact Recreation

Table 3. Sub-watersheds and associated stream characteristics on Fort Campbell.

28 classified streams, 2.5 are perennial, 12 intermittent and 13.5 are wet weather conveyances. Jordan Creek exhibits interstitial flow near its confluence with Piney Fork Creek. Flowing water is typically found 0.75 upstream of the mouth. Jordan Creek designated uses are: FAL, REC, LWW, and IRR.

Fletcher's Fork Creek: This sub-watershed covers approximately 10,718 acres or 17 square miles. Approximately 62 percent of the sub-watershed is forested. Of the 38 classified streams in Fletcher's Fork Creek sub-watershed 9 streams are perennial, 15 intermittent and 14 are wet weather conveyances. There is one stream within Sabre Heliport that was inaccessible and therefore not included in the total classified stream miles. There are several headwater streams that originate off the installation south and southeast. Designated uses for Fletcher's Fork Creek are: FAL, REC, LWW, and IRR. Fletcher's Fork Creek was delisted from the 2014 303(d) list for waters returned to a healthy status to support its designated uses.

Little West Fork Creek: This sub-watershed covers approximately 6,124 acres or approximately 10 square miles. Prior to construction of the new Brigade Combat Team facilities within the Old Clarksville Base and the new Woodlands housing subdivision roughly 50 percent was forested. Impervious surface estimations will need to be calculated to determine the percent forested once the build-out is complete. The sub-watershed contains approximately 6 miles of perennial and 2 miles of intermittent streams. Little West Fork Creek designations are: Industrial water supply (IWS), FAL, REC, LWW and IRR. Little West Fork Creek is listed on the 2014 303(d) list as category 5 impaired for total phosphorus, loss of biological integrity and low dissolved oxygen due to major municipal point source, siltation, and other non-point source pollution from military base.

3.2 Saline Creek Watershed

Two streams make up the Saline Creek watershed; Saline Creek and Dry Fork Creek West. The watershed is composed of approximately 76 stream miles which drain 13,944 acres or 19 square miles of the western portion of the installation in a southwesterly direction. Saline Creek originates on Fort Campbell with the majority of the Fort Campbell portion of the watershed located in the north impact area and therefore inaccessible. Additionally, much of the Saline Creek watershed exists west and downstream of Fort Campbell. Of the 33.08 miles of classified streams in the sub-watershed, approximately 5 miles are perennial, 14 miles are intermittent, and approximately 18 miles are wet weather conveyances. Dry Fork Creek West and Ross Branch drain to Saline Creek.

Saline Creek Watershed is characterized by steep, hilly terrain. Stream banks are steep with greater than 50 percent of the stream bank slopes nearly vertical. The mean annual discharge is 4,250 gpm. Training in this watershed has the potential to cause erosion and affect water quality in this watershed. (Tetra Tech, 1999).

Saline Creek designations are: FAL, REC, LWW and IRR. None of the streams on Fort Campbell within this watershed are listed on the 2014 303(d) list.

3.3 Little River Watershed

Casey Creek and Skinner Creek and their tributaries make up the Little River Watershed that lies within the installation. This watershed is composed of 49 stream miles, which drain the northwestern portion of the

installation in a northern direction. Per Tetra Tech (1999) mean annual discharges range from 16 to 4066 gpm for the streams contained within this watershed. Little River Watershed is divided into two sub-watersheds on Fort Campbell, Casey Creek and Skinner Creek watersheds.

Casey Creek Sub-watershed: The majority of the Casey Creek sub-watershed, which consists of 10,380 acres or 16.2 square miles originates within the North Impact Area and is inaccessible. The sub-watershed drains north off the installation. Of the 13.20 miles of classified streams there are approximately zero perennial miles, 5 intermittent miles and 8 miles of wet weather conveyances. There are three storm water retention basins located with training area 44 to control flash flooding during storm events. Casey Creek designated uses are: cold water aquatic habitat (CAH), PCR and SCR. From the 2014 303(d) list Casey Creek segment 0.0 to 3.6 is impaired and partially supporting aquatic habitat due to sedimentation/siltation.

Skinner Creek Sub-watershed: A small portion, 748 acres or approximately 1.2 square miles, of the Skinner Creek sub-watershed lies within the installation. The majority of the watershed exists north of Fort Campbell. Of the 3.25 classified stream miles, zero was perennial, 2.7 miles were intermittent and .52 miles were wet weather conveyances. Skinner creek is designated as warm water aquatic habitat (WAH), PCR and SCR. Skinner Creek is listed on the 2014 303(d) list segment 0.0 to 5.8 as not supporting aquatic habitat. Kentucky Division of Water lists cause unknown.

4.0 Management Strategies

This section summarizes the recommended watershed strategies (Figure 5) for Fort Campbell as well as the management cycling phases (Figure 6).

4.1 Status Quo and Data Collection

Continue 5 year Management Cycle: Due to dated records and/or lack of data this plan recommends following the five year management cycle established with the initial watershed management plan written in 2000. The 2000 plan outlines a five-year schedule designed to accomplish all five phases of watershed management in every sub- watershed, while balancing annual workloads of the Fort Campbell resource programs.

Continuing the cycle, per the 2000 plan, allows continuity and integrity with existing programs within the Conservation Branch and Environmental Division and with programs outside the Environmental Division. Due to lapses in monitoring and sampling over FY11, phase one of the watershed management plan will be rebooted for FY12 to maintain integrity in reporting and efforts. Fort Campbell is currently monitoring water quality to assess baseline stream conditions. To date, Jordan Creek and Fletcher's Fork Creek have been monitored and TMDL's developed. Evidence of suboptimal habitat and excessive siltation were recorded, indicating impaired habitat.

A primary cause of stream impairment on Fort Campbell is siltation from habitat modification. Stream sediment deposition ranges from moderate to severe. Per the 2008-2012 INRMP, from September 2002 to May 2003, water samples were collected following heavy rain events to determine total suspended solids in the streams. Sediment loading ranged from an average of 2,728 tons per year to 59,130 tons per year. Water quality assessments will be conducted per the management cycle outlined in the 2000 watershed

Status Quo and Data Collection
1. Continue to execute the five year management cycle per the existing Watershed Management Plan.
2. Establish baseline data for all streams & calculate impervious surface acreage.
3. Develop TMDLs for impaired streams.
4. Develop watershed stakeholders/partners group.
5. Develop a priority list for stream repair and specific watershed action plans.

Update Plan
1. Update plan upon completion of first five goals and develop a timeline for and track stream repair/maintenance.

Develop Strategies to Prevent Future Degradation
1. Incorporate better construction design that imitates natural flow regimes as well as incorporate green spaces into overall master plan and individual construction sites.
2. Stream bank protection to include maintenance and development of wide riparian buffers and bridge maintenance.

Develop Strategies to Increase Watershed Stewardship
1. Watershed outreach and education for schools/community programs/home school associations.

On-going Management
1. Stream and watershed monitoring.

Figure 5. Recommended Watershed Strategies for Fort Campbell.

plan. Historical sediment data has been compiled and continued turbidity monitoring is currently being conducted to determine areas of highest capacity for impairment to support the facilitation of remediation efforts.

4.2 Cycle Summary for the Watershed Management Plan: Management Units

The Conservation Branch has historically used streams and stream segments as the spatial basis for coordinating selected water quality management activities. Evaluations and assessments for historical work within all streams on the reservation have indicated a need for a higher level of spatial analysis and review. Watershed boundaries have been determined as the management level required for sound decision making. Fort Campbell contains 3 recognized drainage areas for rivers and streams that are further divided into 9 sub-watersheds (Fig. 3 & 4). The boundaries of the watersheds are hydrologically defined, and because of their use in reservation resource management, they provide an important precedent in support of a watershed management approach. While streams and stream segments have been historically used on Fort Campbell as the geographic units for water quality work and management, the Conservation Branch and other resource management agencies have identified various limitations in the system:

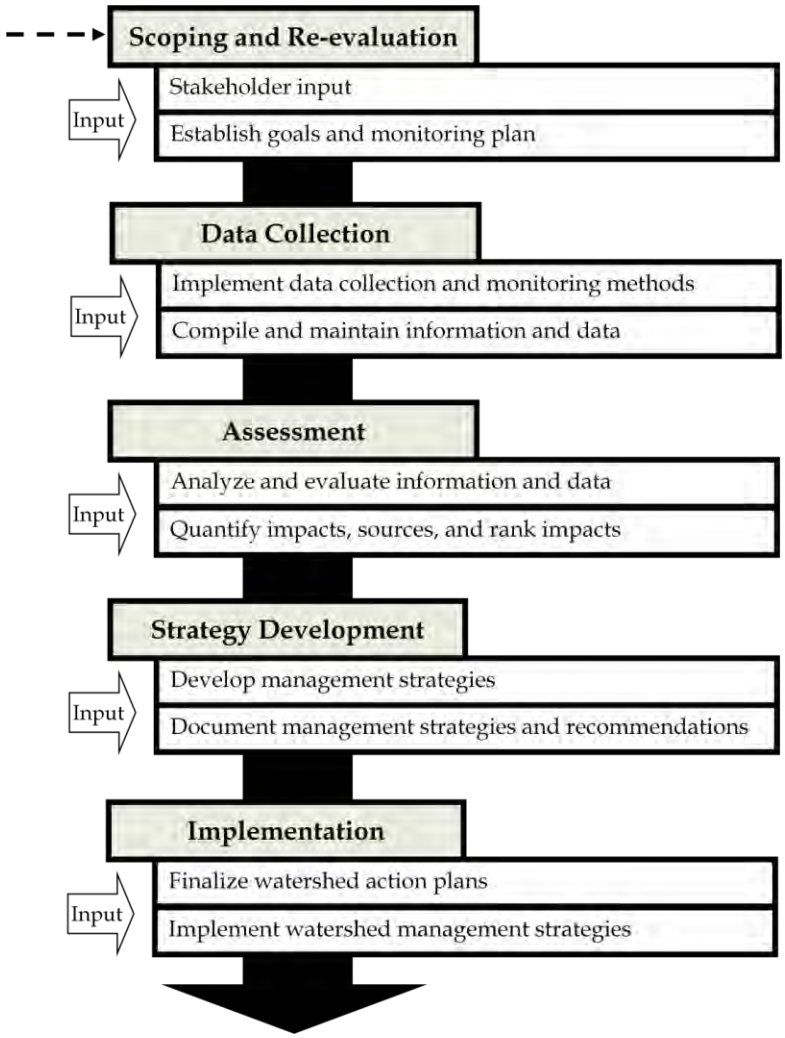

Figure 6. Watershed Management Cycle Phases for Fort Campbell.

- The historical focus on stream segments has led to a perception of water quality that is restricted to the stream, its bed, and its banks. As a result, the land (or watershed) that drains into each segment has not been based on consistent criteria.
- The spatial resolution of existing stream segment work is not examined on a large enough scale to identify and address many water pollution sources.

These limitations have led the Conservation Branch and other resource management programs to consider adopting a more consistent, hydrologically defined geographic unit (i.e., watershed). The readily identifiable boundaries of watersheds provide a functional geographic unit for coordinating management efforts. A common set of geographic units provides standardized means for locating, inventorying, exchanging, and

assessing data relevant to watershed hydrology and water quality issues. Units of different sizes (e.g., watersheds and river basins) allow for watershed- based activities at different scales.

Just as the reservation's watersheds provide geographic focus for coordination, the watershed management cycle provides the focus for scheduling activities and coordinating resources within each watershed. The cycle combines three features into an orderly system for continuously focusing water quality management activities through:

- A phased series of watershed management planning and implementation activities to achieve a complete iteration of the watershed management cycle every five years.
- A sequence and schedule for conducting these activities in all watersheds.

The watershed management cycle establishes a rational process for developing and implementing TMDLs and other statues, which are now viewed as action plans that specify activities needed to restore and protect water quality standards of individual water bodies.

4.3 Update Basin Management Schedule

The basin management schedule is designed to accomplish all five phases of watershed management in every reservation basin, while balancing annual workloads of resource programs. The reservation's 9 sub-watersheds, along with its rivers, streams, and tributaries, are assembled into groups:

- Group A (Jordan Creek)
- Group B (Piney Fork Creek)
- Group C (Fletchers Fork Creek)
- Group D (Noah's Spring Branch)
- Group E (Saline Creek, Casey Creek, Skinner Creek, Dry Fork Creek, Little West Fork)

Several watershed attributes were utilized to produce the groups. Of major importance are the statuses and scheduled workload of the Fort Campbell Cultural Resources program. Training requirements are also being considered to best coordinate available times and resources for watersheds that run through training areas on base.

Complete transition to the watershed management cycle will take approximately 5 years. Cycling began in 2012 with Basin Group A, the Conservation Branch will phase in the management cycle. Each year, the cycle will be phased in for the next basin group, until all basin groups have been initiated in 2016. Activities in all basin groups will continue sequentially in the same order, repeating the cycle every five years. The reservation basin schedule provides resource programs, partners, and other Stakeholder involvement is essential with a basis for long-term work planning.

All programs will know well in advance when certain activities will occur and can plan accordingly. Therefore, programs will spend less time trying to synchronize schedules on an ad hoc basis each year. Although some flexibility in meeting schedules may be allowed under certain circumstances, programs need to stay on the basin schedule to maintain the continuity and integrity of the framework.

The Conservation Branch recognizes that circumstances differ in each watershed in a given year-for example, weather patterns may delay planned strategic monitoring, or complexity may delay development of management strategies for certain issues. If circumstances occur that prevent the collection of all recommended information, the available data will be used to formulate the most complete management strategies possible. Activities not completed and priorities not addressed in one iteration of the cycle can be addressed in the next five-year cycle.

Establish baseline data for all streams and calculate impervious surface area of installation:
Baseline monitoring of physicochemical parameters shall be conducted on every water body in the watershed. Per the 2000 Watershed plan, this is the traditional monitoring performed continually at key sites on high-profile water bodies regardless of the watershed cycle. Data are collected to adequately characterize water quality and monitor progress of streams. Baseline data are critical for determining water quality standards by allowing findings to be measured against a standard that highlights fluctuations in range value. Targeted monitoring will establish the geographic extent and degree of water quality impairment necessary to revise water quality standard and to support specific permits.
Watershed TMDL assessments have been completed for Jordan and Fletcher's Fork Watersheds. Recommendations for impairment restoration in these watersheds can be found in reports from Aerostar Environmental Service (Aerostar 2011a & b). Field verification of reach restoration recommendations is necessary to develop a priority list of stream repair/restoration. Further recommendations: Baseline turbidity data for all streams along w/ flow data, install water gauge station on Little West Fork Creek at 101st Airborne Division Road at Bridge, and install remote weather stations to correlate turbidity data.

Lastly, Fort Campbell's soils are highly erodible and therefore vulnerable to increase in storm water runoff especially as the installation is developed. Hydrologic impacts pose one of the greatest challenges in the watershed; therefore calculations of impervious cover within the cantonment and rear areas have been calculated utilizing GIS for 2015, highlighting areas with the highest potential for detrimental impacts to water quality. As the installation continues to develop the loss of vegetation and the increase in impervious surfaces will impact stream health, often forcing the stream system beyond its carrying capacity which leads to stream erosion and degradation. Following protocols that deter construction/development from further impacting the system is the only way to restore a degraded stream while allowing new development to continue. Storm water must be managed on development sites according to Best Management Practices (BMPs) set forth in the 2014-2018 Integrated Natural Resource Management Plan (INRMP) so that post-development storm water peak flow and total volume are reduced to the greatest extent possible.

Develop TMDLs: The strength of a total maximum daily load (TMDL) program or clean- up program is its ability to support development of information-based, water quality management strategies. The TMDL provides critical direction for watershed management at the local and regional levels. Per the 2000 watershed plan, "A total maximum daily load is no longer merely, a load allocation number obtained through a water quality modeling exercise. Instead, a TMDL is a process that should culminate in a written, quantitative assessment of water quality problems and contributing sources, and an implementation plan identifying responsible parties and specifying actions required to restore and protect water quality standards. The TMDL provides a pollutant allocation mechanism that is useful in coordinating local, regional, state and federal and international actions to restore water quality."

The seven streams listed on the 303(d) listed are mandated for TMDL development; therefore, this plan recommends the installation fund TMDL development for all seven streams listed impaired on the 303(d) list. The purpose of a TMDL is to provide consistent reference documentation that presents specific management strategies and corresponding roles for those responsible for implementing water quality restoration and protection measures. The level of effort and extent of documentation necessary for developing a TMDL will vary per watershed. Watershed size, model complexity, number and complexity of pollutants, distribution and quantity of point and non-point sources and extent of public participation will affect TMDL development.

An important component of the success of the TMDL program is to build linkages to other programs, such as nonpoint source management. In other words, build from the "bottom up" to link water quality concerns to solutions. Therefore, another purpose of the TMDL is to reach as wide an audience as possible to increase general awareness of watershed health and management among members of the resource management community and the public. A list of watershed members is included in the 2000 Watershed Management Plan. Watershed Action Plans must be developed to keep watershed members informed of watershed status. Figure 7 illustrates the recommended contents of a Watershed Action Plan initiated in the 2000 Watershed Plan.

- Watershed Name (s)
- Stream Name
- Site Number
- Locations
- List of Participants Involved in the Development of the Watershed Action Plan
- General Description of the Watershed Issues
- Designated Uses
  - Supported
  - Partially Supported
  - Not Supported
- Sources of Impairment
  - Characterize and Quantify Point Source
  - Characterize and Quantity Nonpoint Source
- Description of Existing Management Activities in the Watershed
- Summary of Analysis
  - Include Modeling
  - Recommendation for Point Source Reduction
  - Recommendation for Non-point Source Reduction
- Proposed Actions and Schedules for Implementation
  - Rationale and Detail Description of Proposed Activity (include alternatives)
  - Recommendations for Future Monitoring
  - Schedule of Regulatory and Non-regulatory Solutions
  - Specific Roles of Responsible Parties

Figure 7. Recommended Contents of Watershed Action Plan

Develop Stakeholder's/ Partnership Group: This plan recommends the development of a watershed stakeholder's group. These partners include Federal, State, and local agencies. Communities, organizations, and others should be involved as well. The Conservation Office will enlist the assistance of

partners in order to accomplish the goals set forth in this document and will offer support to further the activities of other organizations and individuals with complementary objectives.

The quality of our waters is a reflection of our land use practices. Today 40 percent of our nation's waters do not meet their water quality goals/designated criteria due to runoff from natural resource management practices, streets, farms, mines, yards, parking lots and other nonpoint sources of pollution. Over 291,000 miles of 840,000 miles of assessed rivers and streams in the United States do not meet water quality standards (EPA 2000). Therefore, commitment and participation by community watershed stakeholders is required in order to effectively solve the watershed issues.
A stakeholder is a person or group responsible for making or implementing a management action, who will be affected by the action or who can aid or prevent its implementation. Effective stakeholder involvement provides a method for identifying public concerns and values, developing consensus among affected parties, and producing efficient and effective solutions through an open, inclusive process. Per the EPA, Involving stakeholders:

- Builds trust and support for the watershed management process and product
- Shares responsibility for the decisions and actions
- Creates solutions more likely to be adopted
- Leads to better, more cost-effective solutions
- Forges stronger working relationships
- Enhances communication and coordination of resources

Managing that process requires some attention to the logistics and synergies of creating and operating a team of diverse people pursing a common goal, in this case, delisting Fort Campbell streams and keeping the remaining streams from being listed on the 303(d) list.

Per the 2000 Fort Campbell Watershed Plan, the Fort Campbell watershed management team is an advisory team to support watershed management decisions. In addition to the functions outlined in the 2000 watershed plan, the watershed management will coordinate stakeholder meetings and provide technical advice.

Develop a Priority List of Stream Repair and Action Plans: Once sufficient data has been collected and analyzed a restoration / repair list and stream priority list should be developed. The watershed management team, technical experts and stakeholders will identify, evaluate and select management strategies that will be effective at achieving pollutant reduction goals. These plans should be flexible documents that allow for the dynamic nature of streams and watersheds.

4.4 Update Watershed Management Plan

Once the first five strategies/goals have been achieved (listed below) the watershed management plan will need to be updated with current data and implemented. Future updates to the plan will incorporate the following:

Watershed characterized:

- Gather data / create watershed inventory

- Identify data gaps / collect additional data as necessary
- Analyze data
- Identify causes and sources of pollution that need to be controlled
- Estimate pollutant loads

Finalization of goals and solutions identified:

- Set overall goals and management strategies
- Develop indicators/targets
- Determine load reductions needed
- Identify critical areas

Develop management measures to achieve goals Implementation of program design:

- Develop implementation schedule
- Develop interim milestones to track implementation of management measures
- Develop criteria to measure progress
- Develop monitoring component
- Develop information / education component
- Develop evaluation process
- Identify funding required

Assign responsibility for reviewing and revising the plan Partnerships built:

- Identify key stakeholders
- Conduct stakeholder meeting

4.5 Strategies to Prevent Future Degradation

Incorporate Better Site Design and Green Spaces: As development on Fort Campbell continues natural vegetation is replaced by impervious surface and compacted soil. As previously mentioned, impervious surfaces, compacted soil, and loss of trees increase and/or alters movement of water through the environment. As interception, evapotranspiration and infiltration are reduced and precipitation is converted to overland flow an increase in the number and severity of impacts to the watershed will materialize. Calculating the current and predicted impervious surface coverage is necessary to understand storm water infiltration and runoff coefficients necessary to calculate stream capacity. Fort Campbell streams are already stressed, as indicated by the type of pollutants on the 303(d) list, additional impervious surfaces will further stress the streams/watersheds. Additionally, Fort Campbell soils are highly erosive and vulnerable to increases in storm water runoff. Hydrologic impacts are a significant management challenge for the watershed. The only way to restore degraded streams while allowing further development is by preventing that development from further impacting the stream system. To achieve this, storm water must be managed in a way that decreases the impact of built areas and promotes a more natural movement of water within an ecosystem or watershed while treating storm water as a resource rather than a waste product.
Low-Impact Development (LID) is a storm water management strategy that seeks to mitigate the impacts of increased runoff and storm water pollution by utilizing practices such as: rainwater capture, native landscaping, onsite infiltration, conveyance, preserve exiting trees/vegetation, pervious construction materials, and detention/retention basins. LID can reduce the volume and intensity of storm water flows. In addition, incorporating green spaces into the overall master plan of the installation will help capture, retain, and slow storm water, mimicking a more natural flow.

Stream Bank Protection: Several streams on Fort Campbell are listed impaired due to loss of biological integrity due to siltation and habitat alterations. There is broad, scientifically based consensus that intact riparian areas are essential for the healthy functioning of streams (Roy et al 2006). Based on stream assessments there is evidence of suboptimal habitat and excessive siltation, indicating impaired habitat quality for Fort Campbell streams. While the natural width of a riparian zone typically is determined by topography, the width of riparian zones in managed areas often is established by management practices. At Fort Campbell, 100-foot wide, vegetated buffers are maintained along each side of perennial streams (first-order and larger), lakes, and ponds. For first- and second-order streams, the buffer area is measured from the center of the stream. For larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from the stream bank. A 50-foot wide, vegetated buffer is maintained along each side of intermittent streams. With approximately 62 miles of perennial streams and 115 miles of intermittent streams, Fort Campbell has approximately 2,897 acres of riparian management areas. Stream classification and the associated riparian buffer are maintained within the GIS database. Additionally, keeping bridges free from debris will allow for unimpeded flow. Blocked water flow increases erosion at the bridge abutments as well as upstream and leads to damaged bridges. Developing a maintenance plan specifically targeting bridge debris will decrease installation cost for bridge repairs, stream damage/repair costs and loss of training time due to road closures.

4.6 Develop Strategies to Increase Watershed Stewardship

Watershed Outreach and Education: Successful watershed plans actively engage stakeholders and the public since the watershed is used and affected by many entities and not a single source. Military communities face additional challenges due to the transient nature of their population. For continuity and overall watershed progress, it is imperative that not only the garrison but also the more stable community members are actively engaged and understand the role they play in watershed health. Additionally, units, brigades, businesses, and residences all need to be informed and engaged to understand the role they play in the health of the watershed and the impact their actions can have on the quality of the water that they rely upon. Education needs to target stakeholders, citizens and focus on the unique ecological and recreational values as well as the economic and training values of the watershed. This plan suggests updating and engaging the stakeholders and developing a comprehensive education plan to educate the military and installation businesses as well as the residents.

An initial stakeholder's member list was developed in the 2000 Watershed plan. The stakeholder list is included in Appendix B.

This plan recommends the following:

- Hold a meeting with the initial stakeholders and representatives of the Red River and the Little River Watershed members to update the watershed status and engage the stakeholders in implementing the watershed plan.
- Develop an Education Plan/Programs that includes: web-site development, flyers, news articles, hands-on opportunities for community members, stream cleanup activities, a community watershed festival, unit adopt-a-stream, develop natural trails, and a quarterly newsletter along with continued involvement with Earth Day, 160th annual Safety Day and other public awareness forums.

Outreach should be conducted by stakeholders as well as the Conservation Branch. Outreach efforts should be flexible and evolve as the watershed members become more aware of the issues and solutions to watershed health.

4.7 Sustained Management

Stream and Watershed Monitoring: Streams are constantly evolving and therefore continued data collection, evaluation, and monitoring are needed to access stream status and health. In addition, an important element of any planning effort is monitoring the plan effectiveness. A monitoring program needs to be developed to assess results of the watershed management strategies and plan.

Recommended short-term monitoring objectives:

- Establish understanding of baseline conditions
- Continued investigation of watershed pollution Recommended long-term monitoring programs:
- Continue annual stream walks and monitoring per five year plan to gauge progression of in-stream erosion, bank failure, and extended periods of inundation to the flood plains surrounding impacted streams
- Install a USGS gauging station to monitor physicochemical parameters in Little West Fork Creek
- Involve stakeholders and local community members

The results of the monitoring program should be used to refocus efforts as needed. The monitoring program should also highlight successes and identify new or unforeseen needs.

5.0 Proposed Actions for FY12-18

5.1 TMDL Development for Fletchers Fork, Little West Fork, and Dry Fork East Creeks:

To improve water quality on Fort Campbell, the goal is to develop TMDL's for Saline, Skinner, Little West Fork, and Dry Fork East creeks in consecutive years to coincide with WMP (2000) guidelines. The current trend toward a comprehensive interpretation of TMDL requirements under the CWA is forcing local, regional, state, federal, and international water resource management agencies to consider a much broader approach to point and nonpoint source pollution controls. A total maximum daily load is no longer merely a load allocation number obtained through a water quality modeling exercise. Instead, a TMDL is a process that should culminate in a written, quantitative assessment of water quality problems and contributing sources, and an implementation plan identifying responsible parties and specifying actions needed to restore and protect water quality standards. In a priority watershed, the TMDL provides a pollutant allocation mechanism that is useful in coordinating local, regional, state, federal, and international actions to restore water quality. Allocations for point source pollutants can be incorporated as pollution limits in enforceable discharge permits. Allocations for nonpoint source pollutants are targets to be met through cooperative agreements and incentives. In outlining appropriate management strategies and objectives, establishing implementation schedules, and identifying potential sources of funding, the TMDL provides critical direction for watershed management at the local and regional levels.

As more emphasis is placed on developing and implementing TMDLs, there will be a growing need to document stakeholder agreements such as pollution reduction goals, pollutant load allocations, management solutions, funding options, and implementation schedules. To meet this need, a general format has been established for documenting TMDLs (or watershed action plans), which will become an output of Phases 4 and 5 of the watershed management approach. The purpose of a TMDL is to provide a consistent reference document that presents specific management strategies and corresponding roles for those responsible for implementing water quality restoration and protection measures.

TMDLs document sources of water resource impairment, pollutant load allocations, appropriate management strategies and objectives, implementation schedules, and potential funding sources for the management strategies. The level of effort and the extent of documentation necessary for developing a TMDL will vary from watershed to watershed. The primary factors affecting the development of TMDLs include watershed size, model complexity, number and complexity of pollutants, distribution and quantity of point and nonpoint sources, and extent of public participation. While the Environmental Division's water resource programs will rely on watershed action plans when coordinating water quality monitoring and assessment activities, the document is intended to reach as wide an audience as possible. Thus, another purpose of the plans is to increase general awareness of watershed management among members of the resource management community and the public. Due to the relatively small size of Saline Creek and Casey Creek watersheds they will be evaluated in consecutive years rather than on the 5 year rotation the Watershed management plan calls for in its protocol.

- Saline Creek was evaluated and data was collected FY12
- Skinner Creek was evaluated and data was collected FY13
- Fletchers Fork was evaluated and data was collected FY14
- Dry Fork East was evaluated and data was collected FY15
- Little West Fork was evaluated and data was collected FY16
- Jordan Creek is on the rotation for monitoring for FY17

TMDL's will be calculated for the aforementioned watersheds the following year after they are evaluated and impacts have been statistically determined.

5.2 Water Quality Calculations based on Indices of Biotic Integrity (IBI):

The use of fishes and other aquatic communities for calculations of water quality is a cost effective and reliable predictor of conditions occurring within warm water streams in the Midwest (Compton et al. 2003). The IBI was first developed by Karr in 1981 incorporating 12 metrics to assess freshwater fish assemblages and biotic integrity of surface waters. By determining the assemblages and trophic strata of the ichthyofaunal communities on base we can identify areas of concern at little to no cost while obtaining relevant and accurate results. All 303(d) listed streams will be monitored utilizing IBI's as well as physicochemical, discharge, and EPA Rapid Visual Habitat Bio-assessment protocols (Barbour et al. 1999).

5.3 Annual Macroinvertebrate sampling of foraging stream reaches:

Field samples will be collected to determine the assemblages and abundances of aquatic macroinvertebrates. These samplings will be conducted on an annual cycle to aid in the management of stream reaches utilized by the federally endangered Indiana and Gray bats. By calculating *Ephemeroptera/Plecoptera/Trichoptera* (EPT) indices based on taxa richness and tolerance level we can evaluate water quality as well as productivity for foraging bats. The sampling will be conducted in early April; during this time the larvae are actively utilizing the substrate and have not yet emerged from the streams. This will add credence to habitat and water quality issues that may be present. By adding to the data set model for monitoring streams on base this added input will deliver a robust overview of stream quality status, and aid in supporting the foraging habits of the endangered bats that utilize Fort Campbell streams.

5.4 Continued monitoring of streams with **established TMDL's:**

Extensive stream assessment must still be conducted on watersheds with developed TMDL guidelines (Fletchers Fork, LWF, and Dry Fork East) to determine if impacts are static or plastic in their nature. Each watershed will be evaluated by CB employees hiking the entire length of the streams contained therein and making visual assessments of degradation, erosion, riparian status, etc. and data-basing this information into GIS. This action will be performed on an annual rotation basis as to give adequate time to perform the required task.

- Fletchers Fork monitoring was conducted FY14-15
- Dry Fork East monitoring was conducted FY15
- Little West Fork monitoring was conducted FY15-16
- Jordan Creek monitoring will be conducted FY2017

By continuing to update these streams and any areas that are still in need of management impairments can be identified and remediated.

5.5 Determining Essential Fish Habitat along all 303(d) listed streams on base:

Essential fish habitats (EFHs) are areas identified as being vital for sustaining marine or anadromous fish populations. They include the waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. As amended in 1986, the Magnuson Act requires regional fisheries management councils to evaluate the effects of habitat loss or degradation on their fishery stocks and take actions to mitigate such damage (USDA 2012). By determining the occurrence or lack of viable habitat for recruitment we can begin to determine mitigating practices that will enhance the stream quality and in turn increase water quality. Shoring up sloughing banks, creating in stream habitat, enhancing allochthonous materials to be introduced to the stream will be a natural improvement to stream health. By determining EFH's we can link quality loss to any anthropogenic or natural degradation that is occurring along these stream reaches, and begin to draw up remediations for the impacted areas.

6.0 Conclusion

All of the streams on Fort Campbell, with the exception of Piney Fork Creek, are impaired and listed on the 2014 303(d) list submitted to the EPA by the states of Tennessee and Kentucky. This plan outlines strategies to begin the process to delist the streams. It is imperative that the stakeholders are involved and a public awareness plan/program be developed as the watershed health is a reflection of local land use practices. Multiple entities and actions are responsible for the watershed's current condition and therefore 303(d) listing. To fully support Fort Campbell's mission, the health of the aquatic systems that are contained within the base must be a priority for improvement and sustainability.

Any single set of recommendations will have a positive effect on its own; however, only a comprehensive strategy is expected to improve water quality and aquatic habitat in the watershed.

Due to lack of data or dated records these steps are recommended:

1. Continue to execute the five year watershed management plan/cycle per the existing 2000 Watershed Management Plan;
2. Establish baseline data for all streams and impervious surface acreage;
3. Develop TMDLs;
4. Develop a priority list for stream repair and specific watershed action plans;
5. Develop watershed stakeholders group; and
6. Update plan upon completion of the above five goals.

Lastly, it is imperative that a comprehensive management approach be implemented to protect water quality and the biological integrity of the streams.

This plan further recommends the following to prevent additional degradation and increase watershed stewardship:

1. Better construction design;
2. Stream bank protection;
3. Watershed outreach and education plan/program; and
4. Continued stream/watershed monitoring.

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Appendix A
Watershed Planning Process Stakeholders

Below is a partial list of programs that may play a role in the development and implementation of the watershed management approach.

Directorate of Public Works
Master Plans
Environmental Division
- Water Program (Compliance Branch)
- Land Management (Conservation Branch)
- Agricultural Outlease (Conservation Branch)
- Fish and Wildlife (Conservation Branch)
- Threatened and Endangered Species (Conservation Branch)
- Cultural Resource Management (Conservation Branch)
- Forestry (Conservation Branch)

Directorate of Plans, Training, Mobilization, and Security
Training Division
- Range Branch
- Integrated Training Area Management

Directorate of Morale, Welfare, and Recreation
Recreation Division
- Outdoor Recreation Branch

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Appendix B Glossary

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Anthropogenic: Any action or impact as a result of human activity.

Aquifer: a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to springs and wells

Bed Load: Particles of sand, gravel or soil carried by the natural flow of a stream on or immediately above its bed.

Best Management Practice (BMP): A practice or combination of practices determined to be the most practicable means of preventing or reducing, to a level compatible with water quality goals, the amount of pollution generated by nonpoint sources. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

Biochemical Oxygen Demand (BOD): The quantity of oxygen utilized primarily in the biochemical oxidation of organic matter in a specified time and at a specified temperature. Dissolved Oxygen: The amount of free (not chemically combined) oxygen in water. Usually expressed in milligrams per liter (mg/L).

Ecoregion: A broad geographic area delineated by regional patterns in land surface form, land use, natural vegetation, and soil type. Streams derive their chemical and biological character primarily from the climate, topography, substrate, biota, and culture of the watershed they drain. Therefore, an ecoregion approach to stream classification is useful for describing the regional variability of water chemistry, instream habitat, and fish community structure.

Ecosystem Approach: A long-term planning and management commitment to ensure the appropriate integration of ecological, economic, and social factors in order to restore, maintain and enhance the quality of the environment to best meet current and future needs.

Geographic Unit: An area based primarily on hydrologic boundaries adjusted as needed using a specified set of criteria to accommodate the inventory and analysis of natural resources. A geographic unit can vary in scale depending on the criteria used, the level of inventory andanalysis needed, and the problems perceived. In all cases, geographic units incorporate both groundwater and surface water.

Groundwater Recharge: The addition of water to the zone of saturation. Infiltration of precipitation and its movement to the water table is one form of natural recharge.

Hydrologic Unit Area (HUA): A set of maps depicting approved boundaries of, and numerical codes for, river basins of the United States, developed by the United States Geological Survey. These maps and associated codes provide a standardized base for use by water resources organizations in locating, storing, retrieving, and exchanging hydrologic data.

Hydromodification: any activity that increases the velocity and volume (flow rate) of surface waters, and often the timing of storm water runoff.

Intermittent Stream: A stream that flows only part of the time. Flow generally occurs for several weeks

or months in response to seasonal precipitation, due to groundwater discharge, in contrast to an ephemeral stream, which flows but a few hours or days following a single storm.

Load: The total amount of material (point or nonpoint source) carried by a stream or river. Plural: loads or loadings.

Metadata: The criteria that define a data field. For example, for the data field "family income," the metadata might include the type of currency, time period (annual, lifetime); what constitutes a family, what constitutes income, and so on.

Natural Systems: The interaction of atmospheric, terrestrial, and aquatic forces and processes within the ecosystems of the natural environment.

Nonpoint Source (NPS) Pollution: Human-made or human-induced pollution caused by diffuse, indefinable sources that are not regulated as point sources, resulting in the alteration of the chemical, physical, biological, and/or radiological integrity of the water.

Perennial Stream: A stream that normally has water in its channel at all times.

Quality Assurance: An integrated system or program of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance Project Plan: A quality assurance project plan (QAPP) provides a project-or task-specific blueprint for an environmental data operation to ensure that the results obtained are of the type and quality needed. The purpose of the QAPP is to reduce the risk of the users making an incorrect decision because of faulty data. The QAPP applies methods of quality assurance and quality control to achieve this goal.

Quality Control: The overall system of routine technical activities, the purpose of which is to measure and control the quality of a product or service so that it meets the needs of the user. River Basins: The 3 recognized drainage areas for the major rivers within the reservation boundary that are further divided into 9 sub-watersheds.

Siltation: The pollution of water by fine particulate terrestrial clastic material, with a particle size dominated by silt or clay

Stakeholders: Any entities involved in or affected by watershed management activities within a watershed. The term "stakeholders" covers a broad range of people and organizations.

Stream Segment: Surface waters of an approved planning area exhibiting common biological, chemical, hydrological, natural, and physical characteristics and processes. Segments will normally exhibit common reactions to external stresses (e.g., discharge or pollutants).

Total Dissolved Solids (TDS): An aggregate of carbonates, bicarbonates, chlorides, sulfates,

phosphates, nitrates, etc., of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts. High-TDS solutions have the capability of changing the chemical nature of water. High TDS concentrations exert varying degrees of osmotic pressures and often become lethal to the biological inhabitants of an aquatic environment.

Total Maximum Daily Loads (TMDLS): A written, quantitative assessment of water quality problems and contributing sources, which identifies responsible parties and specifies actions needed to restore and protect water quality standards. TMDLs must include allocations for permitted point source discharges, nonpoint sources, and a margin of safety in setting the total amount of pollutants that a water body can safely assimilate. The margin of safety cannot be used as a set-aside for future growth or impacts to the water body.

Total Sediment Load: The sum of the bed load and the suspended sediment load. Watershed: An area bounded peripherally by a water divide and draining to a particular water course or body of water. Topography is the primary determinant of watershed boundaries. These boundaries are subject to change based on the needs of individual criteria.

Water Quality Standards (WQS): Acceptable limits on water quality parameters are set by the state, with review by the EPA, so that when enforced they will meet the goals of the Clean Water Act.

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Appendix C
Acronyms

BMP - Best Management Practice

CB - Conservation Branch

CWA - Clean Water Act

EPA - Environmental Protection Agency

ESF - Essential Fish Habitat

FAL- Fish and Aquatic Life

GIS - Geographic Information System

IBI - Index of Biotic Integrity

INRMP - Integrated Natural Resource Management Plan

IRR - Irrigation

ITAM - Integrated Training Area Management

LID - Low Impact Development

LMF - Land Management Forum

LRAM - Land Rehabilitation and Maintenance

LWW - Livestock and Wildlife Watering

NPS - Nonpoint Source Pollution

PCR - Primary Contact Recreation

SCR - Secondary Contact Recreation

SWQM - Surface Water Quality Monitoring

TMDL - Total Maximum Daily Load

TRI - Training Requirements and Integration

USFWS - United States Fish and Wildlife Service

WAH - Warm Water Habitat

WAP - Watershed Action Plan

WMT - Watershed Management Team

WMTL - Watershed Management Team Leader

WQ - Water Quality

FORT CAMPBELL

FOREST MANAGEMENT PLAN

FORT CAMPBELL, KENTUCKY

Forest Management Plan

Signature Page

Scott P Osborne, Forestry Program Manager

Jeffrey J Atkins, DPW, Environmental Division Chief

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SECTION 1.0 Introduction

1.1 Purpose

The purpose of the Forest Management Plan (FMP) is to serve as a guide to manage the forest resources on Fort Campbell Military Reservation. This plan serves as a supporting document for the Integrated Natural Resource Management Plan (INRMP). The INRMP describes natural resources management activities and provides a foundation from which to build the program beyond the year 2017. The INRMP implements the Army Strategy for the Environment, which is to integrate environmental values into the military mission to sustain readiness, improve the soldier's quality of life, strengthen community relationships, and provide sound stewardship of resources.

The FMP has been developed in accordance with Federal Acts, Department of Defense and Army Regulations (ARs) and guidance, other Federal laws, and Fort Campbell regulations (Appendix A).

The intent of this plan is to provide information about the way in which forest resources are managed on the installation. The management of military lands incorporates many sources of instruction and guidance. Forest managers must carry out this duty while facing adjustments in the way the installation will support current and future training while maintaining the vision for the management of the forest resources and the ecosystem.

Society of American Foresters (SAF Dictionary of Forestry, 2008) defines forestry as the profession embracing the science, art, and practice of creating, managing, using, and conserving forests and associated resources for human benefit and in a sustainable manner to meet desired goals, needs, and values — note the broad field of forestry consists of those biological, quantitative, managerial, and social sciences that are applied to forest management and conservation; it includes specialized fields such as agroforestry, urban forestry, industrial forestry, nonindustrial forestry, and wilderness and recreation forestry.

It is not the intent of this plan to reference the many sources of direction that exist for natural resource managers. The INRMP breaks these out in detail and this plan supports the INRMP. In an effort to keep this plan a living document, and keep it viable longer, effort has been made to exclude reference to specific guidance. Rather this plan's goal is to encompass the entirety of direction and form the vision of forest management from those sources. It is only through knowledge, vision and flexibility that forest resource managers will continue to support the mission and the environment.

The Acts, Laws, Regulations, Guidance and Direction forest managers use and apply daily are contained in a glossary located in Appendix A.

This plan incorporates ecosystem management to achieve goals and objectives by using adaptive management techniques. Managing for the ecosystem does not place one consideration above another. Using this approach, forest land will not be managed exclusively for maximum timber production. The intent is that all natural resources are considered when planning actions, during implementation and

after the action has been completed. Evaluation of the actions and regular reviews to determine if the goals and objectives of the action were achieved is part of the process. All actions outlined in this plan are based on funding.

The goals of natural resources on Fort Campbell are consistent with the Army's Strategy for the Environment, DoDI 4715.3, and the Army Regulations described above. The goals of natural resources management are:

- Ensure the long-term sustainability of the lands to support the military mission.
- Maximize integration among natural resources programs, and integration of those resource management strategies with military operations.
- Ensure that all Fort Campbell activities, including natural resources management activities, comply with federal and state laws, DoD Instructions, Army Regulations, and Fort Campbell policy related to natural resources.
- Manage natural resources according to an ecosystem management approach to maintain a healthy natural environment.
- Maintain or increase the abundance and diversity of native species.
- Maintain effective reimbursable programs.
- Provide ample recreational opportunities.
- Accommodate multiple uses of the land.

Using these goals, natural resources managers have developed objectives for natural resources management to support training mission requirements as well as conserving natural systems.

1.2 Scope

This plan is meant to be a five-year plan with an annual review for needed changes and project monitoring.

This plan outlines the present state of the forest resource and the desired future conditions (DFCs) for forested land on Fort Campbell. These DFCs describe the goals, objectives, and management actions proposed in each unit. In addition, a list of standards and guidelines for implementation is given for each DFC. It is intended that the DFC be general and applied to large land units. When project planning begins, an area will be compared to the assigned DFC and differences noted. These differences form the purpose of and need for management action on a particular land unit. Management actions will help meet the DFC of an area or will initiate movement toward the DFC.

Certain base-wide standards and guidelines are applied regardless of DFC. These are also detailed in this plan.

The completion of a base-wide forest inventory at Fort Campbell, KY in 2000 for hardwood and 2004 for pine provided forest data, including forest cover typing as well as timber volume estimates. It is estimated that another forest inventory will be needed in 2020 to capture changes and update current data.

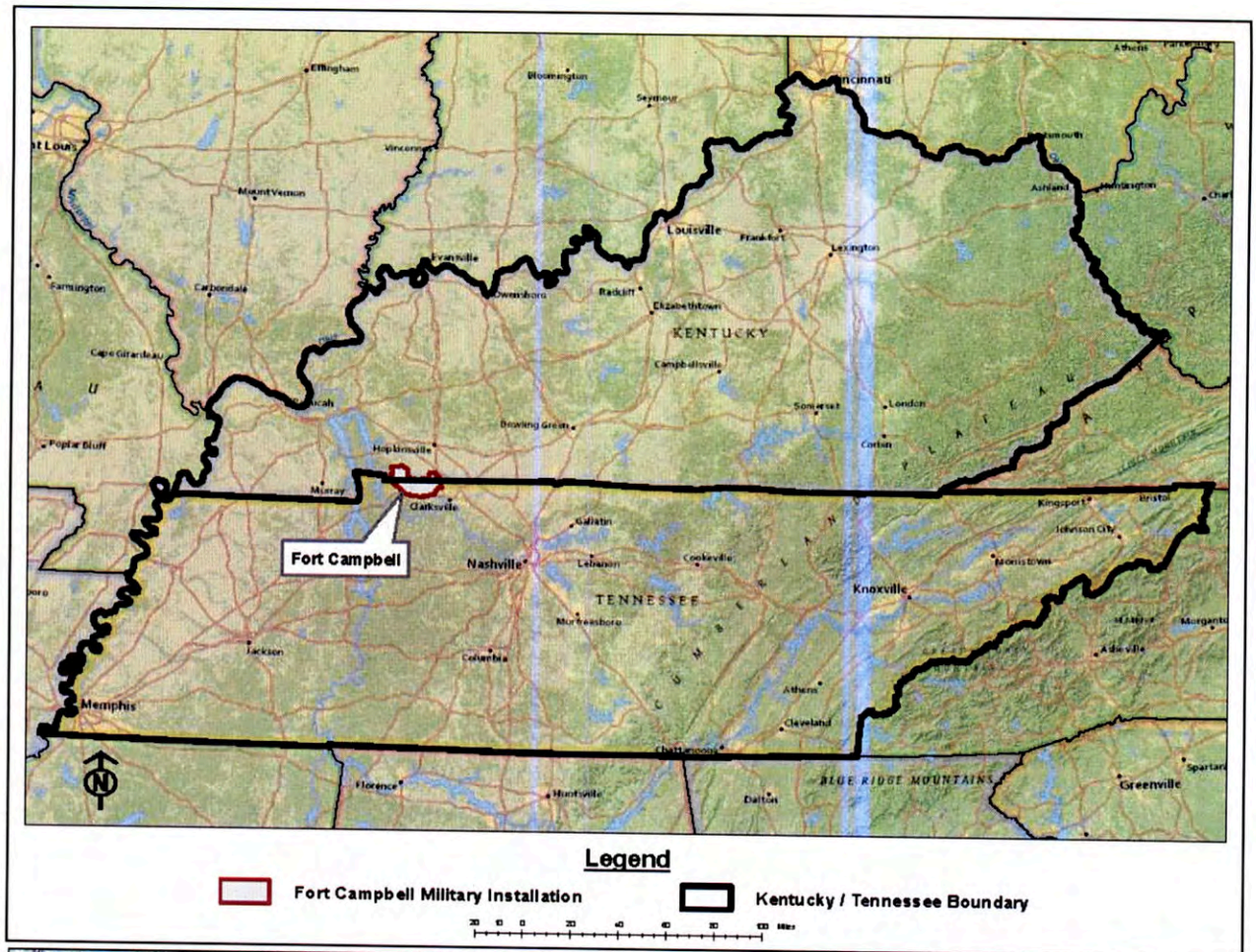
1.3 Location and description

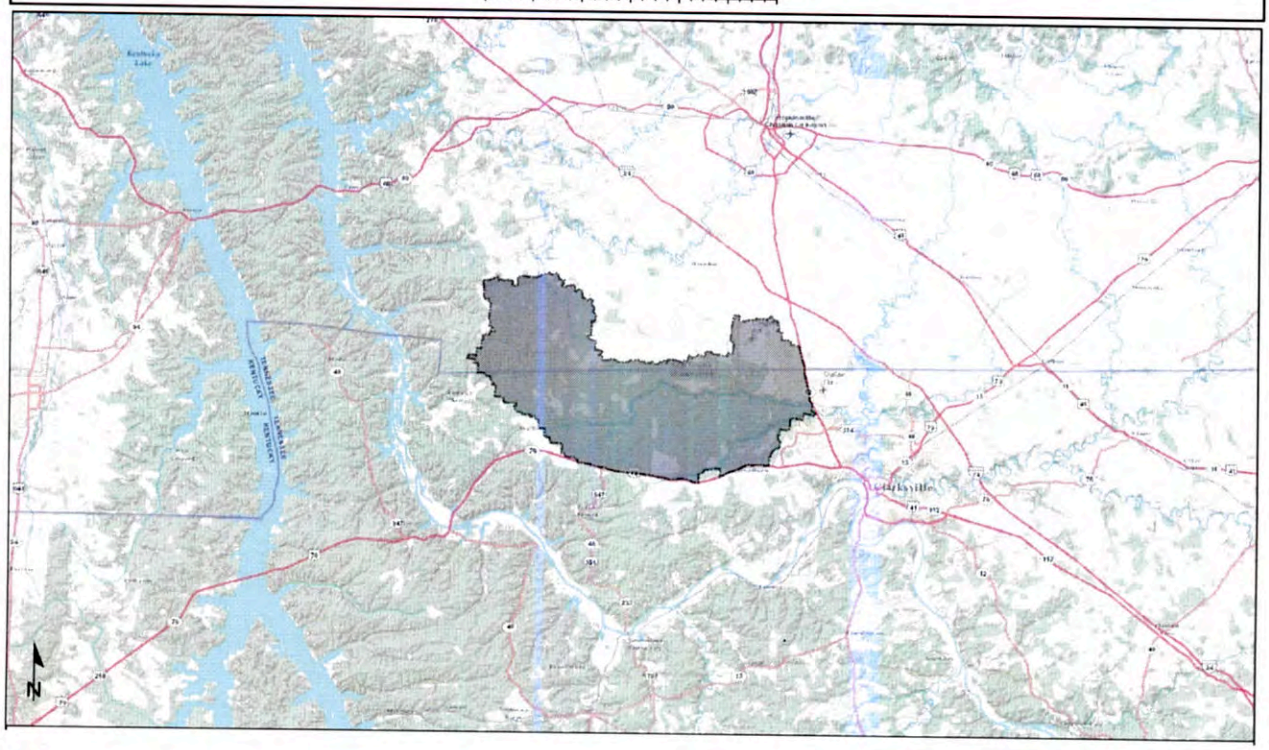
Fort Campbell, KY, straddles the borders of southwestern Kentucky and northwestern Tennessee in portions of four counties (Christian and Trigg Counties in Kentucky and Montgomery and Stewart Counties in Tennessee). See Figure 1 Location Map. Fort Campbell occupies 104,664 acres of land, of which approximately 45,145 acres are currently under active forest management, with 33,545 acres in mixed hardwoods and approximately 11,600 acres in pine plantations. Approximately 13,757 acres is located in impact areas, and while not actively managed, natural processes occur creating a "reserve" of old growth. It is unlikely that these areas will ever be opened or cleared for active forest management. These areas do contain large contiguous areas of forested land which age and mature, die and rot, burn and regenerate in an undisturbed manner which replicates an old growth forest ecosystem.

The initial acquisition of land for the creation of Camp Campbell was made in 1941 from local farmers. Prior to Army acquisition, large tracts of land were converted to agricultural use, and the present vegetation is the result of natural succession on abandoned cropland or pastures and artificial reforestation. This initial purchase (101,755 acres) of farm fields and woodlots includes the forests now managed. Additional acreage was transferred in 1959 from the United States Air Force (USAF) and is currently managed as Campbell Army Airfield (CAAF). In recent years, purchases and sales of installation property has occurred on the south of the installation along Highway 79. A land swap with the Bi-County landfill exchanged land in Training Areas 8b and 9b for land to the west of the installation. This land is located in Training Area 52 on the western boundary.

The area surrounding Fort Campbell today is a mix of woodlands, farmlands, and urban development. Fort Campbell lies within the Western Highland Rim physiographic province, a transition area between Kentucky farmlands to the north, the steeply dissected and wooded rim of the Cumberland River to the south and west, and gently rolling hills of low to moderate relief to the east.

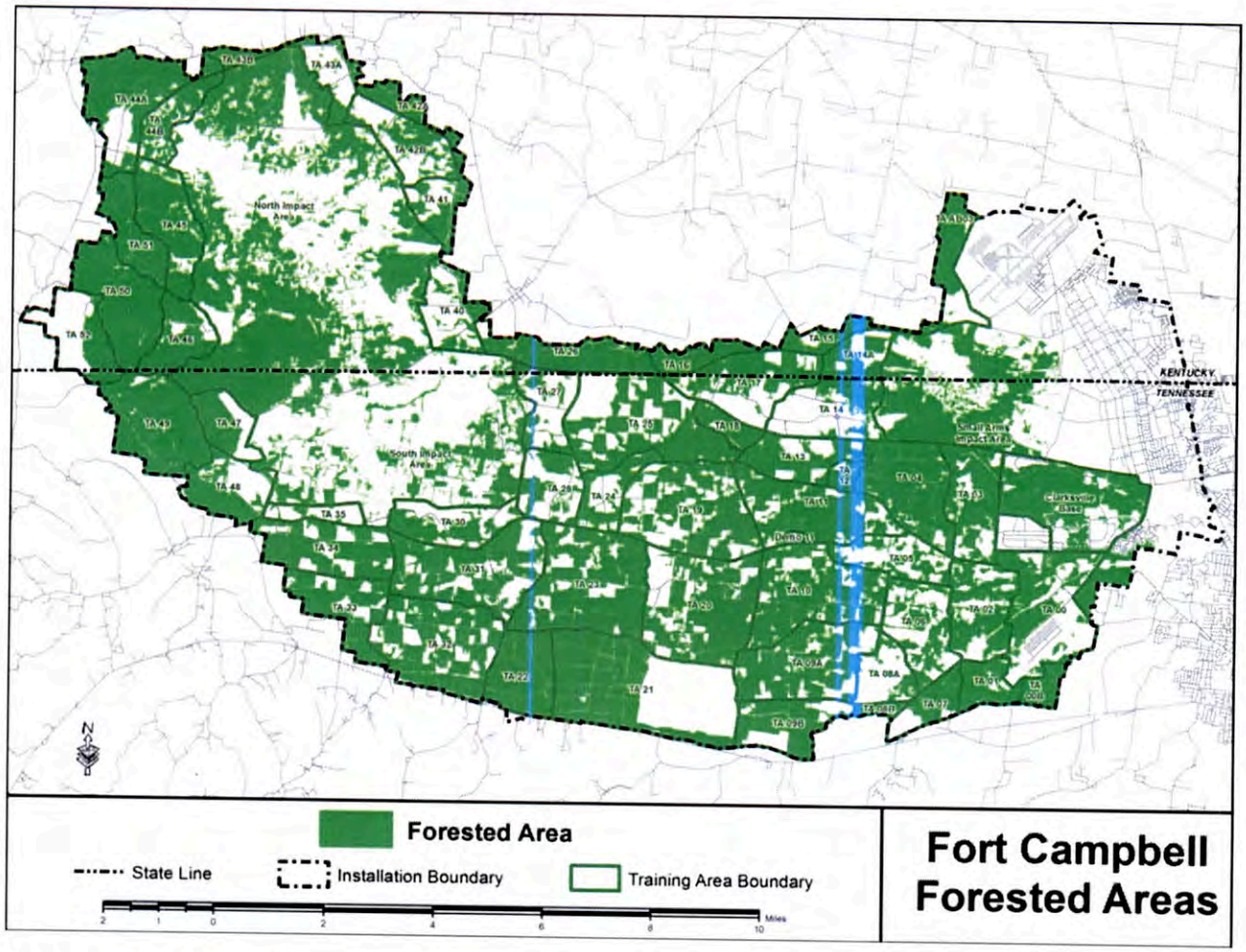
Figure 1. Fort Campbell Location Map


Fort Campbell
KENTUCKY
TENNESSEE
Nashville
Louisville
Cincinnati
Knoxville
Memphis
Clarksville
Hopkinsville
Bowling Green
Lexington
Frankfort
Elizabethtown
Owensboro
Evansville
Paducah
Murray
Jackson
Columbia
Cookeville
Lebanon
Gallatin
Murfreesboro
Chattanooga
Athens
Cleveland
Dalton
Florence
Huntsville
Greenville
Kingsport
Johnson City
Morristown
Asheville
London
Somerset
Corbin
Campbellsville
Radcliff
Mount Vernon
Carbondale
Cape Girardeau
Poplar Bluff
Farmington
Effingham
Bloomington
Seymour
Ashland
Portsmouth
Huntington
BLUE RIDGE MOUNTAINS
PLATEAU
Legend
Fort Campbell Military Installation
Kentucky / Tennessee Boundary



The topography of Fort Campbell is gently rolling, with the exception of a relatively flat area along the eastern boundary and approximately 5,000 acres of steep, hilly land along the western boundary. Slopes range from 2 to 70%, with the steepest slopes in the stream valleys. Fort Campbell has areas of karst topography, dominated by sinkholes, and some related sinking streams. In addition, areas of highly erosive soils (Brandon, Crider, Dickson, Lax, Saffell, and Sengtown soil types) cover the majority of the base. Both the karst topography and the erosive soils influence forest management. There is moderate to severe potential for erosion on more than half of the soil-mapping units occurring on the installation based on United States Department of Agriculture (USDA) Land Use Classification.

Figure 2. Forested Area Map



1.4 History of forest management

The Forestry Program was initiated in 1953 with the primary purpose of fire suppression.

In the latter part of the 1950s, 1960s and 1970's, the forestry program began an artificial regeneration program, triggering the beginning of management of more than 11,000 acres of pine seedlings planted in plantations and hardwood planting of seedlings and seed stock across the installation to cover open ground and farm land. (See Figure 2 Forested Area Map.) In 1956, loblolly pine (Pinus taeda L.) and

shortleaf pine (Pinus echinata) plantations were established on abandoned agricultural fields and pastures by artificial regeneration. A few plantations had been established before 1956, but the total area planted was less than 500 acres. The artificial regeneration of loblolly pine was the result of the military's request to reforest some of Fort Campbell's vast open land and create a specific training landscape. The hardwood planting efforts, to establish mixed hardwood stands, was scattered across the installation.

In 1962 a system of 159 continuous forest inventory (CFI) plots was established. These plots, located only in hardwood stands on Fort Campbell, have been measured on a 5-year cycle since 1962 to 2013, when a 10 year rotation was established. This inventory and the resulting data continue to be used for forest growth, yield, and health monitoring. Currently there are 158 established CFI plots.

Prior to 1971, no applications of herbicides, annual fertilization, or other vegetative controls were applied to pine plantations. During the first 10 years of plantation establishment, a disked "bog" line was maintained around stands to protect the trees from wildfires or escaped prescribed burns. In 1971, the first mechanical "second-row" thinning occurred. A second-row thinning required that every other row be cleared and the remaining row be left untouched. Row thinnings were mainly conducted to increase military access to the stands and increase productivity.

The 1993 forest management plan's goal was to produce timber volume at its maximum rate, increase the stocking of the best species suited for the site, and to use proper harvest methods to produce reproduction for the forest of the future. Although shelterwood and group selection silvicultural practices are listed for use, the majority of the forest was harvested by diameter limit cutting. One of the driving principals of the forestry managers was the need to place quality white oaks in reserve. Even though many harvest operations used diameter limit cuts, there was usually a driving factor to keep quality white oak in reserve whenever possible. This factor is evident in many stands to this day and one of the reasons Fort Campbell has a quality white oak component in forested stands.

Pine plantations were harvested by row thinning. Silvicultural activities such as timber stand improvement, plantings, or other techniques were not included. In the 1993 plan, the forestland on the installation was divided into 10 compartments for management by acreage.

Until 1996, the dominant hardwood forest management tool used was diameter limit harvest. In the past, forest management activities were based on a ten-year rotation in ten hardwood forest management compartments across the forested landscape. Compartments were formed based on geographical location and artificial military boundaries and include several training areas grouped together to form a commercially productive unit. The most mature hardwood forest "patches" were cut across a training area(s). During these operations, hardwood trees greater than 12 inches diameter at breast height (DBH) were harvested; however, concessions were made in the field for "good" wildlife trees (i.e., superior mast producers, wolf-trees, and cavity/den trees). Current science at the time favored open cutting, creating maximum light to the ground, to get oak and hickory regeneration in the stand. These diameter limit harvests generally removed the faster growing, genetically superior trees from the stand and favored shade tolerant regeneration. This cutting practice reduced the genetic

potential of many stands; moreover, silvicultural prescriptions, as identified by current science, never accompanied a hardwood forest management operation prior to 1996. These management practices resulted in uneven-aged stand structure and advance regeneration of shade-tolerant species in most units.

Beginning in 1996, uneven-aged and even-aged silviculture, in hardwood stands, was applied. Most of the prescriptions have involved management through the use of commercial harvest. TSI, herbicide application and prescribed fire have been used for management; however these have been applied on a very limited scale. Pine management continued to be row thinning and production. Pine desired future conditions (DFCs) and the management of pine was postponed in efforts to manage hardwoods. Row thinning was applied several times in some stands and pine was harvested heavily.

In 1998-2000, the forest was sampled and management units identified by soil type, site productivity, DBH size class, and SAF Forest Cover Type. The forest is now divided into management units within 55 training areas. Hardwood management units range in size from 12 - 307 acres and have been managed by stands; pine stands were divided into stands ranging from .1 to 148 acres but managed by training area.

Watersheds and sub-watersheds were identified and stands were broken down into units based sub-watershed. Goals were identified for forest stands based on a 60 rule per sub watershed, and forest managers attempted to schedule order of entry for actions based on a sub-watershed approach. Sub-watersheds occurring naturally on the installation have also been delineated for ecosystem management purposes.

Starting in the early 2000's, pine was the mainstay of timber sales as hardwood prices moderated and pine prices moved upwards. The forestry program used proceeds of pine sales to stabilize firebreaks across the installation in efforts to improve water quality and control advanced soil erosion. Over much of the course of the last 20 years the forestry program revenues, from the sales of timber, have been used for wildfire suppression, efforts to remediate firebreaks, build access roads and indirect forest benefits. Little investment of personnel time, funding or contracting was placed in planting, reforestation, timber stand improvement or other silvicultural improvements. Stand management to further delineate stands as management progressed was not applied. Pine stands, which have been row thinned several times have vague and hard to define boundaries. This has resulted in a mixed hardwood and pine system in many stands across the installation. This method, whereby commercial timber sale or commercial timber stand improvement, has been the main and sometimes only tool in hardwood and pine management, limited options and limited potential outcomes. However in the pine stands it sometimes created remarkable advanced oak regeneration. In hardwood it allowed pine to creep into the stands and occupy places in the understory and mid-story.

Since 2012 reforestation of native shortleaf has occurred on approximately 90 acres. Shortleaf has been planted in abandoned fields after intense site preparation. However, oak and other native hardwoods are present in the reforested areas as well. This is lending itself to diversity in those stands and is

desirable to many program managers. Shortleaf and oak planting is planned for open areas and under stocked stands.

Timber stand improvement in the walnut bottoms started in 2013 on 29 acres with the emphasis on removing damaged and diseased trees that do not possess desirable forest traits. Once the action is complete, a decision to under plant hard mast species, allow and encourage the already present native river cane to spread, or another unforeseen management action will be made by managers. Monitoring, in accordance with responsible adaptive management, should yield a desired future condition that is acceptable for natural resource managers and trainers alike.

The Fort Campbell forests can and have been influenced by fire. Wildland fires are commonly caused by military maneuvers and training related activities. The current firebreak system has kept fires small; typically there are between 20 and 50 fires a year ranging from 0.1 to 1000 acres in size. The size and frequency of fires fluctuates directly with military training. Areas near or adjacent to the impact areas, or areas where frequent training occurs have a higher occurrence of fire and a higher return interval.

Prescribed fire has been used to reduce fuels and remove woody vegetation from open fields. Aggressive prescribed burning efforts have sometimes crossed control lines into hardwood and pine stands bordering fields and impact areas. Prescribed fire has also been applied to selected pine stands to improve conditions for military training, reduce undesirable regeneration, and improve wildlife habitat by reducing understory density. Prescribed fire has been introduced into hardwood stands with the intent of removing or lowering the stocking of undesirable species and encouraging advanced oak regeneration.

1.5 Forest Product Sales

Forestry personnel are responsible for timber inventory, sale layout and marking timber for harvest. See Appendix F for Timber Marking Stand Operating Procedures.

Forestry personnel calculate the estimated volume of the timber to be sold. A record of environmental consideration, preliminary assessment screening, and statement of timber availability are completed for each timber sale, or can be completed and applied to the Annual Report of Availability of timber sales. The record of environmental consideration assures coordination with other resource areas and documents that impacts to resources are avoided or mitigated.

The U. S. Army Corps of Engineers (USACE), Louisville District, advertises, prepares contracts for, and administers timber sales. Forestry personnel assist the USACE with administration of timber sale contracts including harvest inspection, contract compliance and skid road and log landing layouts. Forestry personnel and the USACE determine final release and compliance with contract terms.

1.6 Forest Improvements

The Forestry Program staff prescribes silvicultural actions, both commercial and pre-commercial. These actions may involve stand improvement or land use changes through pre-commercial thinning, crop tree release in young stands, planting, prescribed fire, salvage harvest, sanitation harvest, or application of pesticides. Planting may also be done to enhance species diversity, endangered species habitat, or

water quality protection. The need for these actions is determined by comparing existing conditions with desired future conditions.

1.7 Forest Monitoring

The Forestry staff maintains a database for the continuous forest inventory (CFI) begun in 1962. Re-measurement of the 159 nested plots (1/5-acre plots for saw timber and pole timber, 1/20-acre for saplings, and 1/1000-acre for regeneration) was on a 5-year rotation. The sampling interval and intensity was changed to a 10 year interval and 1/5-acre plots for saw timber and pole timber based on current instruction, best available science, staffing and funding. Periodic review of the data for accuracy, relevance, and addition of plots is performed. USFS Southern Research Station has analyzed data to help estimate timber inventories and forest health conditions.

1.8 Forest Pest Monitoring

Gypsy moth (*Lymantria dispar*)

Gypsy moth (Lymantria dispar) traps are placed across the base for annual estimates of populations in cooperation with USDA Forest Service in June through August. Gypsy moth monitoring began in the 1980's to monitor the occurrence and spread of the insect. The mass defoliation and subsequent forest health issues occurring in hardwood forests of the northeast have spurred concern and led to migration monitoring, in turn, allowing a proactive management approach. General forest health and mortality are monitored in an informal way throughout the year during the course of normal activities.

Southern Pine Beetle (*Dendroctonus frontalis*)

Recent outbreaks and the northern migration of the southern pine beetle (Dendroctonus frontalis) is a forest health concern. The beetle's destructive effects on yellow pine, including loblolly, shortleaf, and Virginia pine species, could have a severe impact on the pine forests of Fort Campbell and thus affect military training. Should an outbreak on the installation occur, best science practices will be applied in conjunction with USDA cooperation to find a suitable solution. Efforts have also been coordinated with USDA to share monitoring and results of findings both on post and across the geographical area.

Emerald Ash Borer (*Agrilus planipennis)*

Fort Campbell acknowledges that there is an emerald ash borer (EAB) outbreak in many surrounding counties. EAB is a green buprestid beetle, native to East Asia. Its known hosts are white and green ash, although there is consideration that other hosts may be used. At this time there is no known presence of EAB on Fort Campbell. Fort Campbell Forestry annually monitors for presence and will continue to in the future. If an outbreak is detected the most current scientific based control methods will be considered and utilized. General forest health and mortality are monitored in an informal way throughout the year during the course of normal activities.

1.9 Planning

A Forest Management Plan is required for Fort Campbell and is to be reviewed annually and updated every five years. Updates will include the latest forest data, trend analysis, and program goals. As the INRMP is revised, the Forest Management Plan will also be revised and appended.

1.10 Environmental Quality Officer Training

The Environmental Division at Fort Campbell conducts bimonthly training to raise awareness of environmental issues during mission training. The Forestry staff presents the relevant CAM regulations, describes forestry practices on Fort Campbell to military personnel, and explains how forestry activities support the environmental conditions necessary for soldiers to train as they fight.

1.11 Environmental Education

Occasional requests for school and college programs, Earth Day activities, and Girl and Boy Scout programs are made of the Forestry Program. This represents a small amount of personnel time per year, but could increase and is an excellent way to build relationships with civilian and military communities.

1.12 Forestry Program Activities

The following are currently scheduled activities of the Forestry Program:

- Wildland fire management (prescribed and wildland fire suppression)
- Pine stand desired future conditions evaluations
- Pre-harvest inventory
- Silvicultural decisions
- Applied management to include identifying long term planning of timber stand improvement , prescribed fire and under planting of hardwoods
- Forest product sales and administration
- Timber stand improvement
- Reforestation and planting of shortleaf pine, bottomland hardwoods and upland hardwoods
- Continuous forest inventory
- Forest pest monitoring
- Preparation of NEPA document for forestry activities
- Review of NEPA activities across the installation
- Continuous updates of the forest management data

1.13 Status of Forest Management

The forestry program has developed a tool to display management unit data and make decisions on needed silvicultural actions, the Management Unit Evaluation Document (MUED – Appendix E). This document includes a summary of basic forest information (volume, trees per acre, diameter distribution) and highlights other ecosystem and management considerations that need to be

addressed, such as presence of endangered species or cultural resources in a management unit. The conflicts and concerns considered in the MUED are concurrent with NEPA documentation. The MUED is based on a management unit (or stand) scale and is generally updated when a harvest or cutting action is planned.

MUED documentation, stand data, maps, forest management actions and related information is maintained in management folders located in the forestry office. The establishment of management folders, in 2014, was an effort to create a tracking system for all forest management activities and provide constancy and broad sharing of information across the program. This effort establishes the ability for anyone to track management actions, determine successes or needed improvements, track changes in management units and acreages, and follow actions through time to better manage the Installation's forest resources. It was established to minimize institutional loss due to personnel turnovers and loss of program knowledge over time and attrition.

SECTION 2.0 Installation Forest Management Direction

2.1 Introduction

Forest management direction is found in laws and regulations listed in Section 1 and Appendix F.

Current forest management direction is to manage for sustainable forest resources in the context of ecosystem management using an adaptive management approach.

Ecosystem is defined as: A dynamic and natural complex of living organisms interacting with each other and with their associated physical environment.

Ecosystem management is defined as : A goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity, is at a scale compatible with natural processes, is cognizant of nature's timeframes, recognizes social and economic viability within functioning ecosystems, is adaptable to complex and changing requirements, and is realized through effective partnerships among private, local, state, tribal, and Federal interests. Ecosystem-based management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.

Adaptive management is defined as the process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans and using the resulting information to improve the plans helps to apply best available science in efforts to manage for success.

Sustainability and biodiversity is at the forefront of forestry direction. Biodiversity is the variety and abundance of life forms, processes, functions, and structures of plants, animals, and other living organisms, including the relative complexity of species, communities, gene pools, and ecosystems at spatial scales that range from local through regional to global biological diversity, diversity or an index of richness in a community, ecosystem, or landscape and the relative abundance of these species. There are commonly five levels of biodiversity: (a) genetic diversity, referring to the genetic variation within a species; (b) species diversity, referring to the variety of species in an area; (c) community or ecosystem diversity, referring to the variety of communities or ecosystems in an area; (d) landscape diversity, referring to the variety of ecosystems across a landscape; and (e) regional diversity, referring to the variety of species, communities, ecosystems, or landscapes within a specific geographic region . Each level of biodiversity has three components: (a) compositional diversity or the number of parts or elements within a system, indicated by such measures as the number of species, genes, communities, or ecosystems; (b) structural diversity or the variety of patterns or organizations within a system, such as habitat structure, population structure, or species morphology; and (c) functional diversity or the number of ecological processes within a system, such as disturbance regimes, roles played by species within a community, and nutrient cycling within a forest. (The Dictionary of Forestry, Society of

American Forestry, 2008) Thus, the principals of ecosystem management and biodiversity each contribute to sustainability. Each concept mutually supports the other. Biodiversity ensures a healthy ecosystem that is not dependent on one species or a dominant principal. The end result is a viable and sustainable forest resource which facilitates high quality military training and offers trainers a landscape that supports mission needs.

2.2 Mission of the Forestry Program

The mission of the forestry program is to support and enhance the immediate and long-term military mission and meet natural resource stewardship requirements set forth in federal laws. The primary goal is to retain the capacity of the land to support training while maximizing acreage meeting current training requirements. The primary objective is sustaining installation forest resources and forest ecosystem for the future.

2.3 INRMP Goals and Objectives

The INRMP outlines goals and objectives for natural resources management, to include forest management. The INRMP is the guiding directive for natural resources management on the installation. The following are excerpted from the INRMP and directly related to activities or programs which are performed or supervised by the forestry section and the forest management team. Many goals and objectives are accomplished by efforts across many programs and in coordination with trainers and land managers alike. This is not an inclusive list; rather it is excerpted to identify those areas where the forestry program supports the INRMP.

Communication, Training, Education and Outreach

Goal 1: Maintain an INRMP that facilitates integration among conservation and training activities, and effectively communicates natural resource management plans to natural resource managers, Fort Campbell Command, and federal and state regulatory agencies.

> Objective 4: Promote Fort Campbell sustainability goals by providing professional and informative education to the installation military staff regarding positive relationship between natural resources and the military mission, and instruction about how and why adverse effects to natural resources are to be avoided.
>
> Objective 7: Provide up to date, concise, and informative training lectures to the EQO class.
>
> Objective 8: Prepare and deliver a program/educational materials about natural resource management responsibilities and stewardship during the annual Earth Day event. Materials and/or presentations will be designed to educate school children who participate in the event.

Goal 2: Establish and implement procedures to improve communication among natural resource program managers and support staff.

Objective 2: All natural resource managers and support staff will be trained in the use of GIS. Upon completion of training, digital spatial data will be made available to facilitate land use planning, management, and monitoring.

Goal 3: Participate and support, to the extent possible, opportunities for information exchange, research, and partnerships with local, regional, or national agencies, academic institutions, and conservation organizations.

Objective 1: Support efforts to author/coauthor papers in scientific journals presenting research conducted on Fort Campbell.

Objective 2: Participate in national or regional scientific meetings and training sessions to ensure Fort Campbell staff is trained to provide the best available scientific and technical knowledge for the management of natural resources.

Objective 3: Coordinate with state wildlife agencies, conservation organizations, and volunteers to obtain support with surveys and monitoring.

Objective 4: Support requests from local youth groups and schools to conduct projects or field trips that promote understanding of conservation, and the role of the U.S. Army as a steward of natural resources.

Objective 5: Encourage academic institutions to propose research projects on Fort Campbell that address the guiding principles and goals of natural resource management on the installation.

Objective 6: Participate in a regional monitoring partnership, composed of all affected parties, to develop and implement a White-Nose Syndrome monitoring program.

Objective 7: Review and approve requests, when feasible, from research-oriented groups to use Fort Campbell for research, contingent on coordination with Range Division not to adversely impact military training.

Objective 8: Review, evaluate, and respond to unsolicited proposals for area designations, such as scenic rivers, important bird areas, registered natural areas, etc. Responses to these unsolicited proposals for area designations are contingent on coordination with all Fort Campbell organizations and are not to adversely impact military training.

Objective 9: Utilize the Public Affairs Office (PAO) for dissemination of information to the general public.

Goal 4: Provide an understanding of the Fort Campbell natural resources program to installation and surrounding communities.

Objective 1: Provide decision makers with information to make sound decisions which affect the Fort Campbell natural resources program.

Objective 2: Provide information to the military community and general public on recreational opportunities on Fort Campbell, especially those related to hunting, fishing, and other natural resources-based activities.

Objective 3: Provide information to units, leaders, soldiers, civilian employees, and other installation users to improve their understanding of impacts of their activities on the environment.

Objective 4: Emphasize the importance of fire in the survivability and maintenance of the remnant tall grass prairie/barrens ecosystem.

Objective 5: Look for opportunities to host or sponsor conferences pertaining to natural resources. Conferences should have regional significance and promote resource management actions on Fort Campbell.

Objective 6: Participate in activities in observance of National Hunting and Fishing Day, Earth Day, Arbor Day, and the Red River Clean-up.

Objective 7: Continue to participate in local events with natural resources significance.

Objective 8:. Continue to mentor and supervise scouts and other youth group projects.

Objective 9: Provide lectures and slide presentations on conservation careers, wildlife biology, and fish and wildlife management when requested, generally about 10 presentations annually. Provide training for teachers at local schools during staff development training.

Objective 10: Participate in the local "shadowing" career development program.

Soil

Goal 1: Prevent/minimize damage to soils by educating soldiers.

Objective 1: Educate soldiers about the importance of avoiding damage to soil, about Fort Campbell Regulations (CAM-Reg 385) that address protection of soil, and about procedures for minimizing damage to soils. Instruct the Environmental Quality Officer's class, and provide information in the DPW Environmental Handbook. Review the EQO class and handbook information annually to ensure it is up to date.

Goal 2: Reduce erosion by remediating existing areas with bare/damaged soil.

Objective 1: Map areas of potential and known sites of erosion and input information into GIS. Reduce known areas of erosion by 20% within all watersheds on Fort Campbell by 2018.

Objective 2: Annually develop a list of projects necessary to stabilize, cover, or otherwise rehabilitate damaged soils. The list will be developed cooperatively by the Conservation Branch and ITAM. Projects will be discussed, prioritized, and assigned to a lead program during the Land Management Forum. Projects may include installation of erosion control structures appropriate for the site (e.g., check dams, wind breaks, diversions), seeding, application of mulch or gravel, stream bank stabilization, or revegetation of riparian zones. The status and priority of listed projects will be evaluated at least quarterly at the Land Management Forum, and priorities adjusted as warranted.

Objective 4: As funds allow, projects on the soil rehabilitation list that are not addressed by the LRAM program will be implemented by natural resource programs in the Conservation Branch.

Objective 5: Implement the new forest access road system plan, which is described in detail in Section 6 of the FMP. Close, revegetate, and decommission a total of 287 miles of firebreaks that are not necessary for use as forest access roads. Upgrade approximately 20 miles of firebreaks to forest access roads, and convert 48 miles to disked bog lines. Decommissioned fire breaks will be graded, revegetated, and mulched to minimize further erosion. Apply site- specific repair/rehabilitation measures (e.g., seed road surfaces, stabilize eroding slopes, drain impounded areas) to support the eventual conversion to natural habitat. Forest access roads will have gravel surfaces. The desired result of the new forest access road system is 20 miles of forest access road (gravel top), 48 miles of bog lines around the impact areas and installation boundary, and no firebreaks consisting of bare dirt. Bog lines will be seeded following the burn season to reduce soil erosion.

Objective 6: Where firebreaks have crossed perennial and intermittent streams, use bioengineering techniques to restore stream banks and beds to natural condition. Repair at least five sites per year.

Objective 7: Support efforts by the Compliance Branch to enforce placement of erosion and sediment controls on all construction sites. Report to the Compliance Branch observations of sites where control measures are lacking or failing.

Objective 8: Reduce the cost for site repair and restoration through maximization of bioengineering techniques as an alternative to conventional "hard" design and construction methods.

Goal 3: Maintain vegetated riparian zones to stabilize soil on stream banks and minimize run off of sediment and pollutant-laden water into streams.

Objective 1: The area within 100 feet along each side of perennial streams (first-order and larger), and within 50 feet of intermittent streams must be maintained in vegetative cover. To the extent practicable, trees should be maintained or encouraged to grow in these areas. For first- and second- order streams, the buffer area is measured from the center of the stream. For

larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from each stream bank. Avoid removing vegetation in these areas during natural resource management activities.

Goal 4: Avoid/minimize disturbance to the ground that results in bare soil and potentially leads to erosion.

Objective 2: For natural resources activities (e.g. timber harvest) that result in soil disturbance, integrate soil conservation best management practices into 100 percent of project plans and contracts. Application of best management practices will be determined on a site-specific basis, as necessary to control erosion, sedimentation, and dust. When vegetative cover must be disturbed, apply gravel, fabrics, mulch, riprap, or other materials that are environmentally safe and compatible with the location to control erosion in problem areas.

Objective 3: Enforce restrictions described in the Forest Management Plan regarding timber harvest, installation of skid trails, and revegetation of fire control lines in riparian zones.

Goal 5: Develop and Implement a comprehensive sedimentation control plan to prevent soil erosion on drop zones, ranges, roads, streams and firing positions.

Objective 2: Complete an inventory of drop zones, large areas having inadequate vegetative cover or denuded, firebreaks, and tank trails. Evaluate for impacts/degradation and priority for corrective action.

Objective 3: Perform water quality studies on major watersheds. Evaluate for impacts/degradation and priority for corrective action.

Objective 4: Develop a soil management plan for the installation that includes a soil rating system and incorporates an inclusion/exclusion of mission support functions.

Objective 5: Have all priority erosion sites in each watershed in compliance by the end of FY 2020 and to move Fort Campbell's soil conservation focus from restoration to maintenance.

Objective 6: Review and update soil conservation portions of this INRMP annually.

Objective 7: Develop a formal Land Restoration Team, which will have access to project implementers and others as they are identified.

Objective 8: Experiment with native and high value wildlife plants in soil stabilization activities, as feasible and compatible with training needs and other considerations.

Water Resources and Aquatic Habitat

Goal 1: Prevent/minimize degradation of aquatic habitat and water pollution by educating soldiers, residents, employees, and contractors, and distributing accurate information about surface and groundwater resources in the GIS database.

Objective 5: The Forestry Program will ensure that 100 percent of timber sale contracts require Forestry Best Management Practices designed to minimize input of sediment, chemicals, and other contaminants into surface and ground water.

Objective 6: The Pest Management Program will ensure that 100 percent of pesticide applicators are properly certified and trained about pesticide applications in and near surface water, sinkholes, and wetlands.

Goal 2: Minimize input of sediment and other contaminants in storm water run-off entering Fort Campbell surface water (streams, lakes, ponds) and groundwater (sinkholes).

Objective 1: Vehicles must not cross streams except at bridges or designated, hardened fords. As part of stream inspections conducted under the Watershed Management Plan (WMP), and/or the RTLA Program, identify vehicle crossings at undesignated areas. Stream inspections conducted as part of WMP implementation will follow the schedule and approach described in Section 4.2.6 of this document. Create a database in the GIS system to map "unauthorized stream crossings." Work with trainers to enforce crossing at appropriate locations. Alternatively, design a hardened stream crossing to provide stream crossing sites essential to the training mission.

Objective 2: Maintain vegetated riparian zones to minimize run off of sediment- and pollutant-laden water into streams. The area within 100 feet along each side of perennial streams (first-order and larger), and within 50 feet of intermittent streams must be maintained and vegetated. For first- and second-order streams, the buffer area is measured from the center of the stream. For larger streams (third-order and higher) and rivers, the 100-foot buffer is measured from the stream bank. Avoid removing vegetation in these areas during training and natural resource management activities. Presence of herbaceous vegetation is important to filter sediment and other contaminants from run-off. To the extent practicable, trees should be maintained or encouraged to grow in riparian buffer zones to promote stable stream banks, to reduce mean summer stream temperatures and to provide a source of organic matter for aquatic biota. Limit training activities within the buffer zone to foot travel; tracked and wheeled vehicles should be kept outside the buffer zone. Do not harvest timber within 100 feet of streams and lakes.

Objective 3: Establish and maintain vegetative cover on side slopes of sinkholes, and 100-foot vegetated buffers around sinkholes.

Objective 4: As funds are available, prepare and implement site-specific plans to minimize potentially polluted storm water run-off into sinkholes or karst features in the rear area.

Objective 5: Do not apply pesticides, fertilizers, and other chemicals into, or within 100 feet of perennial and intermittent streams, sinkholes, and other karst features.

Objective 6: Refuel vehicles and conduct other activities with potential for pollutant spills at least 100 feet from sinkholes. Ensure all training units maintain up-to-date spill prevention and control techniques to be implemented in karst areas.

Objective 7: Continue to coordinate with the local soil and water conservation district, state agricultural extension service, and Tennessee Department of Conservation and Kentucky Division of Water to improve management practices designed to reduce nonpoint sources of pollution.

Goal 3: Improve quality of water and aquatic habitat in streams that are currently not fully supporting of designated uses (Fletcher's Fork Creek, Piney Fork Creek, Casey Creek, Dry Fork East Creek, and Skinner Creek watersheds). Maintain the quality of streams that are currently fully supporting such that reaches located on Fort Campbell do not become listed on the Tennessee or Kentucky 303(d) lists. Water quality in the stream reaches located on Fort Campbell should meet or exceed standards for the Inner Nashville Basin Region found in Habitat Quality of Least- Impacted Stream and, Regionally-Based pH, and diversity and abundance of invertebrates should be similar to Inner Nashville Basin reference streams as described in Regionally-Based Biological Integrity Criterion.

Objective 1: Annually develop a list of projects necessary to improve water quality in streams. The list will be developed cooperatively by the Conservation Branch and ITAM. Projects will be discussed, prioritized, and assigned to a lead program during the Land Management Forum. Projects may include installation of erosion control structures appropriate for the site (e.g., check dams, wind breaks, diversions), stream bank stabilization, restoration of natural stream channels, or revegetation of riparian zones. The cost of each project should be estimated to assist project prioritization and scheduling. The status and priority of listed projects will be evaluated at least quarterly at the Land Management Forum, and priorities adjusted as warranted.

Objective 3: As funds allow, projects on the water quality improvement list that are not addressed by the LRAM program will be implemented by natural resource programs in the Conservation Branch.

Native Grassland Barrens and Old Fields

Goal 1: Monitor resources that are important indicators of overall ecosystem integrity, wildlife habitat conditions, and the capability of lands to support military missions.

Objective 1: Implement a three tiered approach to monitoring; utilizing benchmark monitoring, restoration monitoring; and maintenance monitoring to determine success toward desired future conditions.

Objective 2: Develop and implement a method to evaluate prescribed burning results based on multiple burning objectives.

Objective 3: Develop computer database to track the management prescription process and monitor its progress.

Goal 2: Measure the response of stand structure, density and composition of woody vegetation, and herbaceous ground cover to ongoing management through the use of prescribed burns, as well as to natural (e.g., climate, light gaps) and human (e.g., training, silviculture) disturbance factors.

Objective 1: Measure the following parameters to assess the response to treatments:

- Percent cover of all plant species, litter, bare ground, dead woody material (3 feet long, 3 inches in diameter), non-native species
- Percent cover by cover class of all species.
- Density of all tree species < 4"dbh by 1" size classes.
- Percent canopy cover in different height categories.
- Burn severity and fuel bed depth.
- Other site characteristics, such as elevation, slope, aspect, topography, and hydrology.

Goal 3: Manage the landscape to achieve the amount of suitable training and maneuver area described in the 2004 Range Development Plan and 2010 Range Complex Master Plan.

Objective 1: Throughout the 65,800 acres of training and maneuver area, implement Open Area Management Plan prescriptions to establish 40 percent (approximately 26,320 acres) of trainable area by 2020. Trainable areas are native grass barrens (those without restrictions related to rare species), agricultural fields, or old fields having no woody growth greater than 21 inches high. Management techniques will be described in the Open Area Management Plan (Appendix H) and may include clearing trees and brush mechanically, with prescribed fire, and/or with herbicides. The Forestry, Fish and Wildlife, AO Lease, and ITAM Programs will coordinate to identify old fields and native grass barrens that are currently unsuitable for training due to presence of woody growth. Management prescriptions necessary to establish conditions suitable for training will be prepared, prioritized, and implemented.

Goal 4: Manage open areas on Fort Campbell on a landscape scale to support multiple uses of open areas, sustain native species, and maximize efficiency of management actions.

Objective 2: Update the Grassland Management Plan. For each parcel of native grass barrens and old field, develop a description of the desired future condition, and prescriptions for achieving the desired future condition, including management of woody growth,

noxious/invasive species, wildlife, and sensitive species of plants and animals. The Plan will be designed to meet goals for developing adequate training area and expansion of native barrens.

Goal 5: Expand the acreage of open space on Fort Campbell by 2020.

Objective 1: By the end of FY 2015, use GIS and field data to identify parcels that have vegetation, soil, and other characteristics conducive to restoration to native grass barrens. To the extent practicable, establish large patches, and/or maintain connectivity with other native grassland barrens to minimize fragmentation of grassland or forest, and maintain corridors for wildlife.

Objective 2: Implement activities prescribed by the Grassland Management Plan to create/restore Tier 1 and 2 barrens on an average of 500 acres per year in 2013 through 2018.

Objective 3: Convert power line rights-of-way (ROW) to native grass. Require newly developed ROWs to be revegetated with native grass. Develop guidelines for managing native grass ROWs that ensure long-term sustainability of those areas.

Goal 6: Support regional planning efforts for grassland areas to restore native habitat types and enhance habitat for wildlife.

Objective 1: Develop and maintain a MOA and periodic coordination with the USFWS, KDFWR, and TWRA to establish a regional initiative for native grass barrens restoration and protection. Support efforts to conserve native habitat near the Fort Campbell boundaries to reduce potential encroachment on training activities.

Goal 8: Implement landscape level habitat management using strategies and goals outlined in resource specific management plans.

Objective 1: Develop priorities for training area treatment schedules and selection of target species.

Objective 2: Develop and implement plans for experimentation and adaptive management to restore natural communities to reach habitat targets as outlined in the Grassland Management Plan.

Objective 3: Develop treatment prescriptions in phases to allow for scoping, draft, and final input levels. Consider both broad based management objectives and specific area needs, such as soil erosion control, training impacts, or natural area management requirements. Treatment schedule may include up to several years for full implementation.

Objective 4: Establish post treatment evaluation schedules to assess treatment success and determine needs for follow-up prescriptions and management actions.

Objective 5: Apply experimental design, ecosystem and other monitoring, research, and habitat models to predict and measure the influence of management treatments, training, and other

land uses on training area habitat values. Use target species abundance and ecosystem monitoring to measure prescription success. Adjust treatments as needed.

Objective 6: Manage natural communities within training areas on a stand-by-stand level.

Objective 7: Develop annual burn plans based on habitat conditions and plant community restoration requirements of training areas.

Goal 9: Maximize work efficiency through coordination and utilization of shared labor and equipment resources.

Forest

Goal 1: Manage forest resources in the rear area to support planned military use of the land.

Objective 1: Regularly coordinate with G3, DPTMS and other Conservation Branch programs to ensure DFCs established in the FMP are on track to achieve the size, location, and conditions of training areas needed. At least once per year, discuss the proposed forest management activities in the FMP during the Land Management Forum, to ensure forest management goals are consistent with the military mission and other natural resource management initiatives.

Objective 2: Thin pine stands to create open canopy conditions. If possible, maintain canopy cover at or below 55 percent and remove up to 50 percent of the basal area. Promote and encourage additional sunlight penetration in ecotone areas.

Objective 3: Manage low density pine areas to increase stocking, as needed, through natural and artificial regeneration. Favor shortleaf pine for all natural and artificial regeneration. Apply environmentally accepted site preparation methods, where applicable, to encourage regeneration of loblolly pine.

Objective 4: Control hardwood midstory in selected oak/hickory forest stands with growing season fire to increase plant diversity.

Objective 5: Create, retain, and/or maintain oak/hickory and scrub patches in an area coverage and patch configuration that encourages habitat values for hardwood and mixed habitat dependent priority species. Provide a diversity of age classes, shrub and tree species, fruit-bearing vines and shrubs, and habitat structure within each training area.

Goal 2: Maintain a healthy, sustainable forest on Fort Campbell that provides for natural habitat, conservation of endangered species, revenue from timber sales, and recreational opportunities.

Objective 1: Implement the FMP to achieve forest DFCs in each watershed.

Objective 2: Review the FMP annually and update it every five years, or more frequently as appropriate to maintain current information about forest conditions, progress toward goals and objectives, and current goals that support the military mission.

Objective 3: Update installation-wide inventories every ten years or more frequently.

Goal 3: Manage fire in a manner that protects human life and safety, minimizes damage to property, natural and cultural resources, and contributes to ecosystem management goals.

Objective 1: Implement fire prevention and suppression measures described in the Installation Wildland Fire Management Plan.

Objective 2: Implement the objectives and prescribed burning projects established in Section 6.0 of the FMP.

Objective 3: Update the Integrated Wildland Fire Management Plan, in accordance with Department of the Army guidance that is integrated with other natural resource management activities.

Objective 4: Each year, certify installation staff and support personnel according to the guidelines per the Army regulation.

Goal 4: Maintain the system of forest access roads to create a system that is effective at controlling fires and providing access to forest, but minimizes soil disturbance, soil erosion and drainage problems.

Goal 5: Manage the forest applying Kentucky and Tennessee's Forest Practices Guidelines Related to Water Quality which include recommendations for streamside management zones, stream crossings, access roads, timber harvest, site preparation, reforestation, prescribed burning, wildfire suppression, chemical treatments, and wetland management.

Objective 1: Incorporate BMPs into all forest product availabilities for inclusion in Corps of Engineers contracts for forest harvest on Fort Campbell.

Goal 6: Maintain the health of natural communities and generate forest product income through silvicultural treatments used to manage Indiana bat habitat and other priority floral and faunal species.

Objective 1: Identify and maintain functional flora and fauna corridors to minimize fragmentation and maintain genetic and demographic linkages.

Objective 2: Control or eradicate invasive species, which can compete with native species.

Objective 3: Emphasize tall grass prairie/barren restoration as the primary vegetative cover, recognizing that native warm season grasses are essential fuel for the fire regime necessary to maintain this ecologically imperiled ecosystem.

Objective 4: Perpetuate and enhance other vegetative ground cover to optimize wildlife values regarding food and cover.

Objective 5: Preserve and maintain the status of those species associated with each natural community. Status is evaluated by the species abundance and species richness within the community.

Objective 6: Determine the abundance and richness of understory species or indicator species in assessing the integrity of managed natural communities.

Goal 7: Provide firewood to the Fort Campbell and civilian communities.

Objective 1: Sell firewood through minor forest product contracts (permits) at the Forestry office. Make permits available to military and civilian communities. Maintain a list of available harvest areas at the Outdoor Recreation Unit. Do not allow firewood harvesting from impact areas.

Goal 8: Provide improved forest conditions to promote biological diversity and maintain viable populations of native species, while simultaneously enhancing Army training, in accordance with the Endangered Species Management Component for Indiana and gray bats.

Goal 9: Prepare timber sales in compliance with regulatory requirements and integrated natural resources goals.

Objective 1: Conduct timber sales using the following procedures:

- Determine approximate tree volumes to be harvested at the beginning of each fiscal year.
- Consider habitat needs for the Indiana bat to determine approximate volumes.
- Coordinate timber availability through the Wildlife program and Range Control to ensure no endangered species and training mission issues.
- Forward the availability, upon completion of coordination, to the Louisville District Corps of Engineers, for sale action. Include location maps indicating all known endangered species sites, wetlands, and archaeological sites in the availability. Include volumes and harvest specifications. Use the Louisville District to advertise, sell, and conduct field inspections during harvesting activities.
- Conduct a post-harvest inspection prior to clearing the contract.

Objective 2: Conduct salvage and sanitation sales for small volumes of wood needing removal on construction projects, as well as areas involved in forest insect control and/or storm damage.

Goal 10: Re-establish forests in areas appropriate with other management needs.

Objective 1: Plant shortleaf pines on approximately 1,000 acres of existing loblolly pine acres by 2018.

Goal 11: Minimize forest insect outbreaks on the installation.

Objective 1: Monitor insect spots during the growing season. Request technical assistance from the U.S. Forest Service (USFS) forest entomologist to verify occurrence of southern pine beetle and make control recommendations. Use continuous ground surveillance by Natural Resources personnel and helicopter flights during the growing season to pinpoint insect activity on the reservation.

Objective 2: Use the most current control recommendations in accordance with regulatory guidelines.

Objective 3: Update forest insect activity reports and table of forest insect control activity at the end of each fiscal year.

Goal 12: Minimize forest tree diseases.

Objective 1: Monitor for forest tree disease throughout the growing season and make recommendation for control prescriptions.

Objective 2: Take appropriate control action if significant tree disease problems are discovered.

Goal 13: Apply herbicides to control vegetation to target levels in areas where prescribed fire is ineffective.

Objective 1: Evaluate growing season burns for undesirable hardwood control effectiveness at the beginning of each burning cycle.

Objective 2: Chemically control hardwoods to target hardwood levels using hexazinone herbicide (Velpar®) or other approved herbicides.

Objective 3: Determine chemical control treatment areas for Fiscal Years 2013-2018.

Objective 4: Update annually a summary of hardwood control prescription on Fort Campbell.

Goal 14: Use forest management to support military training throughout the training areas.

Objective 1: Consider the need for special vegetative cover requirements, i.e. density, overstory, and understory, to support the military training mission and construction projects. Assess training actions which require tree removal for potential impacts on endangered species. If assessment determines a no effect: initiate treatment. Use consultation with the USFWS for a "may affect" determination.

Objective 2: Coordinate forest management activities and contracts with Range Branch during planning stages.

Objective 3: Conduct all forest product harvesting to minimize impacts on training activities. If necessary, delay harvesting activity in certain areas until the completion of training activities. Coordinate the annual prescribed burning plan through Range Control. Notify Range Control each day that prescribed burning is planned. Use the Fire Management Officer and Range Control to resolve areas of conflict.

Wetlands

Goal 1: Ensure compliance with the Clean Water Act Sections 404 and 401.

Objective 4: To the maximum extent practicable, plan development and training to avoid impacts to wetlands. When impacts are unavoidable, prepare appropriate permit applications and mitigation plans in coordination with the USACE.

Goal 2: Protect wetlands to ensure "no net loss" per Executive Order 11990.

Objective 1: Continue the environmental clearance review process to protect wetlands.

Objective 2: Provide certified jurisdictional wetland delineations (and permit application, if necessary) before construction occurs in a suspected wetland.

Objective 5: Incorporate BMPs into all forest product availabilities for inclusion in Corps of Engineers contracts for forest harvest on Fort Campbell.

Goal 4: Minimize damage to wetlands, and input of sediment and other contaminants to wetlands.

Objective 1: Maintain vegetated buffers at least 100 feet wide around wetlands. Where it is determined that a wetland has, or could have, significant habitat value, or where current activities adjacent to a wetland are causing noticeable adverse impacts on the habitat, buffers of wider than 100 feet will be considered. Activities within buffer zones are limited to those that would cause little or no impact on or disturbance to the wetland. Unless required by the military mission, training activities within the buffer zone should be minimized; foot travel should be limited, and vehicles should be kept outside the buffer zone.

Objective 2: Review operations and maintenance programs that potentially affect wetlands (e.g., mowing), and develop procedures and guidelines to avoid the degradation of wetland functions.

Fish and Wildlife

Goal 1: Manage habitat to promote a balance of natural ecological processes and trophic structure that sustain native wildlife and fish.

Objective 1: Manage habitat to maintain a mosaic of natural habitat types (e.g. forest, old field, native grass barrens, riparian zone, and streams) that support self-sustaining communities of native non-game and game wildlife and fish species.

Objective 2: Where monitoring shows significant changes in abundance of indicator wildlife/fish species relative to the baseline population, modify DFCs in the Open Area Management Plan or the Forest Management Plan to adjust the abundance or quality of available habitat, including restoration of certain habitat types.

Goal 2: Identify and inventory important wildlife habitat features; determine habitat values for special management and natural areas; determine burning requirements for habitat restoration and maintenance; and identify potentially limiting factors to wildlife populations.

Objective 1: Create and maintain an installation-wide wildlife habitat inventory for Fort Campbell. Incorporate forest inventory data, natural community maps, soils, hydrology, and land use maps. Develop and annually update map for determination of burning needs within annual burn areas.

Objective 2: Create and maintain habitat maps showing both existing and desired habitat conditions, commensurate with the rate of management treatment schedules. Incorporate maps into forest stand and natural community layers.

Objective 3: Create and maintain specialized wildlife habitat and management maps.

Objective 4: Incorporate wildlife habitat inventory into the training area prescription process and other natural resource management planning. Prioritize map development for management prescriptions.

Goal 6: Minimize conflict between aviation activities and wildlife at Campbell Army Airfield (CAAF).

Objective 2: Standardize coordination between the airfield, flight safety, operations, fish and wildlife and pest management program managers to minimize wildlife hazards to aircraft, and to manage habitat near the air field to minimize presence of potentially hazardous wildlife.

Objective 3: The Pest Management Program and Fish and Wildlife Program manager will coordinate to develop and implement plans, based upon the U.S. Air Force BASH (bird-air strike hazard management) procedures, to manage and control potentially hazardous wildlife near CAAF.

Goal 9: Provide supplemental feed, cover, and brood rearing wildlife habitat and enhance outdoor recreational opportunities.

Objective 3: Plant and maintain wildlife openings by providing supplemental food, cover, or habitat structure as follows:

Objective 4: Manage log decks to supplement wildlife openings.

Objective 5: Evaluate the feasibility and management potential for enhancement of grassland habitat functions in multiple-use open areas. Experiment with soil stabilization,

LRAM, and other land management programs to find win/win multiple objective strategies in permanently open areas.

Goal 10: Maximize military training land value and wildlife habitat values for cover dependent priority wildlife species throughout Fort Campbell without compromising habitat requirements for those priority species that are cover intolerant.

Objective 1: Complete projects to create and maintain coarse woody debris, brush piles, and/or cover plantings in conjunction with silviculture, troop training, soil stabilization, and other activities. Use byproducts from forest treatments, Christmas tree production, and other activities to economically create wildlife cover. Monitor wildlife use of these types of cover and adjust the program as required.

Objective 2: Protect scrub and oak/hickory patches, cedar plantations, coarse woody debris, and other cover features from fire. Experiment with fire protection techniques including, but not limited to, manipulation of patch canopy closure and species composition for fuel suppression, pre-burning patches within burn blocks using low intensity fire, suppressing fire within patches during intensive burning, combining wildlife opening and cover locations into fire suppression areas, development and use of burn maps showing target fire intensity within burn blocks, planting fire retardant woody vines in brush piles, and the testing and application of other innovations as conceived.

Objective 3: Develop and implement a strategy to inventory, monitor, and manage snags and natural cavities across forest stands. Initiate monitoring and research as needed to assess snag use and/or requirements for priority wildlife species.

Endangered, Threatened, and Species at Risk

Goal 1: Ensure proposed projects are in compliance with the ESA.

Objective 1: The Conservation Branch will support project planning and timely environmental reviews under NEPA to identify potential effects to listed or rare species. The Conservation Branch will prepare a Biological Assessment to determine if a proposed project may affect a federally listed species. If a proposed project may affect federally listed species, the Conservation Branch will coordinate with the USFWS.

Goal 2: Continue to provide suitable habitat on Fort Campbell for gray bats and Indiana bats.

Objective 1: To provide suitable roosting and foraging habitat for Indiana bats on the installation, allow 4000 acres of forest to achieve old growth conditions, characterized by numerous large-diameter trees with dominant trees between 100 and 200 years old, snags and dying trees of all sizes, and downed rotting trees. Detailed description of old growth forest conditions is provided in the FMP. At least 2,830 acres in the Saline Creek and Casey

Creek watersheds, where Indiana bats have been captured, will be allowed to achieve old growth status.

Objective 2: During forest management activities (including those under contract) evaluate all cavities on snags and trees on a case-by-case basis, except where they are hazardous to humans.

Objective 3: Restrict removal of trees to times of the year when the Indian bat is not present (15 November through 15 March) to avoid harm to roosting Indiana bats.

Objective 4: Provide good quality water and aquatic habitat for foraging gray bats and Indiana bats.

Objective 5: Maintain forested riparian zones at least 100 feet wide along perennial and 50 feet wide along intermittent streams, which provide foraging habitat for gray bats and Indiana bats. In riparian zones that are not currently forested, encourage development of forest by planting trees, and/or avoiding actions that inhibit natural succession to forest. Minimize activities that remove forest in riparian zones, including timber sales, and establishment of skid trails or firebreaks. Timber stand improvement and prescribed fire, when used in riparian zones, will be carefully planned to avoid removing canopy trees.

Objective 6: Develop and implement a snag creation and management program in conjunction with the HMA prescription process and other natural resource management activities.

Goal 4: To the maximum extent practicable, contiguous tracts of forest will be maintained in the Casey, Saline, Fletcher's Fork, Jordan, and Piney Fork watersheds. These watersheds lie between foraging areas and roost caves (Tobaccoport, Big Sulfur Springs, and Bellamy caves used by Indiana bats and gray bats.

Objective 1: The Fish and Wildlife Program Manager will review proposed construction projects. To the maximum extent practicable, proposed tree clearing within the Casey, Saline, Fletcher's Fork, Jordan, and Piney Fork watersheds will be sited in previously disturbed, non-forested areas. The F&W Program Manager will advise project proponents to design and site projects such that forested corridors are maintained.

Goal 7: Maintain self-sustaining populations of state-listed and rare species on Fort Campbell to the maximum extent practicable.

Objective 3: Restrict access into and disturbance of, nesting and breeding grounds of Species at Risk or state-listed birds during critical periods. Incorporate this restriction into proposed project plans as an impact avoidance measure.

Objective 4: Plan habitat management activities to avoid harm to State-listed plants and animals. Management prescriptions for barrens/old fields inhabited by rare plants will include techniques not likely to destroy existing plants. Prescriptions will include specific timing of

activities designed to avoid harm to plants or animals (e.g., nesting birds). Management measures will include:

- Disturbance along training road, 0.3-mile south of Range Marker 31, will be minimized to avoid damage to *Carex alata*.
- Timber harvest will be restricted in two locations along Saline Creek, and natural barriers will be installed/ maintained to discourage visitation to sites *containing Hydrastis canadensis*.
- Timber harvest and prescribed burning will be restricted near five *Juglans cinerea* trees along Saline Creek.
- Timber harvest and digging will be restricted, and natural barriers will be installed/ maintained to discourage visitation near the three populations of *Panax quinquefolius*.
- Mowing and deep disking will be restricted in areas containing *Silphium pinnatifidum*.
- Cultivation and early mowing will be restricted in areas containing *Tomanthera auriculata*, *Prenathes barbata*, and *Prenathes aspera*.

Objective 5: Plan and implement management activities that improve the availability and/or suitability of habitat for State-listed species of animals and plants. Management measures will include:

- In areas containing *Rudbeckia subtomentosa*, woody growth will be mechanically cleared to prevent encroachment on the State-listed plants.
- Implement prescribed burning in the portion of Range 46 containing *Scleria ciliatata*.
- Implement prescribed burning near *Tomanthera auriculata*, *Prenathes barbata*, and *Prenathes aspera*.

Goal 10: Develop conservation strategies to protect and manage for species at risk in consultation with the USFWS, TWRA, and KDFWR.

Objective 1: Consider DoD Species at Risk and Federal Species of Concern in all Army actions, per 32 CFR 651 and AR 200-1.

Objective 2: Utilize species prioritization, habitat modeling, and population monitoring projects to determine wildlife management needs, and measure management effectiveness and land use impacts for priority species. Develop and implement focused or specialized adaptive management plans for priority species or groups of species as needed.

Goal 11: Develop conservation strategies to protect and manage for State-listed species in consultation with TWRA and KDFWR.

Objective 1: Consider State-protected species in all Army actions, per 32 CFR 651 and AR 200-1.

Goal 12: Provide focus for Fort Campbell natural resource management by identifying wildlife species at risk with the highest management priorities for species conservation.

Objective 1: Develop and apply species priorities and habitat models to direct natural plant community management and habitat landscape design to meet life requisite needs of high priority species.

Objective 2: Apply species priorities as adaptive management targets in treatment monitoring and for alteration of management activities.

Pest Management

Goal 1: Implement the IPMP in accordance with AR 200-1.

Objective 1: The IPMP will be updated at least once per year and reviewed by AEC.

Objective 2: Appropriate certifications and training will be maintained for Fort Campbell professional pest management personnel, pesticide applicators, and others involved in implementing the pest management program. Provide required refresher training and certification training for any new personnel, using the Academy of Health Sciences, Fort Sam Houston, Texas or other approved sources for certification.

Objective 3: Ensure contract personnel are either Kentucky or Tennessee certified applicators.

Objective 4: Detailed records of all pesticide usage, spills, and reportable human exposures for pest management activities (including those performed under contract, by tenant and supported activities, and by lessees per formal agreements) will be maintained and reported in formats per the DOD Instruction or on equivalent automated systems. The database will be developed and updated annually or more frequently as required. Applicators will be provided palm computers to efficiently record, transfer, and review data.

Objective 5: Maintain a GIS database of pesticide applications (location, purpose, formula) that is updated annually. At least once per year, query the database to identify trends in the locations, types, and amounts of pesticides used.

Objective 6: Pesticide procurement, handling, storage, and disposal will strictly adhere to guidelines established by Federal laws, and DoD and Army guidance, which are described in the IPMP.

Objective 7: Standards for safety and health described in AR 200-1 will be met for each pest management activity conducted by in-house staff or under contract.

Objective 8: Control the quality of pest management activities by conducting detailed inspections of in-house and contract pest control activities. Establish quality control measures to ensure pesticide application is according to label instructions, locations and frequencies of applications follow guidelines of the IPMP, and all pesticides used on the installation are approved and recorded in the IPMP.

Objective 9: Follow precautionary statements on labels regarding contamination of water when pesticides are sprayed near wetlands. Implement special requirements for the protection of recreation areas.

Objective 10: Take special precautions during pest management activities that could affect endangered species or species of concern.

Goal 2: Reduce pesticide use as required by guidelines.

Objective 1: Emphasize surveillance before chemical application.

Objective 2: Use more efficient equipment and techniques to reduce chemical volume and toxicity.

Goal 5: Control noxious and invasive plants in terrestrial and aquatic habitat. Plants listed as noxious and/or invasive by the US Department of Agriculture and/or the states of Kentucky and Tennessee will be included in the IPMP.

Objective 1: Implement portions of IPMP that address undesirable vegetation (pre- and post-emergence), broadleaf and grass weeds in corn and soybeans, aggressive species in grasslands, and aquatic weeds in ponds and streams. Depending upon the area to be treated, the Pest Management, Fish and Wildlife, Forestry, and/or AO program managers will coordinate to develop site-specific prescriptions for controlling invasive plants. Methods may include application of herbicides listed in the IPMP, mechanical control (mowing, disking), or prescribed fire.

Objective 2: Evaluate requirements and conduct control activities for kudzu and other invasive plants as needed.

SECTION 3.0 Current Conditions and Desired Future Conditions

3.1 Ecosystem Management on Fort Campbell and How It Affects Current and Desired Future Conditions (Dfcs)

The production of forest products through ecosystem management benefits the Forestry Program, but managing for production on a military installation is integrated with, though subordinate to, the broader need of supporting the military mission and maintaining the ecosystem. The primary goal of ecosystem management on Fort Campbell is to sustain the integrity of ecosystems (i.e., their function, composition, and structure) through time while providing immediate and long-term support to increasingly diverse military training strategies. A balance is needed among demand for resources, the maintenance of ecosystem integrity, and the conservation of forest management options to satisfy future military training requirements.

Once a current condition is identified, through a forest inventory, a plan is developed using the ecosystem management approach to move the stand towards a desired future condition. This could mean active management or just monitoring. It could mean a commercial harvest or under planting of hard mast species. Often the current condition requires action but that action generally requires methods based on a longer interval than most resource managers and trainers plan, due the natural cycle of forests and the time and age forests need to develop.

Reaching the desired future condition requires two things: a plan and a purpose. Desired future conditions are constantly evolving on a military installation due to training requirements and the shaping of the landscape to match conditions needed for military activities. Often a compromise between a forest manager's ideal desired future conditions to achieve maximum forest production and viability and the desired future condition to meet installation needs related to T&E species, species at risk, biodiversity or training requires a focused approach.

Ecosystem management on Fort Campbell requires cooperation with other natural resource managers who have the expertise and responsibility over other ecosystem components. Specifically, a direct relationship exists between the silvicultural system and rotation length to the availability of wildlife habitat features. Cooperation also exists with military personnel who have authority over and specific requirements for the training land.

3.1.1 Ecosystem Guidance and Direction

Some ecosystem management guiding principles are as follows:

- Retain natural patterns of biological legacies
- Allow sufficient recovery periods between disturbing activities to sustain biological diversity
- Incorporate time as an ecological factor

- Never terminate the forest
- Maintain the forest ecosystem in its entirety
- Balance a range of values from the land
- Prioritize stewardship of rare or declining species and communities
- Build towards older trees
- Base on system health
- Think in decades and centuries rather than months and years
- Use low impact logging and management activities whenever possible
- Conserve when removing trees
- Variation in stocking distribution is important
- Consider the complexity of the ecosystem
- Integrate wildlife management
- Native species, always

3.1.2 Encouraging Biodiversity

Forest management encourages biodiversity by implementing a variety of scientifically sound silvicultural systems that promote or maintain the structure, function, and composition of forests in the sub-watersheds and the larger Fort Campbell landscape through space and time. This Plan identifies sensitive areas that require special attention and acknowledges that commercial timber production does not necessarily equal good wildlife habitat or conditions conducive to military training. Effective ecosystem management requires cooperation among all resource specialists and military personnel.

3.2 Current Conditions

Current conditions in forested stands on the installation have been derived from field inventories. Information from field inventories has been evaluated and final data is contained in the tables located in Appendix C. Appendix C contains stand data broken down into useable categories such as stand identification, acreage, site index, cover type, sub watershed, structure or current condition, top three species present in the overstory, desired future condition, last management action and date.(This data will constantly be updated as management actions are taken and as inventories are conducted. A copy of the first spreadsheet is kept in the management unit folder, and as conditions are updated, a new copy is placed on top so stand changes and actions can be tracked by forest managers.)

The installation 8 chain hardwood inventories of 2000 and the ongoing 4 chain inventories in hardwood prior to management actions identified the current conditions for hardwood stands.

Current conditions for pine stands was derived from planting information, an inventory which was completed in 2004, and ongoing inventories to determine desired future conditions. Much of the pine inventory information is directly related to post harvest conditions, stand size and management principals.

Past management of pine stands was not limited to the size of the stand. Many pine stands less than four acres exist. It is difficult, if not impossible; to manage pine in stands less than 4 acres. By planting any open field in pine, to achieve a forested installation, the forestry managers of the 50's, 60's and 70's created many small fragmented stands. Current and projected manpower and funding dictate the management of forested stands to four acres or more in size. Four acres is also the limit other federal agencies use in determining the size requirement of managing forested stands. If funding or manpower increases, efforts could change and stands could be managed at a smaller scale.

Hardwood stands were delineated in early 2000 and are fairly uniform in size. Most stands were broken out into sizes that support manageable units and harvestable volume. However, stands are sometimes overly large or do not fit best management practice guidelines related to streams or other features. It is foreseeable that some hardwood stands will be delineated into smaller, more uniformly manageable units.

3.3 Silvicultural Systems

Silvicultural systems are a planned series of treatments for tending, harvesting and re-establishing a stand (SAF Dictionary of Forestry, 2008). The system is based on the number of age classes in the current stand and the desired future condition of the stand. Two methods of classification are used to identify the system: age class or regeneration method. Age classes are broken down into coppice, even-aged, two-aged, uneven-aged. Regeneration methods are clear cutting, seed tree, shelterwood, selection, coppice and coppice with reserves.

When we refer to age classes we are generally referring to the current conditions of the stand. As the result of a management action (or sometimes no management action) a condition developed the stand into the current state. Foresters evaluate the current conditions to determine age class.

Age classes are defined as one of the intervals into which the age range of trees is divided for classification or use or; a distinct aggregation of trees originating from a single natural event or regeneration activity, or a grouping of trees (SAF Dictionary of Forestry, 2008).

Regeneration method is a cutting procedure by which a new age class is created; the major methods are clearcutting, seed tree, shelterwood, selection, and coppice (SAF Dictionary of Forestry, 2008). However, a cutting procedure could have taken place in the past or a stand could have developed from an old field and have an age classification of the current condition. Generally when we think of managing a stand of timber we are considering a cutting of some sort. That gives managers the opportunity to achieve a desired future condition which might create a new age class, convert a less desirable age class into a

desirable one or achieve a management objective through cutting that would not otherwise be available.

3.3.1 Methods of regeneration

3.3.1.1 Coppice

The coppice method achieves the majority of regeneration from stump sprouts or root suckers. Choices with this method are coppice, coppice selection and coppice with reserves. This method is not currently a viable option for achieving consistent hardwood or pine management on the installation.

3.3.1.2 Even aged

Even aged methods regenerate and maintain a stand with a single age class. These methods are clearcutting, clearcutting with reserves, seed tree, shelterwood and shelterwood with reserves. Even aged methods have been and continue to be used on the installation.

3.3.1.3 Two aged

Two aged methods regenerate and maintain stands with two age classes. These methods are clearcutting with reserves, seed tree with reserves, shelterwood with reserves. Two aged methods are used to achieve goals other than regeneration, and are not currently being used but could be used on the installation in the future.

3.3.1.4 Uneven aged

Uneven-aged methods regenerate and maintain a multi-aged structure by removing some trees in all size classes either singly, or in small groups or in strips. These methods include group selection, group selection with reserves, and single tree selection. Uneven-aged methods have been used extensively on the installation and continue to be used.

3.3.2 Discussion

The end result of any management is achieving a desired future condition that supports the goals and objectives of the INRMP and consequently the installation.

Based on the descriptions above, an example of the desired silvicultural system for hardwood bottomland cover types such as hackberry-American elm-ash or American sycamore-sweetgum-American elm is uneven-aged. Upland species such as red oaks, white oaks, and hickories require a more intense approach to forest management as described using even-aged silvicultural systems.

Hardwood stands are further assigned an upland or bottomland forest cover type classification, and this usually lends itself to a prescription of a short rotation or long rotation interval based on soils, species and site index. Soil type and site index plays a major part in determining the current conditions and the possible desired future conditions for a stand.

All pine management units are plantations and, therefore, inherently even-aged but moving towards a DFC will often break down the plantation-like structure and this might lend itself to uneven aged or two aged stands.

Matching the forest type (e.g., pine, upland hardwood, or bottomland hardwood) to the appropriate silvicultural system generates a distribution or patchwork of forest cover types. Military trainers, wildlife managers, and other land managers contribute their goals and objectives, and an integrated mosaic, or mixture, of desired future conditions results. This is desirable in that it creates diversity. It also inherently creates sustainability because forests are in various stages of development and not as susceptible to insect, disease or natural occurrences if they were of one age class or in one stage of development.

The Fort Campbell Forestry Program faces a major challenge to determine what combination of treatments, or silvicultural systems, would prove best ecologically and economically, while also meeting military needs over the long run. The goal of the shifting forest mosaic model is to establish a mixture of vegetative communities that will provide an array of ecological conditions and military-use opportunities across sub-watersheds and the larger Fort Campbell landscape. The designation of desired future conditions is the format that will aid in achieving this management challenge. By describing desired future conditions for a forested area and comparing them to the present condition and structure of the forest, a clearer picture is available for determining the silvicultural systems and timber stand improvements needed to attain the desired goal.

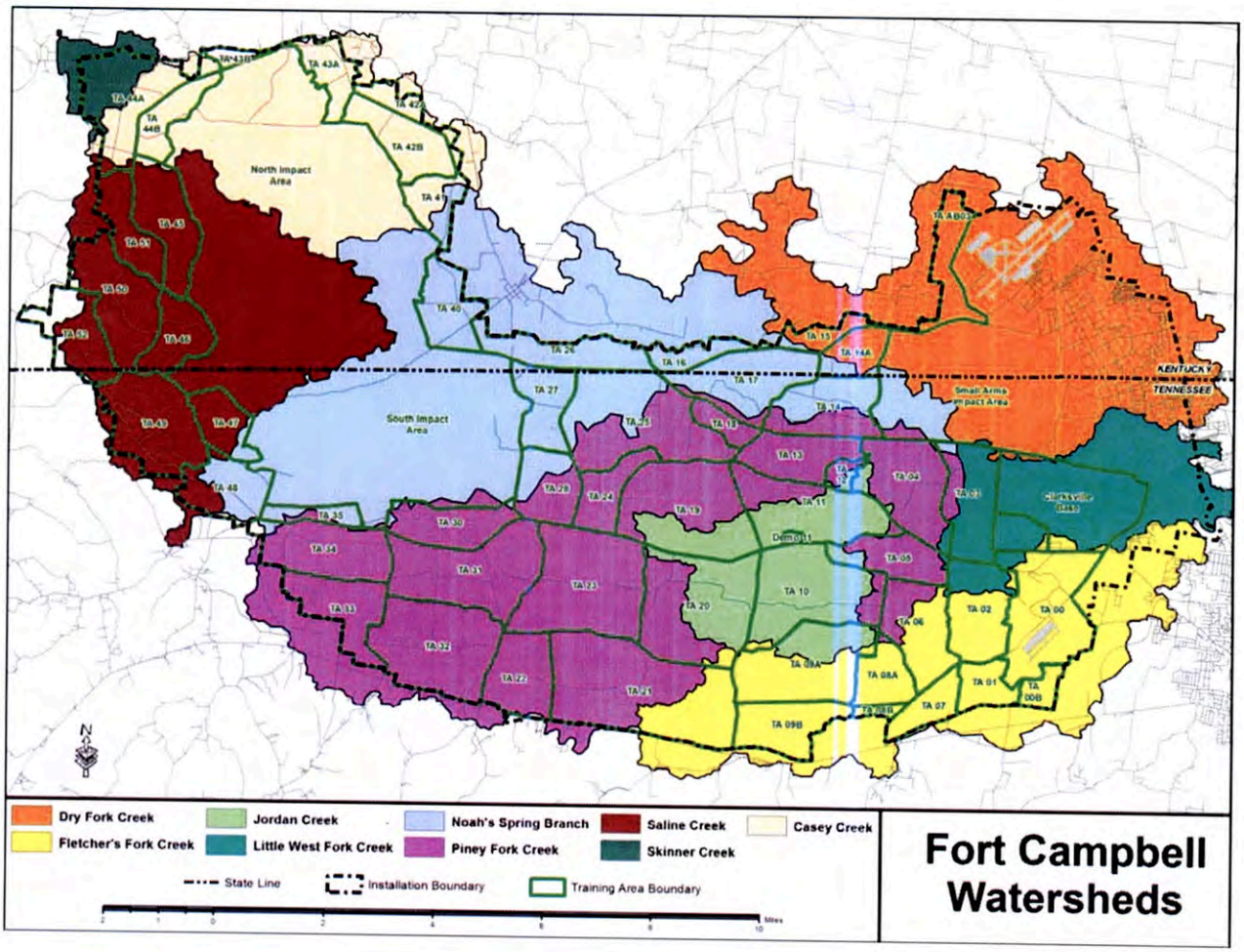
3.4 Desired Future Conditions

The desired future condition (DFC) is a description of the conditions that are expected to occur as this Forest Management Plan and the INRMP are implemented. DFCs consider resource conditions, land capabilities, ecosystem functions, and human interaction. DFCs are outlined for every forest stand in Appendix C.

The Fort Campbell forest is delineated into management units (or stands) within training areas. The forest is also divided into sub-watersheds for resource management purposes. The desired future condition is applied over a sub-watershed and broad goals, such as maintaining upland cover types, also apply at this scale. Stand management varies by existing sub-watershed conditions. These conditions include cover type, relative productivity, and age structure.

Each DFC includes a description of the location, the present condition of the land and forest structure, and a breakdown of the desired conditions in the area, including ecosystem conditions and desired human facilities and activities.

Figure 3. Fort Campbell Watershed Map



3.4.1 DESCRIPTIONS OF DESIRED FUTURE CONDITIONS

A detailed description of the process is contained below. Desired future conditions are broken down into hardwood and pine. At some time in the future hardwood and pine management may exist together in mixed stands. Until that time, hardwood and pine management will be considered separate management actions.

3.4.1.1 Hardwood Desired Future Conditions

Even-aged Long Rotation Emphasis

The even-aged long rotation system is not only beneficial to the Forestry Program, but also to military training activities as they will enhance visibility and maneuverability with a more open understory condition. A longer rotational range (80 to 100 years) produces a forest with greater occurrences of large, medium, and small size sawtimber compared to shorter rotations. This larger diameter class distribution is more conducive to military training operations involving a more mature forest setting;

that is, larger trees with wide variations in tree size and spacing between trees and a forest canopy with few gaps and a patchy understory.

Even-aged Short Rotation Emphasis

Even-aged short rotation (60 to 80 years) is highly beneficial to the forestry and wildlife programs, but may be less conducive to military training activities. When compared to a long rotation emphasis, these stands will spend proportionately more time in the regeneration stage characterized by a younger forest with smaller trees for a particular species and site. Moreover, there is less variation in tree size and spacing between trees with few canopy gaps and a thick understory, causing a stand to be less conducive to light infantry military training. In terms of commercial timber management, a short rotation captures potential mortality, removes excess growing stock, and maintains full commercial production per acre. For wildlife, it increases early-stage habitat features such as herbaceous forage, woody browse, soft mast and promotes plant species diversity. To reduce the impact on military training, short rotation emphasis is located within stands with less frequent military training operations.

Old-Growth, Natural Processes Emphasis

The old-growth, natural processes emphasis is beneficial to specific military training operations such as live-fire exercises. Old-growth forests are an important component of biodiversity. They provide structural and functional contrasts to younger forests, and the number of old-growth forest stands and their sizes and arrangement across the land contribute to landscape diversity. As a result of the military's need for open understory conditions and the Forestry Program's interest in this ecosystem component, old-growth communities are located around the impact areas where most live-fire exercises occur. Additional acreage in old-growth structure will also occur in riparian buffers where no forestry activities will occur.

Community Biodiversity Emphasis

This emphasis is reserved for areas where a variety of cover types exist – no one type dominates. Community biodiversity is emphasized when there is a distribution among all silvicultural systems (including old-growth) resulting in a diversity of species and communities.

Diversity of plant species and communities creates a wide variety of military training opportunities. Trainers are better able to match the operation with the desired forest structure including such attributes as tree size, spacing between trees, number of canopy layers, gaps in the canopy, and understory thickness. Forest management will control the establishment, composition, and growth of desired tree species, while improving plant species richness and diversity of species and communities.

On Fort Campbell, maintaining a long rotation oak and hickory component is very desirable for timber, wildlife, military training, and biodiversity values. Though successful regeneration may be difficult, most management units can be managed without an oak component while continuing to yield multiple benefits.

Uneven-aged Emphasis: Black Walnut Stands

The even-aged black walnut (*Juglans nigra*) plantations will be slowly moved to uneven-aged structure. Timber stand improvement actions, planting, natural regeneration and re-establishment of river cane across the stands will be given equal weight. Black walnut stands are not currently planned for black walnut replanting however planting of native bottomland oaks is planned. The uneven-aged emphasis is beneficial to forestry goals and wildlife habitat features and abundance. The timber stand improvement practice of crop-tree release of superior black walnut trees creates canopy gaps and encourages the development of understory species diversity. In turn, the availability of late-stage habitat features such as downed woody material and snags is increased. Through time, multiple-level regeneration should develop and all stages of wildlife should increase, while also providing diversified concealment for light infantry military training. Growth is focused on the most vigorous trees, and the establishment of regeneration is encouraged. River cane, and other native species establishment, will be encouraged in walnut bottoms.

3.4.1.2 Pine Plantations Desired Future Conditions

The locations of pine stands tend to occupy old fields. These areas were chosen by early settlers for their productive qualities and so the pine plantations generally occupy relatively good sites. Desired future conditions are harder to manage in these locations due to productive soils and the short term nature of pine (35-50 year rotations). As the desired future conditions evolve, decisions will be made based on the ecosystem and when used with current information, will be used by managers to determine the desired future conditions of the pine on Fort Campbell.

Previously, there was a forestry direction which stated: There will be no active management directed towards maintaining pine plantations. However, excluding any form of management, including pine plantations, which have supported military training and served it well for so many years, is short sighted. Efforts to convert loblolly pine towards other DFCs will always be evaluated and considered. Some locations, due to soil type, training intensity, and other factors lend themselves to the pine plantation DFC due to the ability of loblolly pine stands to sustain rigorous training return intervals. Pine stands provide a viable buffer around the installation boundary in regards to sight and noise. They also function well in lower areas where training would not be possible if the site were occupied by water tolerant species.

Repeated row thinning, without movement towards DFCs, moved some pine stands to a disjointed state. Fractured stand boundaries are often present and hard to delineate. Some stands have been harvested to a point that intense forest management is needed to achieve a DFC. Each pine stand will be evaluated for its use to the military, wildlife, and native ecosystem goals. Location, understory species composition, and structural features will be of primary concern in delineating future stands.

Tactical Concealment Areas

These pine stands are highly beneficial to mounted and dismounted military training. Highly accessible stands are located on high, dry ground and adjacent to a landing zone, drop zone, or other tactical operation control centers and do not pose an encroachment threat to barrens communities. The understory, in lower and wetter areas, is sometimes dominated by undesirable hardwood species.

Canopy closure, visual obstruction, and tree density, which reflect the stand's structural features, are conducive to infantry training when managed correctly. The evergreen canopy provides year-round concealment.

Old-Growth

Pine stands located in impact areas and training areas that are off limits to heavy equipment operation and have limited access lend themselves to this DFC. Some of these stands have limited access to management and forestry activities. Old-Growth stands provide a unique community on Fort Campbell and contribute to landscape diversity. The structure and location of these pine stands are beneficial to live-fire exercises, are noise buffers and create a fuel change which in the past has allowed for fire containment on the installation. Old growth enhances the overall military mission by allowing open understory conditions and increased training visibility.

Pine / Hardwood Mix

These stands are found across the installation. Due to management priorities, such as maintaining installation boundaries in a forested condition, or management limitations, such as riparian area regulations, some stands do not lend themselves to conversion to a pine savanna and are not a threat to a barrens community. Some stands will be converted to a pine/hardwood DFC to maintain a higher fire return interval and achieve a higher fire intensity. The benefit of these pine stands depends on the location. The areas near the installation boundary are maintained to mask the origin of sound pollution. Stands, or portions of stands, in riparian areas protect the water quality. Stands that are not suited for hardwood, grassland, or savanna conversions or supporting intense military training are managed as a pine-hardwood mix. Additionally this DFC can be used to move a pine or hardwood stand towards another DFC which supports training or resource management objectives. The key in this DFC is thinking in the long term.

Native Grassland Conversion

These pine stands are usually located near or adjacent to open fields that are classified as critical habitat for threatened and endangered plant species, including ear-leaved false foxglove (Tomanthera auriculata), in areas historically known to be barrens, and are supported by current fire regimes and soil conditions. Pine stands containing undesirable tree species in the understory will be systematically removed and the area will be converted into native grassland. The benefit of these areas is the availability of more open and accessible training land for airborne training and the removal of an encroachment threat on the barrens ecosystem.

Hardwood Conversion

Pine stands suited for a conversion to hardwood are scattered throughout the installation. They have an understory dominated by desirable hardwoods such as oak and hickory, or are located adjacent to a desired hardwood cover type. This conversion will benefit the installation by restoring a native forest component, thus adding another component to the shifting forest mosaic, and by producing desired

growing stock for future timber harvests. During the conversion, there will be no net loss of the training area for the military over the short term; however, as the hardwood stand matures, the area will better lend itself to training than does the current structure. Maintaining a pine component, in some stands, may facilitate a longer fire season or achieve higher fire intensity. This may be desirable for oak regeneration through fire management applications.

Pine Savanna

These pine stands are neither of primary training importance to the military, due to unfavorable location, structure, or density, nor encroaching on native grasslands. They also have an understory dominated by undesirable hardwoods and/or grassland species. In addition, the forest productivity in these stands is low due to adverse soil conditions such as fragipans or poor water holding capacities. The pine savannas add structural and species diversity to the landscape. Pine savanna conversion will benefit the military by providing an area for mounted and dismounted training.

Pine Management

These pine stands are located in areas where factors lend themselves to an active pine management approach. Some areas lend themselves to maintaining a pine overstory. Such locations are usually low or wet natured areas along the installation boundary, areas which receive high concentrations of military training, or where hardwood species would suffer from extensive soil compaction. Pine, when managed successfully, lends itself well to military concealment and dismounted maneuver. Pine can also support T&E species, species at risk and native game species if managed correctly.

3.4.2 Methods for Assigning Desired Future Conditions

The desired future conditions for this Forest Management Plan are applied base-wide and to the nine sub-watersheds. The desired condition at the landscape level was first determined to be a mix of stands of different ages, structures, and forest types. An examination of the present forest type, forest productivity, wildlife habitat needs, and military interests determined the silvicultural system DFC to use for each management unit.

3.4.2.1 Hardwood Methodology

Each hardwood management unit was assigned a cover type designation of upland or bottomland based on volume estimates for the dominant three species. All bottomland hardwood management units are to be managed using the uneven-aged silvicultural systems. If an upland hardwood management unit has a high site index, the area is to be managed under an even-aged short rotation – defined as 60 to 80 years. If an upland hardwood management unit has a low site index, the area is to be managed under an even-aged long rotation – defined as 80 to 100 years.

The flow charts and decision models for management are designed to visualize the decision process. Often, the process is complicated and factors exist beyond what a flow chart can describe. The flow chart and decision process is provided to assist in understanding the process and should be only be used as an aid.

Figure 4. Hardwood Management Methodology Flow Chart

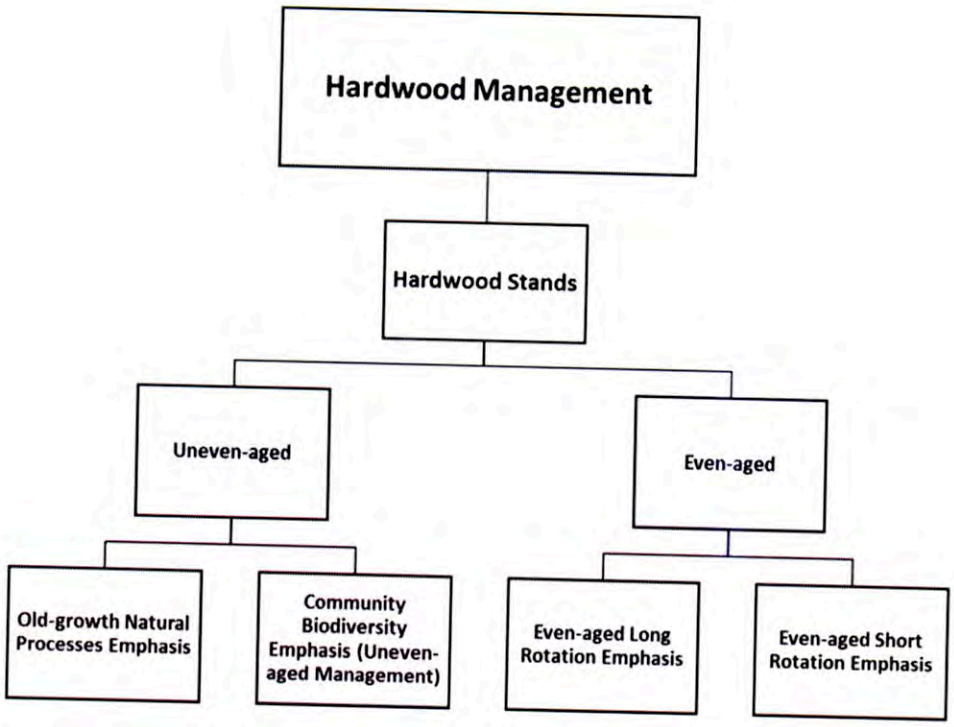
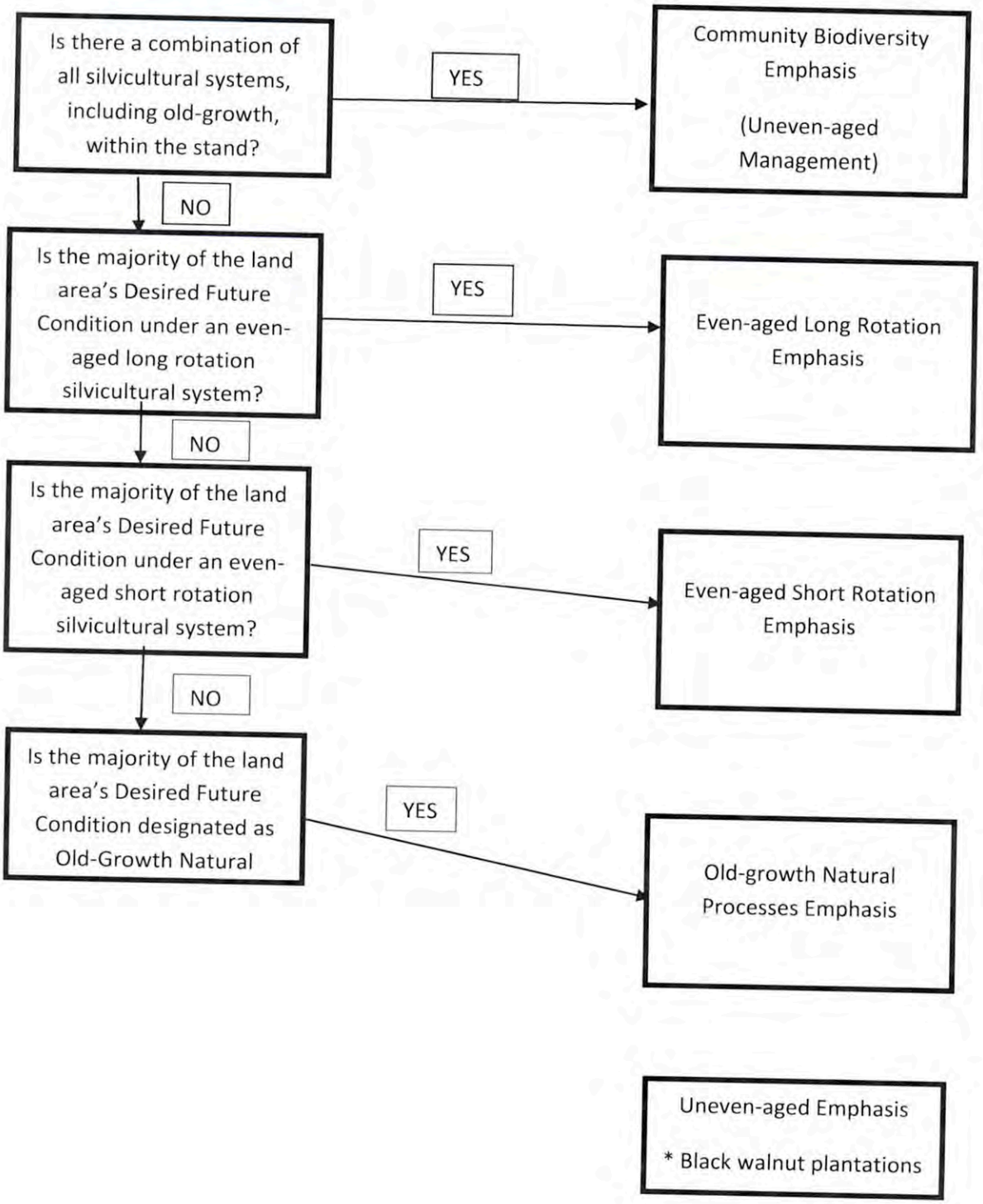


Figure 5. Desired Future Conditions Designations Model for Hardwood



3.4.2.2 Pine Plantation Methodology

Generally, the pine management units and DFCs are delineated based on their physical layout across the Fort Campbell landscape as well as military training needs and guidance. However, harvests greatly affect the stand boundaries and sometimes create soft edges to what was once a very clear pine plantation stand boundary. Stands are delineated using many factors. Stands located in impact areas or areas that do not allow active forest management are usually allowed to grow into an old-growth structure. These areas are usually greatly affected by fires, both prescribed and wildfire. Stands located on xeric sites within proximity to drop zones or landing zones and providing good concealment for military training will be managed for tactical concealment area characteristics or hardwood conversions. Pine stands located on the installation border or within a riparian area will be assigned a pine management or pine/hardwood mixture DFC, allowing the hardwood understory to establish itself in the stand naturally. Stands will be converted to native grassland in areas adjacent to open fields deemed to be favorable for barrens management and to mitigate encroachment of pine in critical habitats. Stands located in areas which contain undesirable hardwood regeneration components, but get frequent military training activity, may be managed for pine. The desire of all future pine management is to break down the row aspects of pine management and attain a more natural stand which creates transitions and soft edges. This concept lends itself to more intense management but also sustains a greater variety of native ecosystem factors and aids in military training. In many cases foresters already evaluate the stand to sustain the present ecosystem or to perpetuate better military training conditions. The presence or potential use by species at risk and threatened and endangered species plays a part in the management decision process as well.

This process, much like hardwood methods, evolves and develops as a stand matures, as regeneration is evaluated, as management actions occur and as military training changes.

The flow charts and decision models for management are designed to visualize the decision process. Often, the process is complicated and factors exist beyond what a flow chart can describe. The flow chart and decision process is provided to assist in understanding the process and should be only be used as an aid.

Figure 6. Pine Management Methodology Flow Chart

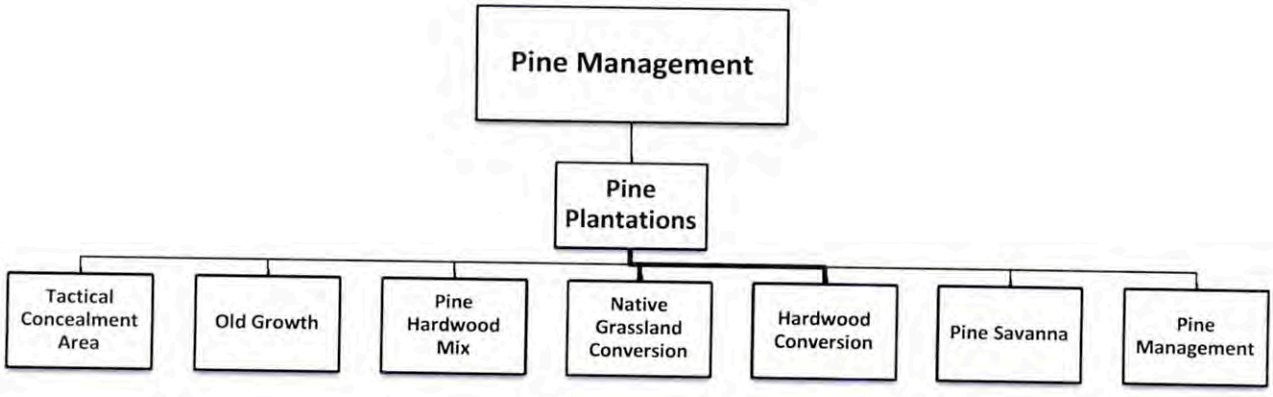
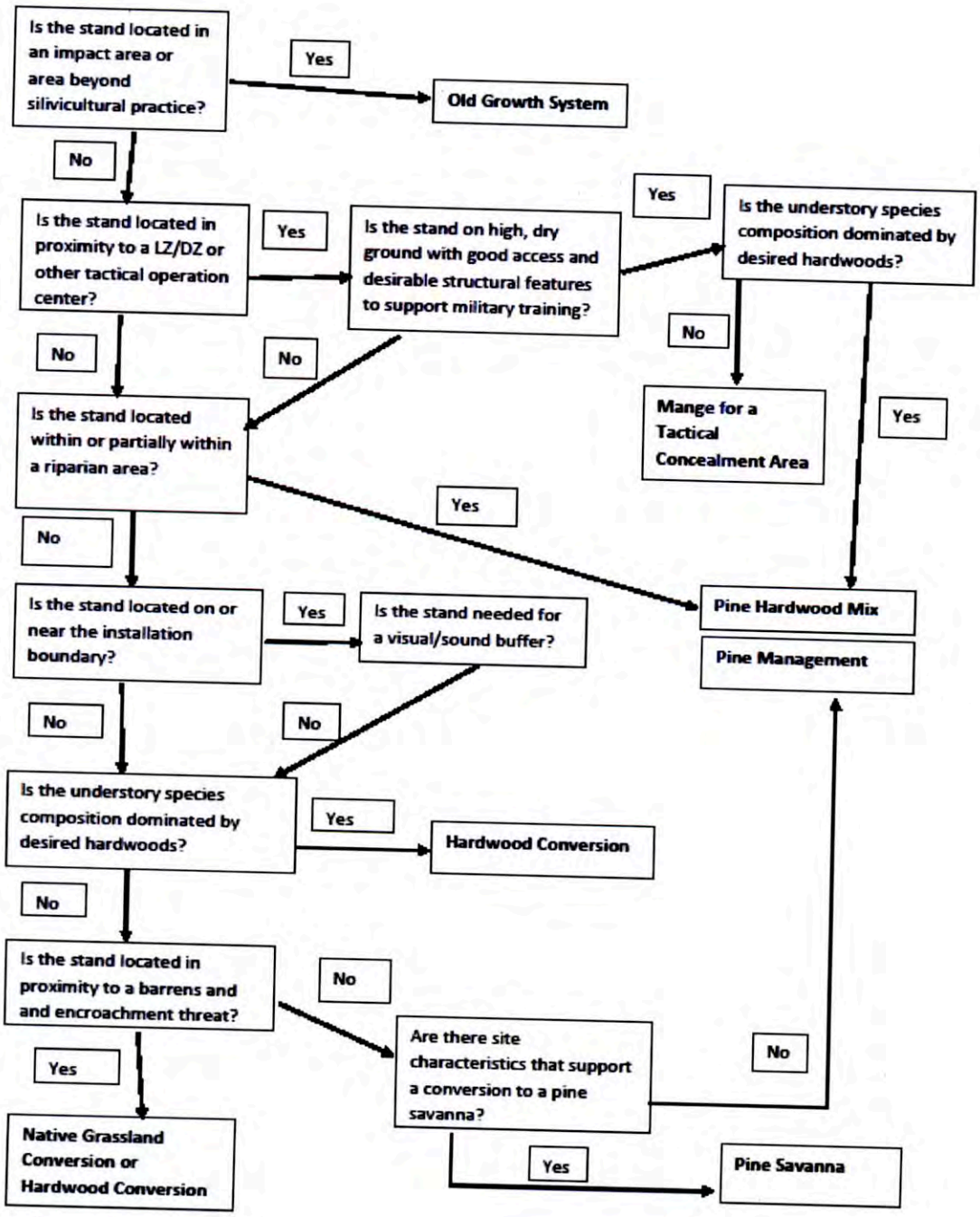


Figure 7. Desired Future Conditions Designations Model for Pine



Section 4 Implementation

4.1 Introduction

Implementation involves the process and procedures for carrying out forest management activities to meet the military mission and the stewardship requirements defined by federal laws. The focus of this implementation process entails turning the forest management plan and decisions into projects and practices on the ground. The scope includes developing and prescribing ways to change the character and condition of a management unit (i.e., forest stand) to make it more useful for the military mission, or to sustain and enhance an environmental condition.

The Forestry Program at Fort Campbell has overall responsibility for implementation of this Forest Management Plan. The twelve-step process for achieving implementation is described below.

4.2 Twelve-Step Process

In contrast to traditional, single-purpose timber management practices, the twelve-step process focuses on selecting and treating management units that will yield multiple benefits. This method is a bottom-up process from the management unit (i.e., stand) to the higher-level sub-watershed goals that have previously been defined. This necessitates an interdisciplinary approach requiring a clear understanding of sub-watershed and management unit goals. Based on these, a forester will develop criteria to guide the selection of candidate stands for timber stand improvement, timber harvest or other forest management activities. Management units, in turn, are ranked and prioritized based on parameters such as forest stand stocking, diameter size class distribution and trees per acre. To meet statistical requirements, such as a 90% confidence interval or an acceptable coefficient of variation value or percentage, a re-inventory of the candidate management unit may be needed. With improved data, a forester will establish specific objectives for the management unit and develop a prescription. Feedback on the proposed prescription will involve monitoring, evaluation and adaptive management procedures. The necessary National Environmental Protection Act (NEPA) action will precede all proposed forest management activities. A Geographic Information System (GIS) will be used to develop, maintain and revise relational databases throughout the process.

Forest Management Implementation

Twelve-Step Process

Step 1

Identify and Confirm Management Unit Goals

Step 2

Develop Management Unit Selection Criteria

Step 3

Prioritize and Schedule Management Units

Step 4

Re-inventory the Proposed Management Unit(s)

Step 5

Revise the Management Unit Evaluation Document/Database (if necessary)

Step 6

Establish Management Unit-Specific Objectives

Step 7

Develop a Prescription

Step 8

Complete NEPA Documentation

Step 9

Develop and Apply Marking Guide (if applicable)

Step 10

Monitor Treatment

Step 11

Evaluate Treatment

Step 12

Adjust Future Treatments

4.3 Twelve-Step Process Description

1.) Identify and Confirm Management Unit Goals

Complete all management unit evaluation documents and confirm that management unit goals comply with the pre-established sub-watershed goals proposed for the Forest Management Plan. Goals are based on the short- and long-term Forestry Program goals and objectives.

Examples might include the following:

- Restore and protect the ecological integrity of old-growth ecosystems to support the military mission.
- Improve tree species composition to increase biological diversity.
- Increase the effectiveness of the riparian zone as a nutrient filter to reduce non-point source pollution.
- Accelerate the growth of high-value crop trees so they will be financially mature in 20-25 years.

2.) Develop Management Unit Selection Criteria

Develop selection criteria for specific forest management activities such as timber harvesting and timber stand improvement (note that selection criteria can be developed for any forest management activity). Listed below is an example of the selection criteria for selecting and prioritizing management units for commercial timber harvesting. The complete selection criteria matrix for all forest management activities can be found on Table 19.

Selection Criteria for Commercial Timber Harvesting include the following:

- Upland cover type (e.g., oak-hickory, yellow poplar-oak, etc.)
- Highly overstocked
- Dominant/co-dominant trees are large and medium sawtimber
- Above average large and medium sawtimber trees per acre
- Above average tree quality (i.e., tree grade)
- Pole-sized, midstory trees dominated by desirable species (oak, hickory, yellow-poplar)

3.) Prioritize and Schedule Management Units

This approach for prioritizing and selecting areas for treatment builds on the past procedure of identifying candidate management units. Although some management units may provide little opportunity to accomplish the higher-level, sub-watershed goals, others might have great potential to do so. A list of candidate management units will be developed and serve as the initial basis for considering prescriptions under this new strategy; however, the prioritization and scheduling must also

consider budget requirements and constraints. Flexibility is also essential when managing projects on a military installation due to changing regulations and training strategies.

Prioritization of management units for a specific forest management activity such as timber harvesting or timber stand improvement is based on the following forest attributes: species composition, stocking, size of dominant and co-dominant trees, density, and tree quality.

4.) Re-inventory the Proposed Management Unit(s)

Re-inventory the management unit to meet required statistical parameters and an acceptable measure of variation

5.) Revise the Management Unit Evaluation Document

Revise the management unit evaluation document based on the updated re-inventory data, if indicated from Step 4. Specific numbers and parameters will change, but the goal of the management unit should remain valid. Perform new calculations of density, species composition, diameter class distribution, structure, and tree quality to confirm previous numbers. If these new figures do not support previous assumptions or reveal new information, then the goal must be reevaluated.

6.) Establish Management Unit Specific Documents

Management unit-level resource objectives should be SMART (Specific, Measurable, Approved, Realistic, and Time bound). These objectives dictate the relative amount of attention paid to managing for timber, wildlife, water or other resources of the management unit. Various laws and regulations governing military training and other natural resource management must also be considered. Analysis of the objectives will normally define the type of woody plants to be maintained, the kind of trees to be grown, and the amount of time, money and care that can be devoted to the process.

7.) Develop a Prescription

List and consider the attributes of the silvicultural systems (stand structures and silvicultural treatments) appropriate for each management unit-level resource objective, in keeping with:

- ecological conditions and stand or site limiting factors;
- sub-watershed goals as described in higher-level plans;
- stand structural goals;
- natural stand development processes; and
- wind throw hazard and possible risk mitigation measures.

Once the desired sequence of stand structures over time has been determined, a forester will consider alternative combinations of silvicultural treatments (including harvest strategies and methods) that will allow the management unit to develop, with the aid of the treatment(s), from its existing structure and composition to the desired condition.

During this analysis, a forester will keep in mind the overall management unit objectives, site and stand limiting factors, natural stand development processes that will continue without management intervention, the risk of loss of stand values, and mitigation measures. A checklist of a variety of stand and site limiting factors and considerations such as advance regeneration, existing stand structure, competing vegetation, soil sensitivity, and riparian sensitivity will be addressed in the management unit evaluation document.

The silvicultural treatment(s) that are chosen as components of the silvicultural system must have objectives that contribute to the development of the desired stand structure and composition. Many of the treatments will be carried out to aid the establishment and growth of regeneration. From the feasible alternatives, a forester will select the most appropriate combination of treatments for achieving the long-term stand structural goals, in light of all management unit-level objectives and site conditions.

In the silvicultural prescription (i.e., the MUED), name and describe the selected silvicultural system, post-harvest stand structural goals, desired leave-tree characteristics, stocking requirements and other required and supporting information. While more than one combination of treatments may achieve the stand structural goals over time, in most cases only one prescription for a silvicultural system will be proposed for each entry.

If evaluation of all considerations and potential risks demonstrates that there is no suitable silvicultural system for the site, recommend deferral of the area from forest management. Ensure that any such decision is adequately recorded in the forest inventory database.

8.) Complete NEPA Documentation

The organization or program responsible for planning and implementing a proposed action is the proponent of the action. The proponent is also responsible for the preparation, content, and quality of the NEPA document and sometimes, the final decision on how to implement the proposed action. In developing a silvicultural prescription, the Forestry Program is the proponent.

Using the NEPA process and the proposed silvicultural prescription, the Forestry Program will brief other natural resource managers on how the proposed treatment works. These documents and discussions will help the military and other resource managers understand the proposed action and give the Forestry Program feedback on what results the other programs may desire from the proposed action. Based on the feedback received, adjust the proposed treatment.

9.) Develop and apply marking guideline (if applicable) or develop a prescription to achieve the DFC

From the silvicultural prescription, develop the most appropriate marking guide for achieving the long-term stand structural goals, in light of management unit-level objectives and site conditions. A marking guide is the means to accomplish the stated objectives. It largely involves instructions on which types of trees to leave and what to remove.

10.) Monitor Treatment

Monitoring is the process of collecting and evaluating information to both determine baseline conditions, if planned activities have been accomplished, if assumptions are correct, and whether management objectives have been met. This information is then used to reassess objectives, alter decisions or treatments, change implementation, or maintain current management direction.

The Forest Management Plan includes three types of monitoring: implementation monitoring to determine if a planned treatment or activity was accomplished; effectiveness monitoring to determine if the treatment achieved its objective or goal; and validation monitoring to determine to what degree assumptions used in the silvicultural prescription are correct. Each monitoring type will have a set of objectives that are applied differently depending on the questions asked.

Definitions of issues and problems are needed to determine monitoring data needs. An adaptive management approach dictates that monitoring will occur at defined intervals to determine future courses of action and to identify what works and what needs to change to meet planned objectives. Objectives of the monitoring program address the appropriate spatial extents and time frames within the hierarchy of the sub-watershed and/or installation landscape. For instance, if one anticipates change in vegetation structure to take 10 years, monitoring on an annual basis would not be warranted. In this way, monitoring information from local efforts can be applied at multiple spatial extents and time frames.

Information gained from a monitoring program will be useful for identifying changes in conditions, predicting impacts, testing cause and effect relationships, and providing information to the Forestry Program manager and other program managers for future actions.

11.) Evaluate Treatment

The evaluation or assessment process begins by recognizing what questions surround the completed treatment. The questions may or may not be clear at the outset of the process.

The general framework for assessment questions include the following:

- Was the planned treatment accomplished?
- Did the proposed treatment accomplish the stated objective(s)?
- Were the assumptions inherent in the silvicultural prescription correct?

12.) Adjust Future Treatments

Linked actions that integrate management and results of monitoring will be used to generate adjustments, and facilitate informed future decisions. Decisions will be consistent and integrated with other military or natural resource management decisions affecting the same piece of ground (in keeping with the notion that ecosystems interact).

In short, this evaluation information will then be used to reassess actions, alter decisions, change implementation, or maintain current management direction.

Appendix A

ENVIRONMENTAL LAWS AND REGULATIONS

NEPA
National Environmental Policy Act (42 USC 4321-4347)
Council on Environmental Quality (40 CFR 1500-1508)

Wetlands
Rivers and Harbors Act of 1899 (33 USC 403)
Protection of Wetlands (EO 11990)
Clean Water Act, Sections 401 and 404 (33 USC 1344, 1341)
Wetlands Action Plan (NPI 99.01)
Emergency Wetlands Resources Act of 1986 (16 USC 3901-3932)

Migratory Birds
Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186)
Migratory Bird Treaty Act (16 U.S.C 703-711)
Wild and Game Bird Preservation (16 U.S.C. 701)
USFWS General Permit Procedures (50 CFR 13)
Migratory Bird Permits (50 CFR 21)

Rare, Species at Risk, Threatened and Endangered Species
Endangered Species Act (16 U.S.C. 35)
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)
Fish and Wildlife Coordination Act (16 U.S.C. 661-666c)
Implementing Regulations of Endangered Species Act (50 CFR 401-423)
Non-game and Endangered or Threatened Wildlife Species
Conservation Act (TCA 70-8-101 thru 112)
Rare Plant Protection and Conservation Act (TCA 70-8-301 thru 314)
Endangered Species Protection (KRS 150.183 thru .990)
Rare Plant Recognition Act (KRS 146.600 thru .619)

Natural Resources
Sikes Act (16 U.S.C. 670a-670o)
Military Reservations and Facilities, Hunting, Fishing, and Trapping (10 U.S.C. 2671)
OSD Natural Resources Management Program (32 CFR 190)
Taking, Possession, Transportation, Sale, Purchase, and Barter, Exportation and Importation of Wildlife and Plants (50 CFR 10-16)
Aquatic Nuisance Prevention and Control (16 USC 4701–4751)
Invasive Species (EO 13112)
Environmental Security (DODD 4715.1)
Strengthening Federal Leadership in Environmental, Energy, and Economic Performance (EO 13514)
Federal Environmental Control Act (PL 92-516-1972)
Federal Pesticide Act (PL 95-396)
Clean Air Act (42 USC 7401-7642)
Clean Water Act (33 USC 1251-1387)
Conservation and Rehabilitation Program on Military and Public Lands Act (PL 93-452)
Federal Insecticide, Fungicide and Rodenticide Act (7 USC 136-136y)

Fish and Wildlife Conservation Act of 1980 (PL 96-366: 16 USC 2901)
Forest and Rangeland Renewable Resources Planning Act of 1974 (16 USC 1601 et. seq.)
Multiple-Use Sustained Yield Act of 1960 (16 USC 528-531)
National Historic Preservation Act of 1966 (PL 89-665; 16 USC 470 et seq.)
Timber Sales on Military Lands (10 USC 1001)
Watershed Protection and Flood Prevention Act (PL 92-419; 68 Stat 666 as amended and 86 Stat
667; 16 USC 1001)
Protection and Enhancement of Environmental Quality (EO 11991)
Environmental Effects in the United States of DoD Actions (DoD 6050.1)
Kentucky Water Quality (401 KAR 5:026, 5:029, 5:030, 5:031)
Kentucky Forest Conservation Act (KRS 149.330-149.355)
Guide to Forestry Best Management Practices in Tennessee (TN Department of Agriculture, Division of Forestry 2003, 00800-7-3)
National Wildfire Coordination Group Wildland and Prescribed Fire Qualification System Guide (PMS 310/NFES 1414)
National Fire Protection Association (NFPA Standards 295, 299, 1051)
1995 Federal Wildland Fire Management Policy
Material Management Regulation (DoD 4140.1-R)
Leases (Agricultural and Grazing Outleases) (10 USC 2667)

ARMY REGULATIONS

AR 200-1 Environmental Protection and Enhancement

AR 405-90 Disposal of Real Estate

AR 200-5 Pest Management

Appendix B

Fort Campbell Tree Species List

Fort Campbell Tree Species List

Common Name	Family	Genus	Species
Ash, Green	Oleaceae	*Fraxinus*	*pennsylvanica*
Ash, White	Oleaceae	*Fraxinus*	*americana*
Beech, American	Fagaceae	*Fagus*	*grandifolia*
Beech, Blue	Betulaceae	*Carpinus*	*caroliniana*
Birch, River	Betulaceae	*Betula*	*nigra*
Boxelder	Aceraceae	*Acer*	*negundo*
Buckeye, Ohio	Hippocastanaceae	*Aesculus*	*glabra*
Butternut / White Walnut	Juglandaceae	*Juglans*	*cinerea*
Cherry, Black	Rosaceae	*Prunus*	*serotina*
Chestnut, American	Quercus	*Castanea*	*dentata*
Cottonwood, Black	Salicaceae	*Populus*	*heterophylla*
Cottonwood, Eastern	Salicaceae	*Populus*	*deltoides*
Dogwood, Flowering	Cornaceae	*Cornus*	*florida*
Downy Serviceberry	Rosaceae	*Amelanchier*	*arborea*
Eastern Redcedar	Cupressaceae	*Juniperus*	*virginiana*
Elm, American	Ulmaceae	*Ulmus*	*americana*
Elm, Rock	Ulmaceae	*Ulmus*	*thomasii*
Elm, Slippery	Ulmaceae	*Ulmus*	*rubra*
Elm, Winged	Ulmaceae	*Ulmus*	*alata*
Gum, Black	Nyssaceae	*Nyssa*	*sylvatica*
Hackberry	Ulmaceae	*Celtis*	*occidentalis*
Hawthorn	Rosaceae	*Crataegus*	*spp.*
Hemlock, Eastern	Pinaceae	*Tsuga*	*canadensis*
Hickory, Bitternut	Juglandaceae	*Carya*	*cordiformis*
Hickory, Mockernut	Juglandaceae	*Carya*	*tomentosa*
Hickory, Pignut	Juglandaceae	*Carya*	*glabra*
Hickory, Shagbark	Juglandaceae	*Carya*	*ovata*
Hickory, Shellbark	Juglandaceae	*Carya*	*laciniosa*
Holly, American	Aqulfoliaceae	*Ilex*	*opaca*
Honeylocust	Leguminosae	*Gleditsia*	*triacanthos*
Hophornbeam, Eastern	Betulaceae	*Ostrya*	*virginiana*
Kentucky Coffeetree	Leguminosae	*Gymnocladus*	*dioicus*
Locust, Black	Leguminosae	*Robinia*	*pseudoacacia*
Maple, Red	Aceraceae	*Acer*	*rubrum*
Maple, Silver	Aceraceae	*Acer*	*saccharinum*
Maple, Sugar	Aceraceae	*Acer*	*saccharum*
Mulberry, Red	Moraceae	*Morus*	*rubra*
Oak, Black	Fagaceae	*Quercus*	*velutina*
Oak, Blackjack	Fagaceae	*Quercus*	*marilandica*
Oak, Cherrybark	Fagaceae	*Quercus*	*pagoda*
Oak, Chestnut	Fagaceae	*Quercus*	*montana*

Oak, Chinkapin	Fagaceae	*Quercus*	*muehlenbergii*
Oak, Northern Red	Fagaceae	*Quercus*	*rubra*
Oak, Overcup	Fagaceae	*Quercus*	*lyrata*
Oak, Pin	Fagaceae	*Quercus*	*palustris*
Oak, Post	Fagaceae	*Quercus*	*stellata*
Oak, Scarlet	Fagaceae	*Quercus*	*coccinea*
Oak, Shingle	Fagaceae	*Quercus*	*imbricaria*
Oak, Shumard	Fagaceae	*Quercus*	*shumardii*
Oak, Southern Red	Fagaceae	*Quercus*	*falcata*
Oak, Swamp Chestnut	Fagaceae	*Quercus*	*michauxii*
Oak, Swamp White	Fagaceae	*Quercus*	*bicolor*
Oak, White	Fagaceae	*Quercus*	*alba*
Oak, Willow	Fagaceae	*Quercus*	*phellos*
Osage Orange	Moraceae	*Maclura*	*pomifera*
Pawpaw	Annonaceae	*Asimina*	*triloba*
Persimmon, common	Ebenaceae	*Diospyros*	*virginiana*
Pine, Eastern White	Pinaceae	*Pinus*	*strobus*
Pine, Loblolly	Pinaceae	*Pinus*	*taeda*
Pine, Shortleaf	Pinaceae	*Pinus*	*echinata*
Pine, Virginia	Pinaceae	*Pinus*	*virginiana*
Redbud, Eastern	Leguminosae	*Cercis*	*canadensis*
Sassafras	Lauraceae	*Sassafras*	*albidum*
Sourwood	Ericaceae	*Oxydendrum*	*arboreum*
Sweetgum	Hamamelidaceae	*Liquidambar*	*styraciflua*
Sycamore, American	Platanaceae	*Platanus*	*occidentalis*
Tree-of-Heaven	Simaroubaceae	*Ailanthus*	*altissima*
Walnut, Black	Juglandaceae	*Juglans*	*nigra*
Willow, Black	Salicaceae	*Salix*	*nigra*
Yellow-poplar	Magnoliaceae	*Liriodendron*	*tulipifera*

Appendix C

Forested Stand DFC Charts

Legend

Pine Stands							
MGMT NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**SIZE_CLASS**	**SUB_WSHED**	**STRUCTURE**	**DFC**
Name of management unit (Training Area followed by stand identifier)	Acres in each stand	Site Index identified as a numerical figure	Pine overstory cover type	Small, med or large size class breakdown	Sub Watershed identified as abbreviation	Current condition	Desired future condition
No management name for stands under 4 acres							
	Total acres of all stands						

Hardwood Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**TOP3_SAWSP**	**SUB_WSHED**	**STRUCTURE**	**DFC**
Name of management unit (Training Area followed by stand identifier)	Acres in each stand	Site index identified as Hi Med or Low	Top three cover types from list in Appendix B	Top three sawtimber cover types from list in Appendix B	Sub Watershed identified as abbreviation	Current condition	Desired Future Condition
	Total acres of all stands						

Airfield Base 03 (AB03)

Pine Stands

MGMT NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.8	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP01	13	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP02	5.1	62	eastern white	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP03	26.1	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP04	28.5	62	eastern white	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP05	38.3	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP06	23.7	62	eastern white	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP07	4.7	62	eastern white	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP08	2.4	62	loblolly pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP09	4.2	62	eastern white	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP10	1.6	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP11	21.5	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
AB3AP15	3.5	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	173.4						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
AB3AH	121.8	HI	YEP-WHO-NRO	CHY-YEP-BKL	DFC	Uneven_Age_Management	Uneven_Age_Management
AB3BH	185.5	HI	YEP-WHO-NRO	YEP-BKO-WHO	DFC	Uneven_Age_Management	Uneven_Age_Management
AB3CH	94.3	HI	WHO-BKO-NRO	CHY-SRO-BKO	DFC	Uneven_Age_Management	Uneven_Age_Management
AB3DH	37.6	MED	HAC-ALM-ASH	SRO-ALM-HAC	DFC	Uneven_Age_Management	Uneven_Age_Management
	439.2						

Clarksville Base (CB)

Pine Stands

MGMT NAME	ACRES	SITEINDEX	COVERTYPE	SIZE CLASS	SUB_WSHED	STRUCTURE	DFC
CBAP01	0.7		Southern pine		LWF		PINE HWD MIX
CBAP02	6.5		Southern pine		LWF		PINE HWD MIX
UNKNAMED	0.4		Southern pine		LWF		PINE HWD MIX
	7.6						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
CBAH	167.6	HI	SYC-SWG-ALM	BCH-SYC-BLW	LWF	Uneven_Age_Management	Uneven_Age_Management
CBBH	234.5	HI	HAC-ALM-ASH	COT-YEP-ASH	LWF	Uneven_Age_Management	Uneven_Age_Management
CBCH	210.5	HI	SYC-SWG-ALM	SVM-SYC-COT	LWF	Uneven_Age_Management	Uneven_Age_Management
CBDH	163.1	MED	SYC-SWG-ALM	SYC-COT-SRO	LWF	Uneven_Age_Management	Uneven_Age_Management
CBEH	218.6	MED	YEP-WHO-NRO	SRO-YEP-NRO	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
CBFH	209.1	LOW	YEP-WHO-NRO	YEP-SRO-ERC	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
CBGH	244.4	LOW	YEP-WHO-NRO	YEP-SRO-SGM	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
CBHH	307.4	MED	YEP-WHO-NRO	SRO-YEP-CHY	LWF	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	1755.2						

Training Area 00

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
00AP2	29.9	65	loblolly pine	small sawtimber	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
00AP1	33.2	70	loblolly pine	small sawtimber	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
00AP3	16.9	62	loblolly pine	small sawtimber	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
	80						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
00AH	178.2	MED	YEP-WHO-NRO	YEP-SRO-WHO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00BH	150.8	MED	YEP-WHO-NRO	SRO-BKO-YEP	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00CH	159.8	MED	YEP-WHO-NRO	YEP-BKO-WHO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00DH	157.7	HI	YEP-WHO-NRO	SRO-YEP-ERC	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00EH	160.6	MED	YEP-WHO-NRO	YEP-SRO-SYC	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00FH	164.8	MED	YEP-WHO-NRO	SRO-BKO-YEP	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00GH	125.5	MED	YEP-WHO-NRO	YEP-BKO-SRO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00HH	163.5	MED	YEP-WHO-NRO	YEP-SRO-WHO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00IH	114.6	MED	YEP-WHO-NRO	PNO-SRO-YEP	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
00JH	120.1	MED	WHO-BKO-NRO	SRO-BKO-WHO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1495.6						

Training Area 01

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
01LP01	3.9	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP04	8.4	61	LOBLOLLY	LARGE SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP03	15.5	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP02	7.6	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP05	4.2	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP07	1.6	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	TCA
01LP08	6.7	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP06	5.5	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP09	8.1	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP12	1.5	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP13	6.7	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
01LP10	4.5	61	LOBLOLLY	LARGE SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP11	4.3	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP15	3.5	61	LOBLOLLY	LARGE SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
01LP16	6.8	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP20	23.2	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP19	4.9	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP17	6	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP14	1.2	61	LOBLOLLY		FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP18	1.6	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP24	14.5	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	TCA
01LP21	1.8	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
01LP28	11.3	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP31	12.8	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP23	7.2	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
01LP27	17.2	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP25	0.9	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
01LP33	8.4	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP37	19.6	61	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP30	5	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP35	24	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP26	1.5	61	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
01LP39	8.6	61	LOBLOLLY	SMALLSAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP41	10.4	61	LOBLOLLY	SMALLSAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP29	3.4	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP34	4.8	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP36	4	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP32	4.8	61	LOBLOLLY	LARGE SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX

01LP42	6.3	61	LOBLOLLY	SMALLSAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP43	2	61	LOBLOLLY	SMALLSAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP44	3.6	61	LOBLOLLY	SMALLSAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.8	61	Southern pine		FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.8	61	Southern pine		FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.6	61	Southern pine		FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP38	2.5	61	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
01LP40	1.1	61	LOBLOLLY	SMALLSAWTIMBER	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
	304						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
1AH	64.6	MED	YEP-WHO-NRO	RDM-SRO-YEP	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
1BH	79.5	MED	PNO-SWG	PNO-SRO-RDM	FFC	Uneven_Age_Management	Uneven_Age_Management
1CH	86.4	HI	PNO-SWG	PNO-SRO-SWG	FFC	Even_Age_Management_Short_Rotation	Uneven_Age_Management
1DH	71.8	MED	WHO-BKO-NRO	SRO-RDM-BKO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
1EH	94.3	MED	WHO-BKO-NRO	SRO-WHO-BKO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
1FH	66.6	N/A	PNO-SWG	SRO-PNO-RDM	FFC	Uneven_Age_Management	Uneven_Age_Management
1GH	58.3	LOW	PNO-SWG	RDM-PNO-YEP	FFC	Uneven_Age_Management	Uneven_Age_Management
	521.6						

Training Area 02

Pine Stands

MGMT_NAM	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	1.1		Southern pine		LWF		Pine HDWD Mix
	1.1						

Hardwood Stands

MGMT_NAM	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
2AH	165.5	MED	YEP-WHO-NRO	SRO-YEP-BKO	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
2BH	115.1	HI	YEP-WHO-NRO	SRO-YEP-BKO	LWF	Uneven_Age_Management	Even_Age_Management_Short_Rotation
2CH	100.3	MED	WHO-BKO-NRO	SRO-BKO-WHO	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
2DH	85.2	HI	WHO-BKO-NRO	SRO-NRO-WHO	FFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
2EH	137.4	MED	YEP-WHO-NRO	SRO-YEP-SGM	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
2FH	144.7	MED	YEP-WHO-NRO	SRO-YEP-BKO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
2GH	127.7	MED	YEP-WHO-NRO	YEP-SRO-WHO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	875.8						

Training Area 03

Pine Stands							
No Pine stands in TA3							
Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
3AH	113.4	LOW	SYC-SWG-ALM	BOX-SYC-BCH	LWF	Uneven_Age_Management	Uneven_Age_Management
3BH	133.4	HI	HAC-ALM-ASH	YEP-ASH-BOX	LWF	Uneven_Age_Management	Uneven_Age_Management
3CH	166.4	HI	YEP-WHO-NRO	SRO-BKO-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
3DH	159.5	MED	YEP-WHO-NRO	SRO-YEP-CHY	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
3EH	163.9	MED	YEP-WHO-NRO	YEP-BKO-SRO	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
3FH	77.1	LOW	WHO-BKO-NRO	SRO-BKO-PTO	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
3GH	55.7	LOW	YEP-WHO-NRO	SRO-YEP-CHY	LWF	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	869.4						

Training Area 04

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
04AP01	1.9	61	Pine mix	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP02	3.4	61	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP03	6.8	61	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP04	15.3	61	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP05	2.9	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP06	3.5	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP07	1.9	61	loblolly pine	large sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP08	2	61	Pine mix	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP09	2.2	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
04AP10	18.8	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
04AP11	4.9	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
04AP12	7.9	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
04AP13	3	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
04AP14	2	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
	76.5						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
4AH	110.4	LOW	YEP-WHO-NRO	SGO-YEP-SRO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
4BH	120.3	MED	HAC-ALM-ASH	YEP-SGM-ASH	PFC	Uneven_Age_Management	Uneven_Age_Management
4CH	185.7	MED	YEP-WHO-NRO	YEP-SRO-WHO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
4DH	122.1	MED	YEP-WHO-NRO	YEP-SRO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
4EH	119.1	LOW	YEP-WHO-NRO	SRO-YEP-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
4FH	150.9	MED	YEP-WHO-NRO	BKO-YEP-SRO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
4GH	144.8	MED	YEP-WHO-NRO	YEP-BKO-SRO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
4HH	107.8	MED	YEP-WHO-NRO	SRO-YEP-CHY	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
4IH	134.0	MED	YEP-WHO-NRO	SRO-YEP-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1195.1						

Training Area 05

Pine Stands

No Pine Stands in TA5

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
5AH	116.9	MED	WHO-BKO-NRO	SRO-BKO-CHY	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
5BH	83.4	HI	YEP-WHO-NRO	SRO-CHY-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
5CH	67.2	MED	WHO-BKO-NRO	SRO-PTO-CHY	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
5DH	90.0	MED	WHO-BKO-NRO	SRO-CHY-MCH	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
5EH	105.1	MED	YEP-WHO-NRO	SRO-YEP-WHO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	462.6						

Training Area 06

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
06LP01	2.7	64	LOBLOLLY	SMALL SAWTIMBER	PFC	Uneven_Age_Management	PINE HW MIX
06LP02	1.2	64	LOBLOLLY	POLE	PFC	Uneven_Age_Management	PINE HW MIX
06LP03	1.8	64	LOBLOLLY	SMALL SAWTIMBER	PFC	Uneven_Age_Management	PINE HW MIX
UNNAMED	0.5	64	LOBLOLLY	SMALL SAWTIMBER	PFC	Uneven_Age_Management	PINE HW MIX
	6.2						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
6AH	102.5	MED	WHO-BKO-NRO	SRO-PNO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
6BH	92.3	MED	WHO-BKO-NRO	SRO-BKO-PTO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
6CH	133.2	HI	YEP-WHO-NRO	SRO-BKO-YEP	FFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
6DH	155.7	MED	YEP-WHO-NRO	YEP-SRO-BKO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
6EH	67.7	MED	WHO-BKO-NRO	BKO-WHO-SRO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
6FH	89.8	MED	YEP-WHO-NRO	YEP-WHO-NRO	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	641.2						

Training Area 07

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	1.1	64	southern pine		FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
07LP01	7	64	LOBLOLLY	SMALL SAWTIMB	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07LP02	9.2	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07LP03	36.3	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07LP04	30	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07LP05	7	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07LP06	6.9	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07LP07	3	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07LP08	15.5	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07LP09	11.3	64	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07LP11	2	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07LP12	25.7	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07LP13	3.8	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07LP17	9.1	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07LP18	1.9	64	LOBLOLLY	LARGE SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07LSP16	27.4	64	LOBLOLLY	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HW MIX
07SLP10	13.5	73	SHORTLEAF	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
07SP15	5	73	SHORTLEAF	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.4	64	Southern pine		FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
	216.1						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
7AH	51.43	MED	WHO-BKO-NRO	BKO-PNO-RDM	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
7BH	106.7	HI	WHO-BKO-NRO	SRO-STO-BKO	FFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
7CH	12.23	MED	WHO-BKO-NRO	SRO-LOP-CHY	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	170.36						

Training Area 08a

Pine Stands							
No Pine Stands in TA8A							
Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
8AAH	73.0	MED	WHO-BKO-NRC	SRO-CHY-RDM	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
8ABH	113.9	MED	WHO-BKO-NRC	SRO-BKO-WHC	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	186.9						

Training Area 08b

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
8B_LP01	12.4	67	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
8B_LP02	8.3	67	LOBLOLLY	LARGE SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
8B_LP03	14.5	67	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
8B_LP04	2.6	67	LOBLOLLY	LARGE SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
8B_LP05	4.5	67	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
8B_LP06	6.9	67	LOBLOLLY	LARGE SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
	49.2						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
8BAH	65.1	HI	WHO-BKO-NRO	SRO-WHO-SWG	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
8BBH	87.6	MED	YEP-WHO-NRO	SRO-SGO-YEP	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	152.7						

Training Area 09a

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
9A_LP1	18.4	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	HARDWOOD
9A_LP10	11.8	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP11	4.9	62	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	
9A_LP12	8.3	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP13	12.1	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP14	12.5	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP15	14.6	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP16	2.9	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP17	10.5	62	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	
9A_LP18	3.5	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP19	22.7	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP2	6.1	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
9A_LP20	5.6	62	LOBLOLLY	POLE	FFC	Even_Age_Management_Short_Rotation	
9A_LP21	16.5	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP22	14.9	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP23	33.7	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP24	2.7	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP25	8.2	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP26	4.2	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP27	34.5	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	
9A_LP3	16.3	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	TCA
9A_LP4	29	62	southern pine	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
9A_LP5	3.9	62	LOBLOLLY	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
9A_LP6	4.3	62	southern pine	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
9A_LP7	2.6	62	southern pine	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
9A_LP8	4	62	southern pine	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
9A_LP9	5.2	62	southern pine	SMALL SAWTIMBER	FFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.5	62	southern pine		FFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.2	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	1	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	1.1	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	1.3	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.6	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.4	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.8	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.8	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
UNNAMED	1.2	62	southern pine		FFC	Even_Age_Management_Short_Rotation	
	322.8						

Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
9AAH	119.6	MED	WHO-BKO-NRO	WHO-BKO-NRO	FFC	Uneven_Age_Management	Uneven_Age_Management
9ABH	97.2	MED	WHO-BKO-NRO	WHO-BKO-NRO	FFC	Uneven_Age_Management	Uneven_Age_Management
9AGH	80.0	MED	WHO-BKO-NRO	WHO-BKO-NRO	FFC	Uneven_Age_Management	Uneven_Age_Management
	296.8						

Training Area 09b

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
9BLP01	2.2	59	MIXED PINE	POLE	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP02	2.7	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP03	4.9	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP04	3.9	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP05	23.5	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP06	6.2	59	SOUTHERN PINE	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP07	3.2	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP08	16.5	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP09	7.4	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP10	7.6	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP11	10.5	59	SOUTHERN PINE	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP12	27.3	59	SOUTHERN PINE	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP13	1.9	59	LOBSHORTLEAF	POLE	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP14	6.3	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP15	34.7	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP16	7.4	59	MIXED PINE HW	POLE	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP17	16.9	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP18	7.7	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP19	24.2	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP20	5.3	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP21	9.4	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP23	3.3	59	MIXED PINE HW	LARGE SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP24	3.2	59	SOUTHERN PINE	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP25	6.2	59	SOUTHERN PINE	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP26	20.2	59	SOUTHERN PINE	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP27	38.9	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
9BLP28	12.1	59	MIXED PINE HW	SMALL SAWTIM	FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	1.7	59	southern pine		FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.4	59	southern pine		FFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	316						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
9BAH	120.2	MED	YEP-WHO-NRO	RDM-SRO-SWG	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
9BBH	180.3	MED	YEP-WHO-NRO	SRO-YEP-RDM	FFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
9BCH	133.4	MED	SWG-YEP	RDM-SWG-YEP	FFC	Uneven_Age_Management	Uneven_Age_Management
9BDH	150.5	MED	SWG-YEP	YEP-SWG-RDM	FFC	Uneven_Age_Management	Uneven_Age_Management
	584.4						

Training Area 10

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.6	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP01	1.5	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP02	3	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP03	2.8	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP04	2.6	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE HWD MIX
10AP05	11.3	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP06	10.1	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP07	2.9	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP08	4	58	MIXED PINE	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE HWD MIX
10AP09	16.4	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP10	4.1	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP11	13.7	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP12	5.5	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP13	27.9	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP14	7.4	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP15	21.7	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP16	1.8	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP17	1.7	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP18	3.9	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP19	1.5	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP20	2.6	58	loblolly pine	pole	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP21	43.2	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP22	20.9	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP23	42	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP24	3.2	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP25	23.6	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP26	3.2	58	southern pine	pole	JOR	Even_Age_Management_Short_Rotation	TCA
10AP27	10.1	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP28	2.4	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP29	19.6	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP30	6.7	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	TCA
10AP31	10.9	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP32	6	58	southern pine	pole	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP33	1	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP34	26.1	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP35	5.2	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP36	5.4	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
10AP37	7	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS

10AP38	1.9	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP39	8.8	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP40	5	58	loblolly pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	TCA
10AP41	3.6	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP42	7.4	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
10AP43	3.1	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
10AP44	8.7	58	southern pine	small sawtimber	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.5	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.7	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.8	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.4	58	southern pine		JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.6	58	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.8	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.8	58	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.5	58	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.3	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1	58	southern pine		JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.2	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.7	58	southern pine		JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.5	58	southern pine		JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.7	58	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.6	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	2	58	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	1.2	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.8	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.8	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.4	58	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.1	58	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
	439.4						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
10AH	129.2	MED	YEP-WHO-NRO	SRO-YEP-ASH	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
10BH	143.6	MED	WHO-BKO-NRO	SRO-SYC-BKO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
10CH	193.1	MED	WHO-BKO-NRO	SRO-WHO-BKO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
10DH	115.6	MED	WHO-BKO-NRO	SRO-PTO-PNO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
10EH	241.7	LOW	YEP-WHO-NRO	SRO-YEP-WHO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
10FH	275.1	MED	WHO-BKO-NRO	SRO-WHO-SWG	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
10GH	169.2	MED	WHO-BKO-NRO	SRO-WHO-PNO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1267.5						

Training Area 11

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
11ap01	11.1	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap02	2	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap03	1.4	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap04	8.6	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap05	26.2	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap06	19.3	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
11ap07	29.7	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap08	1.6	52	southern pine	regeneration	JOR	Even_Age_Management_Short_Rotation	PINE HWD MIX
11ap09	1.7	52	southern pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
11ap10	9.5	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
11ap11	8.2	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap12	28.3	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap13	20.8	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap14	3.2	52	southern pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap15	13.3	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap16	15.4	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap17	2.4	52	southern pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap18	2.7	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap19	19.8	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap20	6.1	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
11ap21	7.5	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	TCA
11ap22	5.5	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap23	33.3	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	HARDWOOD
11ap24	4.1	52	southern pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
11ap25	15.5	52	loblolly pine	mall sawtimbe	JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.5	52	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.6	52	southern pine		JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.3	52	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	1.2	52	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	1	52	southern pine		JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1	52	southern pine		JOR	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1	52	southern pine		JOR	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.2	52	southern pine		JOR	Even_Age_Management_Short_Rotation	PINE HWD MIX
	304						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
11AH	230.4	MED	WHO-BKO-NRO	SRO-BKO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
11BH	147.6	MED	YEP-WHO-NRO	SRO-BKO-YEP	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation

11CH	143.3	LOW	YEP-WHO-NRO	SRO-YEP-SWG	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation/TS
11DH	118.3	LOW	YEP-WHO-NRO	SRO-YEP-WHO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
11EH	146.0	LOW	WHO-BKO-NRO	SRO-BKO-WHO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
11FH	155.2	MED	WHO-BKO-NRO	SRO-BKO-WHO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
11GH	142.9	LOW	YEP-WHO-NRO	SRO-YEP-BKO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
11HH	114.8	MED	YEP-WHO-NRO	SRO-BKO-YEP	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1198.5						

Training Area 12

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
12ap1	24.9	61	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
12ap2	28.4	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
12ap3	8.4	61	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.2	61	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
	61.9						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
12AH	104	LOW	BLW	YEP-CHY-SYC	PFC	Even_Age_Management_Long_Rotation	Uneven_Age_Management
12BH	52.4	HI	YEP-WHO-NRO	SRO-YEP-CHY	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
	156.4						

Training Area 13

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
13AP01	13.8	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP02	2.4	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP03	1.2	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP04	1.2	53	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP05	1.3	53	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP06	11.3	53	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
13AP07	9.4	53	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
13AP08	9.3	53	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
13AP09	10.5	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP10	3.8	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP11	8.9	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13AP12	14	53	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
13AP13	29.4	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
13AP14	4.1	53	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
13BP01	1.4	53	loblolly pine	regeneration	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13BP02	0.2	53	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
13BP03	0.6	53	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
13BP04	1	53	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
	123.8						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
13AH	104.1	LO	YEP-WHO-NRO	SRO-SGM-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
13BH	105.8	LO	YEP-WHO-NRO	SRO-BKO-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
13CH	136.4	LO	WHO-BKO-NRO	SRO-NRO-SYC	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
13DH	109.0	MED	YEP-WHO-NRO	SRO-SGM-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
13EH	119.5	MED	HAC-ALM-ASH	ASH-SYC-YEP	PFC	Uneven_Age_Management	Uneven_Age_Management
	574.8						

Training Area 14

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
14LP01	6.4	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP02	5	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP03	2.3	62	LOBLOLLY	POLE	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP04	70.7	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP05	15.4	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP06	11.3	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP07	1.7	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP08	9.7	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP09	4.2	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
14LP10	10.5	62	LOBLOLLY	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.4	62	southern pine	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.5	62	southern pine	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.2	62	southern pine	SMALL SAWTIM	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	138.3						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
14AH	125.7	MED	HAC-ALM-ASH	HAC-CHY-SRO	DFC	Uneven_Age_Management	Uneven_Age_Management
14BH	112.7	LO	YEP-WHO-NRO	SRO-YEP-CHY	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
14CH	200.1	LO	YEP-WHO-NRO	YEP-SRO-BKO	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
14DH	92.3	MED	YEP-WHO-NRO	SRO-YEP-SYC	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
14EH	191.3	MED	YEP-WHO-NRO	YEP-SRO-CHY	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
14FH	47.4	MED	HAC-ALM-ASH	SRO-CHY-SYC	PFC	Even_Age_Management_Short_Rotation	Uneven_Age_Management
	769.5						

Training Area 15

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.6	61	southern pine		DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP01	22.8	61	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP02	26	61	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP03	5.3	61	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP04	8.1	61	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP05	15.4	61	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP06	20	61	loblolly pine	large sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP07	39.7	61	loblolly pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP08	5.9	61	loblolly pine	large sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP09	10.9	62	southern pine	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP10	4	62	eastern white	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
15AP11	2.5	62	eastern white	small sawtimber	DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	1.3	61	southern pine		DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.2	61	southern pine		DFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	162.7						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
15AH	39.2	HI	YEP-WHO-NRO	YEP-SRO-CHY	DFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
15BH	118.6	HI	HAC-ALM-ASH	HAC-ASH-SYC	DFC	Uneven_Age_Management	Uneven_Age_Management
	157.8						

Training Area 16

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
16AP01	48.9	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	
16AP04	3.3	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP02	9.1	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP03	6.7	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP05	0.9	64	loblolly pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
16LP06	14.3	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP07	37.5	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP08	6.7	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP09	14.9	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP10	3.1	64	loblolly pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP11	8.2	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
16LP12	2.8	64	southern pine	pole	NSB	Even_Age_Management_Short_Rotation	PINE
16LP13	1	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE
16LP14	11.8	64	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.6	64	southern pine		NSB	Even_Age_Management_Short_Rotation	
UNNAMED	0.2	64	southern pine		NSB	Even_Age_Management_Short_Rotation	
UNNAMED	0.6	64	southern pine		NSB	Even_Age_Management_Short_Rotation	
UNNAMED	1.1	64	southern pine		NSB	Even_Age_Management_Short_Rotation	
UNNAMED	0.9	64	southern pine		NSB	Even_Age_Management_Short_Rotation	
	172.6						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
16AH	154.9	MED	YEP-WHO-NRO	YEP-SRO-SGM	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
16BH	83.5	HI	YEP-WHO-NRO	SRO-ASH-BKL	NSB	Uneven_Age_Management	Even_Age_Management_Short_Rotation/TS
	238.4						

Training Area 17

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.2	63	southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP01	19.2	63	loblolly pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP02	3.5	63	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP03	25.2	63	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP04	6.9	63	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP05	2.5	63	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP06	1.3	63	loblolly pine	pole	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP07	6.5	63	southern pine	large sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP08	5	63	loblolly pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP09	3.1	63	loblolly pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP10	39.2	63	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP11	1.9	63	loblolly pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP12	4.6	63	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP13	11.3	63	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
17AP14	1.2	63	southern pine	pole	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	1.1	63	southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.5	63	southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.5	63	southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.3	63	southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	134						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
17AH	118.7	MED	HAC-ALM-ASH	COT-ASH-SRO	NSB	Uneven_Age_Management	Uneven_Age_Management
17BH	170.9	MED	YEP-WHO-NRO	SRO-YEP-SGO	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation/TS
17CH	55.5	N/A	RDM	SGM-BLW-RDM	NSB	Even_Age_Management_Short_Rotation	Uneven_Age_Management
17DH	180.6	MED	YEP-WHO-NRO	SRO-BKO-YEP	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
17EH	143.8	MED	WHO-BKO-NRO	SRO-BKO-CHY	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	669.5						

Training Area 18

Pine Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**SIZE_CLASS**	**SUB_WSHED**	**STRUCTURE**	**DFC**
UNNAMED	0.1	MED	southern pine		PFC		
18AP01	0.3	MED	southern pine		PFC		
18AP02	0.9	MED	southern pine		PFC		
	1.3						

Hardwood Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**TOP3_SAWSP**	**SUB_WSHED**	**STRUCTURE**	**DFC**
18AH	110.7	MED	WHO-BKO-NRO	SRO-BKO-WHO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
18BH	113.6	MED	YEP-WHO-NRO	WHO-YEP-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation/TSI
18CH	81.7	MED	WHO-BKO-NRO	SRO-ERC-CHY	PFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	306.0						

Training Area 19

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.4	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19AP01	16.6	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
19AP02	3.8	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP03	4.2	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP04	10	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
19AP05	15.5	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
19AP06	10.3	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP07	1.7	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP08	2.1	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP09	1.7	58	Southern pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
19AP10	1.2	58	loblolly pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP11	18.4	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP12	7	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP13	9.4	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP14	3.4	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP15	8.6	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP16	2.6	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP17	22	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP18	2.7	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP19	2.5	58	loblolly pine	pole	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19AP20	10.4	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP21	14.5	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP22	5.1	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP23	17.4	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
19AP24	14.6	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP25	27.1	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP26	2.3	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
19AP27	16	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP28	34.3	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP29	6.9	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19AP30	9.7	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19AP31	2.7	58	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
19AP32	33.9	58	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP33	5.8	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19AP34	2.1	58	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP35	12.3	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP36	1.9	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP37	2.8	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD

19AP38	12.9	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
19AP39	1.8	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19AP40	1	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19AP41	19.8	58	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19BP01	5.6	58	loblolly seedtre		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
19BP02	1.5	58	loblolly seedtre		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.5	58	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	2.4	58	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.3	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.6	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1	58	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	25.5	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.7	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.6	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.1	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.3	58	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.2	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.6	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	30.4	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.3	58	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.8	58	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.3	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.6	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.6	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.3	58	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
	478.6						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
19AH	98.4	MED	SWG-YEP	SWG-RDM-SRO	PFC	Uneven_Age_Management	Uneven_Age_Management
19BH	179.2	MED	YEP-WHO-NRO	SRO-WHO-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
19CH	159.8	MED	YEP-WHO-NRO	SRO-YEP-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
19DH	120.0	MED	WHO-BKO-NRO	SRO-PTO-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
19EH	164.0	MED	YEP-WHO-NRO	SRO-YEP-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
19FH	185.3	MED	WHO-BKO-NRO	WHO-SRO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
19GH	116.3	LO	PNO-SWG	SWG-PNO-RDM	JOR	Uneven_Age_Management	Uneven_Age_Management
19HH	205.7	MED	YEP-WHO-NRO	SRO-RDM-YEP	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1228.7						

Training Area 20

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	1.6	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
20LP01	8.6	63	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
20LP02	9.2	63	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP03	5.2	63	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP04	18.2	63	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP05	1.8	63	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
20LP06	6.9	63	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP10	2.7	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP11	13.5	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
20LP12	3.5	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP13	16.7	61	Southern pine	Large sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP14	1.4	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP15	2.6	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP16	1.8	61	Southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP17	1.2	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP18	6.5	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
20LP19	3.1	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP20	11	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP21	12.5	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP22	25.4	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
20LP23	6.1	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
20LP24	1.6	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP25	5.1	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
20LP26	5.9	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
20LP27	8.7	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP28	22	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
20LP29	8.6	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP30	1.4	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP31	1.6	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP32	8.2	61	loblolly pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP33	4.8	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP34	5.5	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
20LP35	7.1	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP36	4.2	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP37	16.7	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP38	5.6	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
20LP39	1.5	61	Southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
20LP40	11.1	61	southern pine	Small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD

20LP41	2.5	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP42	2.9	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	PINE SAVANNA
20LP43	4	61	loblolly pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	NATIVE GRASS
20LP44	23.5	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP45	9.3	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP46	2.4	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP47	1.6	61	Southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP48	4.4	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	PINE SAVANNA
20LP49	14.4	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP50	4	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP51	3.5	61	southern pine	pole	PFC	ven_Age_Management_Short_Rotatio	TCA
20LP52	2.8	61	loblolly pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	TCA
20LP53	2.7	61	Southern pine	pole	PFC	ven_Age_Management_Short_Rotatio	NATIVE GRASS
20LP54	5.7	61	loblolly pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	NATIVE GRASS
20LP55	8.9	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
20LP56	2.5	61	loblolly pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	NATIVE GRASS
20LP57	0.9	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	PINE SAVANNA
20LP57	11	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	PINE SAVANNA
20LP58	2.3	61	southern pine	mall sawtimbe	PFC	ven_Age_Management_Short_Rotatio	PINE SAVANNA
20LP59	1.2	61	Southern pine	pole	PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	1.5	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	1.3	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	NATIVE GRASS
UNNAMED	0.7	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	NATIVE GRASS
UNNAMED	0.8	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	0.3	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	0.5	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	0.3	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	0.5	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	TCA
UNNAMED	0.4	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	TCA
UNNAMED	0.4	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	TCA
UNNAMED	0.9	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	TCA
UNNAMED	0.9	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	PINE SAVANNA
UNNAMED	0.3	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	0.7	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
UNNAMED	0.5	61	southern pine		PFC	ven_Age_Management_Short_Rotatio	HARDWOOD
	399.6						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
20AH	96.5	MED	WHO-BKO-NRO	SRO-SWG-SYC	PFC	ven_Age_Management_Short_Rotatio	ven_Age_Management_Long_Rotation/TS I
20BH	78.6	MED	WHO-BKO-NRO	SRO-PNO-LOP	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation

20CH	131.2	MED	PNO-SWG	SWG-PNO-SRO	JOR	Uneven_Age_Management	Uneven_Age_Management
20DH	118.1	MED	WHO-BKO-NRO	SRO-SWG-RDM	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
20EH	119.7	MED	WHO-BKO-NRO	SRO-WHO-BKO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
20FH	130.5	MED	WHO-BKO-NRO	SRO-RDM-PTO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
20GH	224.2	MED	YEP-WHO-NRO	PTO-SRO-WHO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
20HH	153.6	MED	WHO-BKO-NRO	WHO-SRO-SWG	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
20IH	143.2	MED	PNO-SWG	RDM-SWG-SRO	PFC	Uneven_Age_Management	Uneven_Age_Management
20JH	104.8	MED	WHO-BKO-NRO	SRO-PNO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
20KH	172.1	MED	WHO-BKO-NRO	SRO-WHO-PTO	JOR	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1472.5						

Training Area 21

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.30	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP01	7.00	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP02	7.60	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP03	4.20	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP04	1.20	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP05	9.40	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
21LP06	10.10	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP07	2.30	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
21LP14	10.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP15	38.40	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
21LP16	1.40	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP17	7.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP18	5.00	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP19	1.90	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP20	1.90	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP21	6.90	63	Southern pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP22	12.10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP23	29.80	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP24	10.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP25	7.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP26	12.70	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP27	21.10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP28	3.70	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP29	10.00	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP30	2.40	63	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP31	16.80	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP32	18.10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP33	4.70	63	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP34	4.40	63	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP35	5.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP36	6.40	63	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
21LP37	2.20	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
21LP38	30.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP39	25.50	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP40	3.70	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP41	18.90	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP42	6.10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
21LP43	21.90	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX

21LP44	26.10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
21LP45	18.60	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
21LP46	21.40	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
21LP47	2.30	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
21LP48	2.00	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP49	10.10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP50	18.90	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP51	3.20	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP52	21.30	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP53	39.20	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
21LP54	14.40	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP55	8.50	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP56	6.30	63	southern pine	large sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP57	5.60	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP58	5.60	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP59	9.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP60	18.80	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP61	1.50	63	loblolly pine	large sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP62	1.40	63	loblolly pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP63	4.70	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP64	10.90	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP65	2.20	63	loblolly pine	large sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP66	7.60	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP67	23.00	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP68	11.30	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP69	39.10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP70	35.80	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
21LP71	55.60	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP72	1.50	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
21LP73	3.20	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	1.50	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.60	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.50	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.40	63	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.00	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.00	63	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.70	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.60	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.60	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.90	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.20	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD

UNNAMED	0.30	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.20	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.30	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.90	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	1.00	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.80	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.10	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
	835.7						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
21AH	99.9	MED	WHO-BKO-NRO	SRO-WHO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
21BH	130.2	HI	WHO-BKO-NRO	RDM-SRO-BKO	PFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation/TSI
21CH	93.2	MED	YEP-WHO-NRO	RDM-SRO-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation/TSI
21DH	116.9	MED	WHO-BKO-NRO	SRO-PNO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
21EH	72.2	MED	WHO-BKO-NRO	RDM-BKO-PGH	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
21FH	108.5	HI	PNO-SWG	PNO-RDM-SWG	PFC	Uneven_Age_Management	Uneven_Age_Management
21GH	70.7	MED	PNO-SWG	RDM-PNO-LOP	PFC	Uneven_Age_Management	Uneven_Age_Management
21HH	100.6	HI	YEP-WHO-NRO	SRO-YEP-RDM	FFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
21IH	94.6	MED	SWG-YEP	SWG-RDM-YEP	FFC	Uneven_Age_Management	Uneven_Age_Management
	886.9						

Training Area 22

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.7	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP01	33.2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP02	52	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP03	1.3	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP04	11.5	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP05	13.2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
22LP06	7.4	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP07	6.5	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP08	7.4	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP09	4.2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP10	2.6	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP11	3.4	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
22LP12	2.2	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
22LP13	8.6	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP14	36	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP15	1.6	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP16	9.5	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP17	17.5	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP18	0.9	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP19	6.2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
22LP20	6.7	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP21	1.7	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP22	1.6	63	Southern pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP23	5.6	63	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP24	7.1	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP25	21	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP26	14.7	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP27	13.6	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP28	39.2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP29	14.9	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP30	14.3	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP31	2.1	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP32	7	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP33	9.4	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP34	10	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP35	3.5	63	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP36	2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP37	0.7	63	loblolly pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD

22LP38	10.6	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
22LP39	3.7	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP40	5.2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP41	18.1	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
22LP42	6.3	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
22LP43	1.3	63	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP44	22.6	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP45	26.8	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP46	23.6	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP47	30.5	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
22LP48	10.9	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP49	10.5	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP50	5	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP51	3.3	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP52	10.7	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP53	7.7	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
22LP54	7.9	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP55	5.1	63	loblolly pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP56	23.8	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP57	9.1	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP58	22.6	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP59	1.7	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP60	12.9	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP61	5.1	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP62	6.2	63	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP63	64.3	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP64	2	63	Southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP65	1.9	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP66	6.9	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP67	1.4	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP67	22.8	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP68	5.4	63	Southern pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP69	2.6	63	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
22LP70	1.2	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
22LP71	21.3	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
22LP72	0.9	63	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.5	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.1	63	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.7	63	southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.3	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.8	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD

UNNAMED	0.2	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.6	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.4	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.2	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.2	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	1.1	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.2	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.5	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.6	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.2	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	1.5	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.5	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.2	63	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.7	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.6	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
	837						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
22AH	74.2	MED	WHO-BKO-NRO	SRO-SWG-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
22BH	74.5	N/A	PNO-SWG	RDM-PNO-SRO	PFC	Uneven_Age_Management	Uneven_Age_Management
22CH	137.1	HI	WHO-BKO-NRO	WHO-RDM-SRO	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
22DH	129.5	HI	WHO-BKO-NRO	SRO-PTO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
22EH	98.1	MED	WHO-BKO-NRO	SRO-PTO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
22FH	81.9	MED	WHO-BKO-NRO	SRO-PTO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
22GH	94.2	MED	YEP-WHO-NRO	YEP-SRO-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
22HH	68.6	MED	YEP-WHO-NRO	YEP-SRO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
22IH	79.9	MED	YEP-WHO-NRO	YEP-BKO-SRO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	838.0						

Training Area 23

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
23AP13	2.7	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	NATIVE GRASS
23AP56	13.4	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP02	4.2	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP03	7.2	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP04	30.6	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP05	1.1	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP06	0.9	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP07	0.7	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP08	13.9	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP09	2.4	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP10	2.7	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP11	2.8	63	southern pine	pole	PFC	Uneven_Age_Management	HARDWOOD
23LP12	1.8	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	NATIVE GRASS
23LP14	2.2	63	Southern pine	mall sawtimbe	PFC	Uneven_Age_Management	NATIVE GRASS
23LP15	2.8	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP16	5	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP17	2.6	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP18	10.2	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP19	4	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP20	5.1	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP21	26.4	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP22	4.8	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP23	1.7	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP24	7.9	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP25	10.3	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP26	6.5	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP27	8.1	63	southern pine	arge sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP28	47.7	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP29	1.6	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP30	3.2	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP31	3.6	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP32	5.8	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	NATIVE GRASS
23LP33	7.3	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP34	1.2	63	southern pine	pole	PFC	Uneven_Age_Management	HARDWOOD
23LP35	6.8	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP36	1.4	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP37	2.5	63	loblolly pine	pole	PFC	Uneven_Age_Management	HARDWOOD
23LP38	3.9	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD

23LP39	12.7	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP40	1.2	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	NATIVE GRASS
23LP41	6.4	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	NATIVE GRASS
23LP42	11.8	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP43	1.4	63	southern pine	pole	PFC	Uneven_Age_Management	PINE HWD MIX
23LP44	2.3	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP45	12.6	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP46	35.4	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP47	9.4	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP48	1.1	63	southern pine	pole	PFC	Uneven_Age_Management	HARDWOOD
23LP49	37.6	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP50	1.8	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP51	2.5	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP52	2.6	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP53	4.6	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP54	0.9	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP55	2.1	63	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP57	4.8	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP58	4.4	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP59	10.3	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP60	2	63	southern pine	pole	PFC	Uneven_Age_Management	PINE HWD MIX
23LP61	1	63	loblolly pine	pole	PFC	Uneven_Age_Management	PINE HWD MIX
23LP62	6.6	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP63	8.9	63	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP64	1.3	63	loblolly pine	arge sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP65	21.2	61	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP66	8.6	61	loblolly pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP67	3.4	61	Southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE SAVANNA
23LP68	3.4	61	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP69	2.2	61	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	NATIVE GRASS
23LP70	16.1	61	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP71	5.2	61	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	PINE HWD MIX
23LP72	26.6	61	southern pine	arge sawtimbe	PFC	Uneven_Age_Management	HARDWOOD
23LP73	10	61	southern pine	mall sawtimbe	PFC	Uneven_Age_Management	TCA
UNNAMED	0.5	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.5	61	southern pine		PFC	Uneven_Age_Management	PINE HWD MIX
UNNAMED	0.5	61	southern pine		PFC	Uneven_Age_Management	PINE HWD MIX
UNNAMED	1	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.8	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.1	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.7	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD

UNNAMED	0.4	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.2	61	southern pine		PFC	Uneven_Age_Management	NATIVE GRASS
UNNAMED	0.7	61	southern pine		PFC	Uneven_Age_Management	PINE SAVANNA
UNNAMED	1	61	southern pine		PFC	Uneven_Age_Management	PINE HWD MIX
UNNAMED	0.2	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.5	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	1	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.7	61	southern pine		PFC	Uneven_Age_Management	PINE HWD MIX
UNNAMED	0.4	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.7	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.9	61	southern pine		PFC	Uneven_Age_Management	PINE HWD MIX
UNNAMED	0.7	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
UNNAMED	0.9	61	southern pine		PFC	Uneven_Age_Management	HARDWOOD
	561.8						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
23AH	101.2	MED	PNO-SWG	PNO-SWG-SRO	PFC	Uneven_Age_Management	Uneven_Age_Management
23BH	79.7	MED	WHO-BKO-NRO	SRO-SYC-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
23CH	158.9	MED	SWG-YEP	YEP-SWG-SRO	PFC	Uneven_Age_Management	Uneven_Age_Management
23DH	128.6	LOW	WHO-BKO-NRO	SRO-SWG-PTO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
23EH	140.8	MED	WHO-BKO-NRO	RDM-SRO-PTO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
23FH	164.2	MED	PNO-SWG	RDM-SRO-PNO	PFC	Uneven_Age_Management	Uneven_Age_Management
23GH	132.2	MED	YEP-WHO-NRO	SRO-SWG-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
23HH	104.5	MED	SYC-SWG-ALM	LOP-SWG-RDM	PFC	Even_Age_Management_Short_Rotation	Uneven_Age_Management
23IH	129.3	LOW	SWG-YEP	SWG-RDM-LOP	PFC	Uneven_Age_Management	Uneven_Age_Management
	1139.4						

Training Area 24

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.2	63	southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
24ap1	0.7	63	LOP Seed Tree	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
24ap1	3.6	63	LOP Seed Tree	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
24ap3	13.4	63	LOP Seed Tree	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
24bp1	4.9	63	southern pine	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
24bp2	1.2	63	southern pine	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
24bp3	1.4	63	southern pine	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
24cp1	20.5	63	southern pine	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
24cp2	9.5	63	southern pine	small sawtimbe	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
24cp3	5.9	63	Southern pine	pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
	61.3						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
24AH	125.7	MED	WHO-BKO-NRO	SRO-ASH-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
24BH	61.0	MED	WHO-BKO-NRO	WHO-BKO-SRO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
24CH	128.0	MED	YEP-WHO-NRO	SRO-YEP-CHY	PFC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	314.7						

Training Area 25

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
UNNAMED	0.6		southern pine		PFC	Even_Age_Management_Short_Rotation	
25LP01	24.3		southern pine		PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
25LP02	3.3		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP03	5.9		southern pine		PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
25LP04	22.9		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP05	44.7		southern pine		PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
25LP06	3.2		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP07	39.9		southern pine		PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
25LP08	2.7		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP09	6.5		southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
25LP10	16.6		southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
25LP11	15.1		Seedtree		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
25LP12	13.3		southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
25LP13	42		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP14	24.4		Seedtree		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
25LP15	4		Seedtree		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
25LP16	1.2		Seedtree		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
25LP17	56.2		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP18	15.8		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP19	2.5		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP21	25		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP22	1.3		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP23	2.5		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25LP24	1.9		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
25AP25	22.3		southern pine		PFC	Even_Age_Management_Short_Rotation	SHORTLEAF/OAK SAVANAH
25SLP20	6.9		southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.5		southern pine		PFC	Even_Age_Management_Short_Rotation	
	405.5						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
25AH	201.8	HI	WHO-BKO-NRO	SRO-BKO-WHO	NSB	Uneven_Age_Management	Even_Age_Management_Short_Rotation
25BH	168.7	MED	WHO-BKO-NRO	SRO-BKO-SWG	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
25CH	184.0	MED	YEP-WHO-NRO	YEP-SRO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
25DH	191.1	HI	YEP-WHO-NRO	SRO-YEP-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
25EH	177.3	HI	WHO-BKO-NRO	SRO-NRO-WHO	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
25FH	251.6	HI	WHO-BKO-NRO	SRO-WHO-ERC	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
	1174.5						

Training Area 26

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
26LP01	41.4	67	Southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
26LP02	15	67	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	TCA
26LP03	81.7	67	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
26LP04	6.1	73	eastern white pi	large sawtimber	NSB	Even_Age_Management_Short_Rotation	TCA
26LP05	17.9	67	oak-southern pin	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
26LP06	5.6	67	southern pine	large sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
26LP07	21.6	67	oak-southern pin	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
26LP08	74.5	67	Southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
26LP09	19.9	67	Southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
26LP10	62.3	67	Southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
26LP11	6.4	67	Southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
26LP12	102.6	67	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
26LP13	57.6	67	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
26LP14	24.1	67	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	HARDWOOD
26LP15	10.2	67	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	TCA
26LP16	54.9	67	southern pine	small sawtimber	NSB	Even_Age_Management_Short_Rotation	PINE HWD MIX
26SP17	32.4	67	SHORTLEAF PINE	SEEDLING	NSB	Even_Age_Management_Short_Rotation	PINE
UNNAMED	0.8	67	southern pine		NSB	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.3	67	southern pine		NSB	Even_Age_Management_Short_Rotation	TCA
UNNAMED	0.7	67	southern pine		NSB	Even_Age_Management_Short_Rotation	TCA
	636						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
26AH	144.4	MED	YEP-WHO-NRO	YEP-ASH-SYC	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
26BH	145.0	MED	HAC-ALM-ASH	YEP-CHY-COT	NSB	Uneven_Age_Management	Uneven_Age_Management
	289.4						

Training Area 27

Pine Stands							
No Pine Stands in TA 27							

Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
27AH	128.4	HI	YEP-WHO-NRO	YEP-CHY-SRO	NSB	Uneven_Age_Management	Even_Age_Management_Short_Rotation
27BH	81.3	HI	YEP-WHO-NRO	CHY-SRO-BKL	NSB	Uneven_Age_Management	Even_Age_Management_Short_Rotation
27CH	91.0	MED	WHO-BKO-NRO	SRO-SWG-BTH	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
27DH	90.5	HI	PNO-SWG	PNO-SWG-SRO	NSB	Uneven_Age_Management	Uneven_Age_Management
	391.3						

Training Area 28

Pine Stands							
No Pine Stands in TA 28							
Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
28AH	95.4	MED	PNO-SWG	RDM-SWG-PNO	NSB	Uneven_Age_Management	Uneven_Age_Management
28BH	136.6	HI	WHO-BKO-NRO	SRO-SWG-PTO	NSB	Uneven_Age_Management	Even_Age_Management_Short_Rotation
28CH	125.0	HI	WHO-BKO-NRO	SRO-PNO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
28DH	119.9	HI	YEP-WHO-NRO	SRO-SWG-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
	476.9						

Training Area 30

Pine Stands								
No Pine Stands in TA 30								
Hardwood Stands								
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	MU_STDSIZE	STRUCTURE	DFC
30AH	171.9	LOW	SWG-YEP	RDM-SWG-SRO	PFC	SST	Uneven_Age_Management	Old_Growth
30BH	101.4	MED	PNO-SWG	SRO-PNO-SWG	PFC	SST	Uneven_Age_Management	Old_Growth
30CH	167.0	HI	PNO-SWG	PNO-SRO-SWG	PFC	MST	Uneven_Age_Management	Old_Growth
30DH	69.6	MED	PNO-SWG	SRO-PNO-SWG	PFC	MST	Uneven_Age_Management	Old_Growth
	509.9							

Training Area 31

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
31LP01	3.7	66	LOBLOLLY	POLE	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
31LP02	24.3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE HW MIX
31LP03	3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
31LP04	2.5	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP05	1.6	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP06	7.8	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP07	11.7	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP08	8.3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP09	23.3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP10	1.3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP11	1	66	LOBLOLLY	POLE	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP12	39.4	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
31LP13	3.3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
31LP14	29.9	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
31LP15	10.2	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP16	7.5	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
31LP17	12	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP18	2.8	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	TCA
31LP19	2.7	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP20	26	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP21	21.9	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
31LP22	1.2	66	LOBLOLLY	LARGE SAWTI	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
31LP23	42	66	southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP24	1.3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP25	8.1	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP26	6.8	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP29	21.6	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP30	4.3	66	LOBLOLLY	POLE	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP31	1.4	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
31LP32	9.3	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE HW MIX
31LP33	1.9	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE HW MIX
31LP34	1.7	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	PINE HW MIX
31LP35	1.4	66	LOBLOLLY	POLE	PFC	Even_Age_Management_Short_Rotation	PINE HW MIX
31VP27	2.4	66	VIRGINIA	POLE	PFC	Even_Age_Management_Short_Rotation	PINE HW MIX
37LP28	14.2	66	LOBLOLLY	SMALL SAWTIM	PFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.3	66	southern pine		PFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.2	66	southern pine		PFC	Even_Age_Management_Short_Rotation	
UNNAMED	1.1	66	southern pine		PFC	Even_Age_Management_Short_Rotation	

UNNAMED	0.8	66	southern pine		PFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.8	66	southern pine		PFC	Even_Age_Management_Short_Rotation	
	365						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
31AH	242.0	HI	YEP-WHO-NRO	SRO-RDM-YEP	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
31BH	277.6	MED	YEP-WHO-NRO	YEP-SRO-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
31CH	186.8	MED	SWG-YEP	RDM-SWG-RVB	PFC	Even_Age_Management_Short_Rotation	Uneven_Age_Management
31DH	242.0	MED	SWG-YEP	RDM-SWG-YEP	PFC	Uneven_Age_Management	Uneven_Age_Management
31EH	256.5	MED	WHO-BKO-NRO	SRO-BKO-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1204.9						

Training Area 32

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
32ap01	8.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap02	26.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap03	45.8	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap03	0.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap04	10.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap05	5.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap06	2.9	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap07	2.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap08	5.3	62	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap09	1.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap10	5.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap11	4.2	62	Southern pine	pole	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap12	10.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap12a	4.8	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap13	1.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap14	4.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap15	11.3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap15	0.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap15a	1.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap15a	1.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap15a	2.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap16	3.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap17	18.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap18	23.8	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap19	2.2	62	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap20	32.1	62	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap21	1.8	62	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap22	20	62	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap23	4.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap24	6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap25	5.4	62	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap26	45.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap27	2.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap28	1.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap29	17.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	TCA
32ap30	21.6	62	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap31	0.8	62	loblolly pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap32	1.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD

32ap33	3.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap34	8.8	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap35	6.7	62	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap36	19.3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap37	2.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap38	10.9	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap39	6.5	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap40	11.7	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap40a	2.5	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap40a	3.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap41	5.5	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap42	2	62	loblolly pine	pole	PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
32ap43	8.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap44	24.5	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap45	2.9	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap46	12.3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap47	6.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap48	8.3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap49	22.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap50	21.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap51	2.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap52	25.3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap53	14.9	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap54	34.3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap55	5.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap56	11.1	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap57	1.4	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap58	4.2	62	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap59	3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap60	17.3	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap61	6.5	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap62	2.5	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap63	5.6	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap64	12.9	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap65	1.6	62	southern pine	pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap66	5.5	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
32ap67	2.2	62	southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
32ap68	1	62	Southern pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
32ap69	2.8	62	loblolly pine	small sawtimber	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.2	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.8	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX

UNNAMED	1	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.7	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.6	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.2	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.1	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.6	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	0.5	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.2	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	NATIVE GRASS
UNNAMED	1.6	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.1	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.4	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.8	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.3	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	0.5	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	1.1	62	Southern pine		PFC	Even_Age_Management_Short_Rotation	HARDWOOD
	726						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
32AH	144.7	MED	YEP-WHO-NRO	RDM-SRO-ASH	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
32BH	168.4	MED	PNO-SWG	SWG-RDM-PNO	PFC	Uneven_Age_Management	Uneven_Age_Management
32CH	233.2	MED	WHO-BKO-NRO	SRO-RDM-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
32DH	129.8	MED	WHO-BKO-NRO	RDM-SRO-BKO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
32EH	95.8	HI	SYC-SWG-ALM	RDM-SRO-SWG	PFC	Uneven_Age_Management	Uneven_Age_Management
32FH	161.4	MED	PNO-SWG	RDM-SRO-PNO	PFC	Uneven_Age_Management	Uneven_Age_Management
	933.3						

Training Area 33

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
33LP01	4.3	64	Loblolly Pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP02	3.3	64	Loblolly Pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP03	58.3	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP04	2.3	64	Southern pine	Pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP05	1.9	64	Southern pine	Pole	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP06	3.5	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP07	1.9	64	Southern pine	Large Saw	PFC	Even_Age_Management_Short_Rotation	HARDWOOD CONV
33LP08	6.7	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP09	18.9	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP10	22.9	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP11	42.2	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP12	1.6	64	Southern pine	Pole	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
33LP13	2.5	64	Loblolly Pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	HARDWOOD
33LP14	33	64	Loblolly Pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP15	17	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP16	20.7	64	Loblolly Pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP17	10.5	64	Southern pine	Small Saw	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP18	7.8	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP19	8.2	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP20	1.6	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP21	12.4	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP22	8.4	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP23	14.4	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP24	48.1	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP25	2.8	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP26	4.6	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP27	8.1	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP28	3	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP29	31	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
33LP30	1.8	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE HWD MIX
33LP31	2.2	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.2	64	Southern pine		PFC	Even_Age_Management_Short_Rotation	
	406.1						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
33AH	70.1	LOW	PNO-SWG	SWG-RDM-CBO	PFC	Uneven_Age_Management	Uneven_Age_Management
33BH	96.3	MED	WHO-BKO-NRC	SRO-RDM-CBO	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
33CH	156.7	MED	PNO-SWG	RDM-SRO-SWG	PFC	Uneven_Age_Management	Uneven_Age_Management
33DH	92.9	MED	PNO-SWG	RDM-SRO-PNO	PFC	Uneven_Age_Management	Uneven_Age_Management

33EH	113.5	MED	WHO-BKO-NRC	RDM-BKO-ASH	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	529.5						

Training Area 34

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
34LP01	16.3	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP02	1.6	64	Loblolly pine	Pole	PFC	Even_Age_Management_Short_Rotatior	TCA
34LP03	4.3	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	TCA
34LP04	0.9	64	Loblolly pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP05	0.8	64	Mesic Mixed Pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	HARDWOOD
34LP06	7.6	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HW/ SAV
34LP07	4.6	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HW/ SAV
34LP08	1.9	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP09	4.4	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HW/ SAV
34LP10	6.8	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP11	2.3	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	HARDWOOD
34LP12	26.7	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	NATIVE GRASS
34LP13	26.6	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP14	2.9	64	Southern pine	Pole	PFC	Even_Age_Management_Short_Rotatior	AG
34LP15	4.6	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP16	19.8	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP17	21.1	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP18	7.5	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP19	1.6	64	Loblolly pine	Large Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	HARDWOOD
34LP20	4.5	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP21	9.5	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP22	4.8	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP23	2.1	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP24	6.1	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP25	28.4	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP26	3.7	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP27	1.2	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	HARDWOOD
34LP28	2.6	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP29	6.3	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP30	29.8	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP31	45.9	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP32	19.4	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP33	17.7	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
34LP34	17.7	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE HWD MIX
34LP35	11.3	64	Southern pine	Small Sawtimbe	PFC	Even_Age_Management_Short_Rotatior	PINE SAVANNA
UNNAMED	0.3	64	Southern pine		PFC	Even_Age_Management_Short_Rotatior	
UNNAMED	0.3	64	Southern pine		PFC	Even_Age_Management_Short_Rotatior	

UNNAMED	0.4	64	Southern pine		PFC	Even_Age_Management_Short_Rotation	
UNNAMED	1.4	64	Southern pine		PFC	Even_Age_Management_Short_Rotation	
UNNAMED	0.6	64	Southern pine		PFC	Even_Age_Management_Short_Rotation	
	376.3						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
34AH	152.7	MED	SCO-CBO	CBO-WLO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
34BH	141.7	MED	SCO-CBO	CBO-SRO-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
34CH	144.1	HI	WHO-BKO-NRO	SRO-RDM-SWG	PFC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
34DH	133.5	MED	WHO-BKO-NRO	SRO-PTO-RDM	PFC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
34EH	148.6	MED	SWG-YEP	SWG-YEP-SRO	PFC	Uneven_Age_Management	Uneven_Age_Management
	720.6						

Training Area 35

Pine Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**SIZE_CLASS**	**SUB_WSHED**	**STRUCTURE**	**DFC**
UNNAMED	1.7	MED	Southern pine		NSB	Uneven_Age_Management	
UNNAMED	0.9	MED	Southern pine		NSB	Uneven_Age_Management	
	2.6						
Hardwood Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**TOP3_SAWSP**	**SUB_WSHED**	**STRUCTURE**	**DFC**
35AH	73.9	MED	SWG-YEP	SWG-CBO-SRO	NSB	Uneven_Age_Management	Old_Growth
	73.9						

Training Area 40

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
40AP01	7.4	66	southern pine	mall sawtimbe	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
40AP02	9.7	66	southern pine	mall sawtimbe	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
40AP03	25.1	66	southern pine	mall sawtimbe	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
40AP04	14.3	66	southern pine	mall sawtimbe	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
40AP05	12.9	66	southern pine	mall sawtimbe	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.6	66	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.1	66	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.3	66	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.4	66	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.2	66	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.3	66	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	71.3						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
40AH	80.0	MED	PNO-SWG	RDM-SWG-CBO	NSB	Even_Age_Management_Short_Rotation	Old_Growth
40BH	87.6	MED	PNO-SWG	SWG-RDM-BKO	NSB	Uneven_Age_Management	Uneven_Age_Management
40CH	62.0	HI	SCO-CBO	CBO-PNO-SRO	NSB	Even_Age_Management_Short_Rotation	Old_Growth
40DH	105.3	HI	WHO-BKO-NRO	BKO-SRO-COT	NSB	Uneven_Age_Management	Old_Growth
	334.8						

Training Area 41

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
41LP01	4.7	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
41LP02	27.9	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
41LP03	0.6	63	LOBLOLLY	POLE	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
41LP04	3.2	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
41LP05	5.1	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
41LP06	2.9	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.2	63	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.7	63	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.5	63	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
UNNAMED	0.1	63	Southern pine		NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	45.9						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
41BH	145.4	MED	WHO-BKO-NRO	SRO-BKO-PTO	CAS	Uneven_Age_Management	Old_Growth
41CH	90.2	MED	SCO-CBO	CBO-BKO-SWG	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
41DH	153.7	MED	PNO-SWG	CBO-PNO-SWG	NSB	Uneven_Age_Management	Old_Growth
	389.2						

Training Area 42

Pine Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**SIZE_CLASS**	**SUB_WSHED**	**STRUCTURE**	**DFC**
42AAP01	55.4	59	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
42AAP02	5.8	59	southern pine	pole	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
42AAP03	61.2	59	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.3	59	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.4	59	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
	123.1						
Hardwood Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**TOP3_SAWSP**	**SUB_WSHED**	**STRUCTURE**	**DFC**
42BAH	138.9	MED	SWG-YEP	YEP-SWG-BKO	CAS	Uneven_Age_Management	Old_Growth
42ABH	99.3	HI	WHO-BKO-NRO	BKO-CHY-CBO	CAS	Uneven_Age_Management	Even_Age_Management_Short_Rotation
	238.2						

Training Area 42

Pine Stands							
No Pine in TA 42B							
Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
42BAH	138.9	MED	SWG-YEP	YEP-SWG-BKO	CAS	Uneven_Age_Management	Old_Growth
42BCH	219.6	MED	WHO-BKO-NRO	SRO-BKO-CBO	CAS	Uneven_Age_Management	Old_Growth
	358.5						

Training Area 43a

Pine Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**SIZE_CLASS**	**SUB_WSHED**	**STRUCTURE**	**DFC**
43AAP02	11	59	loblolly pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43AAP01	8	59	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43AAP03	4.2	59	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.2	59	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43AAP04	2.4	59	loblolly pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.9	59	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43AAP05	0.8	59	southern pine	pole	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43AAP06	12.8	59	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43AAP07	15.9	59	southern pine	pole	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
	56.2						

Hardwood Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**TOP3_SAWSP**	**SUB_WSHED**	**STRUCTURE**	**DFC**
43AAH	65.9	MED	YEP-WHO-NRO	YEP-SRO-CHY	CAS	Uneven_Age_Management	Old_Growth
43ABH	67.3	HI	WHO-BKO-NRO	SRO-CHY-BKO	CAS	Uneven_Age_Management	Even_Age_Management_Short_Rotation/TS
43ACH	42.8	MED	YEP-WHO-NRO	SRO-CHY-YEP	CAS	Uneven_Age_Management	Old_Growth
	176.0						

Training Area 43b

Pine Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**SIZE_CLASS**	**SUB_WSHED**	**STRUCTURE**	**DFC**
43BAP01	5.9	63	loblolly pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43BAP02	31.9	63	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43BAP03	0.8	63	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43BAP04	1.3	63	southern pine	pole	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43BAP05	3.9	63	loblolly pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
43BAP06	10.8	63	southern pine	small sawtimber	CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	1.1	63	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.7	63	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	1	63	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.7	63	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.5	63	Southern pine		CAS	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
	58.6						

Hardwood Stands							
MGMT_NAME	**ACRES**	**TOP3_SAWSP**	**SITEINDEX**	**COVERTYPE**	**SUB_WSHED**	**STRUCTURE**	**DFC**
43BAH	108.4	SRO-BKO-YEP	MED	YEP-WHO-NRO	CAS	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	108.4						

Training Area 44a

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
44LP01	53.1	65	Loblolly pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE SAVANNA
44LP02	11.8	65	Loblolly pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP03	7.6	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP04	9.2	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE SAVANNA
44LP05	2	65	Loblolly pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP06	14.2	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP07	2.7	65	Southern pine	Pole	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP08	7.4	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP09	26.2	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP10	112	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP11	16.6	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP12	18.1	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP13	6.8	65	Loblolly pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP14	4.9	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP15	3	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP16	8.1	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE SAVANNA
44LP17	8.4	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP18	13.4	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE SAVANNA
44LP19	12.3	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP20	66.8	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP21	2.5	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP22	3.4	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP23	5.7	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP24	7.8	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP25	3	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
44LP26	4.9	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP27	9	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP28	15.1	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP29	16.4	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP30	6	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP31	5.5	65	Loblolly Pine	Pole	SAC	Even_Age_Management_Short_Rotation	TCA
44LP32	54.6	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP33	12.4	65	Southern pine	Pole	SAC	Even_Age_Management_Short_Rotation	TCA
44LP34	15.3	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP35	1.7	65	Loblolly Pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP36	9.2	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
44LP37	13.7	65	Southern pine	Small Sawtimbe	SAC	Even_Age_Management_Short_Rotation	TCA
44LP38	3.7	65	Loblolly Pine	Pole	SAC	Even_Age_Management_Short_Rotation	PINE SAVANNA

UNNAMED	1	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	1.6	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
	597.1						
Hardwood Stands							
MGMT_NAME	**ACRES**	**SITEINDEX**	**COVERTYPE**	**TOP3_SAWSP**	**SUB_WSHED**	**STRUCTURE**	**DFC**
44AH	117.0	MED	WHO-BKO-NRO	SRO-WHO-NRO	SKC	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
44BH	171.8	MED	WHO-BKO-NRO	WHO-SRO-PGH	SKC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
44CH	152.7	MED	WHO-BKO-NRO	SRO-WHO-BKO	CAS	Uneven_Age_Management	Even_Age_Management_Long_Rotation
44DH	168.5	MED	WHO-BKO-NRO	SRO-WHO-PTO	SKC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
44EH	133.6	MED	WHO-BKO-NRO	SRO-WHO-PTO	CAS	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	743.6						

Training Area 44b

Pine Stands							
No Pine Stands in TA 44B							
Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
44FH	241	MED	SWG-YEP	YEP-SWG-WHO	CAS	Uneven_Age_Management	Old_Growth
44GH	257	N/A	WHO-BKO-NRO	WHO-MCH-STO	CAS	Uneven_Age_Management	Old_Growth
	498						

Training Area 45

(considered Impact Area)

No Stands in TA 45
1095 acres of forest cover

Training Area 46

Pine Stands							
No Pine in TA 46							
Hardwood Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
46AH	236.7	MED	YEP-WHO-NRO	YEP-SRO-WHO	SAC	Uneven_Age_Management	Old_Growth
46BH	188.2	HI	YEP-WHO-NRO	YEP-WHO-BKO	SAC	Uneven_Age_Management	Old_Growth
46CH	210.7	MED	YEP-WHO-NRO	BKO-SRO-YEP	SAC	Uneven_Age_Management	Old_Growth
46DH	88.6	HI	SYC-SWG-ALM	SYC-SGM-YEP	SAC	Uneven_Age_Management	Old_Growth
	724.2						

Training Area 47

Pine Stands							
No Pine In TA 47							
Hardwood Stands							
MGMT_NAME	ACRES	TOP3_SAWSP	SITEINDEX	COVERTYPE	SUB_WSHED	STRUCTURE	DFC
47AH	132.5	BKO-SRO-WHO	N/A	WHO-BKO-NRO	SAC	Uneven_Age_Management	Old_Growth
47BH	67.7	YEP-BKO-MCH	N/A	YEP-WHO-NRO	SAC	Uneven_Age_Management	Old_Growth
47CH	60.4	YEP-BKO-WHO	N/A	YEP-WHO-NRO	SAC	Uneven_Age_Management	Old_Growth
	260.6						

Training Area 48

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
48LP01	11.8	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP02	1.1	63	LOBLOLLY	POLE	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP03	57.1	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP04	1.7	63	LOBLOLLY	POLE	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP06	8.9	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP09	13	63	LOBLOLLY	POLE	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP11	148.8	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP08	3	63	LOBLOLLY	POLE	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP05	2.6	63	LOBLOLLY	POLE	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP07	1.7	63	LOBLOLLY	SMALL SAWTIM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
48LP10	2.4	63	LOBLOLLY	POLE	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation
	252.1						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
48AH	124.0	MED	WHO-BKO-NRO	SRO-SWG-RDM	NSB	Even_Age_Management_Short_Rotation	Even_Age_Management_Long_Rotation/TSI
48BH	96.1	HI	YEP-WHO-NRO	YEP-WHO-BKO	SAC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
48CH	84.8	MED	YEP-WHO-NRO	YEP-WHO-SRO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
48DH	97.8	MED	YEP-WHO-NRO	WHO-BKO-YEP	NSB	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	402.7						

Training Area 49

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
49LP01	12.9	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP26	1.7	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP02	2	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP03	3	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP04	3.6	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP06	6.2	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.5	66	Southern pine		SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP25	2.6	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP08	1.9	66	L0BLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP05	2.1	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP09	0.9	66	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP10	1.4	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP11	0.8	66	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP07	3.8	66	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP14	1.6	66	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP24	2.1	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP21	18.6	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.7	66	Southern pine		SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP13	2	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP22	3.3	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	1.3	66	Southern pine		SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP12	5.9	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP17	3.3	66	LOBLOLLY	LG SAWTIMBER	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP23	2.3	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP20	1.2	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP18	5.6	66	LOBLOLLY	LG SAWTIMBER	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP16	5.3	66	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP19	5.2	66	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
49LP15	1.2	66	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.4	66	Southern pine		SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
UNNAMED	0.2	66	Southern pine		SAC	Even_Age_Management_Short_Rotation	Even_Age_Management_Short_Rotation
	103.6						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
49AH	75.7	HI	WHO	WHO-PGH-YEP	SAC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
49BH	126.6	HI	YEP	YEP-SYC-PNO	SAC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
49CH	77.7	HI	SYC-SWG-ALM	SYC-YEP-ASH	SAC	Uneven_Age_Management	Uneven_Age_Management

49DH	130.1	MED	YEP-WHO-NRO	YEP-SGM-CHY	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
49EH	148.1	MED	YEP-WHO-NRO	YEP-BKO-WHO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
49FH	80.3	HI	YEP-WHO-NRO	YEP-SYC-SGM	SAC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
49GH	234.1	MED	YEP-WHO-NRO	WHO-YEP-BKO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
49HH	155.3	MED	YEP-WHO-NRO	WHO-YEP-BKO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
49IH	149.7	MED	WHO-BKO-NRO	WHO-BKO-CHO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
49JH	215.3	MED	WHO-BKO-NRO	WHO-BKO-STO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
49KH	122.2	MED	YEP-WHO-NRO	WHO-YEP-BKO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1515.2						

Training Area 50

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
50LP04	10.5	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP05	3.4	67	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP06	0.9	67	LOBSHORTLEAF	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP01	3	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP07	2.1	67	LOBLOLLY?	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP02	2	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP08	2.8	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP03	1.3	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP09	6.6	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP10	7.1	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP12	1	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP11	2	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP15	3.8	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP14	4.4	67	LOBLLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP13	3.7	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP18	4.2	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP20	11.1	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP19	2.1	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP16	3.4	67	Southern pine	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP17	0.9	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP22	4	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP23	5.9	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP27	16.2	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP21	4.1	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP29	9.5	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP24	4.3	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP25	5.2	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP26	0.8	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP28	1.3	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP31	1.7	67	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	TCA
50LP30	1.4	67	Southern pine	POLE	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP33	2.3	67	LOBSHORTLEAF	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP32	8.9	67	Southern pine	POLE	SAC	Even_Age_Management_Short_Rotation	TCA
50LP34	3.7	67	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP36	3.5	67	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP35	2.2	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP43	2.9	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD

50LP42	2.5	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP40	5.6	67	LOBSHORTLEAF	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP41	3	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
52LP02	1.4	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP38	8.8	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP39	4	67	Southern pine	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP44	7.9	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	TCA
50LP45	3.8	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
UNNAMED	0.5	67	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	1.3	67	Southern pine		SAC	Even_Age_Management_Short_Rotation	
50LP46	8.1	67	LOBSHORTLEAF	POLE	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP49	16	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE SAVANNA
UNNAMED	0.6	67	Southern pine		SAC	Even_Age_Management_Short_Rotation	
50LP50	2.3	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP47	3.5	67	LOBLOLLY	POLE	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
50LP51	3.1	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
UNNAMED	0.5	67	Southern pine		SAC	Even_Age_Management_Short_Rotation	HARDWOOD
50LP48	3.4	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
UNNAMED	1.3	67	Southern pine		SAC	Even_Age_Management_Short_Rotation	
	231.8						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
50AH	154.9	MED	WHO-BKO-NRO	WHO-SRO-PGH	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
50BH	260.3	MED	WHO-BKO-NRO	WHO-PTO-PGH	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
50CH	174.4	MED	YEP-WHO-NRO	PTO-YEP-WHO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
50DH	152.8	MED	WHO-BKO-NRO	WHO-PTO-CHO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
50EH	229.5	MED	WHO-BKO-NRO	WHO-BKO-SRO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
50GH	208.3	MED	WHO-BKO-NRO	WHO-SRO-BKO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	1180.2						

Training Area 51

Pine Stands							
MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
51LP01	3	65	LOBSHORTLEAF	POLE	SAC	Even_Age_Management_Short_Rotation	TCA
51LP02	4.9	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	TCA
51LP03	2.6	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP04	6.6	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP05	2.1	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE SAVANNA
51LP06	3.4	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP07	1.6	65	Southern pine	POLE	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP08	12.1	65	OAK SOUTH PINE	POLE	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP09	1.8	65	OAK SOUTH PINE	POLE	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP10	6.5	65	OAK SOUTH PINE	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP11	11.7	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP12	29.2	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP13	1	65	OAK SOUTH PINE	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP14	3.4	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP15	18.7	65	OAK SOUTH PINE	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
51LP16	3	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
51LP17	6.6	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
51LP18	8.1	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
51LP19	4.2	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
51LP20	6	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP21	2	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP22	4.2	65	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP23	6.9	65	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP24	3	65	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP25	2.2	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP26	5.9	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP27	5.5	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP28	3.8	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP29	6.7	65	OAK SOUTH PINE	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP30	6.5	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
51LP31	7.6	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP32	7.3	65	MIXED PINE	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP33	4.1	65	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP34	1.6	65	MIXED PINE	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP35	1	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP36	1.1	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX
51LP37	2.8	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	PINE HWD MIX

UNNAMED	1	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.3	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.9	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.2	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.1	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.4	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.1	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.5	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.4	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.5	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.2	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.3	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.5	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.3	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
UNNAMED	0.2	65	Southern pine		SAC	Even_Age_Management_Short_Rotation	
	214.6						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
51AH	112.8	MED	WHO-BKO-NRO	WHO-SRO-STO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
51CH	87.2	MED	WHO-BKO-NRO	WHO-PTO-SRO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
51DH	101.2	MED	WHO-BKO-NRO	SRO-PTO-PGH	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
51EH	130.7	MED	WHO-BKO-NRO	WHO-PTO-STO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
51FH	70.1	MED	WHO-BKO-NRO	WHO-BKO-SRO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
	502						

Training Area 52

(combined from TA 50 and TA 52)

Pine Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	SIZE_CLASS	SUB_WSHED	STRUCTURE	DFC
52LP02	1.4	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
52LP03	8.6	67	Southern pine	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
52LP04	1.7	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
52LP05	2.3	67	LOBLOLLY	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
52LP06	2.2	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
52LP07	2.3	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	HARDWOOD
52LP08	10.9	67	LOBSHORTLEAF	SMALL SAWTIM	SAC	Even_Age_Management_Short_Rotation	PINE
	29.4						

Hardwood Stands

MGMT_NAME	ACRES	SITEINDEX	COVERTYPE	TOP3_SAWSP	SUB_WSHED	STRUCTURE	DFC
50DH	17	MED	WHO-BKO-NRO	WHO-PTO-CHO	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
50FH	177.6	MED	WHO-BKO-NRO	WHO-CHO-PGH	SAC	Uneven_Age_Management	Even_Age_Management_Long_Rotation
50HH	185.0	HI	YEP-WHO-NRO	BKO-WHO-YEP	SAC	Uneven_Age_Management	Even_Age_Management_Short_Rotation
TA52 Non-Delineated	635				SAC		
	1014.6						

Appendix D

Best Management Practices for Silviculture

BEST MANAGEMENT PRACTICES FOR SILVICULTURE

The Best Management Practices (BMPs) outlined below were developed based on the state BMPs employed in Kentucky, Tennessee, and Pennsylvania as well as guidance given in the INRMP and Endangered Species Management Plan for the Gray Bat and Indiana Bat. They are to be applied during silvicultural activities occurring on Fort Campbell.

BMP #1 - Planning, Design, Location and Construction of Log Landings, Access Roads and Skid Trails:

An access road is constructed to connect a timber harvesting operation, or some other forest activity, with the primary and/or secondary road system. Skid trails are secondary vehicle travel routes used to remove harvested timber from a point near where it was harvested to an access road or concentration area. Landings or yards are areas where harvested forest products are temporarily concentrated and stored before being permanently removed. It is important to construct, maintain, and otherwise manage these surfaces to minimize soil erosion and protect nearby water bodies from sedimentation.

Minimum Requirements:

- Do not operate skidders or other logging equipment off hard surfaced roads under conditions, which may cause the development of excessive rutting.
- Minimize soil compaction and rutting by matching operating techniques, season of operation, and equipment to soil types and moisture levels.
- Locate access roads (i.e., road used by trucks to move harvested timber from the log landing to its primary or secondary road) and skid trails as high above and far away from streams as possible.
- Avoid long, level sections of access roads or skid trails that are difficult to drain. Use alternate routes, or use such sections only when the ground is frozen or dry.
- Construct access roads and skid trails so that grades are kept to a minimum. When possible, access roads should not exceed a grade of 15% except for short stretches of 200 feet or less where grades should not exceed 18%.
- Use soil surveys, topographic maps, and on-site evaluations as guides when planning log landing, skid road, and access road locations.
- Select the locations of log landings and skid trials before harvesting begins, i.e., develop a plan for a systematic layout of all main skid trails.
- Provide good drainage by using natural and constructed water bars or S-turns to help direct water off skid trails. Install water bars when the trail slope is 5% or greater.

- Designate “bumper” trees along the skid trails to minimize damage to the residual trees; remove severely damaged previously “marked” trees afterward.
- Organize landings to accommodate sorting, processing, and short-term storage and to allow safe movement of workers and equipment.
- Avoid old cellar holes, stonewalls, wells, and other cultural features.
- Leave debris on the lower side of the skid trail when one side is higher than the other.
- Avoid locating skid trails, access roads and landings on seasonally wet soils (i.e., having water at or near the surface during periods of abundant rainfall or snow melt)
- Fit the skid trails to the topography by following natural contours and slopes below 15 percent.
- Use low ground pressure tires or skidders, when available, and concentrate skidding as much as possible on a few primary skid trails to minimize site disturbance and compaction.
- Keep the landing and road network at minimum size necessary to remove harvested timber efficiently.
- Construct the minimum number and type of access roads or skid trials necessary to meet anticipated traffic loads.
- Keep the number of landings to a minimum.
- Maintain access roads and skid trails regularly.
- Close skid trails upon completion of use.
- Locate landings for best economy and reuse on subsequent sales, but away from streams and ephemeral channels.
- Construct landing sites with slope enough to drain properly but not exceeding 5 percent.
- Log areas furthermost from the log landings first.
- Use or install bridges or culverts to cross streams (perennial and intermittent) or ephemeral channels where feasible.
- Cross streams or ephemeral channels at right angles where bridges or culverts are not used.
- Use existing firebreaks where practical, unless use of such access roads would cause or aggravate an erosional problem.
- Reconstruct access roads only to the extent necessary to provide adequate drainage when using existing firebreaks.

- Vary access road grades to reduce concentrated flow in road drainage, ditches, culverts and on fill slopes and road surfaces.
- Balance cut and fills on access roads to minimize soil disturbance.
- Provide adequate drainage from the surface of all temporary access roads by using out sloped or crowned roads, drainage dips or in sloped roads with ditches and cross drains.
- Out slope access roads toward the fill bank at the rate of ¼-inch per foot of road width or 2-3 percent.
- In slope access roads 2-3 percent on steep slopes and sharp turns, and slippery soils as a safety measure. Drainage ditches should be constructed to collect in slope drainage, and culverts should be installed to carry drainage to the downhill side of the road.
- Crown access roads on gently sloping or flat land, with side ditches provided to catch water draining from the surface. Provide water turnouts or wing ditches to divert water onto the adjacent undisturbed forest floor.
- Install water bars, culverts, or other drainage structures such as drainage dips at the time of access road construction or reconstruction to divert water at the recommended intervals.

BMP #2 - Revegetation:

Establishing a vegetative cover stabilizes the soil and reduces damage from sediment and runoff to downstream areas resulting from silvicultural activity. These requirements are applicable on sediment producing, erodible, or severely eroded areas such as logging roads, skid trails or log landings

Minimum Requirements:

- Scarify severely compacted areas on log landings and access roads.
- Revegetate sediment producing, erodible, or severely eroded areas such as logging roads, skid trails, and log landings as soon as possible. Revegetation should be sufficient to adequately control/significantly abate erosion from the site.
- Promptly reshape, revegetate, and retire access roads and log landings after silvicultural activities are completed. Vehicle access to these areas should be controlled.
- Retire and close skid trails after use. They may be revegetated to help stabilize the trail surface and minimize erosion, and water bars may be installed to provide adequate drainage.

BMP #3 - Streamside Management Zones:

A streamside management zone (SMZ) is a strip of woodland located adjacent to a stream where only limited disturbance is desirable. Streamside management zones are also commonly used in situations where ponds and lakes exist near logging areas. SMZs maintain natural stream temperature in perennial streams through shading, maintain the integrity of the stream bank, and reduce the amount of sediment entering the water by minimizing soil disturbance and filtering overland flow. Intermittent streams are generally dry in the summer months and do not require shading. Both perennial and intermittent SMZs require protection of the stream banks and channel.

Minimum Requirements:

- Do not use wet or dry beds of perennial or intermittent streams or ephemeral channel beds as roads or for the skidding of logs.
- Minimize the number of stream crossings and choose stable crossing sites.
- Locate yards and landings outside of streamside management zones (SMZs). Yards and landings should be on high ground and have adequate drainage.
- Exercise care to use the shortest path in and out of the SMZ with minimal turning.
- Avoid disturbing the forest floor and protect the banks of streams and sloughs in streamside management zones.
- Stop or delay equipment operations in and out of the SMZ when wheel ruts begin to develop which are deeper than 12 inches.
- In areas adjacent to perennial streams, lakes and ponds maintain forest buffers for a surface distance of 100 feet, unless the slope is > 37% where wider buffers will be needed. Forest management activities are not acceptable in these areas, and equipment operation should be avoided except at designated crossings. One hundred percent of the original tree overstory (canopy cover) should be retained to shade the water and to maintain water temperature.
- In areas adjacent to intermittent streams maintain forest buffers for a surface distance of 50 feet. Avoid equipment operation in a zone of at least 50 feet on each side of an intermittent stream except for designated crossings. Mechanical site preparation should be excluded. Tops or other logging debris, which may block the intermittent stream channel, should be removed or placed in such a way that they will not cause a blockage.
- Fertilizers and pesticides should only be applied in SMZs in compliance with silviculture BMPs 7 and 8, respectively.

BMP #4 - Sinkholes:

Forested areas occur in karst topography, which contain sinkholes, open or closed circular depressions in karst (limestone) areas where surface waters flow to join an underground drainage system. Sinkholes are depression areas in karst terrains caused by dissolution of the underlying limestone bedrock. For the purpose of this BMP, sinkholes include: depression areas with or without swallet, sinking streams, caves, karst windows and pits or vertical shafts.

Minimum Requirements:

- Leave a buffer zone between any disturbed area and the open swallet of a sinkhole of 100 feet.
- Divert runoff from haul/access roads, skid trails, and log landings so as not to drain directly into sinkholes, sinking streams, or caves.
- Do not push soil, logging debris, and/or other waste material into the bottom of a sinkhole or into any noticeable sinkhole opening.
- Do not drain fluids from equipment onto the ground. They should be collected in a container, transported off site, and recycled or disposed of properly.
- Maintain a buffer zone along sinking streams or in sinkholes with an open swallet if there is fertilizer and/or pesticide usage in the vicinity.

BMP #5 - Logging Debris:

Logging debris is noncommercial portions of trees and brush (i.e., slash) or other waste products associated with silvicultural operations that may clog, or in some other way, degrade watercourses and water quality. These requirements are designed to protect water bodies from pollution by organic and inorganic debris, to protect stream channels and reduce erosion of stream banks and adjacent areas. The applicability of these requirements is in forested areas where silvicultural practices such as timber harvesting, site preparation, or woodland improvement are to be applied.

Minimum Requirements:

- Do not allow tree debris, such as tops from harvested trees, to be left in or washed into perennial streams.
- Do not leave disturbed soil or concentrated logging slash in streams or ephemeral channels where feasible.
- Use as much of the harvested wood as possible to minimize debris, i.e., encourage maximum utilization of all felled trees in harvest area and leave unmerchantable sections in the woods.
- Eliminate or minimize slash within the first 50 feet from primary, secondary and access roads.

- Reduce cleanup costs on log landings by identifying disposal areas in advance.
- Lop (cut up) top wood of harvested trees near primary and secondary roads, frequently used military sites and recreational areas to a maximum height of 4 feet.
- Avoid slash piles or windrows visible from primary, secondary and access roads.
- Remove all products promptly when landings are visible from rear area roads.
- Keep mud off rear area roads by providing clean fill (gravel, riprap, or mulch) for about 200 feet before the entrance to a primary or secondary road.
- Do not leave equipment on stream banks or change equipment fluids in such a manner where pollutants may wash into a stream.
- Do not contaminate soils or water bodies with fuels, lubricants, and other chemicals.
- Dispose of cans, bottles, lunch bags, oil filters or air filters, etc. properly.

BMP #6 - Proper Planting of Tree Seedlings by Machine:

Minimize potential degradation of water quality and to promote natural-appearing stands by safe and proper operation of mechanical tree planting.

Minimum Requirements:

- Operate mechanical tree planters only on the contour during tree planting operations.
- Use species appropriate for the site.
- Do not plant rows perpendicular to primary or secondary roads.
- Plant irregular or offset rows to encourage natural-appearing stands.
- Promote a mixture of species, both naturally occurring and planted.
- Encourage and maintain diversity within the stand.
- Favor long-lived species where appropriate to minimize frequency of management activities.
- Avoid mechanical methods on sites whose slopes exceed 30 percent.
- Avoid operating heavy equipment during wet periods.

BMP #7 - Fertilization:

Minimize water quality degradation while artificially applying specific chemical elements to the soil to favor increased growth of vegetation. This induces desirable, target vegetation to achieve maximum growth practical for site conditions, while managing the fertilizer in such a way to protect the quality of nearby water bodies.

Minimum Requirements:

- Use only the amount of fertilizer necessary and stay away from bodies of water or those areas immediately adjacent to them.
- Avoid using fertilizers in SMZs or within 50 feet of any noticeable sinkhole opening.

BMP #8 - Application of Pesticides:

Pesticides include insecticides, herbicides, fungicides, rodenticides and nematocides. Applications of these chemicals to destroy, prevent, or control woody or herbaceous vegetation and other forest pests on forested lands or areas being forested. The BMP is to apply pesticides in such a manner that water quality degradation is minimized.

Minimum Requirements:

- Follow label directions regarding application and cleanup.
- Read and follow Material Safety Data Sheets (MSDS) regarding the proper way to use, handle and store pesticides
- Do not clean equipment or dump excess materials near bodies of water.
- Remove empty containers from the woods and dispose of them properly.
- Avoid using pesticides in SMZs or within 50 feet of any noticeable sinkhole opening.
- Favor band treatment or spot treatment over broadcast treatment.
- Favor late-season or dormant-season pesticides.

BMP #9 - Site Preparation for Reforestation:

Site preparation involves the treatment of lands prior to planting tree seedlings or direct seeding for the effect of eliminating or suppressing undesirable vegetation and/or better facilitation of hand or machine planting. This aids in the successful establishment and growth of tree seedlings. The BMP is to apply this treatment in a manner where potential water quality degradation is minimized.

Minimum Requirements:

- Initiate revegetation efforts as soon as possible.
- Carry out all mechanical site preparation operations along the contour of the land.
- Choose a site preparation method that will expose and disturb as little bare soil as possible.
- Avoid or screen windrows and slash piles.
- Avoid clearing uphill on steeper grades to prevent water channeling in tractor tracks.
- Leave low slash and small brush to slow surface runoff, return soil nutrients and provide shade for tree seedlings.
- When possible, use only low impact methods of site preparation during tree planting activities. Low impact methods are defined as those practices that cause a minimum of site disturbance, such as patch or row scarification.
- Construct firelines on the contour in advance of prescribed burning.
- Plow or disk firelines as shallow as possible to minimize soil disturbance.
- Avoid prescribed burning on excessively steep slopes and highly erodible soils.
- Favor herbicide treatments over mechanical methods especially on steep slopes and highly erodible soils.
- Comply with BMP #8, Application of Pesticides.

BMP #10 - Timber Stand Improvement:

Timber stand improvement includes removing some of the trees in a stand to reduce competition for moisture, nutrients, and sunlight for remaining trees. While timber stand improvement (TSI) may improve the aesthetics of a route or area by promoting trees that have visually pleasing properties, some TSI activities may have negative visual impacts because of alterations to the stand and the accumulation of debris.

Minimum Requirements:

- Time the TSI operations so that they will not occur during periods of peak military or recreational use.
- Treat slash and debris from TSI operations (by lopping, removing, crushing or burning) whenever possible. Keep slash height to below 4 feet.

- Inform and educate military users regarding the concept and benefits of TSI during environmental quality officer training.

BMP #11 – Silviculture in Wetland Areas:

Wetlands are defined as areas characterized by soils saturated with moisture during all or a significant proportion of the year and which support a dominance of hydrophytes (plants adapted to primarily wet conditions). Such areas are transition zones between predominately dry upland sites and permanent water in streams and lakes. Forested wetlands, because of their uniqueness, require additional considerations above those listed in other BMPs dealing with silvicultural activities.

Minimum Requirements:

- Avoid or minimize construction or reconstruction of access roads and locate landings on higher ground.
- Avoid vehicle traffic unless absolutely necessary. If forest operations require vehicle traffic, then restrict that traffic to a minimum.
- Avoid crossing of streams and sloughs if possible.
- In areas adjacent to certified wetlands maintain forest buffers for a surface distance of 100 feet. Leave 100% of the original tree overstory (canopy cover) to shade the water and to maintain water temperature.
- Do not cross certified wetlands unless absolutely necessary. If forest operations necessitate taking equipment into wetlands, conduct those operations, whenever possible, during the driest periods or when the wet area is solidly frozen.

BMP #12 – Silviculture and Wildlife Habitat:

Consider the impacts of forest management activities on wildlife resources and understand the trade-offs necessary to accomplish Fort Campbell's goals and objectives. Forest management activities have positive and negative effects on wildlife resources.

Minimum Requirements:

- Protect sensitive habitats, such as spring seeps, vernal ponds, riparian zones, cliffs, caves, and rubble land (area with high content of large rock fragments).
- Protect cavity trees, snags, and food-producing shrubs and vines.
- Maintain overhead shade along cold-water streams.

- Comply with all laws and regulations regarding Threatened and Endangered Species.

BMP #13 – Species of Special Concern and Unique Habitats:

Recognize the importance and contribution of unique or special resources to the ecological integrity of Fort Campbell and the region. Unique areas and plant and animal species of special concern need to receive specific attention in forest management activities. The loss of additional endangered, threatened or rare species diminishes the biological diversity of the installation and may actually constrain military operations.

Minimum Requirements:

- Become aware of the presence of and protect endangered, threatened and rare species' habitats and unique habitat features.
- Know the habitat requirements of endangered, threatened, and rare species on the installation so that activities can be planned either to avoid disturbing or to enhance these habitats.
- Learn to recognize special microsites (small areas where changes in soil nutrients, water availability, sunlight, and other resources affect only one or a few trees and other plants).
- Comply with all laws and regulations regarding Threatened and Endangered Species.

Note: The BMPs outlined in this document are subject to change in order to comply with updated state and federal laws and regulations.

Appendix E

Management Unit Evaluation Document

Management Unit Evaluation Document

Sample Template

Training Area:

Mgmt. Unit:

Location: See Appendix A* "General Location Map"

Acres:

Sample Size:

Collection Date:

Evaluation Date:

Forester(s):

Management Objectives:

Sustain Military Operations

Integrate Natural Resource Management

Fire Suppression and Control

Promote Biodiversity

Tract History:

Agriculture:

Wildfire:

Prescribed Burn:

Military Operations:

* Appendices are included upon completion of the MUED.

Timber Sale History: _____

Cultural Resources: _____

Site Conditions:

Topography:

General:

( ) Flat ( ) Side Slope ( ) Ridge or Upper Slope

Sample Distribution:

Ridge	%	Upper Slope	%	Mid Slope	%
Lower Slope	%	Bottoms / Creek	%	Flat Ground	%

Physiographic Class:

( ) Dry ( ) Wet ( ) Well-drained

Average Slope: %

General Aspect:

Soil Types: Acres: Percent Coverage: Soil Code:[a]

Site Productivity:

General Mgmt. Unit Site Index:

[a] Soil Code refers to *Fort Campbell Mapping Legend* (Soil Survey Update) 6/7/97

( ) Low ( ) Medium ( ) High

Site Index by Species:

Species: Average Site Index: Site Class:

Volume: (compared to all other hardwood management units)

Sawtimber:	( )	Very Low	Less than 1,725
board feet / acre	( )	Low	1,726 to 3,388
	( )	Average	3,389 to 6,715
	( )	High	6,716 to 8,378
	( )	Very High	8,379 and up
Pulpwood:	( )	Very Low	Less than 442
cubic feet / acre	( )	Low	443 to 622
	( )	Average	623 to 980
	( )	High	981 to 1,160
	( )	Very High	1,161 and up

<u>Forest Conditions</u>:

Management Unit Average:

General Size Class:

( ) Saplings

( ) Poles

( ) Small Sawtimber

( ) Medium Sawtimber

( ) Large Sawtimber

DBH: xx.x inches

Age at DBH (Dominate and Codominate): xx yrs.

Forest Stocking:

Percent Stocking: %

( ) Understocked ( ) Fully Stocked ( ) Overstocked

Basal Area per Acre:

square feet Total

Sawtimber (11 inches DBH and up)

Pulpwood (2 to 10 inches DBH)

Distribution:

Size Class:		DBH:
Saplings	%	(2 to 5 inches)
Poles	%	(6 to 11 inches)
Small Sawtimber	%	(12 to 17 inches)
Medium Sawtimber	%	(18 to 24 inches)

Large Sawtimber	%	(25 inches and up)

Trees per Acre:

Total	
Sawtimber	(11 inches DBH and up)
Pulpwood	(2 to 10 inches DBH)

Distribution:

Size Class:		DBH:
Saplings	%	(2 to 5 inches DBH)
Poles	%	(6 to 11 inches DBH)
Small Sawtimber	%	(12 to 17 inches DBH)
Medium Sawtimber	%	(18 to 24 inches DBH)
Large Sawtimber	%	(25 inches DBH and up)

Forest Cover Types: Acres: Percent Coverage: Code:

Sawtimber Species: (compositions are by volume in descending order)

Major:

Minor:

Sawtimber Volume / Acre: Board feet

Total Volume: Board feet

Grade Distribution (trees/acre):

Grade 1	%	Grade 2	%
Grade 3	%	Grade 4	%

Grade Classification: (compared to all other hardwood management units)

Grade 1:

( )	Low	(Less than 6.5 %)
( )	Average	(6.6 % to 21.4 %)
( )	High	(21.5 % to 28.8 %)
( )	Very High	(28.9 % and up)

Grade 2:

( )	Very Low	(Less than 6.6 %)
( )	Low	(6.7 % to 14.8 %)
( )	Average	(14.9 % to 31.2 %)
( )	High	(31.3 % to 39.5 %)
( )	Very High	(39.6 % and up)

Grade 3:

( )	Very Low	(Less than 15.1 %)
( )	Low	(15.2 % to 27.1 %)
( )	Average	(27.2 % to 51.3 %)
( )	High	(51.4 % to 63.4 %)
( )	Very High	(63.5 % and up)

Grade 4:

( )	Low	(Less than 10.9 %)
( )	Average	(11.0 % to 34.3 %)
( )	High	(34.4 % to 45.9 %)
( )	Very High	(45.6 % and up)

Pulpwood Species: (compositions are by volume in descending order, excludes topwood pulp from sawtimber)

Major:

Minor:

Pulpwood Volume / Acre: cubic feet

Total Volume: cubic feet

Continuous Forest Inventory Regeneration:

Seedlings: (Greater than 2 inches in Height to 0.5 inches DBH)

Major Species:

Saplings: (0.6 to 4.5 inches DBH)

Major Species:

Condition:

<u>Predicted Future Growth</u>:

Sawtimber:

Year: Volume per Acre: (bd.ft./acre) Total Volume: (bd.ft.)

Pulpwood:

Year: Volume per Acre (cu.ft./acre) Total Volume: (cu.ft).

Objectives and Guidelines:

Objectives:

Guidelines:

Type of Operation:

Timing

Considerations / Conflicts:

Appendix F

Timber Marking Standard Operating Procedures

Timber-Marking Standard Operating Procedure

Timber marking occurs on a selective basis to thin young timber stands in order to maintain vigor and productivity, create a desired forest structure within an existing stand, and/or to facilitate other sustainable forest practices and encourage natural regeneration. To meet harvesting requirements, timber-marking is a regular activity used to determine volume of timber occurring in a harvest area according to grade. An annual Report of Availability is submitted to FORSCOM with estimated volumes and stand objectives.

This Standard Operating Procedure (SOP) is designed to ensure that timber-marking crewmembers are aware of the procedures involved in this activity. It describes a series of activities including locating the stand, marking the stand boundary, tallying procedures, and painting procedures.

Stand Location and Boundary Demarcation

A map of the stand to be harvested is created using the Geographic Information System (GIS) database. The boundary of the stand is marked on the ground using a Global Positioning System (GPS) according to coordinates determined using the management unit GIS layer. Boundary edges are marked using "timber harvest area" or other clearly identifiable flagging. Flags are placed at each boundary corner and at intervals along the boundary edge allowing each flag to be visible from the previous one.

Timber Tallying and Painting Procedures

The timber is marked and tallied according to the marking guideline designed specifically to meet objectives pertaining to the forest management activity derived in a silvicultural management plan. The crew leader will brief each crewmember on the stand objectives and specific marking guidelines prior to working in the harvest area. A crew usually consists of 2-3 people with one individual tallying the marked timber on a standard field tally sheet and the other crewmembers reporting tree dimensions and painting trees. The field-tallied timber is then entered into an Excel file that calculates number of trees by diameter class, number of trees by species, and tree volume in Doyle.

Timber-marking involves a system of marking trees in a harvest area with paint that will allow a logging crew to remove designated trees without confusion. A "dot" or "slash", as indicated in each timber contract, will be painted on each tree designated for removal at or above breast height (4.5' above the ground). An additional breast height mark will be placed on the opposite side of the tree for ease in tallying. Another mark is painted at the base of the tree for post-harvest inspection. If trees contain metal or other contaminants, a ring will be painted around the contaminant to make the logger aware of the potential hazard.

Paint can be applied by a variety of methods including hand-sprayers, backpack pump-sprayers, or aerosol cans. The hand-sprayers and backpack style-sprayers are filled with latex tree-marking paint and thoroughly cleaned with mineral spirits, kerosene, or water as appropriate at the end of each day. If the sprayers are cleaned in the field it must be done at a site away from

road edges or riparian areas. The SDS concerning the paint and cleaning supplies are located in the forestry building. Other painting equipment needed includes a funnel, funnel paint filter, rags or paper towels, and plastic garbage bags.

Other Considerations

There are special requirements pertaining to timber-marking during the fire season. The timber-marking crews make radio contact with the fire tower operator at one-hour intervals during high-fire hazard weather. Marking crews are also available for fire suppression when needed.

If a proposed harvest area occurs adjacent to a firing range or within the firing range safety fan, the crew leader contacts Range Control. (S)he informs Range Control of the exact location that the timber-marking will be taking place and obtains clearance to enter the area. Without clearance from Range Control, the area is off limits.

Revision in Progress

Urban Forest Management Plan
United States Army Garrison
Fort Campbell, KY
2008 - 2013

Directorate of Public Works
Environmental Division
Forestry Section
July 2008

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APPENDICES

1.0 INTRODUCTION

Fort Campbell, KY occupies approximately 104, 400 acres of Federal land used for our Country's military training and readiness capabilities. The landscape provides a variety of opportunities in meeting the military training requirements while many eco-types support habitats for a variety of plants and animal species. The Department of Defense policy is that lands provide for multiple, sustained use while supporting military training requirements.

The Directorate of Public Works (DPW) personnel are responsible for the preservation and maintenance of Fort Campbell's natural and cultural resources on unimproved grounds (training areas) and the cantonment area (i.e., improved and semi-improved grounds) of the installation. DPW staff insures availability of resources to meet Fort Campbell's military mission and insures safety for soldiers, their families, and post employees. This plan is designed to promote the sustainability of tree resources in the cantonment area on Fort Campbell.

Trees located in the cantonment area require management techniques that differ from trees located in less developed areas. Trees in the cantonment area are subject to greater stresses than those in more natural landscape situations (e.g., soil compaction, mechanical damage from mowing and weed eating, air and water pollution, wind, heat accumulation, vandalism). Because of the increased stresses, a rigorous urban forest program must be implemented to manage these resources. Urban forestry includes the monitoring of current species, replacement of species and maintenance of natural resources within the cantonment area. Trees are living organisms and are susceptible to many different problems such as storm and mechanical damage, insects and diseases, excessive age, and vandalism. These can cause the decline in the health of a tree to a point where it becomes a safety hazard. Hazard trees require immediate attention. Inspection, routine pruning, tree removal, and replacement of problem species are part of the installation's Urban Forest Management Plan and fall under the responsibility of Directorate of Public Works.

1.1 Purpose

This plan provides the technical information and recommendations for all authorized personnel and residents engaged in urban forest management on Fort Campbell. Properly applied, the principles and practices prescribed in this plan will complement ongoing management efforts, conserve natural resources while maintaining and improving the appearance of the installation, and promote operational safety and efficiency. The proper management of natural resources in urbanized areas of DoD installations is in conformance with current policy (Department of Defense, Urban Forestry Manual, August 1996). A wide array of environmental laws and regulatory requirements mandates the thoughtful preservation of natural resources (e.g., the Sikes Act of 1960, National Environmental Policy Act of 1969, Army Regulation 200 -1, Environmental Protection and Enhancement, 28 August 2007).

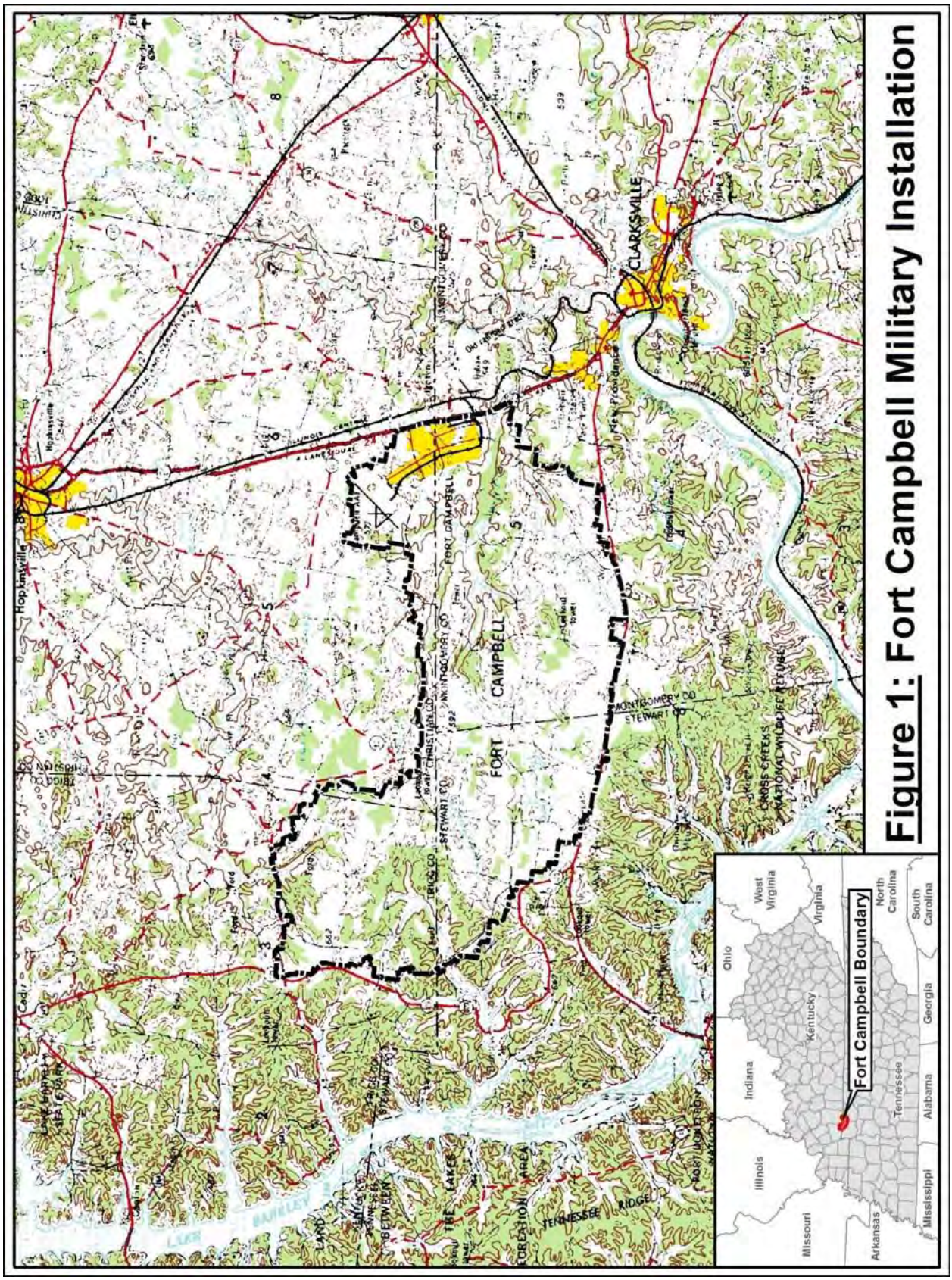

Figure 1. Fort Campbell Military Installation.

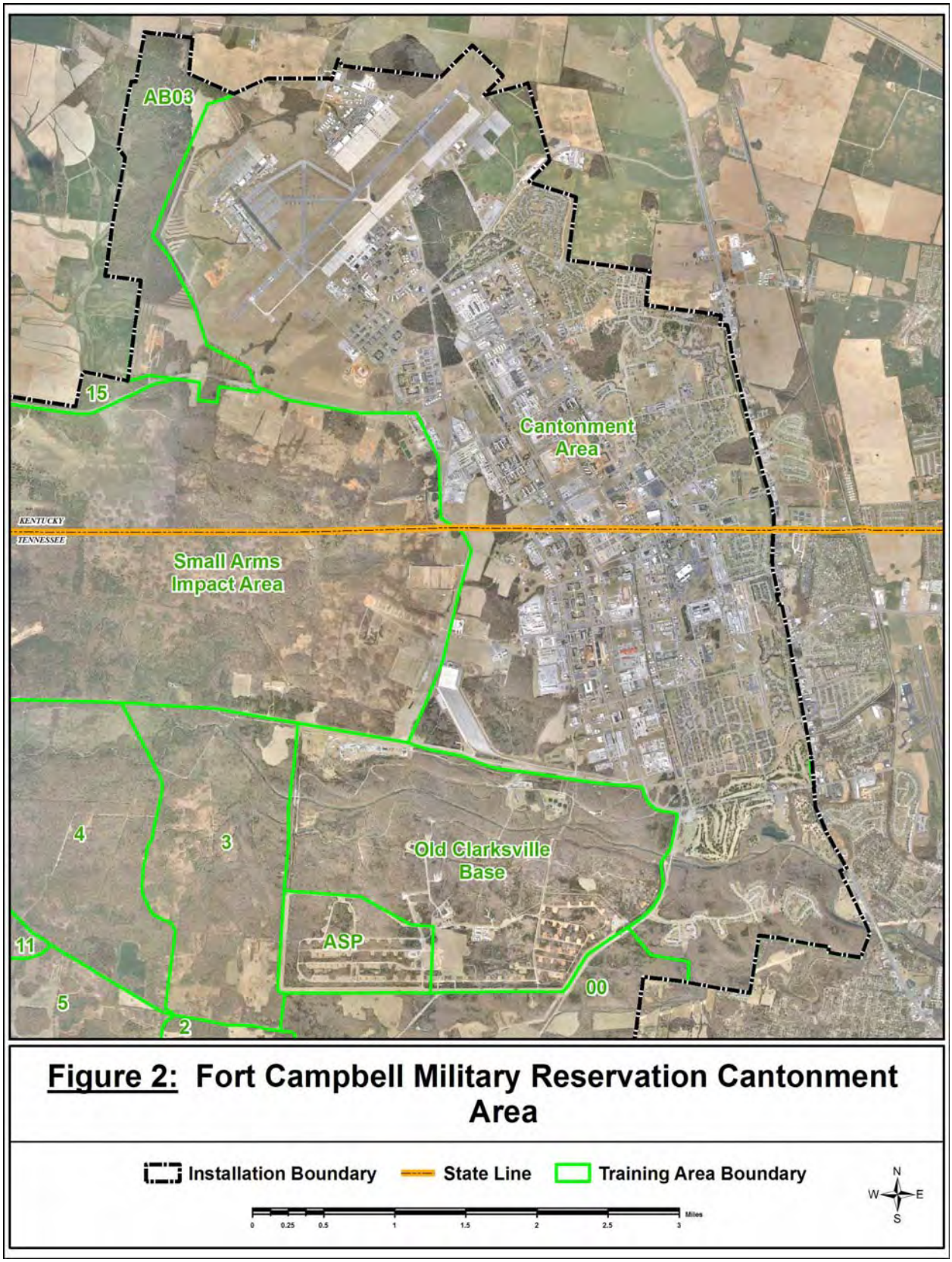

Figure 2. Fort Campbell Cantonment Area.

1.2 Scope

Urbanized trees require perpetual attention and maintenance. This plan is concerned with the resources' distinctive conservation and management needs on Fort Campbell. The plan provides general information on soil, climate, and cultural practices related to the conditions in which landscape trees and shrubs grow and examines and analyzes the 2006 tree inventory information for designated areas, including condition, management need and resource value. It concludes with management practices that will help sustain the urban forest resources.

1.3 Environmental Compliance

All urban forestry management activities on Fort Campbell will conform to applicable portions of environmental statutes, implementing regulations and Executive Orders as set forth in, but not limited to, Army Regulation 200 -1, Environmental Protection and Enhancement, August 2007.

2.0 Urban Forest Management Overview

2.1 Urban Forest Management Definition

Urban Forest Management is a specialized branch of forestry. It includes the planning, designing, establishing, maintaining, regulating, treating, conserving, and protecting of woody vegetation in urbanized areas. This woody vegetation is a collection of trees, shrubs, and vines growing within improved grounds and semi – developed grounds (i.e., the cantonment area). Further, urban forestry embraces a multi-managerial system that addresses issues related to watersheds including water management, wildlife habitat, outdoor recreation grounds, wood waste recycling yards, and individual tree care in general. Application of urban forest management must include measures for storm damage, wind and water erosion and sedimentation, fire hazards, construction damage, pollution, and insects and diseases detrimental to woody vegetation. Maintenance and improvements practices typical to urban forestry programs include care and development of urbanized trees, shrubs and vines, as well as turf surroundings, supplemental irrigation of vegetation requirements, required land drainage, and soil stabilization.

2.2 Department of Defense Objectives

Maintenance of resources is essential to the mission at Fort Campbell, KY. Welfare and morale of personnel are enhanced by healthy, pleasant surroundings, and suitable outdoor recreation facilities. To accomplish these objectives, maintenance operations should be conducted in an orderly sequence designed and adjusted to take advantage of the varied ecological factors involved, including climate, topography, soil, vegetation, and land use. The primary objective of the Department of Defense urban forest management program includes:

1. Develop, maintain, and manage all urban forest land (includes ground cover, soil, and appropriate water areas) under DoD jurisdiction in accordance with proven procedures, scientific methods and techniques to facilitate military missions and operations.

2. Protect land and tree investments from depreciation by adopting urban, land-use practices based upon soil capabilities.
3. Prevent installations from contributing to pollution through vegetative waste disposal or erosional debris.
4. Improve the appearance of installations and facilities through the preservation of the natural terrain and woody vegetation, and by appropriate new, urban forest plantings.
5. Prevent the damage or destruction of the urban forest from uncontrolled fire, careless construction methods, or misuse.
6. Assess the value of trees considering replacement value in kind, air pollution removal, cooling, and wind modification.

2.3 Responsibilities

The Fort Campbell Garrison Commander is responsible for the conservation, improvement, management, and protection of all urban forest resources. Implementation of the program is delegated to the Director of Public Works. Maintenance activities are then contracted out and scheduled by DPW Contract Management, Fort Campbell Family Housing, Directorate of Morale, Wellness and Recreation, and the Fort Campbell School System. Fort Campbell Family Housing and Actus Lend/Lease are partners in Residential Communities Initiative (RCI). In 2003 Fort Campbell leased the housing grounds through the Residential Communities Initiative as part of the 1996 Defense Authorization Act or the Military Housing Privatization Initiative. The privatization of army housing units is intended to provide world class residential areas while leveraging assets with limited funds and to take advantage of the private sector's expertise, creativity, innovation and capital. Though the lease, Fort Campbell Family Housing is responsible for care of grounds so safety, appearance and habitability of facilities is protected.

2.4 Classification of Grounds

Cantonment grounds are classified into three categories: improved, semi- improved and unimproved.

The majority of the cantonment area is classified as improved grounds. This land use includes the housing partnership, Fort Campbell Family Housing, LLC (FCFH), schools, recreation areas, Brigade Combat Training (BCT) facilities, Garrison operations and Campbell Army Air Field. Maintenance in these areas includes mowing, aerating, seeding, sodding, spraying, pruning, trimming, weed control, planting, and other urban forestry practices.

Semi-improved grounds consist of areas that have little maintenance requirements. These areas include the roughs at the golf course, edges of the airfield, and reclaimed waste disposal sites. Although these lands are available for use, many have restricted access and tight regulations governing them.

The last land classification is unimproved grounds. This includes areas that are not considered improved or semi-improved and are mainly unmanaged forest stands. These grounds are utilized for recreation, support unit training, and provide habitat for area wildlife. Some of the grounds

are presently quarantined from use due to a former *Histoplasmosis* contamination. Much of the unimproved grounds have been planned as future BCT facilities or FCFH.

3.0 Factors that Influence Plant Growth

3.1 Climate

Fort Campbell is located in southwestern Kentucky and northwestern Tennessee, occupying portions of four counties: Christian and Trigg counties in Kentucky and Montgomery and Stewart counties in Tennessee. Situated in a transition area, the Western Highland Rim physiographic province is between Kentucky farmlands to the north and gently rolling hills to the east. To the south and west is the steeply dissected and wooded Cumberland River rim. The climate is moderate, characterized by warm, wet conditions of the humid continental climate. Summer temperatures are influenced by Bermuda highs over the Atlantic Ocean, and winter temperatures are controlled by polar and arctic air masses out of the north. These factors can cause vast differences in air temperature and available moisture.

3.2 Temperature

Summer days are usually sunny, warm and humid, averaging forty days with temperatures above 90 degrees Fahrenheit. The hottest month is July and during the summer Fort Campbell receives sixty percent of the available sunlight. Winters are rarely harsh with average high temperatures of 44 degrees Fahrenheit and two days below zero degrees. January is normally the coldest month. Increased cloud cover allows forty percent of the available sunlight to hit the earth surface. This temperature range translates into a United States Department of Agriculture (USDA) plant hardiness zone of 6b. (Hardiness zone is a guide that aids with plant selection based on the lowest temperature a plant species will tolerate. Hardiness zone 6b has an average low temperature between -5 and 0 degrees Fahrenheit.) The spring and fall seasons are pleasant; however, westerly upper layer winds control weather fronts moving across the continent that can produce severe storms across the region.

3.3 Precipitation

Precipitation on the Western Pennyroyal Karst Plain is influenced from moisture drawn up from the Gulf of Mexico. Winds from the south push moisture up across Tennessee and Kentucky and create an average rainfall of 49 inches per year. Summer thunderstorms bring most of the precipitation. Winter snow storms can be expected between December and March with an average snow fall of 10 inches and snow cover usually not persistent more than one week.

3.4 Urban Soil Elements

Understanding soil characteristics and conditions is essential to the successful implementation of Fort Campbell's urban tree program. The amount of water and nutrients in soil determines its ability to support vegetative growth. Soil is naturally formed by the weathering of rock. The five factors that influence soil development are parent material, climate, organisms, topography, and time. Physical (e.g. wind, heat, freezing and thawing) and chemical (e.g. rain, snow) weathering

break down the parent material and affect how fast or slow the soil formation process takes. The addition of organic matter formed by decomposition of dead plants and animals and worked in by microorganisms helps continue the transformation into a well developed soil. The complete process can take hundreds to thousands of years for weakly developed soil to transform into a well developed soil. The characteristics of soil texture determine how soil resists erosion and how much water can be retained for plant growth. Requirements for soil amendments and improvements depend upon the soil structure, soil pH, and available plant nutrients in a given soil.

3.4.1 Cantonment Area Soils Map and Data

The Natural Resource Conservation Service (NRCS) has developed a series of soil survey maps that give details on properties and characteristics of soil types found in each county of Fort Campbell.

Many different soils types are present on Fort Campbell's cantonment area. One of the largest soil types mapped in the cantonment is Udarents – urban land complex. This soil has been altered from its original soil profile during development of the post. The horizons have changed through construction projects, and the structure is varied; for this reason standard NRCS field data was not collected. The other dominant soil in the area is Pembroke silt loam.

Cantonment area soils have the following characteristics:

Parent material varies depending on location in the landscape.
Average depth to parent material is 65 inches.
Soil structure is predominantly silt loam.
Water capacity ranges from 0.18 to 0.23 inches.
Drainage class is primarily well drained.
Depth to water table ranges from 6 in. to 63 in.
The pH ranges from 3.6 to 7.8.
Organic matter for the A horizon ranges from .05 % to 4.0 %

With little basic information on the Udarents – urban land complex, when landscape materials are being planted, soil samples should be collected and analyzed for pH, soil fertility and soil structure. This will assist with plant selection for the site. Figure 3 shows a soils map of the cantonment area.

3.4.2 Undisturbed Soils

Undisturbed soils are areas that have not been disturbed by mechanical earth moving methods. Characteristics can include high organic matter and low bulk densities; structure is constant and soil profiles are easily discerned. These areas easily establish a variety of vegetation that attracts animals. Pore space is created as roots develop and grow penetrating the surface layer allowing water and air to enter the soil while reducing compaction. Organic matter is added back to the soil as plants and animals die and decompose on the surface. Soil microorganisms breakdown dead tissue, converting it to waste products and working the nutrients into the soil. Vegetation and leaf litter help protect the soil surface from water and wind erosion. Training areas outside the cantonment area are considered unimproved and may have undisturbed soils.

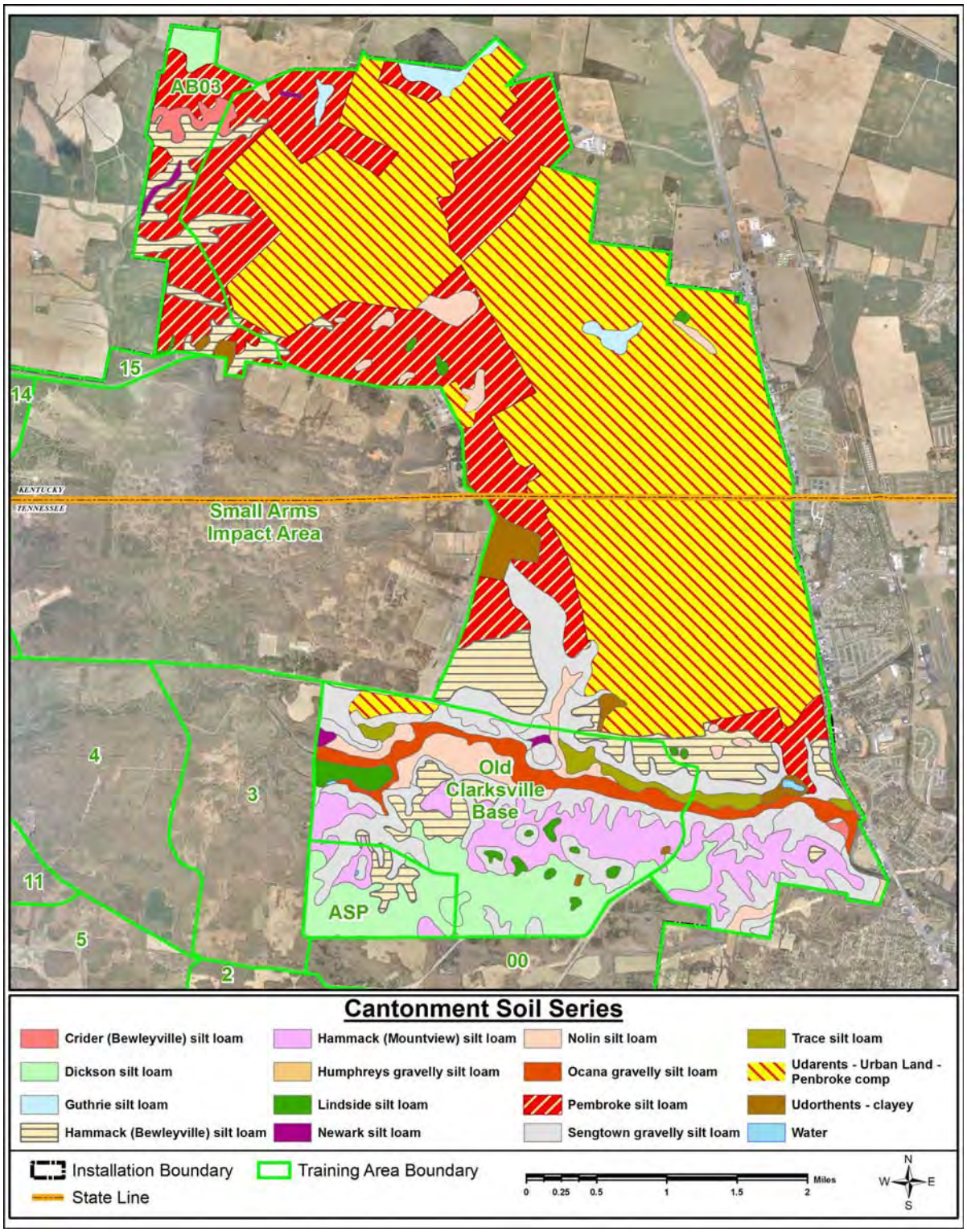

Figure 3. Cantonment Soils Map

3.4.3 Disturbed Urban Soils

Urban soils consist of areas that have been disturbed by the process of excavation or fill. Improved and semi-improved (and some unimproved grounds) are considered man-made because the land form has been changed to meet a designed purpose. After changes the soil can no longer be identified by a single soil series or a single soil name, and generally requires special treatment to establish and maintain vegetative cover. Human activity, by modification of the natural soilscape, is predominantly the active agent.

Disturbed landscapes and urbanized soils display the following characteristics:

Great vertical and spatial variability
Modified soil structure leading to compaction
Presence of a soil crust on bare soil, usually repelling water infiltration
Modified soil reaction, usually elevated pH
Restricted aeration and water drainage
Interrupted nutrient cycling and modified soil organism activity
Presence of man – created materials and other contaminants
Modified soil temperatures

3.4.4 Soil Structure

The natural processes that soils go through for structure formation are commonly lacking in urban soils. Most poor conditions present in urban areas tend to destroy structure and increase bulk density, due to soil compaction.

Disturbance or displacement of most urban soils partially destroys structure and reduces pore space, especially macropores. Macropores are the channels and spaces that help with the movement of air and water. Reduction of soil organism activity decreases the frequency of structure enhancing wet-dry or freeze-thaw processes. Urban soils are often subjected to surface traffic and other forces that, over a range of moisture conditions, contribute to soil compaction. Vegetation is subject to damage and reduction of cover, possibly leaving the surface bare and susceptible to crust formation, compaction, and erosion. All of the preceding conditions may detrimentally influence other soil properties such as water infiltration, permeability, water-holding capacity, aeration status and root penetration, especially in the upper soil layers where tree and shrub roots are concentrated.

3.4.5 Soil Horizons

Well developed, mature soils that have not been altered by construction and grading usually have well defined layers called horizons which differ in color, structure, and texture. From the surface down, the set of horizons (O, A, B, and C) is called the soil profile. The average depth to parent material on Fort Campbell is 65 inches.

At the surface is the organic layer or the O horizon. This layer is a couple of inches deep depending on the percentage of dead and decomposing matter it contains. On improved and semi

– improved grounds this layer is predominately grass and leaf debris. Current maintenance practices often remove dead and dying plant materials from this layer which limits nutrients in the A horizon.

The A horizon consists of the upper surface layer to an average depth of 12 inches of weathered soil. This horizon is subject to more change than the other horizons, due to the fact that the soil forming processes are most active at the surface layer.

The second layer, known as the B horizon, has less weathering and less root activity than the surface layer. It may possess less granular, more block - like structure. The B horizon depth ranges from an average of 12 inches to 40 inches where the average C horizon starts on Fort Campbell. The B horizon receives materials from the A horizon as a result of downward water movement. In humid climates, such as Fort Campbell's, the B horizon can be darker in color and more closely compacted due to a greater content of clay, iron, and aluminum compounds.

The last horizon is the C horizon. It has minor evidence of weathering and root residue. If the C horizon consists of impervious materials, internal drainage is seriously impeded. The principle value of this horizon is water storage. Tree and shrub roots are not often found this deep, however water found at this depth can help sustain trees and shrubs during periods of drought.

3.4.6 Soil Texture

Soil consists of mineral fragments varying in size from sand, 2.00 to 0.05mm (coarse particles), silt, 0.05 to 0.002 mm (fine particles), and clay, less than 0.002 mm (very fine particles). Classification of soil texture is based on the relative percentage of sand, silt and clay. Hydrological and mechanical analyses determine soil textural classification.

3.4.7 Water Holding Capacity

Water holding capacity is the available amount of water the soil holds between field capacity and the wilting point of plants. It is the pool from which growing plants obtain the water necessary for plant growth. Water holding capacity is measured in inches of water per inch of soil. Compaction decreases the water holding capacity and increases surface runoff.

3.4.8 Soil Fertility

Fertility of soil is dependent on the structure of the soil, the presence or absence of nutrients, and soil pH (degree of acidity or alkalinity). Soil pH, cation exchange capacity, and anion exchange capacity largely determine the capability of a soil to adsorb nutrients and relinquish these nutrients to plants.

3.4.9 Soil Nutrients

Nutrients are essential for healthy growth of plants. Nutrients are divided into two types, macronutrients and micronutrients. Macronutrients are those nutrients that are needed in large portions for the normal growth of plants. These include the following: nitrogen (N), phosphorus

(P), potassium (K), calcium (Ca), sulfur (S), and magnesium (Mg); nitrogen, phosphorus, and potassium are the most common macronutrients deficient in urban soils. The nutrients hydrogen (H), oxygen (O), and carbon (C) are obtained from air and water. Micronutrients are elements that are needed in minute amounts to help with plant metabolism and growth. The micronutrients in soils are manganese (Mn), zinc (Zn), boron (B), copper (Cu), iron (Fe), molybdenum (Mo), and chlorine (Cl). Urban soils may also be deficient in magnesium, calcium, and iron.

3.4.10 Soil pH

Soil pH is the measure of soil acidity, with neutral measuring 7 on a scale of 0 to 14. Levels measuring below 7 are considered acidic and levels above 7 are considered basic. In mineral soils most plants grow best with a pH between 6.0 and 7.0. Soil pH is important to the availability of nitrogen, potassium, phosphorus and specific amounts of microorganisms carried in the soil solution that plants need to grow, thrive, and fight off diseases. As pH changes, deficiencies in nutrients may develop allowing trees and shrubs to appear abnormal in color and be more susceptible to insect and disease attacks as well as biotic and abiotic disorders. The pH of urban landscapes tends to be higher than undisturbed soils. The most common reasons for higher pH in urban soils are likely due to: 1) large amounts of cement used during construction process, and 2) scraping and removal of top soil, exposing the more calcareous subsoil.

Soil tests should be conducted every 2 – 3 years unless there are special health problems evident; then soil tests should be done more frequently. Tests can be performed by the Christian County Cooperative Extension Service to determine soil deficiencies. The forestry section personnel can assist in the collection of soil extractions or the extension office could be contacted for soil sample collection procedures. Deficiencies can be corrected with soil amendments and proper fertilizer applications. Plantings in high visibility areas associated with buildings or landscaping around main entrances or thoroughfares should be fertilized as necessary.

4.0 Integrated Pest Management

Integrated pest management is the control of undesirable insects, diseases, plants and mammals through cultural, mechanical, biological and chemical means. The Fort Campbell Integrated Pest Management Plan (IPMP) describes management activities. The IPMP can be accessed on the Directorate of Public Works (DPW) San Server.

4.1 Insect and Weed Pest Control

Insects are part of the natural ecosystem but can be devastating to landscape plants if left un-checked. Control of problem insects can be accomplished through cultural, mechanical, biological and chemical treatments. Pest identification is important to planning proper treatment. Treatments can range from resistant plant selections, introduction of natural enemies, physical and mechanical controls and chemical pesticides. The control method typically used involves physically removing infected trees when they die before they become a safety hazard to people or property and/or to prevent the spread of a disease to other trees. Other methods include mechanical control with the use of insect traps and chemical control for the problem of bagworms in the trees and shrubs. Other insect pest problems are dealt with on a case-by-case

basis. Weed control is done for security and to maintain the aesthetic appearance of lawns and grasses. It also helps to prevent the spread of invasive plant species.

5.0 Emergency Storm Response Plan

Fort Campbell currently does not have an Emergency Storm Response Plan for cantonment trees. Having such a plan in place would provide guidance and assistance in an orderly and prepared manner for maximum safety at minimal cost. A typical plan should include organizational structure and storm responsibilities, resource preparedness and assistance, and operational procedures for major and minor storms.

6.0 Urban Forest Tree Inventory and Procedures

6.1 Urban Forest Tree Inventory

The urban forest is made up of trees, shrubs, turf, and flowers. Like any management strategy knowing what is in the forest is necessary to managing it properly: a comprehensive tree inventory is critical. Setting up maintenance programs, based upon inventory information, will help decrease maintenance costs over time. The Forestry Section, within DPW Environmental Division, Conservation Branch, conducted a comprehensive urban tree inventory from June 2005 to August 2006.

6.2 Inventory Procedure

Inventory of trees involved the identification and mapping of every individual tree in the designated cantonment area. In order to determine the present condition and the future management needs of the forest, each tree had a visual inspection and its location recorded using Global Positioning System equipment. The following information was collected: species, size (inches at 4.5 feet), condition, placement within the landscape, management unit, and maintenance needs, along with other information. The first four fields are used to determine the landscape value of the tree. Other information collected helped identify the tree's location and any physical or insect and disease problems. For purposes of the inventory, a tree is considered a perennial woody plant recognized as a tree species having a distinct trunk which is no less than four and a half (4.5) feet tall. A map showing the management units is at Figure 4.

Equipment used for the inventory included a field computer, GPS receiver, and Biltmore stick or diameter tape. Field computers used were the Trimble Recon and the Allegro CX. Both computers have Windows CE operating systems and data collection software, TerraSync, version 2.52. This software was also used to collect the GPS location points. Two different GPS receivers were used to collect location information. Recording individual points from the satellite to the receiver determined location. A minimum of 20 points was needed to calculate the coordinates. After the points were collected the average of all the points was determined in the Terrasync software and the coordinate set. The Trimble Pocket receiver was used between June 2005 and January 2006. It has a coordinate accuracy of 3 (9 ft.) to 9 meters (27 ft.). In February 2006 the Trimble XP Pro receiver was used until the end of the inventory in August 2006. The

accuracy of this new receiver is sub-meter (<3 ft.). The Biltmore stick and diameter tape are standard forestry instruments to measure a tree's diameter at 4.5 feet above the ground.

Tree data was collected for individual trees around buildings, on streets, parking lots, parks, playgrounds and green spaces. Along with GPS coordinates each tree record includes a building number or block number and street for identification purposes. The tree's arrangement related to the building face was recorded as front, side or rear. Every tree was then assigned a site number for each individual building or block number. This enables easy location of the tree in the field. Site numbers followed the forward direction of street traffic, right to left. Once the field observations were recorded, the tree data was entered. Information collected is used to determine total sum or average of data fields, as well as landscape value of individual trees. An example of the data collected is at Figure 5. Collected data was up loaded onto a personal computer where GPS points are corrected, establishing the tree's coordinates, and editing of data was done using TerraSync software.

The inventory is maintained and analyzed in Davey Resource Group's Treekeeper online database. The database is a D-base structured program that stores data and creates queries related to the data fields. From queries pre-set reports can be printed such as species frequency and tree value, or individual reports can be created. Treekeeper software is also designed to store work records and generate work orders. Data can be converted in to a GIS shape file for display in ArcMap 9.1. A shape file is currently available on the Directorate of Public Work GIS server. Database support is contracted with Davey Resources Group. The findings and analysis of the inventory are discussed in Section 7.

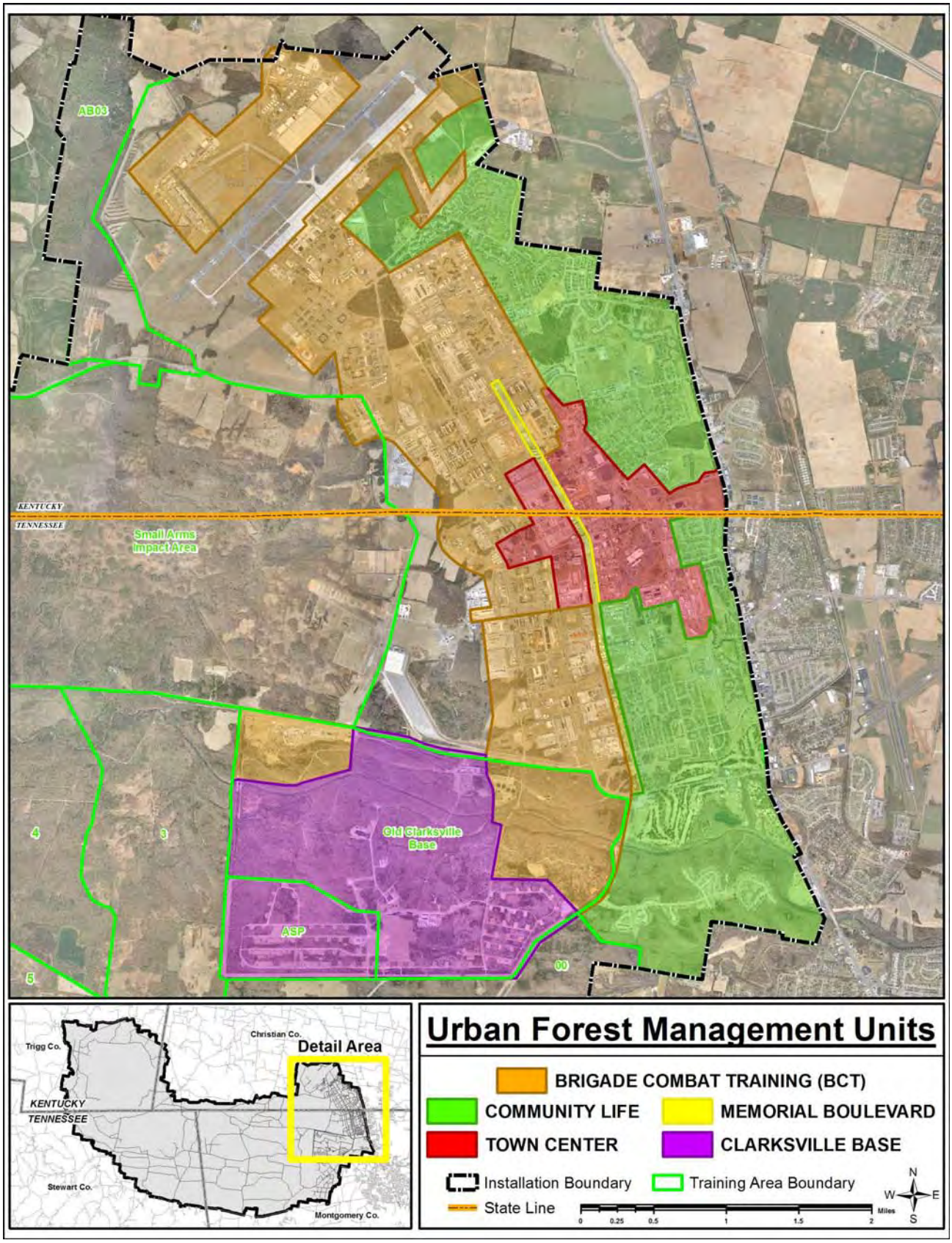

Figure 4. Urban Forest Management Units

Sample Urban Tree Inventory Data

Management Unit	Building or Block Number	Side	Site (1)	Species	Street	Location	DBH	Stems	Condition	Placement	Maintenance	Physical Observations	I & D Observations (2)	Clearance	Overhead Utilities	Grow Space	Space Size (ft)	Growth Stage	Further Inspection	Assigned (3)	Comments
Town Center	39	Rear	2	Yew spp.	Screaming Eagle Blvd.	Building	5	3	Poor	Fair	Routine Prune – Small Tree	None	None	None	No	Planter	11	Structure	No	No	
Town Center	39	Rear	1	Yew spp.	Screaming Eagle Blvd.	Building	5	4	Fair	Fair	Routine Prune – Small Tree	None	None	Signal / Sign	No	Planter	11	Structure	No	No	
Town Center	39	Front	4	Water Birch	Screaming Eagle Blvd.	Building	8	1	Dead	N/A	Removal Priority 3	None	None	None	No	Open	99	Replace	No	No	
Community Life – Residential	1541	Front	11	Tuliptree	Choctaw Loop	Residence	2	1	Good	Good	Training Prune	None	None	None	No	Open	99	Structure	No	No	
Community Life – Residential	1541	Front	13	Mockernut Hickory	Choctaw Loop	Residence	27	1	Good	Good	Routine Prune – Large Tree	Mechanical / Root Damage	None	None	No	Open	99	Structure	No	No	
Community Life – Recreation	540	Tot Lot	1	American Sycamore	Hooper Drive	Tot Lot	19	1	Fair	Very Good	Routine Prune – Large Tree	Mechanical / Root Damage	None	None	No	Open	99	Mature	No	No	
Community Life – Recreation	540	Tot Lot	2	American Holly	Hooper Drive	Tot Lot	2	4	Excellent	Good	Training Prune	Mechanical / Root Damage	None	None	No	Open	99	Mature	No	No	
Community Life – Recreation	540	Tot Lot	3	American Holly	Hooper Drive	Tot Lot	2	4	Excellent	Good	Training Prune	None	None	None	No	Open	99	Establish	No	No	
Community Life – Facilities	175	Greenspace	1	Oak Spp.	Forest Rd.	Park / Public Space	30	1	Critical	Excellent	Routine Prune – Large Tree	Broken Branches	None	None	No	Open	99	Over Mature	No	No	Wildlife Tree
Community Life – Facilities	175	Greenspace	2	Sassafras	Forest Rd.	Park / Public Space	45	1	Poor	Excellent	Routine Prune – Large Tree	Dead Branches	None	None	No	Open	99	Over Mature	No	No	
BCT Housing	3725	Front	1	Pin Oak	Tennessee Ave.	Greenspace	22	1	Poor	Excellent	Routine Prune – Large Tree	Mechanical / Root Damage	Trunk / Branch Rot	None	No	Open	99	Over Mature	Yes	No	
BCT Housing	3725	Front	2	Pin Oak	Tennessee Ave.	Greenspace	22	1	Poor	Very Good	Routine Prune – Large Tree	Poor Structure	None	None	No	Open	99	Mature	No	No	
BCT Facilities	127	Side	1	Lacebark Elm	Forrest Rd.	Building	15	3	Fair	Liability	Removal Priority 2	Poor Structure	None	None	Yes	Open	99	Mature	No	No	
BCT Facilities	127	Rear	5	Lacebark Elm	Forest Rd.	Building	10	4	Fair	Good	Training Prune	Mechanical / Root Damage	None	None	No	Open	99	Mature	No	Yes	
Memorial Boulevard	20900LK	Greenspace	1	Eastern White Pine	Tennessee Ave.	Street	24	1	Fair	Very Good	Routine Prune – Large Tree	Mechanical / Root Damage	None	None	No	Open	99	Mature	No	Yes	
Memorial Boulevard	20900LK	Greenspace	2	Eastern White Pine	Tennessee Ave.	Street	23	1	Good	Excellent	Routine Prune – Large Tree	None	None	None	No	Open	99	Structure	No	No	

1) Site – Individual trees space moving with the flow of traffic.
2) I & D Observations – Significant insect and disease observations.
3) Assigned – Indicates that the tree's block or building number was not visible and was interpreted to give a separate number.

Figure 5. Urban Tree Inventory Data Sheet

7.0 Urban Tree Inventory Results and Analysis

Figure 6. Commanding General's Residence

7.1 Tree Population Findings

The tree population was determined by the species recorded during the 2006 urban tree inventory. The tree inventory indicated a large, diverse population of trees in Fort Campbell's cantonment area. There are 31,143 trees with seventy-six (76) percent of the population considered healthy and vital. Twenty-two (22) percent of the tree population is in poor health and may need major maintenance or removal in the next three to five years. Two (2) percent of the trees are dead and need removing.

Trees in the cantonment area can be separated into one hundred and eighty-three (183) distinct species. The Installation Design Guidelines recommends that native species requiring less maintenance be used in plantings. Sixty-one (61) percent of the tree species found are considered native to the United States, and thirty-nine (39) percent are species that have been introduced from other regions of the world. An important note is that many of the introduced species have been around for centuries and have naturalized into the U.S. landscape.

The diversity of tree species on the installation is excellent. The region naturally supports a variety of native trees which has added to the available selection and sustainability of many of

the species. Continued use of native species would help provide low maintenance trees that are hardy enough to withstand the region's climatic conditions.

Figure 7 shows tree species present in the cantonment area by total number in descending order. The total species list is found in Appendix A. A guideline recommended by the International Society of Arboriculture is that no individual species should make up more than ten percent of the total population. This is in the event of an insect, disease or weather catastrophe that could devastate a large portion of the tree population. An example of this is Dutch Elm Disease (DED). Introduced in the U.S. in the 1930's, by 1970 the disease had killed 77 million American elms throughout North America, leaving many communities to remove large numbers of trees to prevent the spread of the infection. DED has been found in the cantonment area at Fort Campbell.

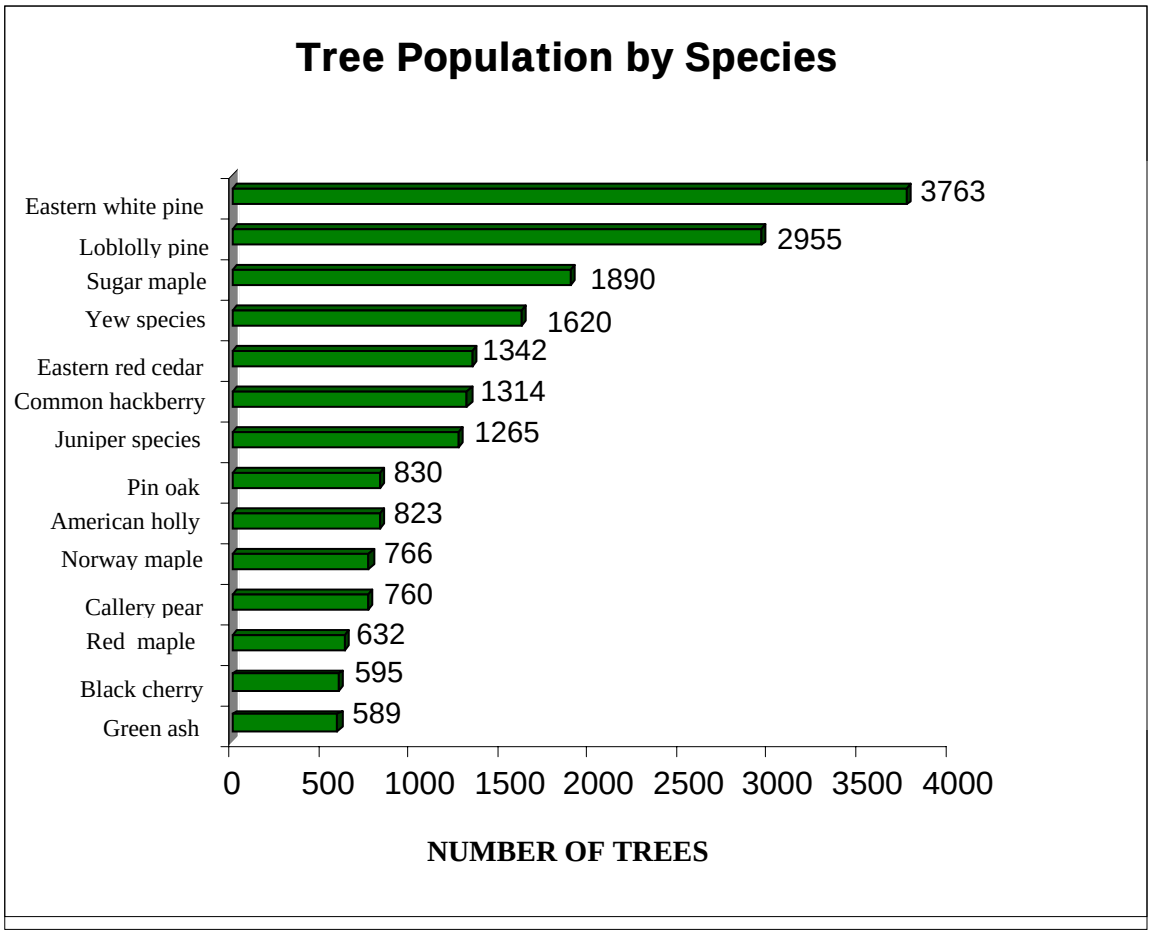

Figure 7. Population Numbers by Species

Eastern white pine currently makes up eleven (11) percent of the population with loblolly pine making up nine (9) percent. The two pines species present a large risk of removal should a traumatic, natural disaster or insect infestation occur. As the figures show, the remaining species' breakdown ranges from five (5) percent to one (1) percent. This is a more desirable density of species.

7.2 Size Distribution

Size classes are broken down in increments of 6 inches up to 36 inches. The distribution of sizes indicates that the majority of trees are relatively young according to the categories of trunk diameter (Figure 8). Although the ages of the tree population are fairly diverse, the middle age trees will probably have the greatest impact on the future maintenance procedures as well as budget requirements as those trees approach maturity.

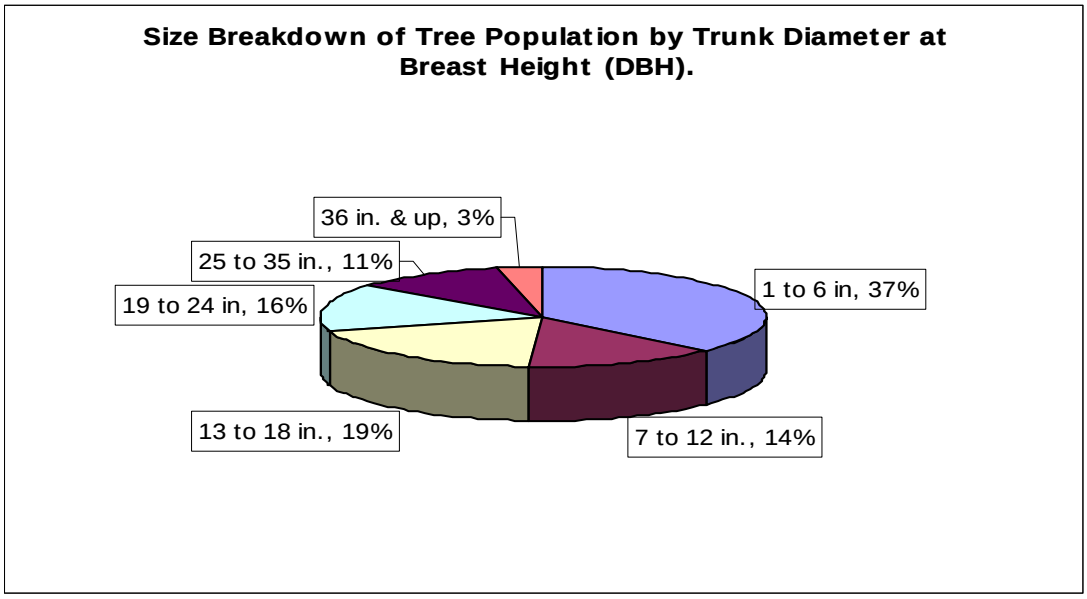

Figure 8. Distribution of Tree Population by Diameter .

Future management costs can be reduced for the younger trees (1 to 6 in.) by practicing routine maintenance. Structural problems and other defects that hinder the health and safety of mature trees can be reduced or eliminated with proper pruning. The long term cost is also reduced by requiring less time and equipment to complete the work.

7.3 Physical Damage

Physical damage is injury from external force to tree roots, trunks and branches. For each tree inventoried the dominant damage was recorded when damage was present. The urban forest had twenty-eight (28) percent of the trees with damaged roots or trunk due to lawnmower or weed eater use. Repeated injuries often create present and future maintenance problems such as weak trunks and decay in the roots and trunk turning safe healthy trees into unsafe and hazardous trees. Other physical problems recorded were caused by weather or animals. Weather damage may include ice, snow, wind and lightning. Weather damage is present in one percent of the trees. Less than one percent of the trees showed animal damage due to birds, wildlife or pets. There was no physical damage present in fifty (50) percent of the trees. Many of the causes of physical damage can be prevented with the use of safe cultural practices. A good cultural practice that will reduce physical damage is mulching, well placed and properly used around trees, to reduce lawnmower and weed eater damage.

7.4 Insect and Disease Problems

Insect and diseases are a part of the natural forest environment. Insects and diseases often infect trees at levels that can be controlled by the tree's defenses. It's when the disease and/or insect's population reaches a point where the defense mechanisms cannot control the infection source, tree health begins to decline.

7.4.1 Existing Insect Problems

The trees in the cantonment area show signs of many different insects. Most of them are in small populations and may impact the health of only a few trees but not pose a threat to the population of a single species. There are three (3) species of insects that are having an impact on the trees on Fort Campbell: horned oak wasp, bagworms, and Japanese leaf beetle.

Figure 9. Horned Oak Gall Wasp on Pin Oak.

Horned oak wasp (*Callirhytis cornigera)* infects many of the red oak species planted on post (Figure 9). Currently sixty-four (64) percent of the pin oaks have galls forming on branches. One gall can have as few as one or as many as one hundred and sixty (160) eggs. Galls have become so serious that aesthetic quality of the tree is reduced. As more galls are produced they will also cause die back on the branches and add stress to the tree. In time, as the galls increase in number the tree will die. Insecticide treatments are available but because of the cost and type of treatment they may be limited to important specimen trees. The other option for control is through cultural methods such as species selection and pruning out the galls when they first appear.

Another insect that is showing an impact is the common bagworm (*Thyridopteryx ephemeraeformis).* A bagworm is the larval/caterpillar stage of a moth. It lays its eggs most commonly on arborvitae, red cedar, pine, spruce and some deciduous trees. Six hundred and sixty-nine (669) trees had bagworms attached to branches. The majority of the infected trees are juniper and arborvitae. Damage is branch dieback caused by the stems being girdled. Bagworms can be hard to control because they often go unnoticed until mature. Currently bagworms are controlled by insecticide spray treatments by pest management in the Roads and Grounds Branch.

Japanese beetle (*Popillia japonica*) is developing into a health as well as a visual problem for the several species of trees in the cantonment area. Japanese Beetles are flying insects that move up to five miles from plant to plant to feed. The beetle feeds on a variety of tree and shrub species. Japanese flowering cherry has a high instance of beetle attack; it makes up sixty-six (66) percent

of the infested trees. Norway maples and lindens are the other trees infested. The adult beetles feed on the top portion of tree and shrub scaring the leaf surface which leaves it skeletonized.

Figure 10. Japanese Beetles in Pheromone Traps.

Damage occurs when large groups of beetles are attracted to the same plant and begin feeding from the top of the plant to the bottom. Pheromone beetle traps were set out in residential areas the summer of 2005 (Figure 10). Thousands of beetles were caught; however, the American lindens in the area still had heavy attacks.

Traps attract high numbers of beetles to the trap area increasing attacks on trees. Placement of traps is critical to the reduction of beetle attacks. The inventory showed that less than one percent of the trees showed Japanese beetles feeding on them. Continued attacks on the same trees will stress the trees and add to branch dieback and ultimately the death of the tree. There are a number of insecticides that are used to control Japanese Beetles. However, to get adequate control the grub/larval stage must also be treated. Treatment of Japanese Beetles is completed on a case by case basis through work order in accordance with the Fort Campbell IPMP guidelines.

7.4.2 Potential Insect Problems

There are three insects that have caused extensive damage to forests and urban forests in the United States. Two of them are exotic and one of them is a native insect. The two exotic insect pests are gypsy moth and emerald ash borer. Southern pine beetle is a native insect but is capable of extensive damage to loblolly and shortleaf pines. Monitoring is an important part of detecting and preventing serious resource damage.

7.4.2.1 Gypsy Moth

Figure 11. Male Gypsy Moth

Gypsy moth is an exotic moth that was introduced in 1869 in Massachusetts. By 1987, gypsy moth had established itself throughout the northeast. In recent years it has spread to Wisconsin and as far south as Tennessee. Gypsy moths have been caught by traps in the majority of the lower forty-eight states but have not established significant population outside the northeast. Since its introduction it has devastated approximately 74.5 million acres of federally owned forest lands. The larvae and adult

caterpillar are the life stages that inflict the most damage by eating the leaves of hardwood trees and shrubs.

Egg masses are laid in August and can be found on the underside of branches, tree trunks, fences, houses and other structures. They can also be attached and transported across state lines on vehicles, trailers, firewood, and mulch. Egg masses over-winter until April of the following spring when the eggs hatch. Larvae climb up nearby tree branches and feed on hardwood leaves while developing into adult caterpillars. In late June or early July they begin to pupate; one month later adult moths emerge from the cocoon. Pheromone traps are used for early detection. Traps should be placed in pre-determined sites in May and taken down in September. The trapping program is to continue until it is no longer needed.

In cooperation with the Southeast Region of the United States Department of Agriculture (USDA) Forest Service and the Tennessee Department of Agriculture Forestry Division, the Forestry Section has been placing survey pheromone traps for gypsy moths within the cantonment area since 1984. The last male moth caught on Fort Campbell was in 1995. The trapping program is designed to slow the spread of the gypsy moth by detection and follow up eradication. With continued success of the program the USDA Forest Service models show that by the year 2025 the gypsy moth should not have advanced to the Fort Campbell area.

7.4.2.2 Emerald Ash Borer

In the last five years the emerald ash borer (EAB) has made its presence known in the Great Lakes region of the upper mid-west. An invasive species from Asia, the borer feeds on the phloem of ash trees. Although the initial detection occurred in 2002, testing has shown that EAB has been in the United States for ten years. Predictions of the spread are not quantified but researchers have determined the ash borer can travel more than three miles per year (Poland and McCullough, 2006).

Figure 11. Adult Emerald Ash Borer

Currently populations have been detected in Indiana and southern Ohio. Presently state and federal regulatory agencies are establishing quarantines in counties where detection has occurred. The quarantines restrict the transportation and use of firewood and other ash products to prevent the spread of the insect.

The adults chew their way out of the tree leaving a D-shaped emergence hole. Emergence occurs in mid-May and peaks in late June to early July. Adults feed on ash foliage leaving only superficial aesthetic damage. Adults feed for 5-7 days before mating begins and females will feed for 5-7 more days before laying eggs. The adults will continue to feed and breed for 3-6 weeks. Eggs are laid in bark crevices and hatch within 2 weeks. Larvae feed on the phloem and cambium from July through autumn. Larvae create serpentine galleries that disrupt the translocation of food and water causing death to the tree in 1-3 years. Larvae pass through four

instars, or growth stages, with most larvae finishing feeding in October or November. Emerald ash borer pre pupate and over-winter in the sapwood or the outer bark. Some EABs over-winter as young larvae rather than pre pupae and need a second year to develop. Pupation begins in mid-April into May, with adult emergence lasting approximately 3 weeks. The need to develop over two years appears to be related to host quality, host resistance and weather.

Fort Campbell's ash trees make up a small portion (5 %) of the total tree population; however, this invasive pest could impact new family housing subdivisions where ash trees were planted as street trees. It is possible that 100% mortality could occur due to the limited knowledge of natural enemies and chemical insecticides. Detection is also difficult due to limited information on EAB. Visual surveys are difficult due to the small size of the emergence holes making large areas of survey samples labor intensive. The other current detection method is to do destructive sampling. This is done by identifying possible ash tree hosts and physically girdling and striping a small section of the bark causing the tree to become stressed which attracts the emerald ash borer and other wood borers. This survey type is also labor intensive and costly and destroys the tree resources. Chemical detection traps are currently under research but nothing has been approved for wide spread use.

7.4.2.3 Southern Pine Beetle

The loblolly and shortleaf pines in Fort Campbell's cantonment area are threatened by southern pine beetle (SPB), a native species of North and Central America. Native home range is the southeast and southwest United States, south through Central America to Honduras. The post is on the northern edge of the southern pine beetle's native range. Loblolly and short leaf pine growing on Fort Campbell are considered the preferred species for SPB. The chance of a major outbreak increases as the loblolly and short leaf pine stands become stressed. Pines are more susceptible to bark beetle attack when stressed by drought conditions or extreme changes in the weather.

Figure 13. Adult Southern Pine Beetle

Like the emerald ash borer, the SPB larvae feeds on the cambium layer of the underside of the bark. Attacks begin in early spring with a male and female pair chewing their way into inner bark and forming S-shaped galleries often crisscrossing other galleries and causing girdling of the tree and death. A fungus carried by the beetle cause blue stain and aids in the death of the tree by plugging up the water conducting structures.

After mating the female lays her eggs along the sides of the gallery creating niches for the eggs to hatch and develop. Newly hatched larvae feed in the soft inner bark and the older larvae move outward and feed on the corky bark. When fully grown the larvae enter the resting stage and begin to pupate. When the pupation is complete, about a month later, the newly formed adults

chew outward creating a small exit hole about the size of bird shot. This action takes place from April through September. Newly emerged adult beetles may attack nearby green trees or fly considerable distances to establish a new infestation. Brood emergence is often about the time the pine tree starts to show signs of the attack.

Detection is usually done by aerial survey looking for fading of green needle color or red needles. Every year the personnel from the Forestry Section participate in an aerial survey to look for signs of SPB in the rear training areas. Emphasis is on the over 10,000 acres of loblolly pine stands in the rear training areas. Due to scattered stands and individual trees in the cantonment area, detection would need to be a visual inspection on the ground. Inspection of loblolly and shortleaf pine trees would begin when trees begin to show signs of fading crowns or needles turn red. Other signs that would indicate the need for a closer inspection is a number of adult exit holes and pitch tubes at entrance holes. If all of these signs are present then removal of the outer bark would be done to identify the galleries and beetle(s) inside. The USDA Forest Service has recommendations for effective suppression techniques when multiple trees are infected. The techniques are designed to reduce the beetle populations to tolerable levels.

7.4.3 Existing Disease Problems

Disease organisms are another element in the health of the urban forest. Diseases like root rot, brown and white trunk rot, cankers, foliar diseases, rusts, and shoot blight affect the condition and vigor of the trees. Although all types of diseases were found, the three that are the most common are brown and white decay rot on the trunk and branches, cankers, and leaf blight.

7.4.3.1 Decay Rot

Figure 14. Decay Fungi Conks on Downed Oak.

Decay rot is caused by fungi that aid in breaking down dead wood cells. Trees often develop decay as larger branches die or are broken off and through mechanical injury. Decay weakens the wood's structure as it spreads and creates hollow cavities. Tree failure can increase as available holding wood decreases; a hazard is created when the tree could injure persons, pets or property when it fails.

One hundred and twenty (120) trees were identified as hazardous because of decay in branches or trunk. Over all, ten (10) percent of the trees have trunk and branch decay. Often, decaying branches can be pruned to prevent the spread of the disease. When the decay is present in the trunk it should be monitored and the tree should be removed when the tree becomes unsafe. The species that have the major presence of decay include common hackberry, sugar maple, eastern white and loblolly pines, oaks, and black cherry. These species would benefit the most from routine crown cleaning.

7.4.3.2 Canker

Cankers are also caused by fungi. Cankers are dead sections of bark on branches or the main trunk of trees. When the main trunk or branches are damaged by yard equipment or other means, canker fungi enter through an exposed wound. The canker spreads when the tree becomes

stressed and its defenses are weakened. If the canker enters the main trunk and encircles the whole trunk the tree will eventually die. Canker fungi are present on a number of species but most commonly viewed on sugar maple, black cherry, Norway maple, and thornless honeylocust. One way to prevent the spread of cankers is to put cultural practices into place to prevent injuries and keep the tree healthy and vigorous. If the canker is found in the tree, treatment includes routinely pruning out the dead and diseased branches, referred to as a crown cleaning. Fungicides are available to control cankers and treatment plans can be determined and put in place.

7.4.3.3 Leaf Blight

Leaf blight is caused by either bacteria or fungi depending on the leaf blight species. Symptoms of leaf blight include dead areas, blotches, black and brown scorched appearance and even death of the whole leaf that is shed prematurely; however on some trees the twigs, shoots, buds, and fruits will become infected. Most leaf blights are spread by wind, rain or mechanical methods. Repeated defoliation reduces or weakens the tree and increases it's susceptibility to attack from other pests or winter injury. Leaf blight infects many different tree species. A common leaf blight seen on post is anthracnose. Anthracnose infects a number of species in the region including American sycamore, Norway maple, white and red oaks, basswood, ashes, dogwoods and hickories. Numbers of trees having leaf blight are less than one (1) percent. Anthracnose was observed on post on sycamore, dogwood and Norway maple. The best way for reducing leaf blight in trees is to promote healthy and vigorous trees. Proper pruning practices and reduction of mechanical damage can help trees fight leaf infections.

8.0 Tree Care and Maintenance

Restrictions placed on trees in the urban forest make maintaining healthy trees a perpetual activity. Army Regulation 200-1, Chapter 4-5 (August, 2007) requires natural resources be sustained while supporting the army mission, and DoD's Urban Forestry Manual (August 1996) supports this regulation with the objective of protecting land and tree investments from depreciation. Growing space for vegetation is often limited and competes with roads, above and below ground utilities, sidewalks and buildings. This plan identifies the tree care needs of the cantonment trees as planting spaces, tree removals, pruning, and structural repairs. Industry standards set by the International Society of Arboriculture and American National Standards Institute (ANSI) Z – 133 Safety Standards and A300 Parts 1 – 6 Maintenance Standards, identify proven scientific methods for pruning, planting and establishment, cabling, bracing and guying supports, fertilization, lighting protection systems, and management of trees during site planning, development and construction. These standards were established to provide safe and sustainable healthy woody vegetation.

8.1 Inventory Removals

Tree removal is part of any urban landscape. Trees are removed for a variety of reasons: hazard to people or property, dead or infected with a disease or insect, planted in an inappropriate site. Tree removals are prioritized by three different categories: priority one removals are hazard trees; priority two removals are non-hazard trees that are diseased, dead and/or have a strong chance of becoming a hazard or are planted or growing in a place that creates a liability. Priority

three removals are declining or dead trees in low hazard areas that can be removed when time and money are available. Note that if priority three trees are left too long they may become hazardous. These three categorizes are based on Davey Resource Group's standard inventory definitions.

8.1.1 Hazard trees – Priority One

A tree becomes a hazard when placed in an area that in the event of failure, it causes injury to a person or damages property. Street trees next to buildings often become hazards. An example occurred in March of 2006, in the Cole Park residential area when an oak tree's root system failed, and the large tree fell into the nearby house. Fortunately no one was home at the time and no injuries occurred. (Figure 15)

Figure 15. Failed Oak Tree in Cole Park.

In urban forestry, public safety is the first priority of any management program. The cantonment area has a number of priority one hazard trees. Much of this is due to the lack of routine care and mechanical damage. Many of the older trees have broken branches and cankers that have not healed allowing decay to enter. The inventory identifies two hundred seventy-eight (278) trees as being hazardous, and recommendations have been made for their removal.

A yearly follow up hazard tree inspection should be conducted for areas where pedestrian and vehicle activity are high (residential areas, business areas, schools, etc.). Medium and low use areas should be inspected at increments of three and five years, respectively. This will ensure that all trees are evaluated during a set period (Pokorny and others, 2003).Tree evaluation should follow a systematic process of assessing the tree or tree parts (Matheny and Clark, 1994). A numeric system is used to determine risk. When corrective recommendations are implemented trees with the highest scores should be dealt with first as they have the greatest chance of failing. Both the International Society of Arboriculture and the U.S. Forest Service have evaluation systems available for reference to set up a hazard tree inspection program. When designing and caring for plant material in the urban forest, public safety should be of highest importance.

8.1.2 Dead, Diseased and Liability Trees – Priority Two

Priority two removals are those trees that are in medium hazard areas (areas where people and vehicle traffic use is intermittent), placement is considered a liability or the tree is dead or badly infected with a disease or insect and may die within the next two years. The inventory identifies eight hundred forty-nine (849) priority two removals. This includes two hundred sixty-nine (269) trees where placement has been identified as a liability. A tree becomes a liability when the placement is such that it could cause an accident or damage a structure. The majority of those identified as a liability are volunteer trees growing in sites too small for a fully mature tree. Examples of this are trees growing next to building foundations or growing in fences or into air conditioners. Two hundred and seventeen (217) of the identified liability trees are six inches or

less in diameter and can be removed with hand tools. The others are either dead or in poor or critical condition. There are five hundred and eighty (580) trees in this condition that need to be removed in the near future (2 to 5 years). Although none of these trees are hazardous at this point in time, if left in place they could become hazardous.

8.1.3 Dead or Declining Trees -Priority Three

Priority three removals are trees that are in a low hazard area (areas of low use, no structures and no vehicles), dead or in a state of decline and will probably die within five years, or growing in a poor planting site that will not support a mature healthy tree.

Fort Campbell's tree population has numerous trees in poor, critical or dead conditions. Six (6) percent, or two thousand and eleven (2011) trees have been identified as priority three removals. This will influence the maintenance budget over the next five to ten years. Size distribution of the largest portion of this category is 1 in. to 6 in. dbh or forty-six (46) percent of all priority three removals. Table 1 shows these numbers.

The majority of these trees can be removed as time and money are available. Those trees that are competing for growing space should be removed as soon as possible. This will reduce the competition for nutrients and water and improve the health of neighboring trees.

DBH SIZE CLASSES	NUMBER OF REMOVALS
One to Six inches	936
Seven to Twelve inches	365
Thirteen to Eighteen inches	302
Nineteen to Twenty four inches	195
Twenty five to Thirty five inches	149
Thirty six + inches	64

Table 1. Size Classes for Priority Three Tree Removals.

8.1.2 Tree Pruning

Pruning is done to remove dead branches, improve structure, remove closely parallel branches and crossed or broken limbs and superfluous growth at the base of the main branches. Pruning should be timed for most species when the tree or shrub is dormant. Pruning practices should follow ANSI A300 (Part 1) Standard Practices (Pruning), and industry standards described in the companion publication published by International Society of Arboriculture, "Tree Pruning" and "Utility Pruning of Trees". One observation made during the inventory was the use of incorrect pruning practices during installation ground maintenance activities. The incorrect practices observed include incorrect placement of pruning cut and pruning technique. Three percent of the urban forest had been pruned poorly at some point in time, as evidenced by cuts beyond the branch collar and pruning wounds that never healed. Poor pruning practices were observed in the housing areas, on Brigade Combat Team areas, and in other barracks and building areas. Most of the poor pruning is probably due to the lack of education or training in proper pruning practices.

Many of these trees now have reduced landscape value and are more susceptible to insects and disease.

In the tree inventory, pruning needs were recorded as follows:

Priority one prunes – Hazard branches four inches or greater to be removed
Priority two prunes – Hazard branches two inches to four inches to be removed
Priority three prunes – Branches needing removal because of interference with an object
Routine prune large – Rotation pruning of large and medium mature trees
Routine prune small – Rotation pruning of small mature trees
Training pruning – Pruning of young trees to develop desired future structure

8.2.1 Hazard Prunes – Priority One and Two Prunes

Hazard prunes are regarded as similar to hazard removals; it is a matter of public safety. Trees that are identified as priority one and two prunes have dead or injured branches that may harm people or damage property when they fail. The inventory identified one hundred forty (140) priority one hazard prune trees. In addition to the priority one numbers, there are one hundred thirty-seven (137) priority two prune trees. Action to trim these trees should be taken as soon as possible.

8.2.2 Clearance Prunes – Priority Three Prunes

Branches that interfere with streetlights, signs or are limiting head clearance over streets or sidewalks can be dangerous to pedestrians and vehicles. Tree limbs growing into buildings can become a hazard if left uncorrected. Low growing branches in parks and green spaces can be dangerous to maintenance personnel and park visitors. Identified were three hundred and fourteen (314) trees needing clearance prunes. The majority of the priority three prunes are in Fort Campbell Family Housing areas: two hundred and seventeen (217) trees were identified. Part of the problem has been in the original landscape design; most likely, the mature tree height and spread size were not anticipated when the landscaping was planned. Trees with large mature size were planted too close to streetlights and houses. The lack of routine maintenance over time has allowed the trees to fill in over sidewalks, driveways and under roof overhangs. These problems are often easy to correct by raising the crown and removing the problem branch(es).

8.2.3 Routine Pruning – Large and Small trees

Standards

Routine pruning involves pruning on a regular cycle. An ideal cycle would be a regular 5 or 7 year rotation, depending on growth stage (mature or over mature) ensuring every tree is evaluated and healthy branches are maintained or problems corrected. This category is assigned to those trees that are in fair, good or excellent condition, and do not have serious pruning needs. Routine pruning involves one of three types of pruning practices. The first and most common is a crown cleaning. This involves the removal of dead, broken, structurally weak or diseased branches to prevent the spread or introduction of disease. This will also allow damaged branches

to heal. The other two practices, crown reduction and crown raising are not used as often but can be used if needed. Crown reduction is a technique used to reduce the windsail effect of a tree's crown, decreasing the weight of heavy limbs and increasing light penetration and air movement throughout the tree. Crown rising, or lifting, is the selective removal of branches to provide vertical clearance for trees interfering with buildings, signs, vehicles, or pedestrians.

Observations

Trees have often been left unpruned for fifteen to twenty years. In that time branches die, become broken due to storm damage, or become infected with primary and secondary insects and/or diseases. Larger dead branches may become hazardous and/or cause the decline of the tree's health. Routine pruning practices were not observed on post. The inventory identified the following numbers of trees needing routine prunes: small trees (mature height 25 – 30 feet) 8030 trees; medium trees (mature height 35 to 40 feet) and large trees (50 feet and taller) together total 15839 trees.

Recommendations

Pruning maintenance was discussed in the "External Review of United States Army Forest Resources 2006" report prepared for the Assisted Chief of Staff for Installation Management, Army Headquarters. It pointed out the scientific justification and benefits of regular pruning on urban trees. Accomplishing routine prunes on post, in an efficient manner, could be by blocks. Selecting a block or blocks and continuing until the whole cantonment area is complete would set up pruning rotation. If it takes five years to complete the whole cantonment area then there would be a five year rotation, with maintenance pruning beginning over with the first blocks selected. Involving routine pruning in the tree maintenance program would benefit tree health and help maintain or increase the landscape value of trees. Improvements would also include educating and training contract management personnel and monitoring tree contractors to insure industry standards are met.

8.2.4 Training Prunes

Training prunes, or structure pruning, is the best way to insure strong and safe mature trees. By training trees from the time they are young, a qualified professional can select the branches that will be the scaffolding, or support branches, for the mature tree. Removing branches that are poorly attached, co-dominant leaders, or are dead or diseased keeps the tree healthy and prevents the tree from becoming a hazard when mature. The first pruning should occur five years after the tree is planted. Pruning should then continue every four to five years until the tree reaches maturity. There are several advantages to training trees when young: cost of pruning is reduced; it is easier and safer to prune with hand tools and a ladder; and less time and money are needed to make corrections. Also, smaller wounds from early pruning take less time to heal as long as correct pruning methods are used. The result is a structurally safer tree with less pruning required when the tree reaches maturity. Over the life of the tree, benefits are increased (landscape value, energy savings, pollution absorption, and aesthetics) and maintenance costs decreased. There are three thousand three hundred and seventy-two (3372) trees that would benefit from

training/structure pruning. Being proactive on early tree pruning will decrease the cost of maintenance over the life of the tree.

8.3 Bracing and Cabling

Standards

Many trees have poor structure due to natural growth forms. Many problems can be eliminated when the tree is young. However, correction of structural problems with mechanical methods is possible to prevent branch or tree failure and preserve the standing tree. The practice is called cabling or bracing. Cabling uses steel wire, steel strand or synthetic-fiber and specialized hardware put into the wood to limit movement and provide supplemental support. Bracing uses lag-thread screws or threaded-steel rods in limbs, leaders, or trunks to provide additional support. Cabling and bracing are specialized skills that should only be performed by a certified arborist with experience in tree stabilization. All work to cable or brace should meet the industry standards set in ANSI A300 (Part 3) – Tree Care Operations Maintenance Standards, Support Systems (Cabling, Bracing, and Guying).

Observations

The inventory documented 18 trees that would benefit from cabling or bracing. Trees represent both conifer and deciduous species, ranging in sizes from 7 in. dbh to 32 in. dbh.

Recommendations

This option may not be appropriate for all identified trees. If determined not to be appropriate because of cost or other factors the other options would be do nothing and wait until the tree fails and then remove the tree, correct the structure problem with pruning, or change the management need to priority tree removal.

8.4 New Tree Planting

Natural forests reproduce trees naturally, producing seeds that are worked into the soil and grow randomly as conditions permit. Urban areas are influenced by man’s presence and planned to produce a desired environment. Planned environments are more appealing comfortable and ordered when trees and plants are included in the landscape. Trees have a limited life span, so to continue the presence of the forest canopy new trees need to be planted on a regular basis.

Standards

Urban forest management not only includes tree maintenance but also new tree planting. New trees planted in the cantonment area should meet industry standards set by the American National Standards Institutes. These standards include ANSI Z60.1 American Standards for Nursery Stock and the ANSI A300 Tree Care Operations: Part 6 (Transplanting). Table 2 shows the number of vacant spaces available in the management units.

MANAGEMENT UNIT	VACANT PLANTING SPACES
Community Life Residential	1264
Brigade Combat Team Facilities	229
Town Center	65
Memorial Boulevard	34
Community Life Facilities	29
Brigade Combat Team Housing	25
Community Life Recreation	21

Table 2. Number of Available Planting Spaces in Each Management Unit.

Observations

Tree planting sites were recorded in areas that have existing trees or could sustain trees to maturity. Areas suitable for planting include among buildings, houses, along streets and sidewalks. Greenspaces and park planting spots were not recorded because of multiple sites available that could support a mature tree. Tree spaces were recorded as one of three different tree sizes, large, medium, and small. Each site indicates the maximum mature size tree that would grow in that vacant site.

The inventory shows are1646 vacant tree spaces available to plant new trees. Table 3 shows the available sizes and numbers:

TREE SPACE SIZE	NUMBER OF SPACES
Large vacant sites	567
Medium vacant sites	546
Small vacant sites	533

Table 3. Number of Available Planting Spaces by Mature Tree Size.

Trees grow best when there is adequate room for root and crown development. The following tree sizes are recommended spacing between trees to allow for mature tree sizes. Three sizes of trees spaces are as follows: small tree – 30 to 35 feet; medium tree – 40 to 45 feet; large tree – 50 feet and greater, mature height.

Recommendations

Tree planting is a positive activity for Fort Campbell that can include participation from the RCI communities, soldiers, civic groups, schools and employees. To increase the number of trees in the Fort Campbell urban area, and to sustain the urban forest, a minimum of 100 total replacement and new trees in planting sites should be planted each year. In areas such as parks and

Figure 16. Tree planting at Fisher House.

greenspaces an inventory to identify available planting sites (in areas not collected in the 2006 inventory) would identify additional areas needing new trees.

9.0 Value of the Urban Trees

The value of urban trees is determined using the trunk formula method found in the ninth edition of the "Guide for Plant Appraisal" prepared by the Council of Tree and Landscape Appraisers. The formula is used on an individual tree and calculates the landscape value. The formula is: [installed plant cost * (species %) * (condition %) * (placement %)].

- The installation cost is the purchase price of the replacement tree plus the cost of materials and labor to install it.

- Species rating (species %), given as a percentage, is the desired value of a particular species. These ratings run from 5% to 100% and vary depending on the region within the United States. The Southern Chapter of the International Society of Arboriculture Tree Species Rating Guide was used to determine this percentage. An example rating is tree-of- heaven is listed as 45 % where southern red oak is rated as 80% (Southern Chapter ISA, 2005). Southern red oaks are more desirable in the landscape than tree-of-heaven.

- Condition (condition %)is based on the health and structure of the tree. Condition percentages are given in the range of 50% for critical condition, very poor = 60%, poor = 70%, fair = 80%, good = 90% and 100% for excellent tree condition.

- Placement (placement %) is a determination of how effective the tree is in providing its function and aesthetic attributes. One element looked at could be whether the site is large enough to maintain the tree's mature size.

The landscape value is the worth a tree has in the location in which it is planted. At the end of the urban tree inventory in 2006 the value of the trees in Fort Campbell's cantonment area was approximately $58.5 million. The value calculation was determined using the Davey Resource Group's Treekeeper software.

This value does not include the other benefits that trees provide such as energy savings, pollution absorption, storm water interception, and carbon dioxide storage. A dollar value can be determined for these benefits also. By knowing the costs of planting, after care and other costs to maintain and administer an urban forestry program and the value of the benefits, a cost benefit analysis, dollar value can be calculated. A cost benefit analysis was completed using the program STRATUM (Street Tree Resources Analysis Tool for Urban Forest Managers). However, STRATUM software only analyzes street tree data, so only street tree records were entered for this calculation. Fort Campbell's street trees represent six percent of the total tree population (number of street trees divided by total tree population). These records were entered to calculate a benefit value. Another limitation of the software is the reference data used within the software. It is from a city in the upper mid-west of the United States. Currently there is no reference data for the south central region in which Fort Campbell is located. Because trees grow differently in the different regions of the U.S., (ex. greater rainfall, longer growing season, and warmer

temperatures) the growth rates are under estimated for the data entered for Fort Campbell's trees and therefore the cost benefit analysis is low.

STRATUM calculated the benefits of energy savings, atmospheric reduction of carbon dioxide, air quality improvement, reduction of stormwater runoff, and aesthetics (from only the street trees at Fort Campbell) of $205,859. The benefit per tree is $107.27; being that this is only a small portion of the total tree population benefit dollar amount, actual dollar amounts would be larger for the whole population. To determine the total population benefits would require a fixed plot survey throughout the cantonment area. The 2006 inventory did not contain all the required data, therefore total population benefits are not available. The landscape trees planted in the cantonment area help increase the land value and the residents and personnel receive the environmental benefits. With the improvement of maintenance and management practices the values associated with better tree condition will increase total landscape values.

10.0 Improved and Semi - improved Tree Summary

The improved and semi-improved urban forest is healthy in 76% of the tree population. Portions of the tree population show mechanical damage and poor pruning practices. Observations during this inventory indicate that lack of knowledge on proper care continues to be the cause of the damage. Improper care has a tendency to stress trees and attract secondary insects and diseases, threatening the health of the tree. Diseases such as decay rot and cankers on branches or the trunk are not treated or pruned out until the tree's health is fading or the tree is dead. Crown cleaning of trees (removal of dead and diseased branches) on a regular cycle would help reduce the spread of disease to other trees and keep trees healthy. Newly planted trees would benefit from improved after-care. After-care practices such as correct mulching, along with watering newly planted trees when natural rain fall is lacking (drought conditions), would help ensure an increase in survival rates. Correct mulching, as outlined in the Installation Design Guidelines, prevents mechanical damage from lawnmowers and weed trimmers. New plantings seem to be limited to new construction and special projects, often planted on a limited basis. Proper care for new trees and shrubs is even more important with limited resources available for new landscape design.

As discussed in the "External Review of Army Forest Resources" the current urban forestry management practices used on Fort Campbell, and many other installations, will not sustain the urban forest resource. Removal of poor and dead trees and limited replacing of trees with poor after-care will reduce the population of trees and the benefits of mature trees. A proactive approach to tree care management would help achieve a sustainable urban forest resource.

11.0 Unimproved Forest Stands

Within the cantonment area there are several fragments of unimproved forest land. These forest stands are remnants of original forests or are planted non-native loblolly and Eastern white pine stands. Some stands are in sink holes and may not be suitable for development. All of the stands are unmanaged with many of them having been identified for future development. Some stands may be used for troop training, storm water interception and wildlife habitat. A list of wildlife and bird species can be found in Appendix B. Collectively, the mapped stands make up 393.6

acres; of these acres, 12.5 acres were either inaccessible or they were less than one acre and not inventoried for statistical reasons. The remaining 381.1 acres were inventoried using a standard timber inventory method.

Additionally, three of the stands were not inventoried because one had been identified for a new building project and two were under quarantine for *Histoplasmosis* and did not fit into the scope of work for the project (Figure 17).

11.1 Inventory Procedure

The inventory was completed between August 2006 and October 2006. The stands were named based on the management units set in the urban tree inventory. A point sampling method was used to collect information on the stand. The points were determined using a four chain by four chain (1 chain = 66 ft) grid layer over the 2004 aerial photos in ArcGIS 9.1 software. The longitude and latitude for each point falling within the stand was input and located in the field with a Magellan Medium Platinum GPS unit. The plot center was established when GPS showed location within five feet of the coordinates entered. The accuracy of the Magellan Medium Platinum is approximately 15 feet.

Once the sampling point was located, a 26.3 foot (1/20 acre) radius was identified to determine vegetation canopy closure for three levels: understory, mid-story, and overstory. The understory area is from the ground to ten feet in height. Plant forms in this zone are forbs, sedges, grasses, seedling trees, small and medium shrubs, and sapling trees. The midstory is the area space that is 10 feet to 30 feet in height. Plant forms in this zone are large shrubs and intermediate and suppressed trees. The overstory trees are above 30 feet in height and are co-dominant and dominant trees.

After canopy closure was determined a ten basal area prism was used to determine plot trees for the overstory tree observations. The information collected included species, tree diameter (measured at 4.5 feet), living status (alive or dead), timber quality (saw log or pulpwood), height of timber product, percent defective wood, crown class and crown condition. The information was used to evaluate the health of the forest stands and estimate the volume of merchantable timber within the stands. The information was collected with an Allegro field personal computer, utilizing NEDDC software developed by the United States Forest Service. The stand data was analyzed using NED2 -Ecosystem Management Decision Support software also developed by the United States Forest Service.

11.2 Forest Stand Information

The stands ranged from less than one acre to 156 acres. Stands are divided into management units: Brigade Combat Training (BCT) and the Community Life (COM). Management units are the same as the urban forest inventory management units. BCT management unit has 17 forest stands with 8 of the stands large enough to inventory. Two stands that were greater than one acre were not inventoried for security reasons. (Figure 17)

The cantonment area forest stands are made up of a variety of forest cover types.

Table 4 shows the forest cover types and their acreages as determined by the NED-2 software. The forest canopy is dominated by the species group “other hardwoods”. These are tree species that are not identified in broader groups such as oaks or southern bottomland hardwoods.

Forest Cover Type	**Sum of Acres**
Other hardwoods (hackberry/American elm/ ash)	339.2
Southern bottomland hardwoods	14.9
Oak – yellow poplar	13.7
Loblolly pine – shortleaf pine	11.2
Cherry	2.1
Total	381.1

Table 4. Forest Cover Type Acres

Canopy closure influences tree species make up and associated shrub and groundcover layers. The average canopy closure was calculated from data collected and input into NED-2. Canopy closure is the degree and depth of closeness of branches and leaves of individual crowns to other crowns and is an indicator of the amount of light reaching the ground. As canopy closure increases tree species that are shade tolerant have a better chance of reaching maturity. Those species that are intolerant of shade will struggle to survive unless the canopy is opened. Shade tolerance of tree species is listed in Appendix C. Table 5 shows the percent of canopy closure for the five cover types.

Cover Type	**% of Canopy Closure**
Other hardwood	50
Southern bottomland hardwoods	65
Loblolly – shortleaf pine	53
Oak – yellow poplar	60
Cherry	25

Table 5. Percent Canopy Closure for Unimproved Forest Stands

Canopy closure can also influence the introduction of invasive species. In a minimum of three stands, canopy closure has decreased, allowing more sunlight to reach the forest floor. The invasive grass species Japanese siltgrass *(Mirostegium vimineum)* has established and is continuing to move across the ground choking out native vegetation and tree seedlings. Japanese siltgrass has the potential to affect native species of insects that lay eggs on ground vegetation. The full effects of population changes have not been researched enough to predict future impact (Swearingen and Sheherezade, 2007). Currently there is no known biological control for the grass. Chemical herbicides have been effectively used for control; pre-emergent herbicide would be the best option as other herbicides used are non-selective and would kill all herbaceous plants. The use of mechanical or manual control methods are not realistic options due to terrain and manpower constraints. Control is possible but with the extent of the spread of the grass it would be costly. Invasive tree species, tree-of -heaven and Bradford pear, were found in stands; however their occurrence is not of enough concern at present. Tree species considered invasive in Kentucky and Tennessee are listed in Appendix C.

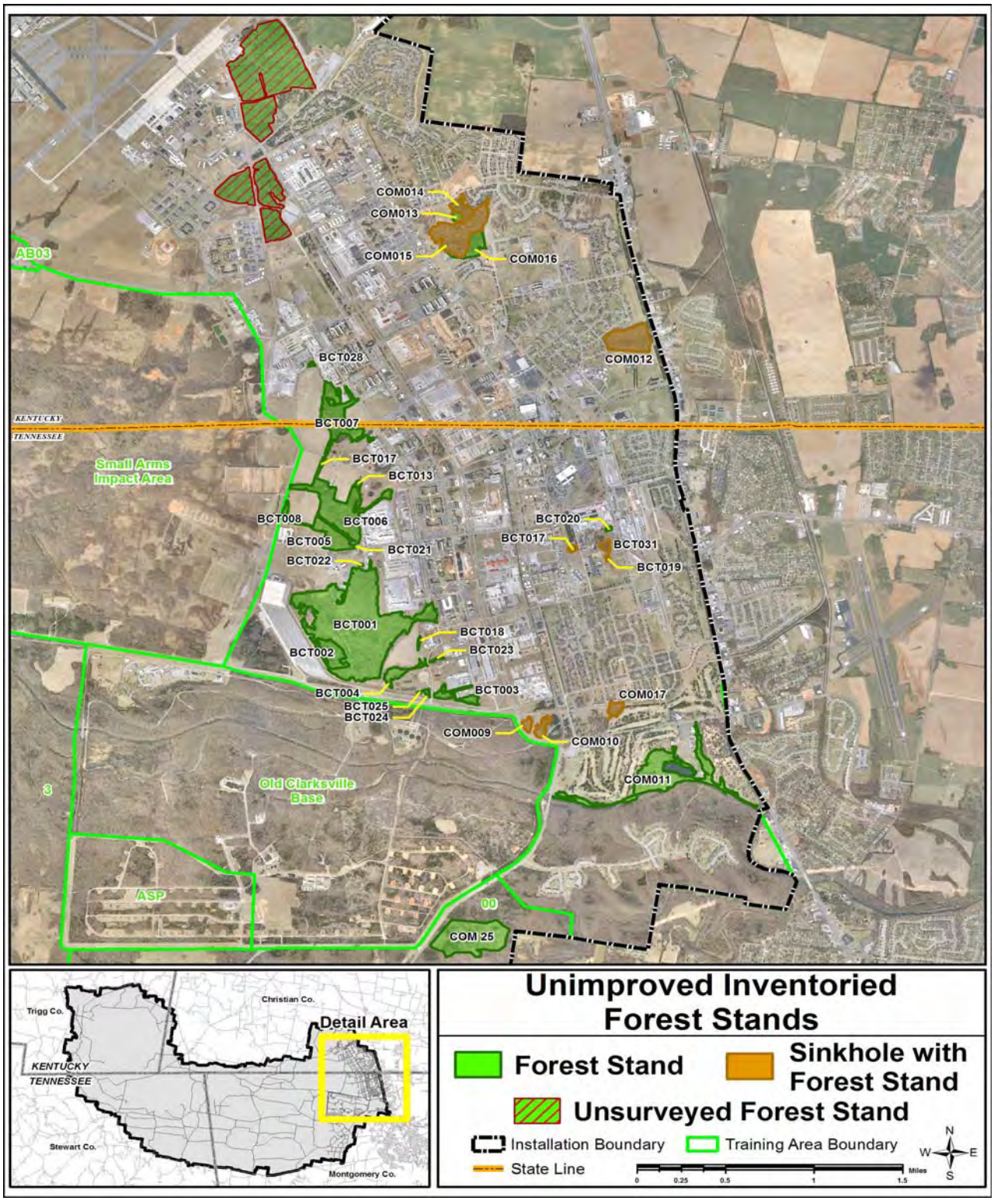

Figure 17. Unimproved Forest Stands

Canopy closure is related to the density of trees and their size. The acre is the standard area of measurement used in forestry to evaluate numbers and volume of trees. Stems per acre, or trees per acre, represents the amount of trees in the specified area. The information has been broken down by size class (< 6 in., < 12 in., $\geq$ 12 in.). This information shows which species have the highest density and occurrence in the stand. With silvicultural and timber management practices the desired species mix can be cultivated for wildlife or timber production. Pine species numbers are typically small in low diameter numbers, because they were planted and not established from seed. Table 6 below shows the stems per acre of the forest cover types.

Stems per Acre by Species

Forest Cover Type	< 6 “	< 12 “	> 12 “
Pine Species			
Loblolly pine	29	68	122
Shortleaf pine	0	7	29
Other Softwoods			
Eastern redcedar	124	128	12
Oak Species			
Southern red oak	2	4	19
Northern red oak	4	1	4
Pin oak	0	21	5
Cherrybark oak	0	18	9
Chinkapin oak	0	0	0
Post oak	1	2	1
Black oak	1	9	12
Scarlet oak	0	0	0
Chestnut oak	0	0	0
Shingle oak	6	6	4
White oak	10	8	3
Maples			
Red maple	0	2	1
Silver maple	0	1	2
Sugar maple	218	43	4
Cherry/Ash Yellow Poplar			
Black cherry	186	146	46
Ash (green, white)	416	129	62
Yellow poplar	27	9	33
Other Hardwoods			
Pecan	0	0	0
Eastern cottonwood	0	3	35
Common hackberry	336	355	98
Common persimmon	20	20	1
Sweetgum	0	0	0
Sycamore	1	1	21
Mockernut hickory	9	7	4
Pignut hickory	0	1	1

Stems per Acre by Species (cont'd)

Forest Cover Type	< 6 "	< 12 "	> 12 "
Other Hardwoods, cont't			
Shagbark hickory	0	0	2
American elm	247	69	23
Slippery elm	0	0	0
Winged elm	1	0	0
American beech	0	0	0
Black walnut	11	30	20
Black locust	1	24	7
Blackgum	0	0	4
Sassafras	106	39	12
Honey locust	52	48	4
Red mulberry	36	9	1
Non-Commercial Species			
Osage-orange	0	1	0
Sourwood	0	1	0
Flowering dogwood	335	9	6
Tree-of-Heaven	2	0	0
Eastern redbud	31	3	0
Boxelder	92	157	32
Hophornbeam	38	0	0
Total Stems per Acre	**2,070**	**1,397**	**640**

Table 6- Stems per Acre in Unimproved Forest Stands

Table 6 shows large numbers for trees less than 6 in. Ash, common hackberry, American elm, and flowering dogwood have the largest numbers in this small size class. As the trees grow, weather, disease, insects, animals and competition will reduce the trees numbers, leaving trees that are hardy enough to survive to maturity. Pine species planted by hand show little or no regeneration for future stands. Pines stands will eventually convert into hardwood stands as trees die or are harvested (Edwards 1987).

In accordance with Army Regulations, 200-1 and 405 – 90, Disposal of Real Property (May 1985), timber products are sold and associated monies are deposited into the proper account(s). Merchantable volume is determined by size (diameter at breast height) and height. Product prices are based on quality of wood product, which influences current market value. Cruise data volumes are estimates, actual volumes are determined when harvest is planned. Species volumes determined for board foot, cubic foot and ton per acre are listed below.

Volumes per Acre by Species

Forest Cover Type	Board Feet	Cubic Feet	Tons
Pine Species			
Loblolly pine	23,452	7,820	78
Shortleaf pine	7283	1,662	49
Other Softwoods			
Eastern redcedar	0	1,241	40
Oak Species			
Southern red oak	2,842	1,057	31
Northern red oak	1,092	285	9
Pin oak	650	382	11
Cherrybark oak	762	430	13
Chinkapin oak	23	6	0
Post oak	517	202	6
Black oak	5,317	1,453	44
Scarlet oak	32	11	0
Chestnut oak	154	6	0
Shingle oak	509	203	6
White oak	10	8	15
Maples			
Red maple	27	34	1
Silver maple	345	113	2
Sugar maple	811	548	16
Cherry/Ash Yellow Poplar			
Black cherry	5,959	3,631	108
Ash (green, white)	4,712	2,638	78
Yellow poplar	10,759	2,625	78
Other Hardwoods			
Pecan	56	23	1
Eastern cottonwood	13,873	3,616	108
Common hackberry	8,161	4,910	146
Common persimmon	98	125	4
Sweetgum	6	7	1
Sycamore	2,894	2,894	32
Mockernut hickory	1,025	337	10
Pignut hickory	92	33	1

Volumes per Acre by Species (cont'd)

Forest Cover Type	Board Feet	Cubic Feet	Tons
Other Hardwoods, cont't			
Shagbark hickory	85	62	2
American elm	1,832	1,057	31
Slippery elm	0	2	0
Winged elm	0	2	0
American beech	134	52	2
Black walnut	553	887	26
Black locust	354	24	7
Blackgum	617	321	8
Honey locust	628	635	19
Sassafras	908	805	24
Red mulberry	15	63	2
Non-Commercial Species			
Osage-orange	0	0	0
Sourwood	0	9	0
Flowering dogwood	0	64	2
Tree-of-Heaven	0	1	0
Eastern redbud	0	10	0
Boxelder	200	1,607	48
Hophornbeam	0	0	0
Total Volume per Acre	**96,787**	**4,921**	**1,059**

Table 7. Volume per Acre in Unimproved Forest Stands

11.3 Regulations

Policies and procedures govern the budgeting, accounting and reporting obligations associated with the production and sale of forest products at Army installations. (Title 10, United States Code (U.S.C.), Section 2665, Sale of Certain Interests in Land; Logs, and Army Regulation (AR) 200-1, Environmental Protection and Enhancement, 28 August 2007.) Chapter 4, Section 4-3 of the AR, Land Resources, regulates the sale of forest products and stipulates where fees received for the sales are deposited. It also stipulates that forest products may not be given away, abandoned carelessly, destroyed, used to off set the cost of construction, or traded for any type of supplies or services. Commercial harvests are administered by the Army Corp of Engineers with assistance of the Forestry Section of the Environmental Division. Non-commercial disposal of forest products requires that fair market value will be used to determine payment. Commercial

harvests shall be completed before construction begins to limit impact to forest resources. CAM Regulation 385-5, Sustainable Range Program, Safety and Integrated Training Area Management (14 September 2007), Chapter 21, Section 21-3, Training Area Stewardship, prohibits the cutting and removal of hardwood trees for use in training without permission of the post forester. This regulation also allows the use of scrub limb foliage (eastern redcedar, sumac foliage and pine) for use as camouflage. These regulations are intended to sustain the forest resource and support mission training and are applied to forest products in the cantonment area. Other pertinent regulations may also apply to protect water supplies, endangered species and cultural and/or historic resources.

11.4 Endangered Species

The Indiana bat and the gray bat are listed on the federal endangered species list and have been surveyed by trapping on post. Only the gray bat has been identified in the cantonment area. Forest stands near streams and riparian areas within the cantonment area can be suitable forage and roosting habitat for the bats. The Fort Campbell's Endangered Species Management Plan (February 2007) addresses the activities that can be detrimental to the conservation of foraging and roosting habitat (ESMP section 4.2). The Fort Campbell Endangered Species Coordinator should be consulted prior to forestry activities to determine if planned activities will degrade bat habitat.

11.5 Unimproved Forest Stand Summary

Unimproved forest stands are a small component of the cantonment area, but are important for wildlife habitat as well as other environmental benefits. They are largely mixed species in uneven-aged stands, currently unmanaged and allowed to grow with only natural, environmental conditions to affect changes to the forest structure. Stands in the northern portion of the area have been quarantined because of Histoplasmosis or identified for future construction projects (Figure 17). Most of the unimproved stands are classified as hackberry, American elm, and ash (green or white), one of the five cover types identified. The volume of merchantable trees for all the stands is 96,787 board feet per acre. Forest product sales in the undeveloped urban forests are sometime difficult based upon available volume and product for sale in traditional timber markets. New markets should be explored to best utilize the resources. In the largest stand much of the species make up is loblolly and shortleaf pine. Loblolly pine will continue to expand in open areas and abandoned roads. However, as the canopy opens up there is a chance of invasive species entering. In three stands the invasive Japanese stiltgrass has entered and is spreading across the forest floor preventing tree seedlings and other native vegetation from growing. This could develop into a serious problem in the future.

Over time the undeveloped forest stands will change as they reach over maturity. Quality of merchantable wood product will decline. Dying trees and increased ground vegetation will build up fuels loads and increase the chance of wildfires. The use of management practices employed in the rear training areas that keep stands healthy and the fire fuels in check would also improve stand structure and forest health. It is unrealistic to use prescribed fire in the cantonment area to control vegetative fuels; however a common saying among natural resource professionals is "It is not a matter of if a fire will happen as when the fire will happen." Fuel reduction with

mechanical measures, thinning tree densities to an acceptable level, could be used instead to reduce potential for wildland-urban interface fire.

12.0 Wildland-Urban Interface

Unimproved forest stands are part of the urban forest and do have benefits such as providing locations for troop training, storm water retention, and wildlife habitat. There is also potential danger from wildland fire. Although rare in the cantonment area, wildfire is always a risk to resources, people and property. However, with knowledge and planning the risk can be reduced.

Fire is a natural part of the forest ecosystem, and it is not unrealistic to expect a wildfire in any of the undeveloped stands. There are two fire hazard seasons in Kentucky, February 15 - April 30 and October 1 - December 15. These periods were set by Kentucky State Bill 164, Chapter 47, Section 1 KRS. 149.400 (amended 2003). These periods can be influenced by above normal moisture or drought conditions. Fort Campbell Fire Department is responsible for suppression of fires within the cantonment area. However, the department is not equipped with wildland fire equipment. When a wildfire occurs the fire department may request the Forestry Section assist with equipment and personnel to suppress the fire.

Many of the undeveloped forest stands in the cantonment area are near homes or buildings, putting these structures at risk in the event of a wildfire. Wildland – urban interface is defined as the fringe area where home and businesses intermingle with forests or wild lands. With buildings being at risk it's important that Directorate of Emergency Services personnel and RCI Partners, Fort Campbell Family Housing and Actus-Lend lease, understand the potential threats to residents and property. Housing areas like Cole Park and Gardner Hills and future development of The Woodlands are considered Wildland – Urban interface because of proximity to undeveloped forest stands. (Figure 21, page 46)

According to the Tennessee Division of Forestry the following factors are important in assessing risk: access, vegetation, building construction, special hazards, additional factors and defensible space.

12.1 Access: The ability of emergency vehicles to enter and exit an area is critical to saving people and structures. There should be more than one road in and out of all areas, so if for some reason the entrance or exit is blocked, emergency vehicles can still enter via another entrance. Currently Cole Park and Gardner Hill's developments each have only one road in and out.

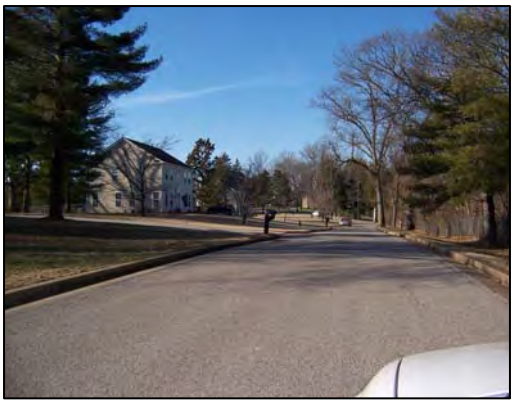

Figure 18. Roadway in Cole Park

Another factor of importance is road width. A narrow road with no shoulders limits emergency vehicles entry and maneuverability. The entrance at Gardner Hills is 21 ft. with 5 ft. shoulders; the rest of the roads are 30 ft. with no shoulders. The entrance at Cole Park is 18 ft. wide and the majority of the remaining roads are 21 ft. wide with little or no shoulder.

The National Fire Prevention Code 1141 states "Road width should be a minimum of 12 feet clearance for each lane of travel" (NFPA, 2003). Provisions in width should be made for drainage, snow removal, parking, and utilities.

12.2. Vegetation: Vegetation will feed the fire around adjacent lands and buildings. In unimproved forest stands vegetation has been allowed to grow with little or no management. This has left dead trees, standing and fallen, ladder fuels, shrubs, saplings and pole trees and build-up leaf litter from trees and shrubs. In some stands the loss of overhead canopy has allowed Japanese stiltgrass, and other weeds to establish, replacing native vegetation and adding to the litter layer. Heavy fuels cause more intense fires which are harder to control. The type of vegetation around buildings is just as important to the possibility of the building burning. Un-maintained evergreen trees and shrubs are more likely to burn than deciduous trees and shrubs, and, when located near buildings, flames can easily spread to the structure.

12.3 Building Construction: Materials used in home construction can also influence the ignition of the structure. Most common building materials will burn. Selecting flame resistant glass, siding and shingles will reduce or prevent the start of a fire and keep it from entering the interior of the structure.

The roof is the largest surface area of a building and the most vulnerable part of the structure. It can easily catch fire from wind blown embers. Asphalt shingles used in the interface area on older homes and newly constructed homes are recommended to prevent structures from catching fire.

Siding and wall construction are best when fire–restrictive or non – combustible construction materials are used. Using a minimum Class III, flame-spread rated siding material such as stone, brick, and/or stucco is best. Walls should be constructed of fire restrictive materials from the ground to the roof overhang. Newly constructed homes in Cole Park and the Woodlands subdivisions are constructed with wood and vinyl siding. Homes in Gardner Hills are constructed with two different materials: Becker Loop houses are constructed with brick from the ground to the roof while the homes along McAuliffe Ave. and other streets are constructed with brick fronts from the ground to the ceiling and vinyl siding on the other three sides from the ground to the roof. Homes in the area are vulnerable to heat and fire damage when wildland fire is in or near these.

The heat of a wildfire may be enough to ignite furnishings inside the home through the windows. Multi – paned glass provides insulation from trapped air and gives more protection from radiant heat than single – paned glass. It also reduces breakage potential from wind-blown debris.

12.4 Special Hazards: There are other elements that can affect the ability of fire fighters to access and save homes. Overhead utilities, such as powerlines, can prevent firefighters from entering an area. The heat from a wildland fire can cause lines to stretch, arc, or break damaging equipment and injuring personnel. Well-marked underground utilities are the safest. Currently overhead electrical and cable lines service the 70 homes on Barker Circle in Gardner Hills.

Underground lines power Cole Park, the Woodlands and homes on McAuliffe Way as well as Dexter, Snell and Hines Avenues in Gardner Hills.

Figure 19. Power Lines in Gardner Hills.

12.5 Additional Factors

The housing areas near forest stands, like Gardner Hills, have additional hazards such as the nearness of adjacent homes and the proximity of unmanaged forestlands. As discussed in the Section 12.3 of the Plan, these forest areas have dead vegetation and leaf litter that can cause a more intense wildfire and complicate its suppression. A more intense fire could increase the amount of hot embers hitting homes and igniting the structure. The proximity of homes to each other also adds to the potential of fire spread.

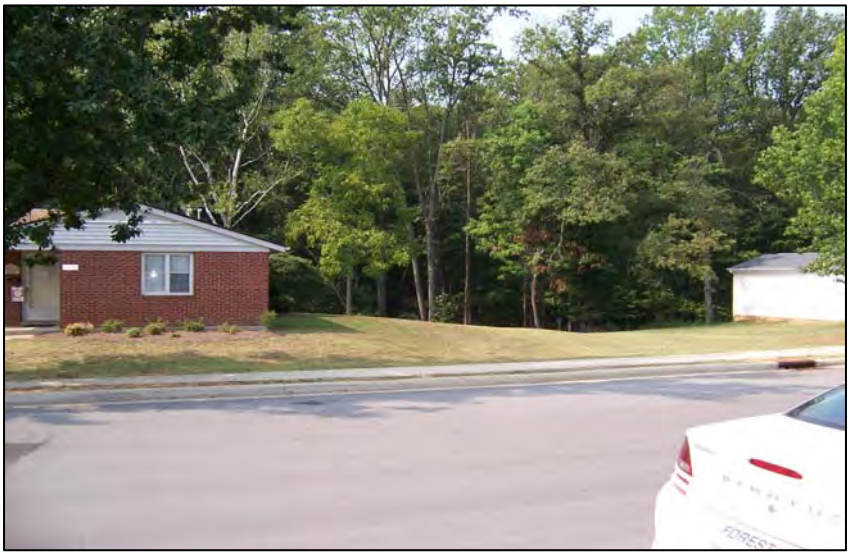

Figure 20. Homes near undeveloped forest stands.

12.6 Defensible Space

Defensible space is the area around a structure that reduces the fuels and fire flame lengths to an easily suppressible height thus preventing the flames from getting to the structure and causing major damage. The standard defensible space is 30 ft around buildings. This distance increases as slopes increase greater than 20 percent. Most of the housing areas on the installation have adequate space with turf grass from the forest edge leading to the structure.

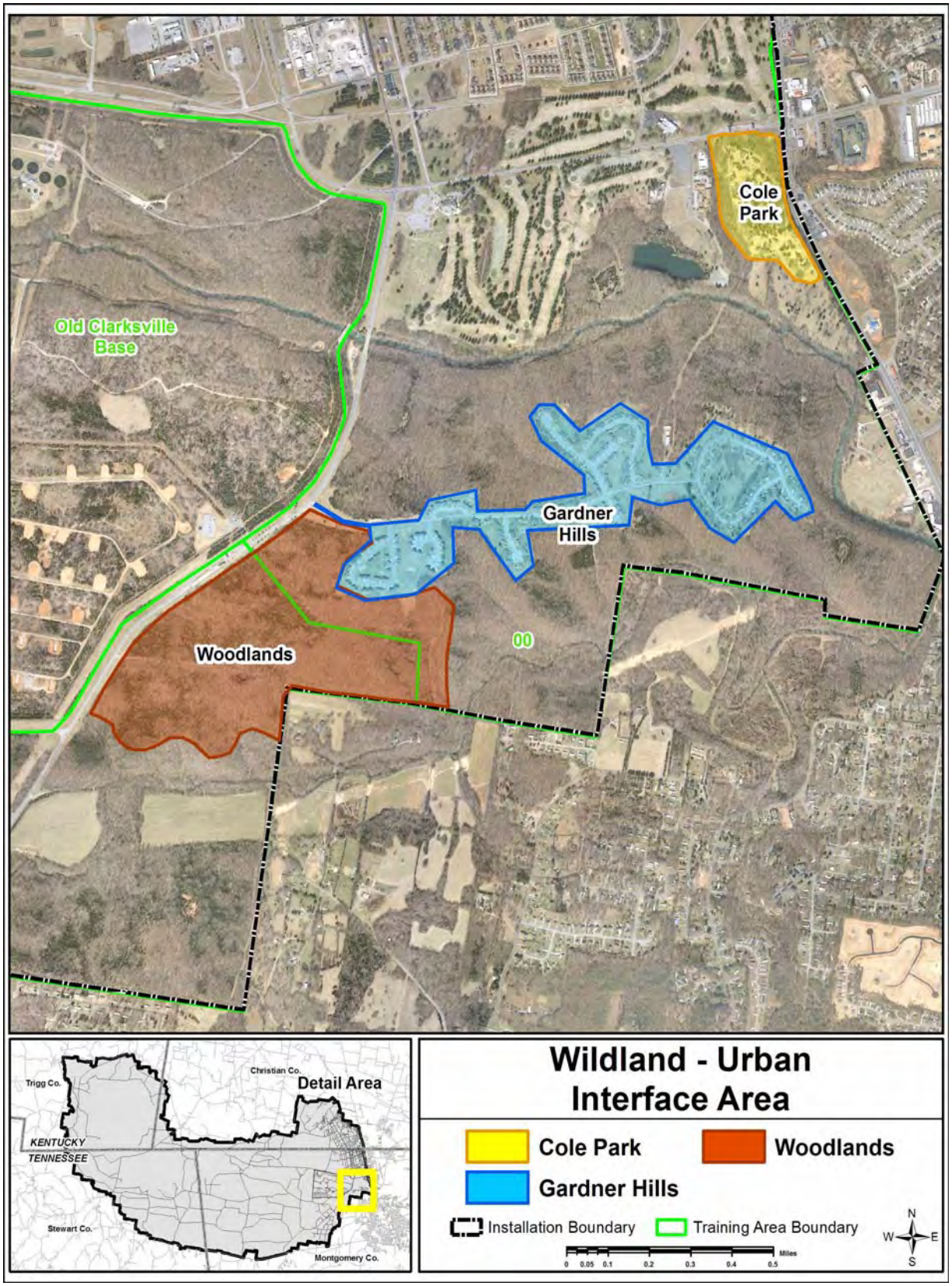

Figure 21. Wildland – Urban Interface Areas

13.0 Management Strategy

13.1 Staffing and Supervision

Management of urban forest trees and forests requires special knowledge and technical skills. Staffing with trained profession forestry personnel to supervise the various program elements will ensure specialized guidance is available to implement DoD policy for the management of urban forests. The number of installation personnel and their necessary technical skills should be dependent on the scope of the Urban Forestry Management program and the size and current condition of the urban forest complex. The use of contractors to accomplish desired goals, coordination and proper scheduling becomes important, and communication between personnel will be the key to success.

13.2 Command Tree Policy Directive/Tree Ordinance

Development of a Command Tree Policy Directive and/or a Tree Ordinance is recommended in Army Regulation 200 - 1. The policy or ordinance should identify and state specific requirements, authorizations and approvals for excavation permits, tree removals, and liabilities for unauthorized tree removal and damage, as well as for failure to use tree protection fencing. State law requires that all underground utilities be located before digging begins. This is accomplished with a dig permit from Directorate of Public Works.

13.3 Technical Assistance

To obtain technical assistance, Fort Campbell personnel may coordinate with forestry personnel at Army Environmental Center, Department of the Army. Also available is the U.S. Forest Service, state forestry, and county extension personnel. Guidance includes policies, standards, procedures, and periodic on-site advice to resolve technical problems and to establish goals to implement Urban Forestry Management Plans. Periodic consultation with specialists in related disciplines is essential to resolve specific problems. This assistance is commonly available through memoranda of understanding and cooperative agreements in applicable directives from the Department of the Army. Fort Campbell has entered into a Cooperative Fire Protection Agreement with the USDA Forest Service at Land Between the Lakes National Recreation Area. This agreement is in effect until 2010 unless renewed. Department of Defense has a Memorandum of Understanding with the United States Department of Agriculture related to food and agricultural sciences, pest management, nutrition, and other areas of mutual interest (e.g. forestry and wildlife). The document was signed in 1992. In the event of a national disaster the Department of Homeland Security's National Response Plan (December 2004) is in place to provide direction and assistance.

13.4 Directorate of Public Works Contract Management Branch

Personnel involved with contract management of the urban forestry program should have the necessary training to understand the basics of proper tree and shrub care and urban forest management. Personnel should also understand industry standards and practices, as required by Department of Defense, to ensure that hired contractors meet those standards and practices. Contractors involved with urban forest activities should have qualified, certified supervisors. Certification may be in the form of federal, state, or industry endorsed programs. Certification is needed for tree care, pesticide technicians, and landscape technicians. Some responsibility for tree and shrub care is passed on to unit personnel and housing residents for vegetation around buildings and homes. These people can be educated on proper watering, pruning and fertilizing practices. Conditions beyond the scope of urban forestry personnel should be referred through command for corrective action.

13.5 Equipment and Supplies

Urban forestry equipment should be maintained in good working order. Monthly inspections and prompt repair of any deficiency should be performed, and equipment should be serviced when needed. New technologies and equipment should be evaluated for use as needed. Equipment used for pruning or cutting trees should be cleaned with alcohol between trees and prior to re-use to eliminate transmission of pathogens.

Requirements for replacement trees and shrubs to maintain a forest canopy, should be evaluated annually and included in the yearly landscape maintenance financial and budget requests.

14.0 Preventive Maintenance for the Urban Forest

Urban forest work must be accomplished when the stage of plant growth is favorable and when soil and climatic conditions permit. Many operations, such as timing of planting and pruning are best accomplished when the plant is dormant or when the plant will have little or no stress. Otherwise plants are more susceptible to insect attacks or disease infections that can cause a decline in health. Well-managed ground maintenance programs should have a comfortable margin of reserve funds for emergencies. The need for these funds can be reduced when a preventative maintenance program is practiced. Preventative maintenance anticipates needs and requirements and accomplishes maintenance activities when they are most efficient and effective.

14.1 Tree Database and Inventory

The tree database created while completing the urban forest inventory is a working management tool. Management needs recorded in the database will provide guidance in maintenance actions. It can also be used to estimate a budget for annual maintenance. The database is most cost effective when used to reflect the changes to the forest and maintenance needs of the trees. The GIS data layer should also be corrected as changes are completed on the ground. An updated inventory should be conducted a minimum of every ten years. However, the urban forest changes frequently and the ideal period of continuous inventory would be five to seven years.

14.2 Wildland-Urban Interface Fire Risk

Wildland fire is always a possibility when undeveloped forest stands are near urban areas. In order to determine the potential risk an evaluation of housing areas should be conducted. This would identify present conditions and corrections that may need to be addressed either with land management or future community renovations.

14.3 Industry Standards and Safe Working Practices

Maintenance of trees and shrubs should be done in accordance with standard practices developed by leading professional organizations. Such standards include, but are not limited to, ANSI A300 for Tree Care Operations - Tree, Shrub, and Other Woody Plants Maintenance. Specific parts include: Pruning (Part 1), Fertilization (Part 2), Support Systems - Cabling, Bracing, and Guying (Part 3), Lightning Protection Systems (Part 4), Management of Trees and Shrubs During Site Planning, Site Development, and Construction (Part 5), and Tree Planting (Part 6). Companion books published by the International Society of Arboriculture for each part (1 – 6) are available describing Best Management Practices for tree care. The Departments of the Army and Defense accept these industry standards.

Post personnel and contractors involved with urban forest maintenance activities should use safe work practices as recognized by Occupational Safety and Health Administration and professional organizations (e.g. Tree Care Industry Association, International Society of Arboriculture). Industry practices are documented in the ANSI Z 133.1 – Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements.

14.4 Tree Removals

Hazard trees should receive first priority for removal, as public safety is a basic principle of urban forest management. Removals would include badly decayed trees and dead branches, especially those that threaten people, structures, powerlines, roadways, walkways, or rail lines. Those plants infected with insect and disease problems that cannot be treated should be removed and disposed of in a sanitary way as to not spread the problem, if contagious, to other plants. Volunteer trees that germinate and grow in unwanted areas should be removed. Stumps should be ground to the required depth and prepared for grass seeding. Trees in undeveloped open areas that are dead and pose no threat to structures or life may be left standing as they help enhance wildlife habitat within the cantonment area.

14.5 Hazard Tree Survey

Trees should be surveyed annually to determine potential risk in high use areas around buildings, residence, and campgrounds, etc. Inspections to determine these trees should be conducted in the fall and should follow the guidelines set in the publication “Urban Tree Risk Management: A Community Guide to Program Design and Implementation” (Pokorny and others 2003). Areas within the cantonment area should be identified as high, medium, or low risk areas. Based on this

assignment the trees should be inspected on a regular cycle (e.g., annually, bi-annually, every five years) to ensure that trees are observed and conditions evaluated on a regular basis.

14.6 Tree Pruning

The following are recommendations for pruning:

- Remove dead, decayed and diseased branches when branch could damage structures or harm people.
- Prune shade trees to reduce damage from wind and ice according to the guidelines established by industry standards.
- Prune trees that are planted too close to buildings to prevent damage to structures.
- Branches interfering with safety structures such as signs, streetlights and stop signs should be pruned and hazard branch(es) removed.
- Pruning should be completed when the cuts will not attract insects or provide access for disease. November to March is the ideal time.
- Pruning scheduling should be timed when wildlife nests are not occupied and active. The dormant season between November and March is the best time to prevent disturbance in these trees.

Pruning cycles help strengthen the sustainability of the urban forests. Plants managed under a routine pruning cycle remain healthy, live longer, and are safer than those rarely pruned. Over the life of the plant, maintenance costs are reduced and landscape value increases.

15.0 Tree Planting

Planting is important to maintaining a sustainable urban forest. Making sure that trees and shrubs are planted in the right place is important to the health of the plant and could reduce maintenance costs for the life of the tree or shrub. Determining the right site and species (or the right tree in the right space) takes planning and understanding of the landscape characteristics and soil properties. Best Management Practices developed by the International Society of Arboriculture will insure proper mechanics of tree planting and an increased survival of plants.

15.1 Site and Species Selection

Selecting a planting site depends on many factors: sunlight, soil properties, available water and the available room for growth. Soils information is part of the NRCS Service soil survey. Interpretation of soil survey data for the site plan will give basic soil properties, information important in the comprehensive plant site selection. Planting sites should be selected that will support a mature plant height and crown spread of the desired species. Minimum distances from buildings, street signs, streetlights, and other facilities should be observed as listed in the Fort Campbell Installation Design Guide. Trees planted under powerlines should be a height, at maturity that will not interfere with the operation and maintenance of the powerline.

Having a healthy plant material is the best start to having a healthy forest. Stock should be the appropriate form and character of the species desired. The plant should be healthy, undamaged and free of disease and insect problems. The foliage should be full, resilient, and moist to the

touch, rejecting overage materials; plants with poorly balanced branching, weak-stemmed plants and other material not well proportioned or fully branched. Commercial nursery stock suitable for use should meet industry standards set in the American Standards for Nursery Stock ANZI Z60.1 by the American Nursery and Landscape Association.

Native plants are best suited, and desired, for use in the landscape. They easily adapt to the region's environmental conditions and most often do not require special maintenance to survive. Those species acceptable for planting on Fort Campbell are listed in the Fort Campbell Installation Design Guide**.** Species not listed in the Design Guide must be approved by forestry section and master planning before planting. Native plants are those plants that will survive within the 6b hardiness zone (0 to -5 degrees Fahrenheit) set by the U.S. Department of Agriculture.

15.2 Tilling, Grading, and Drainage

Tilling and grading are important procedures for preparing soil for the establishment of planting and in preventing erosion. Following construction, soil and subsoil materials are often in poor condition for planting. Debris remaining after construction operations should be removed before further preparation continues. Break-up any stone or gravel layers with appropriate tools then mix and pulverize the upper 5 to 10 inches of soil. A rotary tiller is also helpful, but may be effective to only to a depth of 2 or 3 inches.

Make sure rain runoff does not accumulate on the planted area against structures that have prominent ridges, depressions, and unnecessarily steep grades. Contractors involved with installation of landscaping should meet all federal and state requirements and laws pertaining to the control of stormwater and sedimentation of on-site disturbances. Problems that would hinder the economical maintenance of the planted area should be eliminated.

15.3 Subsoil Improvements

Wherever topsoil is not available but the subsoil is deep enough to be worked, it is possible to institute an improvement program. With the treatment described below, most subsoil will support plant species.

Scarify as deeply as possible (recommended to a depth of 12 to 18 inches, depending upon the terrain, type of soil, and site location). Then incorporate composted organic matter such as leaves, manure, etc. After the additives have been thoroughly worked into the soil, prepare a smooth planting site and adjust the pH following recommendations determined by a soil test. Revegetate with appropriately selected plant material.

15.4 Mulching

Mulching, when done correctly, provides the following benefits: conserves moisture and prevents sharp temperature fluctuations in the soil, improves soil structure and aeration, prevents wind and water erosion, controls or reduces weed growth, decreases maintenance costs and prevents the need for mechanical weeding around the trunk. Mulch is an after planting step to

help the tree survive the root establishment period (1 to 5 years). Mulches should be attractive, resistant to fire, and relatively inexpensive.

Mulches may be classified as follows:

1. Organic

   Organic mulches are usually debris or byproducts of plants. Plant organic matter decomposes on the surface and decomposition products (i.e., humus and other compounds) slowly work down through the soil aggregates. A soil structure with increased porosity develops greater air and water holding capacity. Therefore, organic mulches are a definite benefit to the soil. Many of the commonly used organic mulches are tree bark, wood chippings, pine needles, straw, hay, and sphagnum peat. Each has characteristics to make it more or less suitable for specific situations.

2. Inorganic

   Inorganic mulches are natural and manmade substances which provide long-term protection. Some commonly used inorganic mulches include rock or gravel, sand, plastic roll (weed barrier), and fiberglass. Again, each type of mulch has characteristics that make it more or less suitable for specific situations.

Mulch should be applied to a depth of 2 to 3 inches. Organic and inorganic mulch should never be placed next to the woody stem to prevent mold and fungus from growing on the stem. Mulch should start three inches from the stem and continue out to the plant's dripline.

15.5 Aftercare Maintenance

Aftercare of a newly planted trees or shrubs is important to plant survival. Often without the proper aftercare to relieve the stresses of transplanting, newly planted trees and shrubs succumb to environmental causes of death. The following practices should be used in a landscape maintenance program:

- Newly planted trees should be watered with at least 5 gallons to help the soil settle and remove air pockets in the planting site.
- Newly planted trees should have mulch placed properly at time of planting. Protective tubing placed around the trunk of trees will protect the bark and trunk from mechanical damage (weed trimmer, mower).
- During drought conditions when natural rainfall is behind normal levels, plants should be supplemented with 1 in. of water per week for the first year.
- Trees that are staked should have stakes removed after one growing year (Best Management Practices - International Society of Arboriculture).
- Mulch should be replaced on a yearly basis.
- Structure pruning for newly planted trees should start three to five years after the tree has been planted and continued on a regular cycle until the tree is mature.

16.0 Urban Forest Management Operation Plan

16.1 Long Range Goals

Goal 1: Improve the quality of Fort Campbell's urban forest resource.

Objective: Tree quality will be improved by contracting those companies that show they have the required knowledge to provide quality pruning and removal care that meet industry standards. Army Regulation 200-1 which …"incorporates policy and related requirements from AR 200-3, AR 200-4, AR 200-5 (Chapters 4, 5, and 6)", requires that personnel and contractors involved with tree care and landscaping operations should be certified by a state or professional organization such as the International Society of Arboriculture. Work crews should be supervised by at least one certified arborist or a certified landscape technician when at the work site. Verification of certifications should be completed during the bidding process.

Objective: Implement aftercare practices which promote healthy plants. Such programs should include mulching and shields to protect tree trunks from mechanical and weed eater damage. Construction specifications should be written to identify these practices on all new plantings. Develop pruning schedules that train young trees for mature structural branch growth. Track pruning schedule in tree inventory or other database. Supplement watering for newly planted trees when significant deficit in moisture availability occurs due to lower than normal rainfall conditions.

Objective: Develop a hazard tree rating system and inspect trees during a time of year when defects can be observed. Document hazard tree inspections with prepared forms and arrange for corrective action when needed. Suitable periods would be annually for areas with high hazard species in high use areas (around permanent structures, concentrations of people, and stopped or parked vehicles). Medium risk areas should be inspected every three years for medium risk species (areas in which people and moving vehicles use is intermittent). Low risk areas should be inspected every five years this includes areas (with low people use, no structures and no vehicles). This should ensure all areas in the cantonment are evaluated.

Objective: Monitor potential insect and disease problems through USDA agency web-sites and trade literature. If the presence of an undesirable insect or disease that could have devastating effects on the urban forest and/or the surrounding area is found then sampling method(s) should be identified and implemented to locate the location of the pest(s). Treatment of the pest should be the most economical and safest method available. Make on post observations and identify pest present on trees, treating them as needed. Record insect and disease calls and other significant problems, when observed, in a database or spreadsheet.

Objective: Prepare procedures to respond to natural resource clean up from natural disaster emergencies. Develop an emergency tree response plan that identifies critical personnel and transportation circulation paths in the event of a natural disaster. Document pre-existing conditions and post event conditions to document changes.

Goal 2: Develop a tree replacement plan.

Objective: Replace and increase numbers of trees with the use of the urban forest inventory results and direct field observations. Priority areas would be determined based on current canopy coverage and available room for mature tree sizes as well as need for replacement of dead trees. Plantings should be designed and installed as funds permit. In some cases, existing, poor quality trees or poorly designed plantings should be removed to make way for new plantings. A tree coverage plan could give guidance and recommendations about tree placement. Species selection should follow Installation Design Guidelines. Document replacement trees by adding them to the existing tree inventory. Review all construction plans by 65 % for landscape plans or tree removal requirements. Record projects reviewed in a spread sheet or data base.

Goal 3: Maintain National Arbor Day Tree City, U.S.A award

Objective: Plan and hold an annual Arbor Day celebration and renew the Arbor Day proclamation. Promote proper tree care through education and best management practices within the Directorate of Public Works.

Goal 4: Increase the involvement of post residents and employees in urban forest planning and implementation.

Objective: Directorate of Public Works acknowledges that Fort Campbell's urban forests are managed and maintained (in part) for the people who live and work on post and those who visit. These people are not only affected by the urban forest resources on post, they also have major impacts on the resources and their long term sustainability. Residents and employees should be involved through annual educational and outreach programs, through tree-planting and care programs, and by direct assessments (survey) of their attitudes and desires involving urban forests. The survey should be conducted once during a five year period.

Post residents and employees will also need to be educated or trained since they establish, partially maintain, and significantly affect the health of a significant portion of the trees and shrubs on post. Training will be done through workshops, Earth Day and Arbor Day events, brochures/fact sheets, newspaper articles, newsletters, and other means. Numbers of attendees at educational programs will be recorded, and number of tree care documents produced would be inserted on a spread sheet for records.

17.0 Annual Work Plans

Segments of the long range goals and objectives need to be performed yearly. Projects to be undertaken will be set forth in the annual urban forestry work plan. Examples of these include: special projects, such as Arbor Day celebrations, and high priority items outlined in the long range plan, all recurring work and revisions necessitated by operational change of the installation, and required rehabilitation of reforestation caused by extreme weather, wildfire or other factors. The annual work plans are prepared in advance of the fiscal year in which the work is scheduled to assure adequate supplies, materials, equipment, man-power, and funds. The annual work plans would be coordinated with the installation Master Plan Division. The annual urban forestry work plan would be prepared using DoD Urban Forest manual guidelines and Department of the Army guidelines.

17.1 Recommended Project Descriptions

17.1.1 Tree Hazard Survey:

Survey of housing areas, parks and high traffic areas within the Cantonment area will be performed by a professional on the forestry staff trained in identifying hazard trees. A list of trees needing removal or corrective action will be developed during the survey and submitted to the appropriate maintenance partner (Fort Campbell Family Housing or DPW Contract Management).

17.1.2 Tree Replacement Program:

Periodic tree replacement is necessary to ensure a sustainable urban forest. Replacement plants will be purchased from accepted nursery stock and planted by contract, Fort Campbell Family Housing or special projects. Location of replacements will be determined from observation, tree inventory or tree replacement plan. Replacements will meet nursery and industry standards and follow the Fort Campbell Installation Design Guidelines.

17.1.3 Prepare Tree Cover Plan:

Develop a tree coverage plan that shows existing tree areas. Areas would then be prioritized based on planting sites available for full mature trees and replacement needs.
Tree planting needs shall be determined based on the planting sites inventory and field observations. Update the plan on a bi-annual basis to provide guidance for new and replacement plantings.

17.1.4 Tree Trimming and Removal:

Requests for tree trimming and removals are received via the service/work order desk.
Upon request forestry personnel can respond to requests for inspection and provide a recommendation of work that needs to be done. Other tree trimming work and removals will be developed from the Urban Forest tree inventory. No trimming or removal will be done without approval from DPW Contract Management, Fort Campbell Family Housing and DPW Forestry.

17.1.5 Renew Arbor Day Proclamation and Tree City USA Application:

Summit the annual application each year to the Kentucky Division of Forestry by the end of the current year. Arbor Day proclamation will be read at Arbor Day celebration. Historically the application has been signed by the Garrison Commander.

17.1.6 Natural Resource Management Plan and Forest Management Plan:

Ensure Integrated Natural Resource Management Plan and Forest Management Plan includes an Urban Forestry section and are compatible with this document and annual operational components of this plan. This document will be included as an appendix in the Forest Management Plan to meet this requirement.

17.1.7 Update Urban Forest Inventory:

Maintain the tree inventory database by removing and editing tree records as work is completed; including the urban tree layer in the GIS data base. Continue to add tree records as new trees are planted. Arrange to do a complete re-inventory of the cantonment area trees at year five of the established plan (2013).

17.1.8 Insect/ Disease Survey and Control:

Fort Campbell cooperates with the Tennessee Division of Forestry and the United States Department of Agriculture, Forest Service to detect the presence of exotic pest gypsy moth. Traps are placed in the cantonment area and the back training areas where they are monitored once every month through out the summer. Detection of Dutch elm disease will be done with visual inspections and sampling of suspected trees. Prior to removal of trees, when possible, a forestry staff member will inspect dead or dying trees to determine if insect or disease were a causal agent and if any treatment control needs to be implemented. An annual fly-over is scheduled in early spring, when possible, to detect indicators of Southern Pine Beetle. DoD Forest Pest Suppression projects may be funded following annual submission of project proposals when deemed necessary by installation personnel. Proposals must be validated following a biological evaluation of the problem and suggested controls.

17.1.9 Review all Construction Plans by 65% design for landscape specification or tree removal requirements:

Forestry staff should have the opportunity to review designs as soon as possible in the design process to ensure that trees and shrubs are suited for the area and that existing vegetation is utilized appropriately. Construction projects can be very detrimental to existing vegetation if not properly protected during construction.

18.0 Cost of Maintenance

Maintenance costs are a commitment to achieving a safe and healthy urban forest. Planting, pruning, and removals are only a small portion of the care required for the urban forest. Most of

the time they are the most expensive items needed. To date, most of the hazard trees have been pruned or removed, or have been scheduled for maintenance and the money has been budgeted. With identified hazards being dealt with, the other priorities can be managed as stand improvement. The total cost of pruning and removals of the remaining trees is estimated to be approximately $ 3,182, 165.00, based on 2006 DPW work contract prices. The cost should be included as part of the budgets of DPW and Fort Campbell Family Housing. The table below shows requirement costs.

Priority 2 Removals	$212,615.00
Priority 3 Removals	$464,510.00
Clearance Prunes	$56,420.00
Structure Training Prunes	$135,240.00
Routine Prunes - Large	$1,690,050.00
Routine Prunes - Small	$623,330.00
Total	**$3,182,165.00**

Table 8. Costs of Tree Care and Maintenance.

Increasing trees in the cantonment area planting spaces identified in the inventory is estimated to cost $383,860.00, as estimated from the 2006 Contract Management replacement tree price.

Work can be determined based on funds available for the current year. It is expected that it will take several years to complete routine pruning work. The first time routine pruning is done will cost more due to the fact that many of the trees have never been pruned. After the first scheduled routine pruning, additional future pruning can be scheduled on a set cycle. For example the trees between Tennessee and Kentucky can be pruned once every six years, removing dead and diseased branches. Other costs associated with tree care are establishment, insect and disease control, fertilizing, and supplemental watering.

These goals and objectives are developed to improve the health and safety of the Fort Campbell urban forest. With the dedication of the Directorate of Public Works and Fort Campbell Family Housing, the post can have a beautiful urban forest while supporting the mission of the Department of Defense and providing for the safety, health and education of the community.

Glossary

Best Management Practices:	Best-available industry recognized course of action, in consideration of the benefits and limitations, based on scientific research and current knowledge.
Branch Collar:	Area where a branch joins another branch or trunk that is created by the overlapping vascular tissues from the branch and the trunk. The base of the branch is typically enlarged.
Callus:	Differentiated tissue formed by the cambium, usually as the result of wounding.
Cambium Layer:	A thin layer of living, meristematic cells between the wood that gives rise (inward) to the xylem and (outward) to the phloem of a tree.
Closure:	Refers to the roll of the callus growth around the wound area.
Crown Cleaning:	Crown Cleaning is the selective removal of dead, diseased, detached, and broken branches. This type of pruning is done to reduce the risk of branches falling from the tree and to reduce the movement of decay, insects, and disease from dead or dying branches to the rest of the tree.
Crown Length:	On a standing tree the vertical distance from the leader to the base of the crown, measured to the lowest live branch excluding any epicormics branches.
Crown Raising/ Lifting:	Crown raising or lifting is the selective removal of lower branches to provide vertical clearance. Shortens or removes branches of a tree to provide clearance for buildings, signs, vehicles, pedestrians and vistas. Live crown ratio should be no less than 66 percent when raising/lifting is completed. Structural pruning should be considered when raising the canopy.
Crown Thinning:	Crown thinning is the selective removal of small live branches to reduce crown density. Because majority of the branches are at the outside edge of the crown, thinning is focused in that area. Proper thinning retains the crowns shape and should provide an even distribution of foliage throughout the crown. Thinning increases sunlight penetration and air movement through the crown. Thinning can also remove suckers from the base of the tree and some watersprouts on the interior.
Cultural Practices:	Refers to those maintenance practices that evolve use of plant selection, proper planting, placement, and pruning.

(The) Cut:	The exposed wood area that remains after the branch has been removed.
Cut Back:	Specified reduction of the overall size of the tree or individual branches, but may include the overall reduction of the sides as well as the top of the tree.
Declining Tree:	A tree in a poor state of health due to many combinations of problems. Problems may include old age, poor growing conditions, insect infestation, decay, root rot, mechanical damage, vandalism, drought or cultural practices.
Diameter at Breast (DBH):	Measurement standard for trees taken at four and a half feet (4 ½') height from finish grade.
Dormancy:	Period of naturally reduced physiological activity in the organs of a plant with the potential for reactivation of growth.
Drought Conditions:	A significant deficit in moisture availability due to lower than normal rainfall.
Field Capacity:	Soil water content resulting after the free water has been allowed to drain from a saturated soil for 1-2 days; expressed as a percentage on a dry-weight basis.
Free Water:	Water which moves into, through, or out of soil pores.
Geographic Information System:	An organized collection of computer hardware, software, geographic, and descriptive data, personnel, knowledge, and procedures designed to efficiently capture, store, update, manipulate, analyze, report, and display the forms of geographically referenced information and descriptive information.
Girdling roots:	Located above or below finished grade, whose circular growth around the base of the trunk or over the individual roots applies pressure to the bark area, there by choking or restricting the flow of sap.
Global Positioning:	A commonly hand held, satellite-based navigational device that records x, y, z coordinates and other data allowing users to determine their location on the surface coordinates and other data allowing users to determine their location on the surface of the earth.
Hardscape:	Paved area surrounding a tree and/or adjacent to a tree such as a sidewalk, street, curb, gutter, driveway, planter wall, retaining wall, walkway etc.

Hazard Assessment:	Identifying the risks associated with the trees involving the following: 1) a tree with a potential to fail, 2) an environment that may contribute to the failure, and 3) a target that may be damaged (i.e., person or property), recorded on a form for corrective action and priority determination.
Hazard Tree:	A tree (or part of a tree) that has a high potential for failure and hitting a nearby target because of dead or dying foliage, branches, roots or trunk.
Improved grounds:	Grounds on which intensive maintenance activates must be planned and preformed annually. Activities include mowing, irrigation, aeration, spraying, pruning, trimming, weeding, erosion control, drainage, and planting for landscape effects.
Live Crown Ratio:	The ratio of crown length to total tree height.
Landscape Value:	The calculated appraised value of a tree based on the cost of replacing the tree in the landscape. The Trunk Formula Method used to calculate the value can be found in the book Guide for Plant Appraisal, 9th Edition, published by the International Society of Arboriculture, Champaign, Illinois.
Lion Tailing:	The removal of all inner foliage from a particular branch displacing the weight to the end of the branch giving the appearance of a lion's tail.
Lifting:	The removal of lower branches for under-clearance.
Nuisance Tree:	A tree with the characteristics that include but are not limited to: a. Capability of damaging surrounding hardscapes to the point the costs associated with maintaining the tree exceeds its value. b. Produces excessive litter and creates an annoyance to pedestrian traffic. c. Reproduces itself excessively thus be coming weed like.
Parent Stem:	The main trunk system of the tree.
Precut/Precutting:	The removal of the branch at least 6" beyond the finished cut, to prevent splitting into the stem or branch.
Pruning:	The removal of dead, dying, disease, live interfering, objectionable and weak branches in a scientific manner.
Pruning Standards:	Pruning Standards which have been developed by American National Standards Institutes and have been adopted by the International Society of Arboriculture (ISA) and/or the Tree Care Industry Association (TCIA).

Tree Risk Zone:	An area occupied by mature trees that is defined by the amount of pedestrian traffic, permanent structures, and tree species resistance to decay. Referred to as defective tree risk zone.
Sap Flow:	The definite course assumed by sap in its movement through a tree.
Saprophyte:	An organism that obtains its nutrition from dead organic matter.
Scars and Injuries:	Natural or man made lesions of the bark in which wood is exposed.
Semi-improved Grounds:	Areas with periodic recurring grounds maintenance is preformed but to a lesser degree than on improved grounds. Practices normally include such cyclic variables as soil sterilization, weed, and brush control, drainage maintenance, mowing for fire protection and major land repair/restoration/rehabilitation as a result of mission activities.
Soil Bulk Density:	The mass of oven dried soil per unit bulk volume including the air space. The bulk volume is determined before drying to a constant weight at 105 degrees Celsius.
Street Trees:	Trees planted or to be planted in various parkways, along City streets, roads, boulevards.
Suckers:	Abnormal growth of small branches usually not following the (epicormic growth) general pattern of the tree.
Thinning Out:	The removal of live branches to reduce wind resistance and to create more space within the crown.
Topping:	Same as cut back.
Tracing:	Careful cutting of the bark along the lines of sap flow to encourage closure and to block the outline of the wound area.
Tree or Trees:	Trees, plants, or shrubs, shall mean woody perennial plants which usually have (but not limited to) a single dominate trunk and a mature height of fifteen (15) feet or more, or a trunk diameter of four (4) inches or more measured at twenty four (24) inches above grade.
Tree Space:	A growing spot with enough room to allow mature root growth and normal crown growth.
Trimming:	Same as pruning.

Unimproved Grounds:	Acreages not classified as improved or semi-improved grounds. Practices and intervals of attention are generally unpredictable such as evolve from flood, fire, insects, or disease epidemics.
Volunteer Tree:	A tree that is growing in a site that it was not intended. Most volunteer trees are products of wind, wildlife, or bird dispersal.
Wildland – Urban Interface:	The fringe area where homes and businesses intermingle with forests or wild lands.
Wilting Point:	The minimum soil moisture at which a plant wilts and can no longer recover its turgidity when placed in a saturated atmosphere for 12 hours.

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Appendix A

Improved and Semi-improved Area Tree List
Unimproved Area Tree List
Unimproved Areas Tree Shade Tolerance List

Improved and Semi – improved areas
Tree List

Common Name	Scientific Species	Common Name	Scientific Name
Balsam Fir	*Abies balsamea*	Flowering Dogwood	*Cornus florida*
White Fir	*Abies concolor*	Kousa Dogwood	*Cornus kousa*
Fraser Fir	*Abies fraseri*	Corneliancherry Dogwwood	*Cornus mas*
Amur Maple	*Acer ginnela*	European Filbert	*Corylus avellana*
Boxelder	*Acer negundo*	Common Smoketree	*Cotinus coggygria*
Black Maple	*Acer nigra*	Cockspur Hawthorn	*Crataegus crusgalli*
Japanese Maple	*Acer palmatum*	Washington Hawthorn	*Crataegus phaenopyrum*
Norway Maple	*Acer plantanodies*	Japanese Cedar	*Cryptomeria japonica*
Sycamore Maple	*Acer pseudoplantanus*	Leyland Cypress	*Cupressocyparis leylandii*
Red Maple	*Acer rubrum*	Common Persimmon	*Diospyros virginiana*
Silver Maple	*Acer saccharinum*	Euonymus ssp.	*Euonymus ssp.*
Sugar Maple	*Acer saccharum*	American Beech	*Fagus grandifolia*
Yellow Buckeye	*Aesculus flava*	European Beech	*Fagus sylvatica*
Tree – of - Heaven	*Ailanthus altissima*	White Ash	*Fraxinus americana*
Mimosa	*Albizia julibrissin*	European Ash	*Fraxinus excelsior*
Common Alder	*Alnus glutinosa*	Green Ash	*Fraxinus pennsylvanica*
Serviceberry ssp.	*Amelanchier ssp.*	Ginkgo	*Ginkgo biloba*
Common Pawpaw	*Asimina triloba*	Honeylocust	*Gleditsia triacanthos*
Sweet Birch	*Betula lenta*	Thornless Honeylocust	*Gleditsia triacanthos inermis*
River Birch	*Betula nigra*	Kentucky Coffeetree	*Gymnocladus dioicus*
Paper Birch	*Betula papyrifera*	English Holly	*Ilex aquifolium*
European White Birch	*Betula pendula*	Foster's Holly	*Ilex attenuata fosteri*
Gray Birch	*Betula populifolia*	Chinese Holly	*Ilex cornuta*
Bog Birch	*Betula pumila*	American Holly	*Ilex opaca*
Paper Mulberry	*Broussonetia papyrifera*	Black Walnut	*Juglans nigra*
American Hornbeam	*Carpinus caroliniana*	Western Juniper	*Juniperus occidentalis*
Bitternut Hickory	*Caraya cordiformis*	Rocky Mountain Juniper	*Juniperus scopulorum*
Pignut Hickory	*Caraya glabra*	Eastern Redcedar	*Juniperus virginiana*
Shellbark Hickory	*Carya liciniosa*	Goldenraintree	*Koelreuteria paniculata*
Shagbark Hickory	*Craya ovate*	Common Crapemyrtle	*Lagerstroemia indica*
Mockernut Hickory	*Carya tomentosa*	American Sweetgum	*Liquidambar styraciflua*
Pecan	*Carya illinoinensis*	Tuliptree	*Liriodendron tulipifera*
Chinese Chestnut	*Castanea mollissima*	Osage-orange	*Maclura pomifera*
Northern Catalpa	*Catalpa speciosa*	Southern Magnolia	*Magnolia garndifolia*
Atlas Cedar	*Cedrus atlantica*	Lily Magnolia	*Magnolia liliiflora*
Deoder Cedar	*Cedrus deodara*	Star Magnolia	*Magnolia stellata*
Common Hackberry	*Celtis occidentalis*	Sweetbay Magnolia	*Magnolia virginiana*
Katsuratree	*Cercidiphyllum japonicum*	Saucer Magnolia	*Magnolia x soulangiana*
Eastern Redbud	*Cercis Canadensis*	Common Apple	*Malus pumila*
Sawara Falsecypress	*Chamaecyparis pisifera*	Flowering Crabapple	*Malus spp.*

Improved and Semi – improved areas
Tree List

(Species list continued)

Common Name	Scientific Name	Common Name	Scientific Name
White Mulberry	*Morus alba*	Southern Red Oak	*Quercus falcata*
Red Mulberry	*Morus rubra*	Laurel Oak	*Quercus hemisphaerica*
Black Tupelo / Blackgum	*Nyssa sylvatica*	Shingle Oak	*Quercus imbricaria*
American Hophornbeam	*Ostrya virginiana*	Bur Oak	*Quercus macrocarpa*
Sourwood	*Oxydendrum arboreum*	Chinkapin Oak	*Quercus muehlenbergii*
Royal Paulownia	*Paulownia tomentosa*	Water Oak	*Quercus nigra*
Amur Corktree	*Phellodendron amurense*	Cherrybark Oak	*Quercus pagoda*
Norway Spruce	*Picea abies*	Pin Oak	*Quercus palustris*
White Spruce	*Picea glauca*	Chestnut Oak	*Quercus prinus*
Serbian Spruce	*Picea omorika*	Willow Oak	*Quercus phellos*
Oriental Spruce	*Picea orientalis*	English Oak	*Quercus robor*
Colorado Spruce	*Picea pungens*	Northern Red Oak	*Quercus rubra*
Bristlecone Pine	*Pinus aristata*	Shumard Oak	*Quercus shumardii*
Austrian Pine	*Pinus nigra*	Post Oak	*Quercus stellata*
Scotch Pine	*Pinus sylvestris*	Black Oak	*Quercus velutina*
Eastern White pine	*Pinus strobes*	Carolina Buckthorn	*Rhamnus caroliniana*
Loblolly Pine	*Pinus taeda*	Common Buckthorn	*Rhqmnus cathartica*
Virginia Pine	*Pinus virginiana*	Smooth Sumac	*Rhus glabra*
American Sycamore	*Platanus occidentalis*	Black Locust	*Robinia pseudoacacia*
White Poplar	*Populus alba*	Weeping Willow	*Salix alba 'Tristis'*
Eastern Cottonwood	*Populus deltoides*	Hankow Willow	*Salix matsudana*
Black Cottonwood	*Populus nigra*	Black Willow	*Salix nigra*
American Plum	*Prunus americana*	Sassafras	*Sassafras albidum*
Sweet Cherry	*Prunus avium*	Japanese Pagodatree	*Sophora japonica*
Cherry Plum	*Prunus cerasifiera*	Common Baldcypress	*Taxodium distichum*
Pin Cherry	*Prunus pensylvanica*	Japanese Yew	*Taxus cuspidata*
Common Peach	*Prunus persica*	Eastern Arborvitae	*Thuja occidentalis*
Black Cherry	*Prunus serotina*	Oriental Arborvitae	*Thuja orientalis*
Japanese Flowering Cherry	*Prunus serrulata*	Western Arborvitae	*Thuja plicata*
Higan Cherry	*Prunus subhirtella*	American Linden	*Tilia americana*
Yoshino Cherry	*Prunus x yedoensis*	Littleleaf Linden	*Tilia cordata*
Douglas-fir	*Pseudotsuga menziesii*	Silver Linden	*Tillia tomentosa*
Callery Pear	*Pyrus calleryana*	Eastern Hemlock	*Tsuga canadensis*
Common Pear	*Pyrus communis*	Western Hemlock	*Tsuga caroliniana*
Sawtooth Oak	*Quercus acutissima*	Winged Elm	*Ulmus alata*
White Oak	*Quercus alba*	American Elm	*Ulmus americana*
Swamp White Oak	*Quercus bicolor*	Lacebark Elm	*Ulmus parvifloia*
Scarlet Oak	*Quercus coccinea*	Siberian Elm	*Ulmus pumila*
		Slippery Elm	*Ulmus rubra*

Unimproved Area Tree List

Common Name	Scientific Name	Common Name	Scientific Name
Red Maple	*Acer rubrum*	Blackgum	*Nyssa sylvatica*
Boxelder	*Acer negundo*	Hophornbeam	*Ostrya virginiana*
Silver maple	*Acer saccharinum*	Sourwood	*Oxydendrum arboreum*
Sugar maple	*Acer saccharum*	Shortleaf pine	*Pinus echinata*
Tree-of-heaven	*Ailanthus altissima*	Loblolly pine	*Pinus taeda*
Mockernut hickory	*Carya tomentosa*	Sycamore spp.	*Platanus spp.*
Pignut hickory	*Carya glabra*	Eastern Cottonwood	*Populus deltoides*
Pecan	*Carya illinoinensis*	Black cherry	*Prunus serotina*
Common Hackberry	*Celtis occidentalis*	White Oak	*Quercus alba*
Eastern Red Bud	*Cercis canadensis*	Scarlet Oak	*Quercus coccinea*
Flowering dogwood	*Cornus floidia*	Southern Red Oak	*Quercus falcata*
Common persimmon	*Diospyros virginiana*	Cherrybark Oak	*Quercus pagoda*
American Beach	*Fagus grandifolia*	Pin Oak	*Quercus palustris*
Ash	*Fraxinus spp.*	Chestnut Oak	*Quercus prinus*
Honeylocust	*Gleditsia triacanthos*	Post Oak	*Quercus stellata*
Black walnut	*Juglans nigra*	Northern Red Oak	*Quercus rubra*
Eastern Redceadar	*Juniperus virgianiana*	Black Oak	*Quercus velutina*
Sweetgum	*Liquidambar styraciflua*	Black Locust	*Robinia pseudoacacia*
Tuliptree	*Liriodendron tulipifera*	Sassafras	*Sassafras albidum*
Osage orange	*Maclura pomifera*	American Elm	*Ulmus americana*
Red mulberry	*Morus rubra*	Slippery Elm	*Ulmus rubra*

Unimproved Areas Tree Shade Tolerance List

Common Name	Scientific Name	Shade Tolerance	Common Name	Scientific Name	Shade Tolerance
Red Maple	*Acer Rubrum*	intermediate	Hophornbeam	*Ostrya virginiana*	tolerant
Boxelder	*Acer negundo*	intolerant	Sourwood	*Oxydendrum arboretum*	intermediate
Sugar maple	*Acer saccharum*	tolerant	Shortleaf pine	*Pinus echinata*	intermediate
Silver maple	*Acer saccharinum*	intermediate	Loblolly pine	*Pinus taeda*	tolerant
Tree-of-heaven	*Ailanthus altissima*	intermediate	Sycamore spp.	*Platanus spp.*	tolerant
Mockernut hickory	*Carya tomentosa*	intermediate	Eastern Cottonwood	*Populus deltoides*	intermediate
Pignut hickory	*Carya glabra*	very intolerant	Black cherry	*Prunus serotina*	tolerant
Pecan	*Carya illinoinensis*	intolerant	White Oak	*Quercus alba*	intermediate
Common Hackberry	*Celtis occidentalis*	intermediate	Scarlet Oak	*Quercus coccinea*	intolerant
Eastern Red Bud	*Cercis canadensis*	tolerant	Southern Red Oak	*Quercus falcata*	intermediate
Flowering dogwood	*Cornus florida*	tolerant	Shingle Oak	*Quercus imbricaria*	intolerant
Common persimmon	*Diospyros virginiana*	intermediate	Chinkapin Oak	*Quercus muehlenbergii*	intolerant
American Beach	*Fagus grandifolia*	tolerant	Cherrybark Oak	*Quercus pagoda*	tolerant
Ash	*Fraxinus spp.*	intermediate	Pin Oak	*Quercus palustris*	intolerant
Honeylocust	*Gleditsia triacanthos*	intolerant	Chestnut Oak	*Quercus prinus*	intermediate
Black walnut	*Juglans nigra*	intermediate	Northern Red Oak	*Quercus rubra*	intermediate
Eastern Redceadar	*Juniperus virginiana*	intermediate	Post Oak	*Quercus stellata*	intermediate
Sweetgum	*Liquidambar styraciflua*	intolerant	Black Oak	*Quercus velutina*	intermediate
Tuliptree	*Liriodendron tulipiferia*	intolerant	Black Locust	*Robinia pseudoacacia*	intolerant
Osage orange	*Maclura pomifera*	tolerant	Sassafras	*Sassafras albidum*	intermediate
Red mulberry	*Morus rubra*	intermediate	American Elm	*Ulmus americana*	intermediate
Blackgum	*Nyssa sylvatica*	tolerant	Slippery Elm	*Ulmus rubra*	tolerant

Shade Tolerance Definitions

Shade tolerance – The relative capacity of a plant to become established and grow in the shade of over topping vegetation. The terms below are used to express the relative shade tolerance.

Shade tolerant – Trees in this category require 3 to 10% full light or a closed canopy with some gaps in order to survive.

Intermediate tolerant – Trees in this category require 10 to 30% of full sun. Woodland edge trees are often in this category.

Shade intolerant – These trees require 30 to 60% of full sun to develop properly. Pioneer invader trees are often in this category.

Very shade intolerant – Very intolerant trees require at least 60% of full sun to survive and grow.

Appendix B

Bird and Mammal Species Found in the Cantonment Area

Bird Species Identified in Fort Campbell's Cantonment Area

Family	Common Name	Scientific Name
Blackbirds, Orioles, and Grackles, etc.	Red-winged blackbird	*Agelaius phoeniceus*
Cardinals, Grosbeaks, and Allies	Northern cardinals	*Cardinalis cardinalis*
Cranes	Sandhill crane	*Grus canadensis*
American Crow	American crows	*Corvus brachyrhynchos*
Ducks, Geese and Swans	Wood duck	*Aix sponsa*
Ducks, Geese and Swans	Canada goose	*Branta canadensis*
Falcons and Caracaras	American kestrel	*Falsco sparverius*
Finches, Siskins, and Crossbills	American goldfinch	*Carduelis tristis*
Finches, Siskins, and Crossbills	Pine siskin	*Carduelis pinus*
Grebes	Pied-billed grebe	*Podilymbus podiceps*
Hawks, Eagles, and Kites	Northern harrier	*Circus cyaneus*
Hawks, Eagles and Kites	Red – tailed hawk	*Bueto jamaicensis*
Hawks, Eagles and Kites	Copper's hawk	*Accipiter cooperii*
Hawks, Eagles and Kites	Red – shouldered hawk	*Buteo lineatus*
Hawks, Eagles and Kites	Bald eagle	*Haliaeetus leucocephalus*
Herons, Egrets, and bitterns	Great blue heron	*Ardea herodias*
Herons, Egrets, and bitterns	Green heron	*Butorides virescens*
Herons, Egrets, and bitterns	Cattle egret	*Bubulcus ibis*
Larks	Horned lark	*Eremophila alpestris*
Loons	Common loon	*Gavia immer*
Mockingbirds and Thrashers	Northern Mockingbird	*Mimus polyglottos*
New World Vultures	Turkey vulture	*Cathartes aura*
Nuthatches	Red – breasted Nuthatch	*Sitta canadensis*
Owls	Great horned owl	*Bubo virginianus*
Pigeons and Doves	Rock dove	*Columba livia*
Pigeons and Doves	Morning dove	*Zenaida macroura*
Plovers and Lapwings	Killerdeer	*Charadrius vociferus*
Rails, Gallinules, and Coots	American coot	*Fulica americana*
Sandpipers and Phalaropes	Common snipe	*Gallinago gallinago*
Sparrows, Towhees, and Juncos	Chipping sparrow	*Spizella arborea*
Starling	European Starling	*Strunus vulgaris*
Swallows	Northern rough – winged swallow	*Stelgidopteryx serripennis*
Swallows	Purple martin	*Progne subis*
Swifts	Chimney swift	*Chaetura pelagica*
Thrushes	Eastern bluebird	*Sialia sialis*

Bird Species Identified in Fort Campbell's Cantonment Area

Species list continued

Family	Common Name	Scientific Name
Thrushes	American robin	*Turdus migratorius*
Turkeys	Eastern wild turkey	*Meleagris gallopavo*
Tyrant Flycatchers	Eastern kingbird	*Tyrannus tyrannus*
Vireo	Warbling vireo	*Vireo gilvus*
Wood Warbler	Pine warbler	*Dendroica pinus*
Woodpeckers	Red – headed woodpecker	*Melanerpes erythrocephalus*
Wrens	House wren	*Troglodytes aedon*

Mammal Species Identified in Fort Campbell's Cantonment Area

Scientific Name	Common Name
CANIDAE	**DOGS and Allies**
Canis latrans	coyote
Urocyon cinereoargenteus	gray fox
Vulpes vulpes	red fox
CASTORIDAE	**BEAVERS**
Castor canadensis	beaver
CERVDAE	**DEER, ELK AND MOOSE**
Odocoileus virginianus	white-tailed deer
DIDELPHIDAE	**OPOSSUMS**
Didelphis marsupialis	opossum
FELIDAE	**CATS**
Lynx rufus	bobcats
LEPORIDAE	**RABBITS AND HARES**
Sylvilagus floridanus	eastern cottontail rabbit
MEPHITIDAE	**SKUNKS**
Mephitis mephitis	striped skunk
MURIDAE	**RATS AND MICE**
Peromyscus maniculatus	deer mouse
Reithrodontomys humulis	eastern harvest mouse
Orchrotomys nuttalli	golden mouse
Mus musculus	house mouse
Zapus hudsonius	meadow jumping mouse
Ondatra zibethicus	muskrat
Microtus pinetorum	pine vole
Oryzomys palustris	rice rat
Synaptomys cooperi	southern bog lemming
Peromyscus leucopus	white-footed mouse
MUSTELIDAE	**WEASLES AND ALLIES**
Lutra canadensis	river otter
PROCAYONIDAE	**RACCOONS**
Procyon lotor	raccoon
SCIURIDAE	**SQUIRRELS**
Tamias striatus	eastern chipmunk
Sciurus niger	fox squirrel
Sciurus carolinensis	gray squirrel
Marmota monax	groundhog
Glaucomys volans	southern flying squirrel

Mammal Species Identified in Fort Campbell's Cantonment Area

Species list continued

Common Name	Scientific Name
SORICIADAE	**SHEWS**
Sorex cinereus	masked shrew
Sorex hoyi	pygmy shrew
Blarina brevicauda	short-tail shrew
Sorex longirostris	southeastern shrew
TALPIDAE	**MOLES**
Scalopus aquaticus	eastern mole
VESPERTILIONIDAE	**MOUSE-EARED BATS**
Eptesicus fuscus	big brown bat
Pipistellus subflavus	eastern pipistrelle bat
Nycticeius humeralis	evening bat
Myotis grisescens	gray bat
Lasiurus cinereus	hoary bat
Myotis sodalis	Indiana bat
Myotis lucifugus	little brown bat
Lasiurus borealis	red bat
Lasiurus seminolus	seminole bat
Lasionycteris noctivagans	silver-haired bat

Appendix C

Invasive Tree Species of Kentucky and Tennessee

Common Name	Scientific Name
Tree-of -heaven	Ailanthus altissima
White mulberry	Morus alba
Mimosa	Albizia julibrissin
Princess tree	Paulownia tomentosa
Paper mulberry	Broussonetia papyrifera
Chinaberry tree	Melia azedarach
Bradford pear *	Pyrus calleryana ‘Bradford’
Chinese tallowtree *	Sapium sebiferum

KENTUCKY – TENNESSEE INVASIVE TREES SPECIES

Appendix D

Photographs of the Urban Forest - Care and Concerns

Planting, Placement and Establishment

Good Planting Practices

Correct mulching is important to tree health and establishment.

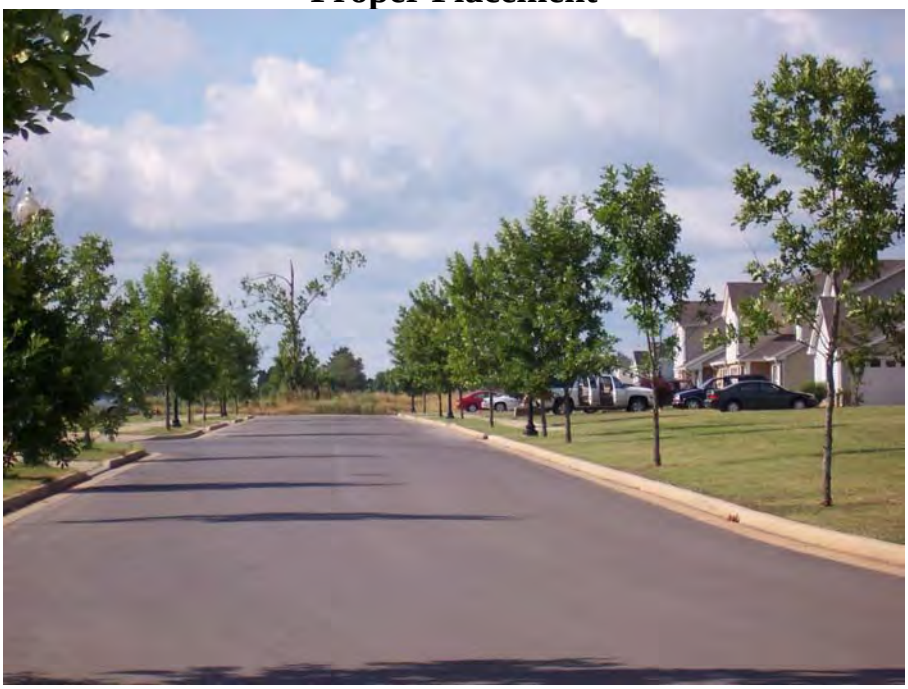
Proper staking method and “water bags” help to stabilize and provide needed water to the roots.

Poor Planting Practices

Wire baskets, burlap, and twine left on the root ball can cause roots to be stunted or girdled, causing the death to the root(s) and tree.

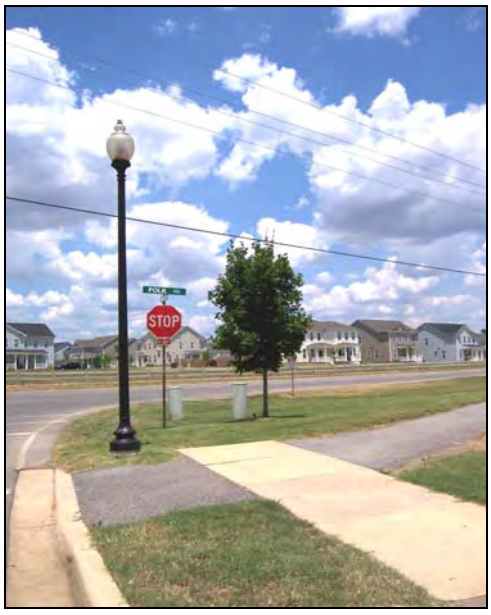
Tree Placement

Proper Placement



Tree lined streets of Milcon Sub-division

Poor Placement



Poor placement of trees creates future maintenance problems. Large trees grow into power lines and block out street lights and stop signs. Spacing and mature tree height should be considered to prevent future damage or create liabilities

Arbor Day Plantings

2005

2006

2007

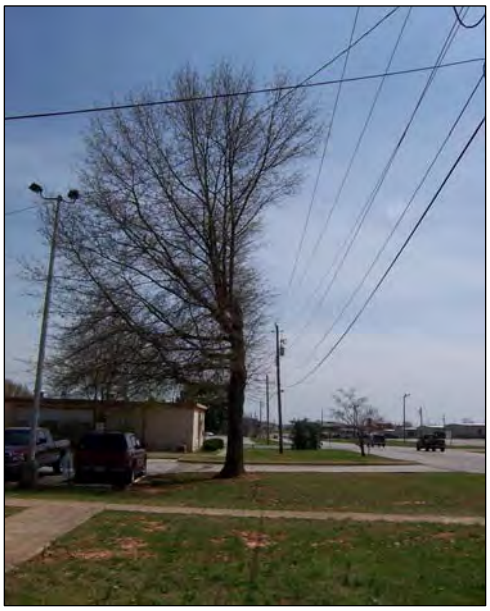
2008

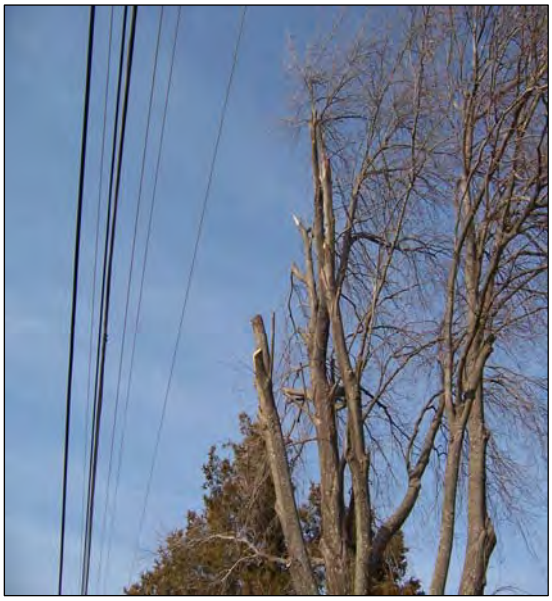
Pruning and Maintenance

Proper pruning cuts allow pruning wounds to heal without scaring.

Flush cuts prevent the trees defenses from healing properly and may allow insects and diseases into the tree.

Leaving poorly pruned branches can introduce decay and weaken the tree’s structure.





Improperly pruned branches near power lines make the tree look ugly
and create future management problems.

Applying best management practices would help trees and utilities co-exist.

Topping trees causes ……

1.…tree stress. 2.…new wounds allowing decay to form.
3....sunburn of tissue below the bark.
4.…branch growth to double, creating hazardous branches in storms.
5.…reduction in home and land value. 6.…the tree to look ugly!

Mechanical damage from lawn mowers and weed trimmers shorten the tree's life by girdling the trunk and allowing decay to enter the heartwood.

Storm Damage

Golf course after ice storm - Christmas 2004
Emergency Storm Response Plan will help organize clean up efforts making them cost efficient.

Barkley Elementary School after Thunderstorm
Identification and removal of hazard trees is important to preventing incidences like this.

Cole Park Elm Tree

Estimated landscape value: $13,575 before 1/23/08

Estimated landscape value: $5, 732 after storm of 1/30/08

Positive Images of Urban Forests

BCT Area

Cole Park Housing Area

Fall at Milcon Park

Gander Memorial Grove

Bastogne Avenue near Werner Park

Tree City, USA - presented Arbor Day 2006

Integrated Wildland Fire Management Plan

2013

Fort Campbell, Kentucky

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Introduction

This plan outlines and defines Fort Campbell's responsibilities and standard operating procedures for wildland fire management. In 2002, the Department of the Army issued Army Wildland Fire Policy Guidance (see Appendix A). In accordance with that guidance, installations with unimproved grounds that presented a wildfire hazard and/or utilized prescribed fire as a land management tool were tasked to develop and implement an Integrated Wildland Fire Management Plan (IWFMP) that was compliant and integral with the Integrated National Resource Management Plan (INRMP). The IWFMP contains programmatic authorities, wildland fire standards, personnel certification, training and fitness standards, and funding direction. The document also contains deployment and reimbursement procedures for civilian firefighters detailed to wildland fire incidents off the installation.

The intent of this plan is to augment and support doctrine and guidance provided by higher. Unless otherwise stated, all incidents will be managed using the Incident Command System (ICS). The flexibility and organization it provides allows for a very adaptive and "military like" approach to incidents. It provides the Incident Commander (IC) the means to plan, manage and adapt to incident objectives and goals. Additionally, Federal and State first responders all use the ICS system. It is a common and mutually supportive structure that is recognized and accepted widely. The intent of the fire management program is to manage incidents, planned and unplanned, for safety and success.

Throughout this document references are made to policy and guidance, National Wildfire Coordinating Group (NWCG) standards and PMS 310-1 standards. It is not the intent of this document to re-write or overwrite Federal policy. This document seeks to establish standards of operation and outline the flow of operations as it applies to fire management on the Fort Campbell Military Installation.

Fire management is adaptive in nature. Lessons learned in wildland fire are hard earned. Ways to conduct fire business safer and better are always evolving through After Action Reviews (AARs), Facilitated Learning Analysis (FLAs), investigations and other tools. These lessons need to be captured and incorporated into operations quickly. In order for this document to be accurate and current with Federal policy it is necessary to use and reference that policy and keep installation and local standard operating procedures to a minimum, while being detailed enough to outline local factors and risks.

1.0 Fire Management

Fire Management includes all activities and/or operations associated with wildland fire and prescribed fire.

Wildland fire is described as "a fire occurring on wildland that is not meeting management objectives and thus requires a suppression response" (as per the NWCG Glossary). For this document, wildland fire is any unscheduled fire that occurs in the training areas, ranges and impact areas.

A prescribed fire operation (also referred to as a prescribed burn) is a "controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions which

allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives" (NWCG Glossary).

1.1 Goals and Objectives

1.1.1 Fire Management Policy

The fire management policy of Fort Campbell is intended to be flexible and responsive to the resource management objectives outlined in the INRMP. The following principles are fundamental in shaping the fire management policy:

- Firefighter and public safety with sound risk management is the first priority in every fire management activity.
- The proper training and certification in wildland firefighting techniques and fire behavior.
- The role of fire is an essential ecological process and natural disturbance that will be incorporated into the planning process of fire management activities.
- Fire management plans and activities will support land and resource management objectives.
- Fire management plans and activities are based on the best available science and incorporate public health and environmental quality considerations.
- Standardization of policies and procedures among federal agencies is an ongoing objective.

1.1.2 Fire Management Goals

Fort Campbell has developed standard operating procedures for fire management activities. Within the framework of the fire management policy, the goals of the fire management program at Fort Campbell are one in the same with the Installation Natural Resource Management Plan (INRMP) and are:

- Ensure the long-term sustainability of the lands to support the military mission.
- Maximize integration among natural resources programs, and integration of those resource management strategies with military operations.
- Ensure that all Fort Campbell activities, including natural resources management activities, comply with federal and state laws, DoD Instructions, Army Regulations, and Fort Campbell policy related to natural resources.
- Manage natural resources according to an ecosystem management approach to maintain a healthy natural environment.
- Maintain or increase the abundance and diversity of native species.
- Maintain effective reimbursable programs.
- Provide ample recreational opportunities.
- Accommodate multiple uses of the land.

1.1.3 Objectives

The objectives of the fire management program are to:

- Enhance military training maneuvers through maintaining low-density understory layer and mature timber through the regular, periodic use of prescribed fire where practical and/or required by the military.
- Facilitate uninterrupted live fire exercises through conducting annual prescribed fire operations on live fire ranges and remove potential wildland fuels along the range boundary to reduce fuel loads, allowing the military to continue training in the event of a wildland fire downrange. Fuel build-up may also threaten off post resources by elevating the intensity of fires in the impact area and increasing the risk of slop-overs and/or spot fires beyond the installation boundary.
- Reduce hazardous fuel build-up throughout the installation by maintaining a reduced understory with the periodic use of prescribed fire, greatly reducing the severity of subsequent wildland fires and the impact to timber resources and military training.
- Manage a sustainable ecosystem by restoring and maintaining fire dependant plant and wildlife species through the use of prescribed fire.
- Use an ecosystem approach to management and incorporate adaptive management into the process.

An ecosystem is the "sum of the plant community, animal community, and environment in a particular region or habitat" (Barbour 1987). Ecosystem management may be defined as management "to restore and maintain the health, sustainability, and biological diversity of ecosystems while supporting sustainable economies and communities" (U.S. Environmental Protection Agency [USEPA] 1994). The goal of ecosystem management is "to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity" (DoDI 4715.3).

Principles and guidelines of ecosystem management, per DoDI 4715.3, are as follows:

- Guarantee continued access to land, air and water for realistic military training.
- Maintain and improve the sustainability of native biodiversity of ecosystems.
- Administer with consideration of ecological units and timeframes.
- Support sustainable human activities.
- Develop vision of ecosystem health.
- Develop priorities and reconcile conflicts.
- Develop coordinated approaches to work toward ecosystem health.
- Rely on the best science and data available.
- Use benchmarks to monitor and evaluate outcomes.
- Use adaptive management.

- Implement through installation plans and programs.

1.2 Compliance with Policy and Procedures

The Wildland Fire Management Plan has been created in compliance with the following:

- Army Regulation 200-1 Environmental Protection and Enhancement, 13 December 2007
- Army Wildland Fire Policy Guidance, September 2002
- Federal Fire Policy 2009
- National Wildfire Coordinating Group (NWCG) Wildland Fire Qualifications Subsystem Guide, PMS 310, 1 April 2010
- DoD Instruction 4715.3
- DoD Instruction 6055.6, DoD Fire and Emergency Services Program, 10 October 2000
- Fort Campbell INRMP

When operating outside the installation under reciprocal agreement the specific agency qualifications and guidelines apply.

1.3 Wildland Fire History

In 1953, the Forestry Program was founded on Fort Campbell with wildland fire suppression as its prime responsibility. Wildland fires typically ignite as a result of military training activities and their frequency required a fire fighting resource on the installation that was specialized in wildland fire suppression. The aggressive approach to suppression altered the understory species composition within some upland oak areas and loblolly pine plantations throughout the installation, increasing the fuel loads, changing stand densities and, as a result, altered possible military and wildlife use of these areas. This increased fuel loading resulted in a higher risk of catastrophic wildfires.

Beginning in 1956, prescribed fire came into use as a management tool and was primarily used to reduce hazardous fuel accumulation. The impact areas were burned annually while fields and stands across the training areas were burned on a three-year cycle. The primary goals for the prescribed burning were to reduce fuel loads, reduce the frequency of wildfires, to keep open fields clear of woody encroachment for military training, and to protect surrounding agricultural and residential areas outside the installation boundaries.

In 1997, the wildland fire management program was reevaluated with an improved understanding of the role that fire plays in maintaining natural processes of the ecosystem. The intent and policy at Fort Campbell was altered to allow the natural processes to occur whenever possible. Fire was used as a management tool for ecosystem benefit when possible. This same year, an Environmental Compliance Assessment Study (ECAS) found that the extensive firebreak system throughout the training areas was

the primary cause of sedimentation into local streams. To protect the water quality, the practice of annually grading the firebreaks ceased in 1998 and 287 miles of existing firebreaks were closed and reclaimed.

Historically, the Forestry Section managed all fires, but after the implementation of the 1999 INRMP the use of prescribed fire in the rear area became a shared responsibility in the Conservation Branch (effectively 2000). Although prescribed fire is a shared responsibility, all fire activities are coordinated through the Forestry Section. A GIS database is kept at Forestry to track occurrence, acreage and dates.

In 2010, a wildland fire escaped the impact boundary and proceeded to leave the installation. The Fire Management Program was tasked to reevaluate current operating procedures and make significant alterations, revisions and improvements. Learning and understanding historic fire events and processes is a key to understanding the continuing role of fire on the installation. Findings determined there were high risk areas surrounding the impact areas. They are a priority for immediate wildfire response and fuel reduction/prescribed fire applications. They are assessed annually and prioritized through communication and coordination with stakeholders.

Historically, the fire season has been from early October through mid April, when the hardwood foliage has dropped its leaves, herbaceous vegetation has died off and all light fuels are at their driest. Most wildfires occur between the months of November and March.

1.4 Fire Management Zones

Fire Management Zones are broken down by watersheds for prescribed fire operations. A prescribed fire rotation for open fields is determined by forestry and wildlife personnel with the wildlife management and barrens program objectives for guidance. Forestry objectives also may be employed for fuel reduction for open field management. Prescribed fire operations ideally are implemented on a watershed basis with the exception of the Small Arms and North/South Impact Areas, drop zones and special use areas which are burned annually. Watershed areas are Skinner Creek, Casey Creek, Noah's Spring Branch, Piney Fork Creek, Jordan Creek, Fletcher's Fork Creek, Little West Fork, and Dry Fork Creek.

1.4.1 Acreage Figures

Skinner Creek	747 acres
Casey Creek	10,183 acres
Saline Creek	13,897 acres
Noah's Spring Branch	18,669 acres
Piney Fork Creek	25,303 acres
Jordan Creek	6,263 acres
Fletcher's Fork Creek	10,709 acres
Little West Fork Creek	6,015 acres
Dry Fork Creek	12,094 acres

1.5 Organizational Structure and Responsibilities (for commitment of FORSCOM assets)

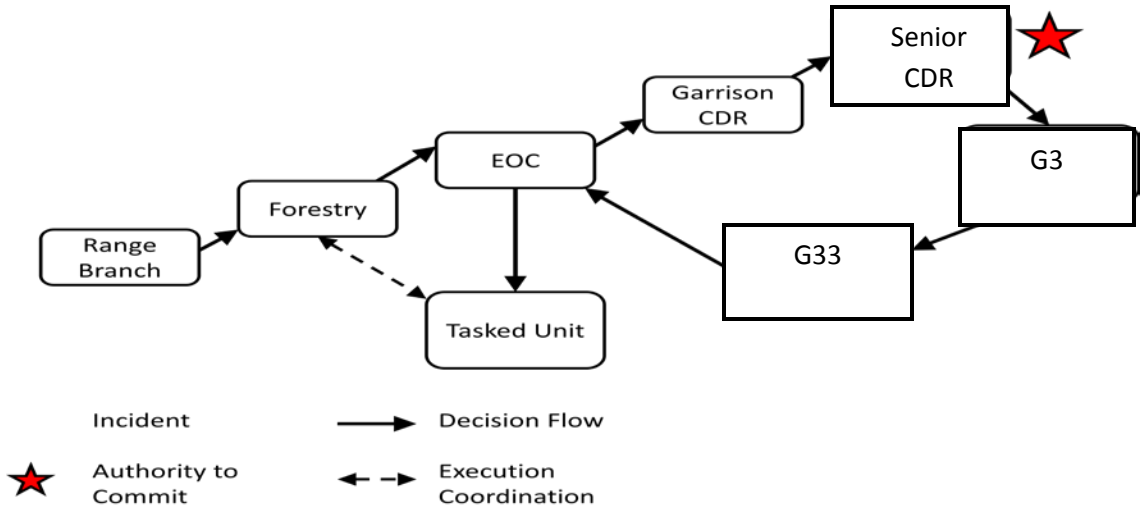


Figure 1. Decision Flow and Authority Diagram

1.5.1 IMCOM Commander

The Assistant Chief of Staff for Installation Management (ACSIM) is responsible for oversight of the program, updating policy, and resolving policy questions through the Facilities and Housing Directorate in coordination with the Environmental Programs Directorate. They will provide information necessary to perform wildland fire management in accordance with the Army Wildland Fire Policy Guidance (see Appendix A). They will assure that wildland fire program reviews are incorporated into Fire and Emergency Services Operational Readiness Inspections and Environmental Compliance Assessment Screenings.

1.5.2 Garrison Commander (GC)

The Garrison Commander defines the roles and responsibilities for the fire management program on the installation. The Garrison Commander at Fort Campbell has designated the Chief of the Environmental Division as the Wildland Fire Program Manager, Emergency Management Officer as the Assistant Program Manager (Installation Support), the Supervisory Forester as the Assistant Program Manager (Operations), and the Fire Chief as the Assistant Program Manager (Training) for the installation and approves the installation IWFMP. Additional responsibilities include approving deployment of Army civilian personnel and equipment to any off installation incidents, approving cooperative agreements with other federal, state and local agencies, and approving installation level policies relating to fire management.

1.5.3 Directorate of Public Works (DPW) Environmental Division

The majority of the responsibility for the fire management program lies within the Environmental Division. The Environmental Division oversees the decisions and implementation of wildland fire management on Fort Campbell. It is in charge of planning and coordination for environmental

assessment, reviews of the burn plans, the assessments of the impact on wildlife and wildlife habitat, Air Quality, as well as other factors that are integral to the wildland fire program.

The Wildland Fire Program Manager for the installation is responsible for the development and implementation of the Integrated Wildland Fire Management Plan (IWFMP) and other related policy. He/she reviews and approves prescribed burn plans, oversees fire suppression activities, provides the necessary training to all wildland fire personnel, and makes recommendations to the GC for Army civilian personnel deployments to off installation fires.

1.5.4 Conservation Branch/Forestry Section

It is the primary responsibility of the Conservation Branch to develop annual and seasonal burn plans. Input from forestry, wildlife, DPTMS and other land users is collected for inclusion into the burn plans. The Forestry Section coordinates with other program managers and ensures that prescriptions are developed and conducted in accordance with all policies and regulations.

There are several directives and regulations requiring fire management be conducted on Fort Campbell, including the Federal Wildland Fire Management Policy, Jan 01; National Fire Protection Agency (NFPA) Standard 295-Standard for wildfire control, Standard 299-Protection of life and property from wildfire; Army Regulation 200-3, Natural Resources – Land, Forest and Wildlife Management and the Integrated Natural Resources Management Plan (INRMP). The Forestry section coordinates annual fire safety refresher training, fire qualification courses and recertification of skills such as chainsaw and ATV use.

GIS is the primary tool used to map, document and develop plans of work. GIS gives managers an accurate mapping tool; it adds attributes to provide insight into dates, times, objectives and correlates that information so that it is available to a wide variety of personnel making management decisions. It is a key component and the established tool of record for all fire management data.

1.5.5 Other Programs that Work in Conjunction with Forestry

1.5.5.1 ITAM

The Integrated Training Area Management (ITAM) program contains the Range Training Land Analysis (RTLA) and Land Rehabilitation and Maintenance (LRAM) groups. These personnel also work to improve military access and training by coordinating prescribed fire operations on firing points and TOC sites through the Forestry Program.

1.5.5.2 Range Branch Wildfire Response Personnel

The intent of the fire management program is to support military training. Live Fire Base is responsible for maintaining the ranges surrounding the North and South impact areas. The purpose for prescribed fire operations in these areas is to conduct prescribed fire under prescription that reduces fuels and risks to targets, improves mounted and dismounted military training and reduce fuel loadings so fires have a minimal impact on training. Range Branch Wildfire Response personnel coordinate prescribed

fire operations through the Forestry Program and assistance may be provided on sites that do not endanger the health and welfare of personnel.

Impact Areas are off limits for Forestry personnel to enter and perform prescribed fire operations, though ignitions operations may take place along the impact area boundary. Operations are monitored and response to wildland fires that leave the impact area is the responsibility of the Forestry Section.

1.5.5.3 Conservation Branch/AG Lease/Wildlife

The Conservation Branch also conducts prescribed fire operations for goals outside the scope of the Forest Management Plan and may include the following:

- Preparing fallow fields for agricultural out lease
- Maintaining or restoring native prairies or savannas
- Improving wildlife habitat for a specific species
- Improving forage quantity and quality
- Enhancing herbaceous seed populations
- Maintaining, promoting, or restoring threatened and/or endangered plant species
- Changing/maintaining seasonal dominance of an herbaceous plant community
- Controlling undesirable annual grasses and forbs
- Enhancing wetland diversity through cattail management

All prescribed fire operations are coordinated and approved through the Forestry Program.

1.6 Personnel Training and Certification Standards

Personnel engaged in wildland fire activities must have, at minimum, successfully completed course requirements for Firefighter Type II (FFT2) according to NWCG standards. These courses include:

- I-100: Introduction to ICS
- S-130: Basic Firefighter
- S-190: Introduction to Wildland Fire Behavior
- L-180: Human Factors on the Fireline

In addition, personnel must have completed the following:

- Basic First Aid training
- CPR/AED training
- Range and UXO course

Individuals operating All Terrain Vehicles (ATVs) are required to complete the following:

- ATV safety training from a certified instructor

Individuals operating chainsaws are required to complete the following:

- Wildland Fire Chain Saws (S-212): OSHA certified training and posses a current qualification card by a certified instructor

Wildland firefighter training will be made available to all government personnel engaged in wildland fire activities. Efforts to conduct training on the installation and/or nearby will be made whenever possible.

Minimum qualifications are established by the NWCG. These standards are available in PMS 310-1, Wildland and Prescribed Fire Qualifications System Guide, Oct, 2012. A breakdown of positions and required training is provided in this reference. The Wildland Fire Program Manager has the ability to grant course equivalences for fire courses and/or training when these courses apply to agency or installation specific requirements.

In order to participate in multi-agency project fires, the training requirements cited in the NWCG publication, PMS 310-1, Wildland and Prescribed Fire Qualifications System Guide, must be met and a NWCG Qualification Card/Incident Command System (also known as a "Red Card") must be obtained. Army policy for the deployment of DOD civilian fire fighters will be followed in accordance with Army Wildland Fire Policy Guidance (see Appendix A).

1.6.1 Physical Fitness Standards

Wildland firefighting demands a high level of fitness to work safely and perform day-long work in varying environmental conditions, including smoke, steep terrain, extreme temperatures and to meet unforeseen emergencies. Therefore a test of physical fitness is needed to gauge work capacity of employees.

NWCG, PMS 310-1 and Army Wildland Fire Policy Guidance dictates the physical fitness standards required for firefighters and first responders.

Personnel with physical fitness requirements as part of their duties in PDs or job descriptions will be required to meet those requirements.

1.7 Equipment

Wildland fire personnel have access to various hand tools for wildland fire activities. The most common hand tools used are the fire rake, McLeod, flapper, shovel and Pulaski. A leaf blower is also available as an alternative to scraping out a control line in specific fuels (i.e., Hardwood leaf litter). Backpack water pumps can also be used in conjunction with other tools to control slow to moderately spreading fire in light fuels. Chainsaws are also available to certified sawyers for cutting line through heavy fuels, dropping snags, and/or bucking logs into smaller sections.

Two types of firing devices are commonly used during wildland fire activities; Drip torches and fusees. The drip torch is a liquid fuel container with a nozzle and wick designed to safely ignite fuels when conducting ignitions operations by hand or mounted to an ATV. The fusee (or road flare) can also be used to ignite grasses and forest litter by hand during ignitions and/or emergency burn out operations.

The forestry program has several vehicles and resources dedicated to wildland fire activities.

- Type 7 Engine: Humvee equipped with a 350 gallon water tank, pump engine and Class A Foam Proportioner
- Type 7 Engine: 150 gallon water tank, pump engine and Class A Foam proportioner
- Two Type III Dozers with mounted Type 5 Tractor Plow units, transported on rollback, tilt bed trucks
- UTV with mounted 75 gallon water tank and pump engine
- UTV with mounted flamethrower unit
- 4x4 ATVs, three mounted with modified drip torches
- Gator command vehicle

In addition, two Type II Dozers are available with double-gang disks, used in the pre-fire season to bog safety/control lines around the installation boundary and sensitive areas within the training areas on an as needed basis. They can be used to construct fire lines in the event of a severe wildland fire year; however, the Type III Dozers are more commonly used during a wildland fire operation due to their mobility and lower impact on the environment.

Additional resources may be called to assist from other programs.

1.7.1 DPW Conservation

For most wildland fire activities, other Conservation Branch programs play a support role to the Forestry Program. Additional resources within the DPW Conservation Branch include:

- Type 7 Engine: 300 gallon water tank, pump engine and Class A Foam Proportioner

1.7.2 DPTMS

Range personnel are the first responders to Range and Impact fires. Resources available for deployment include:

- Two Type 7 Engines: 600 gallon water tanks and pump engines
- Two Type 7 Engines: 200 and 100 gallon water tanks and pump engines
- Type 7 Engine: Humvee equipped with a 250 gallon water tank, pump engine, and a Class A foam proportioner

1.7.3 DES

While their primary responsibility is the cantonment area, the Fort Campbell Fire Department has resources that can be deployed to the training areas but are restricted to wildland fire operations on established roads and combat trails.

- Type 3 Tender: 2000 gallon water tank
- Type 2 Engine: Ladder Truck
- Three Type 1 Engines:

1.8 Interagency Cooperation and Mutual Aid Agreements

In the event that wildland fire activities exceed the capabilities of Forestry and Conservation resources, involvement by the military is likely to occur. Military assistance is requested by a tasking order as outlined in the Fort Campbell All Hazards Plan, Dec 2012. This enables resources and capabilities not normally available to the Forestry Program to be mobilized and deployed in the manner needed, including but not limited to; Mandatory evacuation by military police, curfews, and enabling military battalions to permit the use of resources without going through the formal non-emergency administrative procedures.

1.8.1 326th Engineer Battalion

When additional wildland fire suppression resources are needed, the Forestry Program can request the assistance of the 101st Airborne Division (Air Assault), 326 Engineer Battalion. The 326 ENG can establish forward water supply points throughout the training areas and ranges to replenish wildland fire and fire department engines through the deployment of the 508th and 550th EN DET (under the command of the 716th MP battalion).

Available equipment that can be deployed to wildland fire activities include:

- Two Type 2 Water Tenders: HEWATT with 2500 gallon tank
- Two Type 3 Water Tenders: Portable water tank with 2000 gallon tank
- Two Type 1 Engines: Tactical Fire Truck with 1500 gallon tank

Current suitable locations for preplanned forward water supply points include:

- North/South Impact Area: Ranges 28, 41, 42, 52 and Demo 39
- Small Arms Impact Area: Ranges 26 and 36A

Forestry, Range and Fire Department engines have the capability to draft water required from portable tanks and/or natural sources.

1.8.2 159 and 101 Combat Aviation Brigade

In the event that resources available are not adequate to suppress a wildland fire, or the wildland fire is inaccessible to personnel on the ground (i.e., in an impact area), the Forestry Program can request the assistance of the 101st Airborne Division (Air Assault), 159 and 101 Combat Air Brigade. The 159 and 101 CAB trains and maintains sufficient crews certified on bambi bucket operations, utilizing two Sikorsky UH-60 Blackhawks (159 CAB) and a Boeing CH-47 Chinook helicopter (101 CAB) simultaneously.

Available equipment that can be deployed to wildland fire activities include:

- Five Type 2 Helicopters: Sikorsky UH-60 Blackhawk capable of operating a 660 gallon bambi bucket
- Two Type 1 Helicopter: Boeing CH-47 Chinook capable of operating a 2000 gallon bambi bucket
- Five 660 gallon bambi buckets
- Two 2000 gallon bambi buckets

159 CAB has validated Kyle Lake as the water supply point for bambi bucket operations.

1.8.3 Memorandums of Understanding

Currently, there are nine Memorandums of Understanding (MOU) and one intergovernmental service agreement (ISA) with outside county, state, and federal agencies for wildland firefighting activities occurring on Fort Campbell and/or wildland fires that escape installation boundaries onto private lands.

All current MOUs and ISAs can be found in Appendix B.

1.9 Smoke Management and Air Quality

The purpose of smoke management is to minimize public health and safety impacts of smoke from wildland fire activities. Smoke from wildland and prescribed fire operations are an acceptable form of air contaminant as per the Open Burning regulations for the States of Kentucky and Tennessee (401 KAR 36-005 Open Burning and Chapter 1200-3-4 Open Burning respectively).

In the event of smoke affecting sensitive areas off the installation, the proper offices will be contacted. Air quality, MP's and the Environmental Division will be notified, as needed, for the proper response. Off post notification of law enforcement for hazardous road conditions can be made through the Emergency Operations Center (EOC) or 911 on Fort Campbell.

Areas sensitive to smoke in and surrounding the installation are highlighted in Figure 2. Fort Campbell, Kentucky Smoke Management Sensitive Areas.

The Smoke Management Standard Operating Procedure is located in Appendix H.

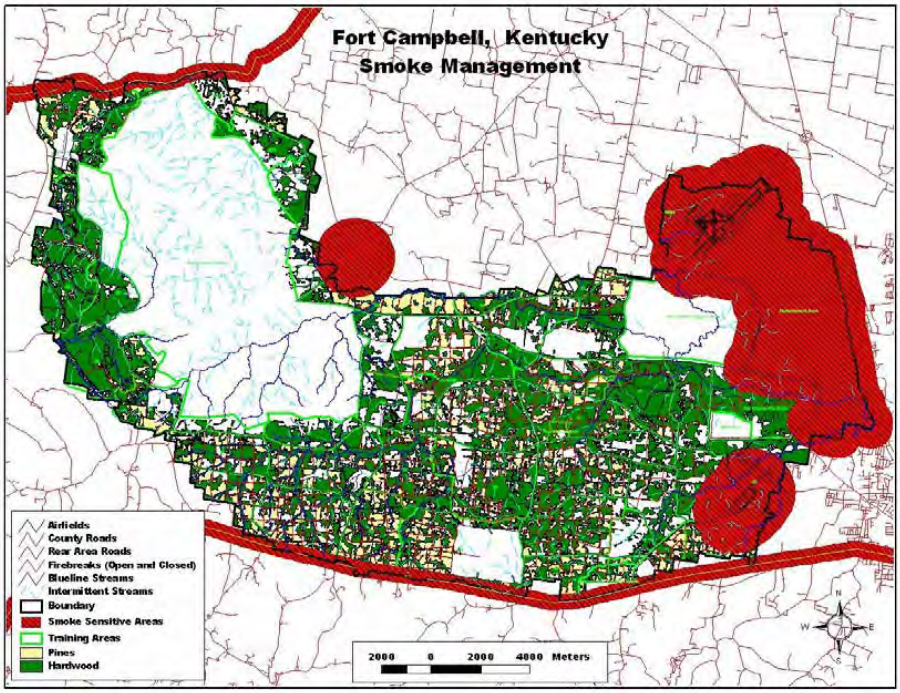


Figure 2. Fort Campbell, Kentucky Smoke Management Sensitive Areas

1.10 Safety and Risk Management

The safety of the firefighter and the general public is the highest priority in every wildland fire activity. A copy of the Risk Management Worksheet can be found in Appendix D.

There may be several managers conducting wildland and prescribed fire operations on Fort Campbell on any given day. This makes for a complex and sometimes hard to control fire management strategy. Therefore, the following installation-specific safety and emergency operations protocols will be followed:

- On a wildland fire operation, the Incident Commander shall be responsible for personnel and property safety
- On a prescribed fire operation, the Burn Boss shall be responsible for personnel and property safety.

1.10.1 Personal Protective Equipment (PPE)

All personnel participating in wildland fire and prescribed fire activities must have and utilize proper PPE. All PPE must meet or exceed National Fire Protection Agency (NFPA) 1977 Standard on Protective Clothing and Equipment for Wildland Fire Fighting, 2011.

Personal Protective Equipment required for all wildland fire activities include:

- Nomex shirt and pants (or coveralls)
- Leather boots: Fort Campbell requires all firefighters to wear a non-steel toe, laced leather boot with at least 8-inch top and skid-resistant soles. Lug-type soles are preferred.

- Fire Shelter: Either carried on web gear or within reach at all times
- Hardhat
- Eye protection: Goggles, face-shield helmets and/or safety glasses are acceptable forms of eye protection.
- Leather Gloves
- 100% cotton underclothing (not issued)

Additional equipment issued and/or recommended:

- Flashlight or headlamp
- Multi-Tool

Additional PPE requirements for anyone operating a chainsaw include:

- Chaps (Kevlar threaded, protective pants)
- Ear protection

Additional PPE requirements for anyone operating an ATV include:

- Motorcycle or ATV safety helmet

1.10.2 Unexploded Ordnance (UXO) Hazard

All fire management personnel will be given a Range and UXO course. The class will familiarize personnel with hazards and actions to be taken upon finding unexploded ordnance. Ordnance found while conducting fire activities will be left in place, location will be marked and/or noted, the location will be communicated to all incident personnel and EOD/Firing Desk will be notified. Operations will be diverted around the area a safe distance away until EOD/Range Branch clears the hazard.

1.10.3 Vehicle Operation

Personnel responding to wildland and prescribed fires will adhere to vehicle safety guidelines at all times. The guidelines help to insure the safety of fire crews and the general public. These guidelines are as follows:

- Speed limits will be observed when responding to all wildland fire activities
- Always wear your seat belt. Fort Campbell and the Forestry Section policy is that seat belts will be used at all times when operating motor vehicles.
- First responders to a wildland fire should assess the threat to vehicular travel and take measures to safeguard against accidents. These measures include, but are not limited to:
    - Light bars and/or dash board emergency lights running
    - Hazard lights on
    - Signs posted to warn of impending smoke and/or fire
    - Road guards posted to stop, slow and/or warn traffic
    - Vehicles parked a safe distance off the roadway

- Stay aware of your surroundings at all times. Watch out for other motorists that may be distracted by ongoing wildland fire activities and cause accident and/or injury.
- Stay in contact with all personnel that are responding and/or in the vicinity. Communicate hazards and watch out for changes in the situation that may have an effect on road conditions and traffic.
- Common sense should be used at all times when operating a vehicle in response to all wildland fire activities.

1.10.4 Medevac

If someone is seriously injured or becomes ill while participating in an incident operation, the Incident Commander or Burn Boss will decide a course of action for MEDEVAC by ground transportation or helicopter.

Ground transportation should be available, planned for, briefed and coordinated by the Incident Commander or Burn Boss. Should a helicopter MEDEVAC be required, it can be reached through request on the Safety channel on the installation Motorola network or by phone to Firing Desk at 798-3001/4122. Preplanned points for MEDEVAC are established and updated annually by Range Branch. They are provided to first responders and are available in vehicle log books. Additionally, MEDEVAC response maps are available from the Life Team website at: http://www.lifeteam.net/service_area/bases and are included in prescribed burn plans and first responder's vehicle log books.

1.10.5 Fire Safety Checklists

Every Wildland Firefighter is familiar with the following lists. These can be found in the Fireline Handbook (NWCG Handbook 3, PMS 410-1, NFES 0065, March 2004) and the Incident Response Pocket Guide (IRPG) (PMS 461, NFES 1077, January 2010). All wildland firefighters should carry both of these documents in their vehicles, fire bag or on their person to be available for use as a reference tool.

The intent of these tools is to manage risk while acting decisively. Management of risk, while performing fire management activities, often comes down to a decision or a choice. These tools are provided to fire fighters to assist with those decisions and are to be used as an aid to sound management and sound response.

1.10.5.1 LCES Checklist

In the wildland fire environment, Lookouts, Communications, Escape Routes, Safety Zones (LCES) is key to safe procedures for firefighters. The elements of LCES form a safety system used by wildland firefighters to protect them and work as a team with others.

LCES is a self triggering mechanism. Lookouts assess and reassess the fire environment and communicate threats of safety to wildland firefighters. Firefighters use escape routes to move to safety zones.

LCES is built on two basic guidelines:

1. Before safety is threatened, each firefighter must be informed how the LCES system will be used.
2. The LCES system must be continuously re-evaluated as conditions change.

Lookouts: Lookouts assess and reassess the fire environment. They must be experienced, competent and trusted. To be effective, they must have knowledge of crew locations, escape routes and safety zone locations, and trigger points while having a good vantage point over the fire.

Communications: Wildland firefighters must communicate with one another to stay aware of safety and potential hazards. Personnel without proper communications should be removed from the incident. Radio frequencies must be confirmed and backup and check-ins established throughout the operation. Crews must update on any situation changes, sounding alarms early to ensure safety of the crew.

Escape Route(s): An escape route is "a preplanned and understood route firefighters take to move to a Safety Zone or other low-risk area" (NWCG Glossary). Firefighters must know when and where to use escape routes. Multiple escape routes must be scouted, marked and evaluated throughout the operation, taking into account the slowest individual, fatigue and temperature factors. Vehicles must be parked for escape.

Safety Zone(s): A safety zone is "a preplanned area of sufficient size and suitable location that is expected to protect fire personnel from known hazards without using fire shelters" (NWCG Glossary). Safety zones must be known by all and every one must know the trigger points that mean move to planned safety zone. Natural and/or constructed sites must be scouted throughout the operation.

1.10.5.2 10 Standard Fire Orders

1. Keep informed on fire weather conditions and forecasts.
2. Know what your fire is doing at all times.
3. Base all action on current and expected behavior of the fire.
4. Identify escape routes and safety zones, and make them known.
5. Post lookouts when there is possible danger.
6. Be alert. Keep calm. Think clearly. Act decisively.
7. Maintain prompt communications with your forces, your supervisor and adjoining forces.
8. Give clear instructions and insure they are understood.
9. Maintain control of your forces at all times.
10. Fight fire aggressively, having provided for safety first.

1.10.5.3 18 Watch Out Situations

1. Fire not scouted and sized up.
2. In country not seen in daylight.
3. Safety zones and escape routes not identified.
4. Unfamiliar with weather and local factors influencing fire behavior.
5. Uninformed on strategy, tactics, and hazards.
6. Instructions and assignments not clear.

7. No communication link with crew members or supervisor.
8. Constructing line without safe anchor point.
9. Building fireline downhill with fire below.
10. Attempting frontal assault on fire.
11. Unburned fuel between you and fire.
12. Cannot see main fire; not in contact with someone who can.
13. On a hillside where rolling materials can ignite fuel below.
14. Weather becoming hotter and drier.
15. Wind increases and/or changes direction.
16. Getting frequent spot fires across line.
17. Terrain and fuels make escape to safety zones difficult.
18. Taking a nap near fireline.

1.10.5.4 Common Denominators of Fire Behavior on Tragedy Fires

There are four major common denominators of fire behavior on fatal and near-fatal fires. Such fires often occur:

1. On relatively small fires or deceptively quiet areas of large fires.
2. In relatively light fuels, such as grass, herbs and light brush.
3. When there is an unexpected shift in wind direction or in wind speed.
4. When fire responds to topographic conditions and runs uphill.

Alignment of topography and wind during the burning period should always be considered a triggering point to reevaluate strategy and tactics.

1.11 Decision Analysis Process

The National Fire Danger Rating System is the measure used to forecast and determine wildland fire actions taken for the day. Personnel staffing, decisions to conduct prescribed fire operations, and current / expected weather will be gathered and available to all personnel involved with fire management activities. Data received through Remote Automated Weather Station (RAWS) sites, the local weather forecast from the Air Force 18th Weather Detachment at CAAF, the National Weather Service and expectations from personal experiences in fire behavior on Fort Campbell all play an important part in determining actions for the day. Some of the weather factors that influence wildland fire activities include:

- Burn Index
- Wind Speed
- Wind Direction
- Relative Humidity
- Fuel moisture of 1 hour, 10 hour, 100 hour and 1000 hour fuels
- Mixing heights of altitude winds and Dispersion Index for predicted smoke behavior

- Current and expected weather conditions
- Keetch-Byram Drought Index (KBDI)

Factors are considered before all prescribed fire operations and addressed in the crew safety briefing before all wildland fire activities begin.

Other factors such as proximity to built up areas, roads, high traffic areas, installation boundaries, logging and training operations all affect the decision process.

1.11.1 Fire Weather

Fire Weather predictions and expectations are used in accordance with Cam Reg 385-5 (Appendix E). They also influence the actions and staffing for the day. A day when there is a high fire danger requires greater staffing and preparedness. Prescribed fire operations may not be authorized if high fire danger is forecasted.

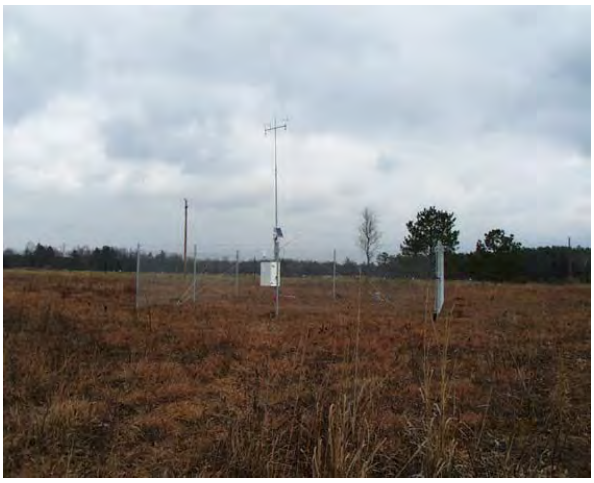
1.11.1.1 Fire Weather Forecasting

Daily, the fire weather forecaster at Fort Campbell Forestry retrieves the forecast, via the Weather Information Management System (WIMS). The RAWS site (located at the corner of On-The-Line Road and Mabry Road, across from Range 37) gathers local data and sends its readings, via GOES satellite, to the WIMS system in Boise, ID. The observations, along with inputs from the NWS, are used to determine the burn index, wind speed, wind direction, dew point, relative humidity, fuel moisture, drought indices, rainfall amounts and other important readings used in the National Fire Danger Rating System (NFDRS). After the information is retrieved, a burn index is established and sent to EOC/Firing Desk and wildland fire personnel for that day.

The RAWS site is maintained and operated by the Forestry Section. Set into operation in Dec. 2004, it provides timely and accurate data for fire weather predictions. Each day an observation is entered into the WIMS system by the Forestry office which verifies the station information and makes a state of the weather determination for the day. The NWS adds an input daily, after the observation is edited by Fort Campbell personnel, and a forecast for fire indices is generated in the WIMS system.

Wind speed and directions are monitored daily from the fire tower during fire season on an as needed basis.

Image 1 and 2: Fort Campbell's Remote Automated Weather Station (RAWS) site



Historical fire weather data is kept on file at the forestry office and files are on record since 1953. Fire occurrences, as they pertain to fire weather, have been examined and reviewed for patterns and trends. A pocket danger card, which allows firefighters to follow trends in fire indices and historical fires is also available and included in Appendix G, Fort Campbell Pocket Danger Card.

Additional on-site, field-based weather readings of dry bulb, wet bulb, dew point, relative humidity, wind speed and wind directions are gathered by fire personnel before and during wildland fire activities.

Spot forecasts may be obtained from the National Weather Services at Paducah, KY. This includes Red Flag Warnings issued by the National Weather Service for expected fire weather.

1.11.1.2 Monitoring Requirements

Changes in weather and fire behavior are monitored during all wildland fire activities by personnel on location and at the fire tower on an as needed basis. After duty hours, individuals called out to respond to a wildland fire are responsible for assessing weather conditions on the ground. Fire behavior is always determined when initially sizing up a fire, watching the rate of spread, the intensity at which certain fuels ignite and numerous other indicators of wildland fire behavior. A field-based fire weather analysis can be made using a belt weather kit. By monitoring these factors, personnel determine the best methods to control and/or contain a wildland fire.

1.11.2 Wildland Fuel Factors

Fuel factors throughout the installation vary by fuel type. Due to the fragmented and complex fuel situation on Fort Campbell, wildland fires may occur in one fuel type and spread into several other neighboring fuel types. Slash, unburned pine or hardwoods, or fields may be encountered and fuel loading may vary greatly. Figure 3, Fuel Load Distribution, shows a breakdown of fuel distribution on Fort Campbell. The ongoing fuel load reduction by prescribed fire, mowing, and pine stand grinding is a constantly changing factor and is monitored by forestry personnel, wildlife biologists, ITAM and Range Branch.

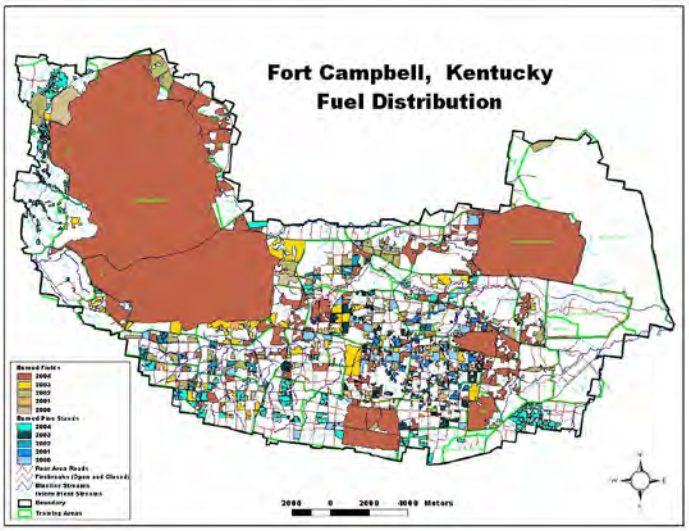


Figure 3. Fort Campbell, Kentucky Fuel Load Distribution

1.11.3.1 Fuel Models

The National Wildfire Coordinating Group (NWCG) utilizes 13 fire behavior fuel models developed by researchers. The 13 models are grouped into four major categories: Grass, Shrub, Timber and Logging Slash (debris). All four categories are present on Fort Campbell. Fort Campbell's open lands are characterized by Fuel Model 3, Tall grass (2.5 feet). Fuel Model 8, Compact timber litter best characterizes Fort Campbell's hardwood stands. Pine Stands are best characterized as Fuel Model 9, Hardwood/Long needle pine timber litter.

1.12 Natural and Cultural Resource Considerations

There are several considerations that are taken into account when conducting fire management activities on Fort Campbell. A comprehensive integrated strategy incorporates the Threatened and Endangered Species and Critical Habitats Program, Fish and Wildlife Conservation Program, Wetlands program, and the Cultural Resources Management program as well as the Forestry Program. Prescribed burn plans contain blocks for signatures of program managers for approval of projects. Using the ecosystem management approach allows for coordination and a "win, win" approach to fire management. Further, by using an adaptive process, success can be capitalized on and mistakes can be identified and possibly corrected. This process builds teamwork amongst program managers and team members.

Prior to any prescribed fire season on Fort Campbell, the prescribed burn project is approved based on environmental considerations of each office using the in-house National Environmental Policy Act (NEPA) process.

Specific areas throughout the installation require an active and engaged fire management approach and special consideration are taken into account to manage these areas.

1.12.1 Wildlife Habitats

Endangered and threatened species on Fort Campbell represent a significant fire consideration at this time. Many endangered species on Fort Campbell could be directly affected by fire. Many habitats on Fort Campbell are supported by fire and are generally fire dependent.

Wildland and prescribed fire activities may lead to improving habitat and improve overall productivity of the site and/or eliminate important structural habitat components on a site, such as snags and coarse, woody debris. Prescribed fire prescriptions are designed to minimize the negative effects of wildland fire on unprotected sensitive sites and unique habitats throughout the installation.

Additional field survey work prior to prescribed fire activities may be required to determine whether endangered, threatened and/or special concern species, rare tree species, and/or sensitive ecosystems are present on site.

1.12.2 Riparian Areas

Perennial and intermittent streams should be protected from mechanical disturbances during wildland and prescribed fire operations, where possible. Riparian vegetation is essential to healthy stream ecology by providing inputs of coarse woody debris and fine litter into bodies of water, retaining nutrients, sediment, and energy along the banks, stabilizing stream banks from erosion, maintaining moderate water temperatures through shading, and providing essential wildlife habitats.

Stream corridors may be used as control lines during wildland fire operations rather than plowing and/or disking fire lines. Minimizing the alteration of riparian vegetation will be taken into account during fire management activities and best management practices will be applied.

1.12.3 Water Quality

Various wildland fire activities may result in the exposure of mineral soil and may increase non-point source pollution. These activities include, but are not limited to; burning organic materials, temporary control line construction, the release of plant nutrients following the application of wildland and/or prescribed fire, and increasing the post-burn surface temperature of the surrounding area.

Equipment operation guidelines and post-burn maintenance help to protect water quality and wetland ecosystems from wildland fire activities. All soil disturbances should be avoided within 100 feet of a blue-line stream whenever possible. Recovery of disturbed soil should be accomplished when necessary.

1.12.4 Cultural Resources

A cultural resource is defined as any site, building, structure, object, or area that has value to American history, archaeology, architecture, and/or culture. The following list provides an overview of the most common categories of cultural resources found on the installation: historic structures, cemeteries, archaeological sites, cultural items, and historic areas.

Fire management activities will be conducted to minimize direct and/or indirect disruption to soils (i.e., rutting, compaction, and/or erosion) that may damage cultural resources. Efforts will be taken to avoid these areas if possible.

1.13 Mission Considerations

In addition to the overall goals of the fire management program, fuel reduction methods using seasonal prescribed fire, grinding operations in pine stands and mowing of open fields are often used to enhance training on the installation.

Fuel reduction in the impact areas is focused on improving vision and reducing impact on training due to wildfire. Without prescribed fire, training time would be lost due to cease-fires for smoke, flames, and risk to personnel and property. Fuel reduction lessens the intensity of burns in the impact area thus reducing the risk of spot fires near the installation boundary, evacuations from ranges during military training, and risk to property from fire along the boundary of the impact area.

Wildland fires in the impact area are allowed to burn without any direct attack suppression efforts until they threaten to cross the impact boundary. Wildland fires are monitored along the impact boundary and spotting outside the impact area is managed. Due to the hazard of unexploded ordinance in the impact areas, the only available suppression tactic for fires within the impact areas are indirect attack (see 2.5 Suppression).

1.13.1 Military Training Restrictions

Weather Data is analyzed at the forestry office daily and a report is sent to EOC/Firing Desk concerning the classification and burn index for the day. Training restrictions are then calculated using the Fort Campbell Fire Prevention Guideline Chart (CAM Reg. 385-5) (See Appendix E). If weather conditions change throughout the day, an updated report will be sent to the Firing Desk.

Every effort is made to conduct prescribed fire operations and manage impact area fires so that military training can continue. Fuels, topography and local factors combine to create locations along the impact boundary that pose a high risk escape due to wildfire. By creating solid “black” or reducing fuel loadings to low levels in these areas, when the opportunity arises, military operations can continue when high fire danger conditions would otherwise restrict training.

It is the intent of the fire management program to support training and the military mission. Using sound tactics and a proactive, timely response to incidents is the key. Fire management personnel seek opportunities to create anchor points, maintain fuels breaks, modify fuel structure or composition and capitalize on ideal fire weather days to burn out high risk areas. This approach allows military training to continue and leads to mission success.

1.14 Public Relations

On days of prescribed fire operations, several agencies on Fort Campbell are notified for public awareness and possible response. These include the following: Range Branch/Firing Desk, Emergency

Operations Center (EOC), Rear Area MPs, the Fort Campbell MP desk, the Director of Public Works and the Environmental Branch Chief, Air Quality, and in the event that smoke may disrupt military air operations, CAAF and Sabre Army Airfield. The EOC notifies the local community, local first responders, social media sites and local contacts of planned and unplanned incidents.

1.15 Fire Reviews

The After Action Review (AAR) is used to identify what went right and what went wrong on incidents. The emphasis is on improvement and not on individuals. Documentation of AAR's is included in incident folders and is covered in annual fire refresher training.

The cause of wildland fire is determined, when possible. Location, time, and acreage is documented and placed in the GIS database and a paper record is kept as a backup. A record of this report is kept on file in the forestry office; records have been kept since 1953 on fire occurrence.

2.0 Wildland Fire

2.1 Wildland Fire Prevention Awareness

Forestry personnel conduct prevention awareness education in the school system and the community at Fort Campbell's Earth Day programs. Soldiers receive education and awareness in Environmental Quality Officer class and range safety briefings. Senior level leaders and trainers receive training in Range Safety Officer briefings and unit training briefings. Since most wildland fires are training related, these briefings are vital to awareness and prevention.

2.2 Detection Procedures

Wildfire detection is accomplished throughout the installation through a number of different sources.

2.2.1 Fire Tower

Image 3. Fort Campbell's Fire Tower

The Fire Tower is located in Training Area 10 off Pleasant Mill Road. The 101 foot tower is situated on the second highest spot on the installation and has an encompassing view of the surrounding area. It serves as a lookout post on an as needed basis and serves as the coordination and communications center during fire management activities. A Standard Operating Procedure for the fire tower is located in Appendix I.

2.2.2 Range Branch

Range Branch personnel (Firing Desk) are in constant contact with military and civilian personnel on ranges and training areas throughout the installation via FM radio and/or Motorola radio. Any military or civilian personnel may notify the Firing Desk of a fire, which in turn notifies the Forestry office and/or initiates the alert procedures.

2.2.3 Central Dispatch / 911 Center

Individuals who spot wildfires can notify the 911 Center, Central Dispatch or EOC. All systems will, in turn, notify the Forestry office and/or initiate the alert procedures.

2.3 Communications Plan

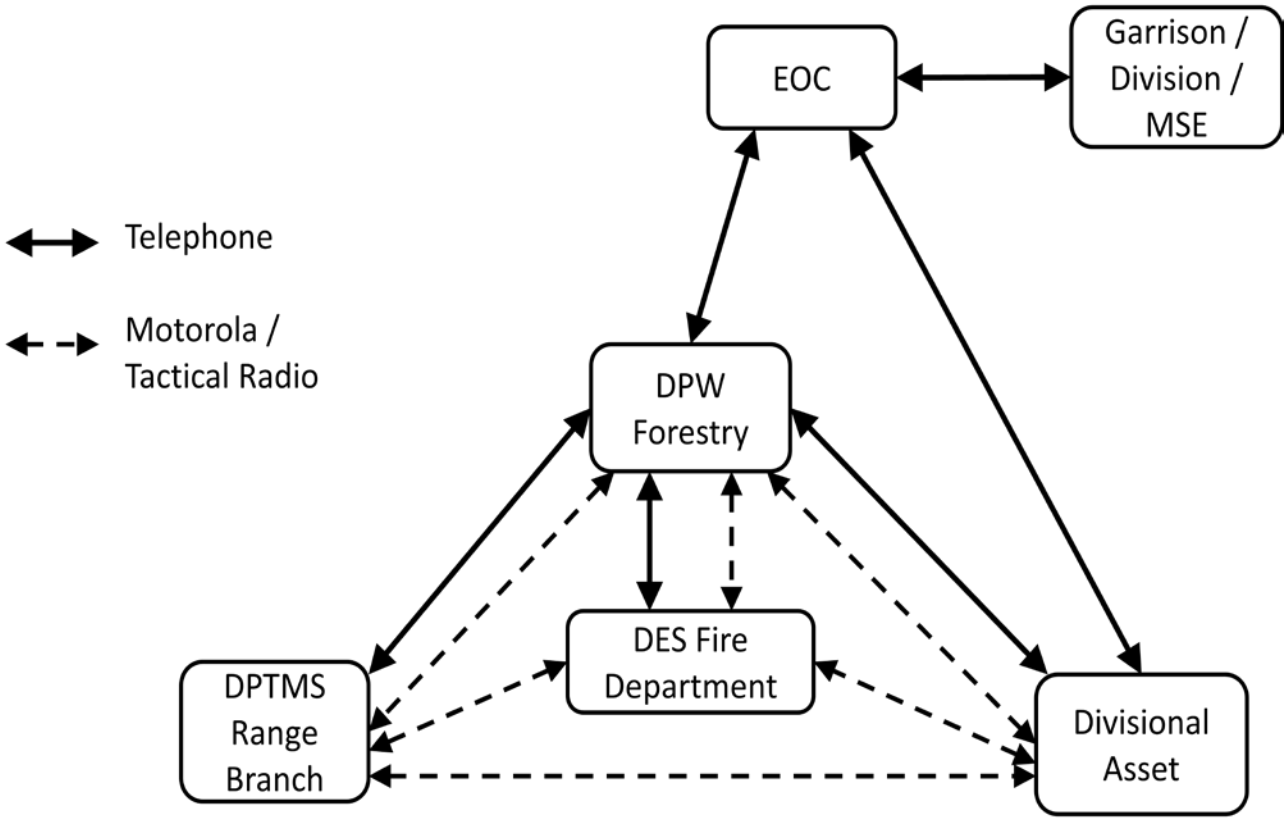


Figure 4. Communications (C2) Diagram

2.3.1 Motorola Radios

The Forestry frequency of Fort Campbell's Motorola Radio network is the primary means of communication by fire management personnel.

A base radio is located in the Forestry office, Bldg 7604, located in Old Clarksville Base at the corner of Georgia Road and East End Road.

All Forestry personnel carry portable radios on their person while away from the base station as per Standard Operating Procedures. All forestry radios are capable of scanning the Range (Safety), Forestry, DES Fire and E-911 frequencies.

2.3.2 Cellular Phones

Cellular phones are the alternate means of communication on the installation. There are times and remote locations where the radio system is weak or unreadable and cellular phones serve to fill in the communications gap.

2.4 Dispatch Procedures

Notification procedures are routed through the Fort Campbell Central Dispatch, EOC, Firing Desk, and/or the Forestry office. Once a member of the forestry staff has been notified, he/she then responds and sizes up the fire. A determination will then be made about suppression measures and action taken.

2.4.1 During Duty Hours

Once a wildfire has been detected, the Forestry office is contacted via Motorola radio or telephone. Forestry then dispatches the closest member(s) of the staff to evaluate the fire. The first personnel on scene will conduct initial assessments and suppression response. That individual is the Incident Commander until they are relieved by more qualified personnel on scene.

The Incident Commander determines what resources are needed and deployed to the scene. The Fire Tower, if manned, acts as a command and control station to relay information and contact additional resources if needed.

2.4.2 After Duty Hours

During off duty hours the Central Dispatch, EOC or Firing Desk is the notifying office. During the wildland fire season (1 Oct through 15 April) forestry personnel are on a 1 hour recall/alert to respond to wildfires on the installation. An alert roster is posted with the 911 Center and Firing Desk to notify forestry personnel in the event of a wildfire. The first person contacted on the alert roster notifies another forestry contact and proceeds to the fire location to conduct initial assessments and suppression response. If more than two personnel are needed, additional alerts are made as necessary to provide the needed personnel and resources.

2.5 Suppression

Wildland fire suppression and prevention in the training areas is the primary responsibility of the Forestry section. With the exception of the ranges and impact areas, all human caused and naturally caused fires receive an initial response.

2.5.1 Suppression Strategies

Wildfires can be suppressed using various strategies, including containment and control. These strategies utilize the tactics of both direct and indirect attack.

Containment strategy is used to keep a wildfire within a certain area, utilizing natural, existing and man-made barriers to stop and/or severely limit the spread of the fire. Firebreaks, roads, blue-line streams, existing bog lines and/or constructed handlines are options for containment strategies.

Control strategy is employed to aggressively suppress and extinguish a wildfire using available personnel and resources. Control line construction with hand tools, fire plow, dozer and/or bog disk is possible. Anchoring control lines will always be used to minimize the chance of being flanked by the fire.

The decision to contain or control a wildfire is based upon a clearly defined set of criteria (See 2.5.3 Suppression Strategy Matrix). The Incident Commander analyzes the risks and strategy and responds accordingly.

Strategies used to manage wildland fire depend on the rate of spread, intensity, spotting potential, natural and military resources at risk, size, available resources, and many other factors.

2.5.1.1 Direct Attack

When the perimeter of a wildland fire is burning at low intensity and fuels allow for safe operations at the fire's edge, direct attack tactics may be utilized. Control and suppression efforts are conducted on the perimeter of the wildland fire, which becomes the control line. Unless special situations dictate otherwise, line construction will start at an anchor point. Direct attack tactics is commonly expressed as "keeping one foot in the black."

In suppressing wildfires after duty hours, personnel typically use control strategies with direct attack tactics, with heavy reliance on mechanized equipment in the form of dozers equipped with fire plow devices.

Advantages include the ability for personnel to escape into the black, burned area. There is usually minimal area burned and no additional area is intentionally burned.

Disadvantages include the stress of personnel being hampered by heat, smoke and flame. Control lines can become very long and irregular as the line follows the edge of the burned area. Direct attack does not take into advantage natural and/or existing barriers and personnel may accidentally spread burning materials across the line. Usually, more mop up and patrol actions are required.

2.5.1.2 Indirect Attack

When direct attack is not possible or practical, indirect attack tactics may be utilized. The control line is located some distance from the wildland fires edge, utilizing terrain, fuels and existing barriers. Firing operations are usually utilized in conjunction with indirect attack to create depth of firelines and increase the ability of the lines to hold.

Advantages include placement of control lines along favorable topography, taking advantage of natural or existing barriers and allows fireline to be constructed in lighter fuels. Personnel can work away from hazardous smoke and heat.

Disadvantages include that more acres will be burned and the possibility of unburned islands of fuel may remain. This tactic may be more dangerous because personnel are some distance away from the actual wildland fire and may be unable to observe potential changes in fire behavior. Another risk is that the wildland fire may spread and hit the control line before burn out operations can ignite fuels between the fire and control line, increasing the potential for jumps across the line.

2.5.2 Suppression Criteria

Many factors influence the suppression strategy and tactics used during wildland fire response. Factors include availability of personnel, location of the fire, burn index, weather and fire behavior smoke conditions, cumulative risk factors, time of day and season.

2.5.2.1 Personnel

Assessment of suppression strategy and tactics to be used incorporates the availability of qualified and trained personnel and appropriate equipment. Available equipment for wildland fire activities can be located in section 1.7 Equipment.

2.5.2.2 Location

Fort Campbell has been divided into ranges, impact areas, training areas and natural resource management areas. These zones are readily identifiable by boundaries that include roads, firebreaks, bog lines, and in some cases the limits of a forest stand.

When assessing suppression actions, location may be the determining factor is strategy and tactics. Due to the wide range of fuel types and terrain found on the installation, the location of the fire may change suppression strategies and tactics drastically.

Due to UXO hazards, etc. wildland fires in the impact areas and other sensitive areas cannot receive direct attack and must be suppressed using containment strategy with indirect attack tactics (burn out operations) from the impact boundary.

2.5.2.3 Burn Index

Fire behavior predictions, or burn indices, are divided into Class I through VII; Class I being low and Class VII being high risk. See Appendix E, CAM Reg 385-5 for further details.

2.5.2.4 Weather and Fire Behavior

Current and predicted fire behavior must be monitored and remain manageable throughout fire management operations

When making suppression strategy decisions, wildland fires with predicted high spread potential are candidates for a containment strategy, while wildland fires with a medium to low spread potential are candidates for control strategy.

Changes in wind direction, relative humidity and temperatures are all signals of weather changes and potentially erratic fire behavior.

Belt weather kits are used, in conjunction with the RAWS station, to monitor weather conditions and local readings are communicated to incident personnel.

2.5.2.5 Smoke Conditions

Weather elements, such as atmospheric inversions, changes in prevailing winds, and unstable air masses may cause conditions where smoke dispersal becomes an issue. Heavy smoke conditions could contribute to respiratory problems in nearby communities and/or disrupts ground and/or air traffic in the vicinity of the wildland fire. If a wildland fire or number of fires creates unacceptable smoke conditions, a control suppression strategy is to be initiated.

2.5.2.6 Risk

Cumulative risk factors include the total effect of interrelated criteria; Factors include, but are not limited to, available funding, staffing and resources, land use, public relations and concerns, and media involvement. A broad examination of all risk factors takes place before the final declaration of fire management strategies and techniques.

The Incident Response Pocket Guide (IRPG) contains risk management tools and an incident complexity analysis table.

2.5.3 Suppression Strategy Matrix

The matrix aids in determining appropriate suppression strategy (See Table 1). The matrix depicts, under predictable and general circumstances, the suppression strategy recommended for wildland fire operations. It does not, however, take into account extreme wildland fire behavior or fires that occur under drought and/or high fire danger conditions. The incident commander will make the final determination for suppression strategies based on all information available at the time.

Table 1. Suppression Strategy Matrix

Ignition	Situation	Strategy
Wildfire regardless of ignition source	Fire in an impact area (i.e., North, South or Small Arms)	Containment
	Unacceptable burn index (i.e., Class V or higher) and/or fire not within a scheduled prescribed fire management area	Control
	Local and/or state fire situation hazardous and/or fire not within a scheduled prescribed fire management area	Control
	Unacceptable smoke conditions	Control
	Outside of impact area, no threat to personnel, resources or installation boundary, unacceptable burn index, weather and fire behavior erratic, local and/or state fire situation hazardous, favorable smoke conditions, and within a scheduled prescribed fire management area	Control
	Outside impact areas, no threat to personnel, resources or installation boundary, unacceptable burn index, weather and fire behavior stable, favorable smoke conditions and within a scheduled prescribed fire management area	Containment
Wildfire or escaped prescribed fire operations	Threat to personnel, resources and/or installation boundary	Control
	Short and/or long-term weather and fire behavior not within acceptable parameters	Control
	Outside impact areas, no threat to personnel, resources or	Containment

	installation boundary, burn index acceptable, weather and fire behaviors stable, favorable smoke conditions, and within a scheduled prescribed fire management area	
	Cumulative risk factors are not acceptable	Control
Wildfire or delayed spotting from prescribed fire operation	Responding to fire after duty hours and fire not within a scheduled prescribed fire management area	Control
	Responding to fire after duty hours, no threat to personnel, resources or installation boundary and within a scheduled prescribed fire management area	Containment
Wildfire, escaped prescribed burn or delayed spotting from prescribed fire operation	Cumulative risk factors are acceptable and within a scheduled prescribed fire management area	Containment

2.5.4 Wildland Fire Decision-Point Matrix

The following matrix lays out the decision making process, notifications and activation of available support units. All coordination takes place through the EOC while the Incident Commander remains in control of responding personnel on site.

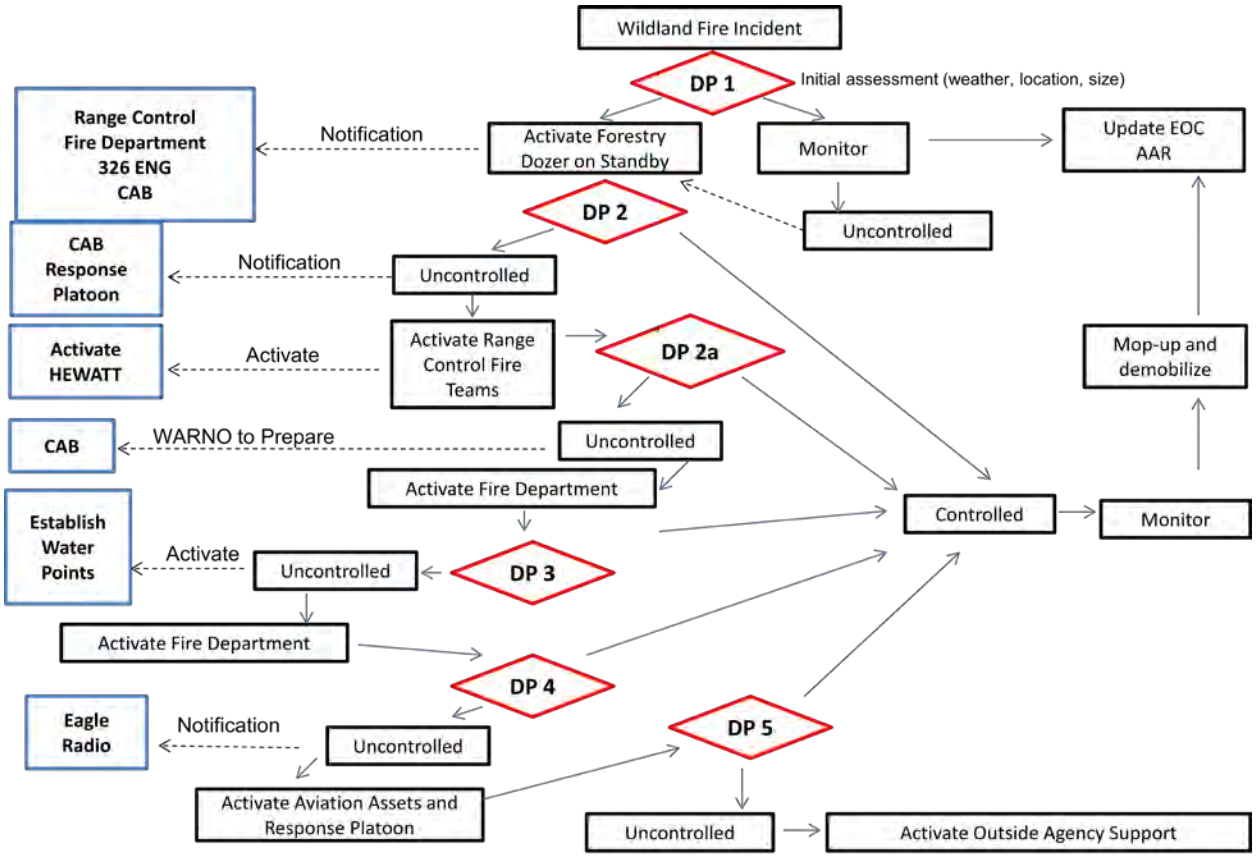


Figure 5. Decision Matrix

2.5.5 Mop-up

Once suppressed, a wildland fire must be checked to ensure all control lines are holding and the smoldering areas such as snags and brush piles are not in danger of crossing existing control lines. Mop up is conducted to extinguish hotspots, push or move hazards back from lines, reduce smoking spots, etc., before fire activities typically pick up in the afternoon.

Standard mop up procedures can be accomplished by walking or riding ATVs along control lines. This must be done to reduce residual smoke and limit the chance of uncontrolled fires endangering persons and/or property. Tactics for mop up can range from hand tool or chain saw use to mechanical equipment like a dozer and fire plow.

2.6 Personnel Positions and Responsibilities

A wildfire response typically consists of an Incident Commander (IC) and one or more other crew members. As the size and/or intensity of the incident increases, the size of the crew may increase, as needed, to include additional personnel and positions. All crew members work for the IC.

2.6.1 Wildland Fire Program Manager

The Wildland Fire Program Manager is responsible for all wildland fire management operations. He/she serves as the responsible party, and lead decision maker, in regards to policy and implementation of activities on the ground. Duties include:

-Establish active monitoring of active fires or when weather conditions warrant, increase monitoring through the use of on duty or off duty manning of the fire tower or scheduled patrols.
-Man Fort Campbell's Forestry Section to full TDA strength consistent with available funding.
-Maintain Fire Department MOA's and maintain mutual aid agreements with bordering local emergency management officials to fight large fires.
-Train 2nd and 3rd tier responders and place them on call during danger periods.

2.6.2 Wildland Fire Program Manager (Operations)

The Supervisory Forester is responsible for managing and coordinating all installation wildland fire activities and the implementation of all suppression and/or control strategies. Additional responsibilities include:

- Coordinating with the EOC for all wildland fire activities.
- Assigning and deploying wildland fire crews and leadership for all wildland fire activities.

2.6.2 Incident Commander (IC)

The IC is responsible for the safety of the members of the wildland fire crew, military personnel and equipment, and civilian resources in the vicinity. They will continuously monitor and reevaluate the suppression strategies and tactics throughout the operation, ensuring that safety is the main priority.

The first wildland firefighter on the scene is the IC until a more qualified individual arrives to relieve him/her.

Responsibilities include:

-Develop an incident action plan, which provides for the safety of first responders and the public, while accomplishing incident objectives.
-Inform the Wildland Fire Program Manager, EOC, Firing Desk and other incident personnel of incident action plans, decisions and changes.
-Log and track decisions and incident plans. The use of an incident organizer, as a guide, is highly encouraged.

2.6.3 Fire Plow Operator

The Fire Plow Operator, a qualified heavy equipment operator, is essential for quick construction of control line for suppression and/or control efforts.

Responsibilities include:

- Preparing containment control lines and/or provide various dozer support functions as instructed by the IC.
- Serving as an additional crew member (if needed).

2.6.6 Fire Tower Operator

The Fire Tower Operator is the primary lookout during wildland fire operations. They monitor smoke conditions, changes in weather, and watch for spot fires and additional wildland fires.

The Fire Tower Standard Operating Procedures can be found in Appendix I.

2.6.7 Fire Crew Member

Fire crew members construct, patrol and monitor control lines to ensure that wildland fires are suppressed and/or controlled through the use of hand tools and/or wildland fire engines (Pump Trucks and ATVs).

2.6.8 Additional Positions (as needed basis)

Road Guard: In the event of smoke obscuring visibility on roads bordering wildland fire operations, road guards may be placed to slow and/or stop vehicular traffic for safety concerns. Warning signs may also be placed to alert motorists of potential smoke hazards.

Monitor: Personnel may be tasked to remain on site and monitor a fire after suppression and/or control activities have come to a close.

2.7 Rehabilitation Needs and/or Procedures

Rehabilitation of fire lines may be needed and are conducted on a case by case basis. Proper line construction, using best management practices, will limit the extent of rehab needed. Currently, reseeding takes place naturally without any additional encouragement and native species are known to respond with vigor to wildland fire activities. Many grassland species on the installation depend on wildland fire activities to sustain its self and thrive. Wildland fire activities allow for new growth and releases species that would have remained dormant had a wildland fire not occurred.

Temporary control lines typically reseed naturally without additional encouragement. Plow lines are usually filled in over time due to winter frost, soil movements and forest duff layers. In many cases, training units benefit from plow and bog lines as they are used as a means of foot travel when encountered.

In specific cases, plow lines are recovered by hand or mechanical means (i.e., on slopes or when natural vegetation is unlikely). The forestry program will evaluate the need for recovery of control lines on an individual basis.

2.8 Records, Reports and Monitoring

Occurrences and frequency of wildland fires are recorded at the Forestry office. Date, type of fire, location, grid coordinates, acreages, and any additional information of wildland fire occurrences are recorded. The report is turned into the GIS section at the end of the fire season and a GIS layer is constructed. Additionally, the Forestry section creates a GIS report to use as a guide and combine burned areas with prescribed fire activities and forestry actions.

3.0 Prescribed Fire

3.1 Use of Prescribed Fire

Prescribed Fire is one of many resource management tools and an established part of Fort Campbell Forestry Program's management regime geared towards supporting the military mission of the installation. Prescribed fire operations are currently performed in fields to control woody encroachment, improve wildlife habitat and maintain access for military maneuvers, and as needed in pine plantations to remove dense understory for access for military maneuvers and manage for regeneration objectives. Prescribed fire may also be used in select hardwood stands to manage species composition, typically after a timber harvest.

3.2 Burn Plans

Burn plans are standardized using the NWCG template found in the Interagency Prescribed Fire Planning and Implementation Procedures Guide. This guide provides standardized procedures, specifically associated with the planning and implementation of prescribed fire. These procedures meet all policy requirements described in the 2003 Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy. The Interagency Prescribed Fire Planning and Implementation Procedures Guide and Prescribed Fire Complexity Rating System Guide provides direction and guidance for prescribed fire planning and implementation.

Burn plans contain 21 basic elements.

Element 1. Signature Page

Element 2. Go/No-Go Checklists

Element 3. Complexity Analysis

Element 4. Description Of The Prescribed Fire Area

Element 5. Objectives

Element 6. Funding

Element 7. Prescription

Element 8. Scheduling

Element 9. Pre-Burn Considerations &Weather

Element 10. Briefing

Element 11. Organization & Equipment

Element 12. Communication

Element 13. Public & Personnel Safety, Medical

Element 14. Test Fire

Element 15. Ignition Plan

Element 16. Holding Plan

Element 17. Contingency Plan

Element 18.Wildfire Conversion

Element 19. Smoke Management & Air Quality

Element 20.Monitoring

Element 21. Post-Burn Activities

3.2.1 Prescribed Fire Goals

Prescribed fire goals are derived from the INRMP, Forest Management and Conservation Management Plans. The goals presented (see Table 2) identify some of the forestry programs goals for the use of prescribed fire in various land cover categories.

Table 2. Prescribed Fire Goals

Goal	Open Fields	Hardwood Stands	Pine Stands
Improve military access and training opportunities	X	X	X
Reduce the probability of larger, greater severity wildland fires	X	X	X
Control certain vegetative diseases	X	X	X
Control non-native and aggressive species	X	X	X
Match the fire regime (i.e., intensity, frequency and timing) to goals and/or desired future conditions	X	X	X
Match the firing technique to goals and desired future conditions	X	X	X
Reduce hazardous fuel accumulation	X		X
Suppress and/or reduce encroaching woody vegetation	X		
Control undesirable woody species	X	X	X
Promote oak and/or hardwood species regeneration		X	X
Prepare site for seeding and/or planting		X	X
Protect hardwood stands from destructive wildland fires	X	X	

The Conservation Branch also conducts prescribed fire operations for goals outside the scope of the Forest Management Plan and may include the following:

- Preparing fallow fields for agricultural out lease
- Maintaining or restoring native prairies or savannas
- Improving wildlife habitat for a specific species
- Improving forage quantity and quality
- Enhancing herbaceous seed populations
- Maintaining, promoting, or restoring threatened and/or endangered plant species
- Changing/maintaining seasonal dominance of an herbaceous plant community
- Controlling undesirable annual grasses and forbs
- Enhancing wetland diversity through cattail management

3.2.2 Prescribed Fire Objectives

Objectives for the use and application of prescribed fire must be SMART (Specific, Measurable, Approved, Realistic and Time bound).

3.2.3 Prescribed Fire Standards and Guidelines

Prior and during all prescribed fire operations, the following standards and guidelines must be followed:

- Completion of a Burn plan for each burn block prior to initiating any prescribed fire operation.
- Coordinate and consult with the ITAM and Conservation Branch program managers to identify and develop prescribed fire objectives in designated areas.
- Coordinate and/or create and maintain control lines for prescribed fire burn blocks.

- Conduct post-burn assessments and/or evaluations, including fire behavior, effect on vegetation, and other information relative to the prescribed fire objectives.

3.3 Project Planning

The following is provided for a greater understanding of the process for prescribed fire operations.

3.3.1 Prescribed Fire Operations Preparation

The proponent for conducting prescribed fire operations is the program manager that has a project requirement or objective that can be achieved through the use of prescribed fire. The project manager initiates the NEPA documentation process required for the use of prescribed fire and is responsible for consulting with other environmental program managers. Requests for proposed prescribed fire operations, including maps and desired weather conditions, should be prepared and provided to the Assistant Wildland Fire Program Manager (Operations) well in advance of the proposed activities. Special prescribed fire requests, as for ranges and endangered species sites, must also be made well in advance and must provide the required window of opportunity associated with the specific prescribed fire prescription.

In order to conduct a prescribed fire operation on Fort Campbell, a burn plan must be completed for each management area or burn block by the proponent and approved by the Wildland Fire Program Manager and the Supervisory Forester before the start of the fire season.

Prior to initiating a prescribed fire operation, the training area in which the burn block(s) is/are located must be assigned to the Forestry Program and clear of all military personnel, equipment, and any potential civilian users. It may be necessary to contact the appropriate military unit to receive permission to conduct prescribed fire operations. Co-uses may also be used with the appropriate documentation and coordination. All coordination must take place through direct contact with Range Branch personnel.

3.3.2 On Site Preparations

Preparation on site is an integral component to successful prescribed fire operations. The Burn Boss is responsible for inspecting the burn block, noting safety precautions, and assessing regulations and requirements prior to starting prescribed fire operations. Control lines must be in place and mapped out with potential hazard areas marked.

A Control line is defined as follows: “An inclusive term for all constructed or natural barriers and treated fire edges used to control a fire” (NWCG Glossary). Since control lines must be in place prior to ignitions. Several options are available for the creation of constructed control lines, including disked bog lines and/or plow lines (scheduled and constructed in advance) and through the use of hand tools.

3.3.2.1 Use of Firebreaks

Starting in 1998 the extensive system of firebreaks throughout the training areas was obliterated and is no longer serviceable for use as control lines without additional maintenance. Specific firebreaks were converted and upgraded to gravel surface roadways and combat trails while an installation boundary firebreak was constructed to prevent wildland fires from escaping onto private lands surrounding the installation.

3.4 Execution of Prescribed Fire Operations

3.4.1 Personnel Positions and Responsibilities

A prescribed fire crew typically consists of a burn boss, firing technicians, and holding personnel. A dozer operator must be on standby or on alert status in the event a dozer is needed. The burn boss, after reviewing the burn plan, determines staffing for the incident.

A single individual may hold multiple positions and responsibilities throughout a prescribed fire operation.

3.4.1.1 Wildland Fire Program Manager (Environmental Division Chief)

The Wildland Fire Program Manager approves prescribed burn plans and approves daily actions.

Responsibilities include:

-Share burn plans with local emergency managers.

3.4.1.2 Wildland Fire Program Manager (Operations) (Supervisory Forester)

The Wildland Fire Program Manager (Operations) coordinates the daily operations of Forestry personnel to support and execute prescribed fire operations. He/she may fill in the organization, where qualified, to support mission accomplishment.

Responsibilities include:

- Briefing the Wildland Fire Program Manager of any issues or problems

-Ensuring documentation, coordination, staffing, training, qualifications are in place and current.

3.4.1.3 Burn Boss

The Burn Boss is responsible for briefing all other personnel on their assignments, objectives, command, safety, and possible communication issues.

3.4.1.4 Fire Plow Operator

The Fire Plow Operator, a qualified heavy equipment operator, is essential. While it is not necessary for the Fire Plow Operator to be on site throughout the prescribed fire operation, they must be on alert and able to respond to control issues, overhead hazards that need mitigation, and other heavy equipment needs.

Responsibilities include:

- Prepares needed constructed control lines (scheduled and constructed in advance).
- Monitors communications with prescribed fire crew
- Serves as an addition crewmember (if needed)
- Responds within a reasonable timeframe as a first responder to escaped fire upon activation to wildland fire response from burn boss.
-Generally serves as the Initial Attack Incident Commander (IAIC) for wildfires and other incidents.

3.4.1.5 Fire Tower Operator

The Fire Tower Operator is the primary lookout during prescribed fire operations. The operator monitors smoke conditions, changes in weather, and watches for spot fires and wildland fires unrelated to prescribed fire operations.

The Fire Tower Standard Operating Procedures can be found in Appendix I.

Responsibilities include:

- Observing all prescribed fire operations, weather conditions and smoke activity.
- Liaison between prescribed fire crew, burn boss, fire plow operator and Range Branch personnel.
- Shutting down prescribed fire operations in the event of hazardous weather changes, conditions or fire behavior.
- Lookout for spot fires and wildland fires

3.4.1.6 Additional Positions (as needed basis)

Road Guard: In the event of smoke obscuring visibility on roads bordering prescribed fire operations, road guards may be placed to slow and/or stop vehicular traffic for safety concerns. Warning signs may also be placed to alert motorists of potential smoke hazards.

Monitor: Personnel may be tasked to stay and monitor a burn unit while the remaining prescribed fire crew moves on to conduct operations in the next unit(s).

3.4.2 Firing Techniques

The burn plan will address the firing technique preferred to achieve project goals.

For a more comprehensive look at various firing techniques refer to A Guide for Prescribed Fire in Southern Forests or NWCG Ignition Operations course material.

3.4.3 Mop Up

All fire management operations require some form of mop-up. Mop-up will occur after a prescribed fire. Checking lines of prescribed fires will occur the morning after the prescribed fire. The intent of mop up is containment of the fire inside the lines and to reduce on-site hazards.

3.5 Evaluation and Monitoring Prescribed Fire

3.5.1 After Action Review

Following the completion of the prescribed fire operation an After Action Review (AAR) is held with the crew. This tool is useful for evaluating and improving individual and group performance and operational safety. Evaluation of techniques used, identifying what worked, what went wrong and how it can be improved is an ongoing process for success.

The AAR covers four specific points:

1. What was planned?
2. What actually happened?
3. Why did it happen?
4. What can be done next time?

An overview of the After Action Review can be found in the IRPG (p. xii).

3.5.2 Monitoring Actions

The monitoring program is a system used to evaluate fuel loads and the affect of wildland and prescribed fire activities on the landscape. Monitoring is done in three steps and considers operational and vegetative components, burn objectives and environmental effects.

- Step 1 identifies the current, pre-burn conditions of the site, accomplished through photos, data or a combination of both.
- Step 2 occurs soon after the application of prescribed fire and includes descriptions of the burn, the effect on fuels, and directions for future action on successive burns of the same unit.
- Step 3 occurs at least 30 days or more after the use of prescribed fire (and/or periodically during several post-burn years) and re-evaluates the current conditions of the site and compares it to that of desired conditions.

Evaluation and monitoring, within the context of fire management planning, will help determine how effective the plan is being implemented, whether the implementation is achieving the desired outcome, and whether assumptions used in the planning are valid.

Prescribed fire's effects on military training, ecosystem components, and fuel load reduction are some of the areas of interest that will be monitored.

4.0 References

401 KAR 63:005. Open Burning. Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection, Division of Air Quality, Kentucky, 15 March 2005

Army Regulation 200-1 Environmental Protection and Enhancement, December 2007

Army Regulation 200-2 Environmental Analysis of Army Actions, March, 2002 (32 CFR 651)

Chapter 1200-3-4 Open Burning. Rules of Tennessee Department of Environment and Conservation, Bureau of Environment, Division of Air Pollution Control, September, 2007 (Revised)

Common Denominators on Fire Behavior on Tragedy and Near-miss Wildland Fires, National Wildfire Coordinating Group, PMS 407, NFES 2225, June 1996

DoD Instruction 4715.03 Natural Resources Conservation Program 18 March 2011

DoD Instruction 6055.06, DoD Fire and Emergency Services Program, December 21, 2006

Federal Wildland Fire Management Policy January 2009

Fireline Handbook, National Wildfire Coordinating Group, NWCG Handbook 3, PMS 410-1, NFES 0065, March 2004

Fitness and Work Capacity, 2009 Edition, National Wildfire Coordinating Group, PMS 304-2, NFES 1596, December 2009

Fort Campbell Integrated Natural Resources Management Plan (INRMP), 2013-2017

Fort Campbell All Hazards Plan, Dec 2012

Gaining an Understanding of the National Fire Danger Rating System, National Wildfire Coordinating Group, PMS 932, NFES 2665, July 2002

Guide for Prescribed Fire in Southern Forests, USDA Forest Service Southern Region, Technical Publication R8-TP 11, February 1989

Guidance for Implementation of Federal Wildland Fire Management Policy, February 13, 2009

Incident Response Pocket Guide (IRPG), National Wildfire Coordinating Group, PMS 461, NFES 1077, January 2010

Interagency Prescribed Fire Planning and Implementation Procedures Guide, July 2008

National Fire Protection Agency (NFPA) 1977: Standard on Protective Clothing and Equipment for Wildland Fire Fighting, 2011

National Fire Protection Association Standard 295 – Standard for Wildfire Control

National Fire Protection Association Standard 299 – Protection of Life and Property from Wildfire

National Fire Protection Association Standard 1051 – Wildland Firefighter Professional Qualification Standard

National Wildfire Coordinating Group (NWCG) Glossary of Wildland Fire Terminology, PMS 205, July 2012

Smoke Management Guide for Prescribed and Wildland Fire, National Wildfire Coordinating Group, NFES 1279, 2001

Wildland Fire Qualifications Subsystem Guide, National Wildfire Coordinating Group, PMS 310-1, Oct 2012

Appendix A

Army Wildland Fire Policy Guidance, August 2002

DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON DC 20310-0600

DAIM-ZA (200-3)

SEP 0 4 2002

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Army Wildland Fire Policy Guidance

1. References:

a. AR 420-90, 10 Sep 97, Fire and Emergency Services.

b. AR 200-3, 28 Feb 95, Natural Resources - Land, Forest and Wildlife Management.

2. The enclosed policy guidance is effective immediately. Resource-dependent requirements should be included in budget strategies and implemented as soon as possible, but not later than the end of FY 07. Implementation is necessary to address safety, land management, and environmental compliance. This guidance supplements references la and 1 b and applicability is the same as those regulations. Army wildland fire policy guidance is compatible with Transformation of Installation Management.

3. Where this guidance impacts bargaining unit employees' condition of employment, statutory and contractual labor relations' obligations must be met prior to its implementation.

4. Responsible organization for all fire and emergency services is Director of Facilities and Housing supported in wildland fire management by Director of Environmental Programs. The points of contact are Mr. Bruce Park, (703) 428-6174 and Mr. Bill Woodson, (703) 693-0680, respectively.

for

LARRY J. LUST
Major General, GS
Assistant Chief of Staff
for Installation Management

Encl
as

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SUBJECT: Army Wildland Fire Policy Guidance

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ARMY WILDLAND FIRE POLICY GUIDANCE

1.0 Integrated Wildland Fire Management Policy. The Army adopts the following policies and standards:

1.1 Review and Update of the 1995 Federal Wildland Fire Management Policy, Jan 01.

1.2 National Wildfire Coordinating Group (NWCG) Wildland and Prescribed Fire Qualification System Guide (PMS 310- 1/NFES 1414), Jan 00.

1.3 National Fire Protection Association (NFPA) Standard 295 – *Standard for wildfire control*, Standard 299 – *Protection of life and property from wildfire*, and Standard 1051- *Wildland firefighter professional qualification standard.*

1.4 DoD Instruction 6055.6, 10 Oct 00, DoD Fire and Emergency Services Program.

2.0 Applicability. This policy guidance has the same applicability as AR 420-90, Fire and Emergency Services and AR 200-3, Natural Resources - Land, Forest and Wildlife Management. This policy guidance supplements both of these Army Regulations. In addition, it is applicable under Transformation of Installation Management.

3.0 Planning. Installations with unimproved grounds that present a wildfire hazard and/or installations that utilize prescribed burns as a land management tool will develop and implement an Integrated Wildland Fire Management Plan (IWFMP) that is compliant and integral with the Integrated Natural Resources Management Plan (INRMP), the installations' existing fire and emergency services program plan(s), and the Integrated Cultural Resources Management Plan (ICRMP).

4.0 Program Authority

4.1 The Assistant Chief of Staff for Installation Management (ACSIM) is responsible for oversight of the program, updating policy, and resolving policy questions through the Facilities and Housing Directorate in coordination with the Environmental Programs Directorate.

4.2 The ACSIM, through the HQ Installation Management Agency, Regions and the Headquarters, National Guard Bureau (HQ, NGB) will provide information to installations necessary to perform wildland fire management in accordance with this guidance. The ACSIM and HQ, NGB will assure that wildland fire program reviews are incorporated into Fire and Emergency Services Operational Readiness Inspections and Environmental Compliance Assessment Screenings.

4.3 The garrison commander, or appropriate designee, defines the roles and responsibilities for wildland fire management on the installation, plans and programs resources, and will designate

an installation Wildland Fire Program Manager in either the Fire and Emergency Services or Natural Resources organization.

4.4 The garrison commander, or appropriate designee, approves the installation IWFMP.

4.5 The garrison commander approves the deployment of Army civilian firefighters to any off installation incident.

4.6 The installation Wildland Fire Program Manager is responsible for development of the IWFMP. Additionally, the Wildland Fire Program Manager reviews and approves burn plans for prescribed fires to insure consistency with the IWFMP, the INRMP, and other applicable operating instructions such as State and local regulations.

4.7 The Director of Military Support is responsible for deployment of military firefighters and equipment.

5.0 Wildland Fire Standards. Army organizations involved in wildland fire activities will incorporate NWCG organizational standards into their organizational structure when necessary to accommodate cooperation and integration with other federal, state, and local wildland fire organizations across jurisdictional boundaries.

6.0 Certification, Training, and Fitness Standards for Wildland Fire Management Personnel.

6.1 Certification Standards. All civilian, contractor, and emergency services personnel involved in wildland fire management must possess certifications appropriate for their expected level of involvement in the wildland fire organization. All Army personnel must meet the NFPA or NWCG Standards for certification or be certified by the State in which the installation is located as a Prescribed Burn Manager. This certification does not apply to military personnel deployed by orders from the Director of Military Support.

6.1.1 Personnel in the GS-081 job series, 51M career paths, and contractors will meet the certification standards specified in NFPA Standard 1051 – Standard for Wildland Fire Fighter Professional Qualifications and NFPA Standard 1002 – Standard for Fire Apparatus Driver/Operator Professional Qualifications. All other Army personnel with jobs requiring wildland fire responsibilities may use the NWCG Wildland Fire Qualification Subsystem Guide (PMS 310-1/NFES 1414) to attain the required NFPA certification. Personnel who have learned skills from sources outside wildfire suppression, such as agency specific training programs or training and work in prescribed fire, structural fire, law enforcement, search and rescue, etc., may not be required to complete specific courses in order to qualify in a wildfire position. However, position task books must be completed for documentation of certification.

6.1.2 Personnel mobilized to participate in wildland fire management activities on properties not under DoD jurisdiction, either through mutual aid agreement or other means, must be certified for the expected level of involvement under NWCG standards. GS-081 job series, Army contractor, and 51M personnel that seek certifications other than the NFPA Job Levels must

comply with the appropriate NWCG criteria. Deployment of civilian or military personnel by national request and reimbursement procedures is contained in Appendix A.

6.1.3 Position descriptions for new hires that will participate in wildland fire activities will reflect the expected level of involvement and required certifications. Position descriptions with wildland fire management duties must state if the position qualifies the position holder as a primary or secondary wildland firefighter, as described in Chapter 46 of the Office of Personnel Management Civil Service Retirement System and Federal Employees Retirement System Handbook for Personnel and Payroll Offices. Personnel not classified as a primary or secondary wildland firefighter will perform duty in wildland fire management activities as qualified.

6.1.4 Primary and secondary wildland firefighters will be certified, as a minimum requirement, in Cardio-Pulmonary Resuscitation (CPR) and Standard First Aid by the American Red Cross or comparable certification authority.

6.1.5 HQ Air Force Civil Engineering Support Agency/Civil Engineering Fire Protection is the executive agent for the DoD Fire Fighter Certification Program (FFCP) and is responsible for issuing, maintaining, and tracking of NFPA wildland firefighter certifications. The ACSIM, Facilities and Housing Directorate, is responsible for maintaining and annually updating a list of NWCG certified wildland firefighters for the Army. The installation Wildland Fire Program Manager is responsible for issuing, signing, maintaining, and tracking of NWCG Qualification Card/Incident Command System (also known as "Red Cards") for installation personnel.

6.2 Physical Fitness Standards.

6.2.1 The installation IWFMP will describe a measurable and objective evaluation test (medical exam, step-test, pack test, etc.) that will be used to establish physical fitness standards for personnel that participate in wildland fire management activities. All required exams will be paid for by the Government. DoD 6055.6-M Department of Defense Fire and Emergency Services Certification Program, and NWCG Publications Management System (PMS) 310-1/National Fire Equipment System (NFES) 1414 – *Wildland and Prescribed Fire Qualification System Guide*, NFES 1596-*Fitness and Work Capacity*, and NFES 2071 – *Fit to Work, Fatigue and the Firefighter* provide guidance for establishing physical fitness standards for wildland fire management activities.

6.2.2 Personnel whose job description requires participation in wildland fire management activities as a primary or secondary firefighter on Army installations will meet the pre-employment medical and physical criteria contained in NFPA 1500 – *Standard on Fire Department Occupational Safety and Health Program* and receive a physical examination as specified in NFPA 1582 – *Standard on Medical Requirements for Fire Fighters*. Medical and physical requirements for personnel not classified as primary/secondary wildland firefighters shall be as specified in the installation IWFMP.

7.0 Integrated Wildland Fire Management Plan. The Installation IWFMP should be developed to reduce wildfire potential, effectively protect and enhance valuable natural resources, integrate applicable state and local permit and reporting requirements, and implement

ecosystem management goals and objectives on Army installations. It should be reviewed and updated annually and revised at a minimum once every five years. The IWFMP will directly support installation missions and be consistent with installation emergency operations plans, while being integrated with the INRMP, the installation's fire and emergency services plan, and the ICRMP, if they exist. The IWFMP may be included in the INRMP or the fire and emergency services program plan(s). Regional IWFMPs under the Transformation of Installation Management are acceptable but must be supplemented locally as needed. The IWFMP will ensure integration by including in its development all organizations having fire responsibility on the installation, and it will be coordinated with installation mission operations and other appropriate installation organizations. Response to wildland fire will be based on the IWFMP and in accordance with land management objectives. Installations with minor wildfire hazard and/or prescribed burning activities may be exempted from the IWFMP requirement by the ACSIM, Facilities and Housing Directorate or HQ, NGB with concurrent notification of the ACSIM, Facilities and Housing Directorate. As a minimum, the installation IWFMP will include the following components:

7.1 Goals and Objectives. The Plan shall establish goals and objectives for the wildland fire management program on the installation.

7.2 Organizational Structure and Responsibilities. The IWFMP will describe the wildland fire management organizational structure, and will indicate its position within the installation command structure. The organizational structure for wildland fire activities will be consistent with NWCG Incident Command System (ICS) standards. The plan will describe responsibilities for all installation personnel involved in fire and emergency response.

7.3 Interagency Cooperation and Mutual Aid Agreements. The IWFMP will identify procedures for cooperative management, emergency assistance, and mutual aid off the installation. Installations are encouraged to develop regional partnerships through reciprocal agreements among DoD installations and other federal, state, local, and private entities to share planning/management strategies and resources (e.g. human, logistical, and operational resources). These reciprocal agreements must be in place if emergency assistance is planned off the installation. Emergency assistance and mutual aid agreements will conform to the guidelines stated in DODI 6055.6 – DoD Fire and Emergency Services Program and AR 420-90, Fire and Emergency Services. Place copies of interagency agreements or mutual aid agreements in the appendix to the IWFMP.

7.4 Smoke Management and Air Quality. Describe the mission, environmental, human health, and safety factors as well as applicable state and local permit reporting requirements specific to the installation and region that affect smoke management and identify necessary mitigation practices. Refer to NWCG publication PMS 420-2/NFES 1279 – *Prescribed Fire Smoke Management Guide* for guidance on factors to consider.

7.5 Safety and Emergency Operations. Identify installation-specific safety and emergency operations protocols. Identify safety procedures for unexploded ordnance in wildfire situations. Identify areas where quality, quantity, or types of unexploded ordnance render the area inappropriate for fire fighting, such as 40 mm. grenade impact areas. Establish appropriate

specialized procedures when ammunition or hazardous materials storage areas might be involved. Use NFPA 1977 – *Standard on Protective Clothing and Equipment for Wildland Fire Fighting*, which establishes the requirements for protective clothing. The IWFMP must reflect that firefighter and public safety is the highest priority in every wildland fire management activity.

7.6 Risk Assessment/Decision Analysis Processes. Sound operational risk management will be the foundation for all wildland fire management plans and activities. Identify the indices and/or fire danger rating systems that must be considered before conducting wildland fire activities to determine fire hazard, severity, intensity, and other significant factors affecting the protection of life and property. Identify the environmental factors that will be measured prior to ignition of a prescribed fire treatment. Identify normal and unique weather patterns that affect fire behavior on the installation.

7.7 Wildland Fire History. Include an appendix that provides an analysis of both recent and long-term wildland fire history.

7.8 Natural and Cultural Resource Considerations. Identify sensitive natural and cultural resources that should be given consideration before conducting any wildland fire management activity. Consider development of a comprehensive, interagency strategy for fire management to help achieve ecosystem sustainability. Incorporate mitigation, burned-area rehabilitation, and fuels reduction and restoration activities that contribute to ecosystem management. Consider use of maintained, vegetated firebreaks to protect sensitive areas.

7.9 Mission Considerations. Identify mission requirements and potential impacts to the installation and tenant unit missions (positive and negative) that may occur as a result of implementation of the IWFMP.

7.10 Wildland Fuel Factors. Identify the effects of installation and community wildland fuel types and fuel loads on fire behavior. Display data on fuel types and fuel loading by maps or other means. Conduct fuel surveys to collect wildland fire fuels data if necessary.

7.11 Monitoring Requirements. Identify the environmental factors that will be monitored and the frequency of monitoring required for both a wildfire and prescribed fire. Identify post-fire assessment protocols for both wildfire and prescribed fires.

7.12 Public Relations. Identify a protocol for notifying the media or other affected public for wildfire incidents and prescribed burning activities. Incorporate wildland fire, both protection and ecological aspects, into installation and public awareness programs.

7.13 Funding Requirements. Identify the funding requirements to train and equip wildland fire management personnel to ensure safe, effective, and cost-efficient operations in support of the IWFMP. Identify the appropriate sources of funding for wildland fire activities.

7.14 Personnel Training and Certification Standards and Records.

7.14.1 Identify the staffing requirements, according to specific certification and training requirements, for the tasks associated with wildland fire management activities on the installation. Current training and qualification records will be maintained for all personnel involved in wildland fire management activities. The garrison commander or designee will assure the maintenance of training records (e.g. through the Civilian Personnel Office, Wildland Fire Program Manager, or Fire Chief (see also paragraph 6.1.5)).

7.14.2 Provide opportunities for maintenance of current knowledge on the science of fire and fire management and to take advantage of new technology.

7.15 Programmatic Environmental Assessment. Implementation of the IWFMP requires an assessment of the environmental effects as required by AR 200-2, *Environmental Analysis of Army Actions*, dated 29 Mar 02.

8.0 Funding.

8.1 Funding for IWFMP implementation, wildland fire prevention, fuels management for hazard reduction, wildland fire suppression, prescribed burning, and other wildland fire management is an installation operations and maintenance responsibility. Resource planning and programming should be addressed in the next Program Objective Memorandum cycle.

8.2 The Integrated Training Area Management funds may be used for construction and maintenance of fire/fuel breaks, or other fuel removal directly associated with ranges/training areas.

8.3 Proceeds from the sale of forest products may be used for protection of forests on land in forestry reimbursable programs in accord with Memorandum, DAIM-ED-N, 17 Aug 99, subject: Army Regulatory Guidance for Reimbursable Agricultural/Grazing and Forestry Programs.

8.4 Wildland fire management activities conducted for the purpose of compliance with environmental laws and regulations will be supported by environmental conservation funds.

8.5 Mission activities, e.g. training and testing, may support wildland fire management and suppression as required and agreed to by the participating organizations. The garrison commander or designee will mediate and organize such arrangements.

9.0 Prescribed Fires.

9.1 Use of Prescribed Fire on Army Installations. Prescribed fire may be used as a management tool to support mission needs and to attain the goals and objectives of the INRMP. The Army recognizes two types of prescribed fires: 1) those ignited by qualified personnel in accordance with an approved prescribed burn plan, and 2) wildfires managed under prescribed conditions as addressed in an approved IWFMP.

9.2 Site Specific Burn Plans. A site specific burn plan will be developed for each prescribed burn conducted on Army property. The installation IWFMP will identify the required components for site-specific burn plans. At a minimum, burn plans will include the following:

- Burn objectives
- Acceptable weather and fuel moisture parameters
- Required personnel and equipment resources
- Burn area map
- Smoke management plan
- Safety considerations
- Pre-burn authorization/notification checklist
- Coordination to consider wildlife, endangered species, cultural resources, and noxious weed effects.
- Alternative plan to cover plan of action if wind direction changes during prescribed burn.
- Plan for analysis of burn success and identification of lessons learned.

9.3 Use of Fire Breaks. When planning for prescribed fires, and when suppressing wildfire, utilize natural and existing man-made features whenever possible. Fire breaks must be constructed, maintained, or rehabilitated to prevent erosion.

10.0 Mutual Aid.

10.1 Following proper coordination with the office of the Deputy Chief of Staff, G-3, military assistance (both military and civilian personnel) may be furnished to the National Interagency Fire Center (NIFC) in national fire emergencies pursuant to the Memorandum of Understanding between the Department of Defense and The Departments of Agriculture and the Interior dated 1975. Support to NIFC is reimbursable under the Economy Act. Procedures for deployment of civilian or military personnel by national request are provided in Appendix A.

10.2 Local area assistance included in existing agreements (paragraph 7.3) may be authorized by the garrison commander.

11.0 Labor Relations. In the implementation of this policy guidance, activities should ensure compliance with their statutory labor relations obligations.

APPENDIX A. DEPLOYMENT AND REIMBURSEMENT PROCEDURES (not applicable outside the Continental US)

1.1 Preparedness Levels 1 – 5 (Non-Military). Army civilian firefighters may be deployed if requested by the National Interagency Fire Center (NIFC) and coordinated with the Director of Military Support (DOMS). The request will be channeled from NIFC through the Geographic Area Coordination Center (GACC) to the Dispatch Center and finally to the specific civilian resource. Conditions for any deployment of civilian personnel include willingness of civilians to volunteer, approval by the installation or garrison commander, and coordination (through the chain of command) with DOMS. If deployed to a different set of duties than normally assigned, the assignment must be accomplished by detail. The Army will annually assemble a list of Department of Army civilians that are certified (red card), their level of certification, and dates of availability. It is from this list that NIFC, through the GACCs, requests appropriate civilian resources. This list is provided to each of the GACCs and to the DOMS annually. This procedure is different than the procedure for deployment of other military assets as outlined below. It is designed to accommodate national requirements for specific civilian expertise to be integrated with other Federal and State agencies.

1.2 Preparedness Level 5 (Military). Army military firefighters may be deployed if requested by the National Interagency Fire Center (NIFC) through (DOMS).

2.0 Fiscal and Entitlement Support. Support to NIFC is fully reimbursable under the Economy Act. Volunteers will continue to be paid from their current payroll offices. All actual costs, including base salary, overtime, TDY travel, and per diem will be paid IAW paragraph 2.2. Employees selected for these assignments would be detailed to a set of duties and placed on TDY. NIFC will report employee work hours and leave to each employee's timekeeper weekly.

2.1 Benefits and Entitlements. All current enrollments in Federal benefit coverage will continue, i.e., Federal Employees Health Benefits, Federal Employee Group Life Insurance, Thrift Savings Plan, Workers Compensation, etc. Individuals with private insurance should check with their respective carriers to determine coverage. Firefighters identified for deployment should be advised to update their designation of beneficiaries, emergency contacts, and medical allergies statements. If required, components would submit a request for waiver of the biweekly maximum earnings limitation for approval.

2.2 Reimbursement. Local resource managers should establish a local automatic reimbursable account. At the conclusion of the mission, components will prepare and forward a SF 1080 billing for all actual expenses incurred to NIFC. For fires located west of the Mississippi River, this should be done through the coordinating activity at 5th Continental U.S. Army, Ft. Sam Houston, TX. The POC for reimbursement can be reached at DSN, 471-2566, commercial, (210) 221-2566. For fires located East of the Mississippi River, the coordinating activity is the 1st Continental U.S. Army, Ft. Gillem, GA. The POC for reimbursement can be reached at DSN, 797-7560, commercial, 404-469-7560.

Appendix B

Memorandums of Understandings (MOUs) and Intergovernmental Service Agreements (ISAs)

Fort Campbell, Kentucky has Reciprocal Fire Protection Agreements (RFPAs) with the following city, county and state agencies:

- Cadiz Fire Department, Cadiz, KY
- Hopkinsville Fire Department, Hopkinsville, KY
- Montgomery County Volunteer Fire Department, Montgomery County, TN
- Oak Grove Fire Department, Oak Grove, KY
- Herndon Volunteer Fire Department, Herndon, KY
- Lafayette Volunteer Fire Department, Lafayette, KY
- Roaring Springs Volunteer Fire Department, Roaring Springs, KY
- Clarksville Fire Rescue, Clarksville, TN
- Stewart County Fire Rescue, Stewart County, TN

Fort Campbell, Kentucky also has a Intergovernmental Service Agreement (ISA) which contains a Cooperative Fire Protection Agreement (CFPA) with the Forest Service located at Land Between the Lakes.

Each individual ISA,RFPA and CFPA is attached.

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND CADIZ FIRE DEPARTMENT CADIZ, KY

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of reciprocal aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special rescue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Cadiz Fire Department agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Cadiz Fire Department in carrying out this agreement will be owned by Cadiz Fire Department. All personnel acting for Cadiz Fire Department under this agreement will be an employee of Cadiz Fire Department.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Cadiz Fire Department normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

a. To provide the City of Cadiz, upon request by the City Mayor or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of the Cadiz Fire Department.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting City of Cadiz official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities performed by a member/employee of the respective fire protection agencies performed in the execution of this agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services (DES) is the proponent for this Reciprocal Fire Protection Agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Officer at (270) 956-3138.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Cadiz Fire Department

PERRY C. CLARK
COL., SF
Garrison Commander

8 Sep 10
Date

LYNN BAILEY
Mayor
City of Cadiz, Kentucky

7-28-10
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

8-31-10
Date

KERRY FOWLER
Fire Chief
Cadiz Fire Department

7-28-10
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND HOPKINSVILLE FIRE DEPARTMENT HOPKINSVILLE, KY

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of reciprocal aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special rescue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Hopkinsville Fire Department agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Hopkinsville Fire Department in carrying out this agreement will be owned by Hopkinsville Fire Department. All personnel acting for Hopkinsville Fire Department under this agreement will be an employee of Hopkinsville Fire Department.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Hopkinsville Fire Department normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Hopkinsville Fire Department

a. To provide the City of Hopkinsville, upon request by the City Mayor or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of the Hopkinsville Fire Department.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting City of Hopkinsville official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities performed by a member/employee of the respective fire protection agencies performed in the execution of this agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services (DES) is the proponent for this Reciprocal Fire Protection Agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Officer at (270) 956-3138.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Hopkinsville Fire Department

PERRY C. CLARK
COL, SF
Garrison Commander

8 Sep 10
Date

DAN KEMP
Mayor
City of Hopkinsville, Kentucky

12 August 2010
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

1 Sept 10
Date

FAGAN PACE
Fire Chief
Hopkinsville Fire Department

8-12-2010
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND MONTGOMERY COUNTY VOLUNTEER FIRE DEPARTMENT MONTGOMERY COUNTY, TN

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of reciprocal aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special rescue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents an agreement for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Montgomery County Volunteer Fire Department agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Montgomery County Volunteer Fire Department in carrying out this agreement will be owned by Montgomery County Volunteer Fire Department; and all personnel acting for Montgomery County Volunteer Fire Department under this agreement will be an employee of Montgomery County Volunteer Fire Department.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Montgomery County Volunteer Fire Department normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement

a. To provide Montgomery County, upon request by the County Mayor or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of the Montgomery County Volunteer Fire Department.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Montgomery County official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities performed by a member/employee of the respective fire protection agencies performed in the execution of this agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services (DES) is the proponent for this Reciprocal Fire Protection Agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Officer.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement

PERRY C. CLARK
COL, SF
Garrison Commander

8 Sept 10
Date

CAROLYN BOWERS
Mayor
Montgomery County

8/18/10
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

8/31/10
Date

STEVEN R. JONES
Fire Chief
Montgomery County Volunteer Fire Department

8/18/10
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND OAK GROVE FIRE DEPARTMENT OAK GROVE, KY

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of reciprocal aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special rescue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Oak Grove Fire Department agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Oak Grove Fire Department in carrying out this agreement will be owned by Oak Grove Fire Department. All personnel acting for Oak Grove Fire Department under this agreement will be an employee of Oak Grove Fire Department.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Oak Grove Fire Department normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Oak Grove Fire Department

a. To provide the City of Oak Grove, upon request by the City Mayor or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of the Oak Grove Fire Department.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting City of Oak Grove official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities performed by a member/employee of the respective fire protection agencies performed in the execution of this agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services (DES) is the proponent for this Reciprocal Fire Protection Agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Officer at (270) 956-3138.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Oak Grove Fire Department

PERRY C. CLARK
COL, SF
Garrison Commander

8/18/2010
Date

DAN POTTER
Mayor
City of Oak Grove, Kentucky

7-6-2010
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

8-9-2010
Date

GREG BEQUETTE
Fire Chief
Oak Grove Fire Department

7/6/2010
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND HERNDON VOLUNTEER FIRE DEPARTMENT HERNDON, KY

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of reciprocal aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special rescue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Herndon Volunteer Fire Department agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Herndon Volunteer Fire Department in carrying out this agreement will be owned by Herndon Volunteer Fire Department. All personnel acting for Herndon Volunteer Fire Department under this agreement will be an employee of Herndon Volunteer Fire Department.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Herndon Volunteer Fire Department normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Herndon Volunteer Fire Department

a. To provide the Town of Herndon, upon request by the Fire Chief or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of the Herndon Volunteer Fire Department.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Herndon official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities performed by a member/employee of the respective fire protection agencies performed in the execution of this agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services (DES) is the proponent for this Reciprocal Fire Protection Agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Officer at (270) 956-3138.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Herndon Volunteer Fire Department

PERRY C. CLARK
COL, SF
Garrison Commander

31 Aug 2010
Date

NEIL FARMER
Fire Chief
Herndon Volunteer Fire Department

8-17-10
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

8-17-10
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND LAFAYETTE VOLUNTEER FIRE DEPARTMENT LAFAYETTE, KENTUCKY

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special recue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents an agreement for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Lafayette Volunteer Fire Department agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Lafayette Volunteer Fire Department in carrying out this agreement will be owned by Lafayette Volunteer Fire Department; and all personnel acting for Lafayette Volunteer Fire Department under this agreement will be an employee of Lafayette Volunteer Fire Department.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Lafayette Volunteer Fire Department normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Lafayette Volunteer Fire Department

a. To provide the Town of Lafayette, upon request by the Fire Chief or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Lafayette Volunteer Fire Department.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Lafayette Volunteer official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities preformed by a member/employee of the respective fire protection agencies performed in the execution of this Agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services is the proponent for this mutual aid agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Office at (270) 956-1453/3138.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Lafayette Volunteer Fire Department

PERRY C. CLARK
COL, SF
Garrison Commander

28 DEC 2010
Date

BOBBY CHANDLER
Fire Chief
Lafayette Volunteer Fire Department

12-9-10
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

12-17-10
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND ROARING SPRINGS VOLUNTEER FIRE DEPARTMENT ROARING SPRINGS, KENTUCKY

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special recue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents an agreement for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Roaring Springs Volunteer Fire Department agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Roaring Springs Volunteer Fire Department in carrying out this agreement will be owned by Roaring Springs Volunteer Fire Department; and all personnel acting for Roaring Springs Volunteer Fire Department under this agreement will be an employee of Roaring Springs Volunteer Fire Department.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Roaring Springs Volunteer Fire Department normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Roaring Springs Volunteer Fire Department

a. To provide the Town of Roaring Springs, upon request by the Fire Chief or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Roaring Springs Volunteer Fire Department.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Roaring Springs Volunteer official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities preformed by a member/employee of the respective fire protection agencies performed in the execution of this Agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services is the proponent for this mutual aid agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Office at (270) 956-1453/3138.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Roaring Springs Volunteer Fire Department

PERRY C. CLARK
COL, SF
Garrison Commander

29 DEC 2010
Date

CARL LEADFORD
Fire Chief
Roaring Springs Volunteer Fire Department

12-4-10
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

12-17-10
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND CLARKSVILLE FIRE RESCUE CLARKSVILLE, TN

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of reciprocal aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special rescue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Clarksville Fire Rescue agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Clarksville Fire Rescue in carrying out this agreement will be owned by Clarksville Fire Rescue. All personnel acting for Clarksville Fire Rescue under this agreement will be an employee of Clarksville Fire Rescue.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Clarksville Fire Rescue normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Clarksville Fire Rescue

PERRY C. CLARK
COL, SF
Garrison Commander

31 Aug 2010
Date

JOHN E. PIPER
Mayor
City of Clarksville, Tennessee

8/13/10
Date

KEVIN E. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

8-19-10
Date

MICHAEL E. ROBERTS
Fire Chief
Clarksville Fire Rescue

8-10-10
Date

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, SOUTHEAST REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF:

RECIPROCAL FIRE PROTECTION AGREEMENT BETWEEN U. S. ARMY GARRISON, FORT CAMPBELL, KENTUCKY AND STEWART COUNTY FIRE RESCUE STEWART COUNTY, TENNESSEE

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance

1. **Purpose:** To set forth, in accordance with section 1856a, Title 42, United States Code, written procedures to secure for each the benefits of mutual aid in fire prevention, the protection of life and property from fire and firefighting to include emergency services, basic medical support, basic life support, hazardous material containment and confinement, and special recue events involving motor vehicle accident extrications, and trench, building and confined space extrications.

2. **Scope**: This agreement will apply between signature agencies anytime assistance or information is rendered between departments for city fire and rescue. This Reciprocal Fire Protection Agreement is intended exclusively to provide guidance and documents an agreement for general support; nothing contained herein creates or extends any right, privilege, or benefit to any person or entity.

3. **Stewart County Fire Rescue agrees:**

a. To provide Fort Campbell, upon request by the Garrison Commander or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Fort Campbell Fire and Emergency Services.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Fort Campbell official will be immediately notified.

c. All equipment used by Stewart County Fire Rescue in carrying out this agreement will be owned by Stewart County Fire Rescue; and all personnel acting for Stewart County Fire Rescue under this agreement will be an employee of Stewart County Fire Rescue.

d. In the event a crash of aircraft owned or operated by the United States or military aircraft owned by a foreign nation occurs within the area for which Stewart County Fire Rescue normally provides fire protection, the Chief of Fort Campbell Fire and Emergency Services, or their representative, may assume full command on arrival of all assets at the scene of the crash.

4. **Fort Campbell Fire and Emergency Services agrees:**

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Stewart County Fire Rescue

a. To provide Stewart County, upon request by the Fire Chief or their designated representative, firefighting equipment and personnel, when available to any point within the firefighting jurisdiction of Stewart County Fire Rescue.

b. The rendering of assistance under the terms of this agreement is not mandatory. If assistance cannot be rendered, for any reason, the requesting Stewart County Fire Rescue official will be immediately notified.

5. Any dispatch of equipment and personnel pursuant to this agreement is subject to the following conditions:

a. Any request for aid under this agreement will specify the location to which the equipment and personnel are dispatched; however, the amount and type of equipment and number of personnel to be furnished will be determined by a representative of the responding organization.

b. The responding organization will report to the officer in charge of the requesting organization at the location to which the equipment is dispatched, and will be subject to the orders of that official.

c. A responding organization will be released by the requesting organization when services of the responding organization are no longer required, or when the responding organization is needed within the area for which it normally provides fire protection.

6. The signatories to this Reciprocal Fire Protection Agreement understand, acknowledge, and agree that all activities preformed by a member/employee of the respective fire protection agencies performed in the execution of this Agreement are within the scope of employment/line of duty for said member/employee. Each department bears the responsibility for injuries/death to its members and exonerates the other agency from any and all liability.

7. The chief fire officers and personnel of the fire departments of both parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and as feasible to jointly conduct pre-fire planning inspections and training exercises.

8. The technical heads of the fire departments of the parties to this agreement are authorized and directed to meet and draft any detailed plans and procedures of operations necessary to efficiently implement this agreement. Such plans and procedures of operations shall become effective upon ratification of the signatory parties.

9. The Director, Directorate of Emergency Services is the proponent for this mutual aid agreement. Effective execution of this agreement can only be achieved through continuing communication and dialogue between the parties. It is the intent of this agreement that channels of communication will be used to resolve questions, misunderstandings, or complaints that may arise that are not specifically addressed in the agreement. All questions should be directed to the DES Operations Office at (270) 956-1453/3138.

10. This agreement will become effective with the last signature and shall remain in effect until modified or terminated upon written notification to all parties concerned. Any party wishing to terminate this agreement will provide 30 days notice of termination to all parties involved. This agreement will be reviewed triennially to determine the need for continuation, modifications, or termination.

SUBJECT: Reciprocal Fire Protection Agreement for Fire Fighting Assistance – Stewart County Fire Rescue

PERRY C. CLARK
COL, SF
Garrison Commander

9 JUN 2011
Date

RICK JOINER
Deputy Fire Chief
Stewart County Fire Rescue

5-23-11
Date

KEVIN P. BAYLOR
Fire Chief
Fort Campbell Fire and Emergency Services

5-24-11
Date

INTRAGOVERNMENTAL SUPPORT AGREEMENT

1. AGREEMENT NUMBER *(Provided by Supplier)*	2. SUPERSEDED AGREEMENT NO. *(If this replaces another agreement)*	3. EFFECTIVE DATE *(YYYY/MM/DD)*	4. EXPIRATION DATE *(May be "Indefinite")*
W34GM7-110721-FC63	MOA 202	Date of last signature	SEPT 2013

5. SUPPLYING ACTIVITY	6. RECEIVING ACTIVITY
a. NAME AND ADDRESS US ARMY GARRISON FORT CAMPBELL, KY IMAR-CAM-RMM 39 NORMANDY BLVD FORT CAMPBELL, KY 42223-5324 POC: Lynn Harrison Commercial/DSN Phone Numbers: (270)798-5318/635-5318 E-mail Address: lynn.harrison1@us.army..mil	**a. NAME AND ADDRESS** Land Between The Lakes NRA 100 Van Morgan Drive Golden Pond, KY 42211 Attn: Dennis Wilson Denniswilson@fs.fed.us POC: Montez Ashley Commercial/DSN Phone Numbers : (414) 29703150 E-mail Address: mashley@fs.fed.us
b. MAJOR COMMAND Installation Management Command	**b. MAJOR COMMAND** USDA, FOREST SERVICE

7. SUPPORT PROVIDED BY SUPPLIER

a. SUPPORT *(Specify what, when, where, and how much)*	b. BASIS FOR REIMBURSEMENT	c. ESTIMATED REIMBURSEMENT
See Attachment I-Cooperative Fire Protection Agreement **TOTAL ESTIMATED REIMBURSEMENT DOLLARS** **Standard level of support is the quality, quantity, frequency or timeliness of a base support service that an installation is able to provide to all applicable customers within available resources.** ADDITIONAL SUPPORT REQUIREMENTS ATTACHED: [X] YES [ ] NO		$ NA

8. SUPPLYING COMPONENT		9. RECEIVING COMPONENT	
a. COMPTROLLER SIGNATURE Anita T Austin ANITA T. AUSTIN, DIR. GRMO	**b. DATE SIGNED** 11/1/11	**a. COMPTROLLER SIGNATURE** Dennis Wilson (same as below) ASHLEY MONTEZ, FS AGREEMENTS COORD	**b. DATE SIGNED**
c. APPROVING AUTHORITY		**c. APPROVING AUTHORITY**	
(1) TYPED NAME PERRY C. CLARK, COL, SF, GARRISON COMMANDER		**(1) TYPED NAME** DENNIS WILSON, LAND BETWEEN THE LAKES, PROG MGR	
(2) ORGANIZATION US ARMY GARRISON FORT CAMPBELL, KY	**(3) TELEPHONE NUMBER**	**(2) ORGANIZATION** USDA, FOREST SERVICE, LAND BETWEEN THE LAKES NRA GOLDEN POND, KY	**(3) TELEPHONE NUMBER** (270) 924-2070/(414) 297-3150
(4) SIGNATURE	**(5) DATE SIGNED** 2NOV11	**(4) SIGNATURE**	**(5) DATE SIGNED** 10/7/11

10. TERMINATION *(Complete only when agreement is terminated prior to scheduled expiration date.)*

a. APPROVING AUTHORITY SIGNATURE	b. DATE SIGNED	c. APPROVING AUTHORITY SIGNATURE	d. DATE SIGNED

DD FORM 1144, NOV 2001

11 .GENERAL PROVISIONS *(Complete blank spaces and add additional general provisions as appropriate: e.g., exceptions to printed provisions, additional parties to this agreement, billing and reimbursement instructions.)*

a. The receiving components will provide the supplying component projections of requested support. *(Significant changes in the receiving component's support requirements should be submitted to the supplying component in a manner that will permit timely modification of resource requirements.)*

b. It is the responsibility of the supplying component to bring any required or requested change in support to the attention of **Support Agreement Managers of both the receiving and supplying activity** prior to changing or canceling support.

c. The component providing support in this agreement will submit statements of costs to the address in block 6a (Customer) of this agreement.

d. All rates expressing the unit cost of services provided in this agreement are based on current rates which may be subject to change for uncontrollable reasons, such as legislation, DoD directives, and commercial utility rate increases. Although DoDI requires costs to be reviewed annually to ensure continued accuracy of estimated reimbursement, limiting factors may preclude accomplishment. In these cases, inflation rates designated in the DoD Comptroller's Annual inflation Guidance will be applied to costs for the Support Agreement. These rates are applicable to all services and recognized in congressional budget justifications.

e. This agreement may be cancelled by either party upon giving at least 180 days written notice to the other party.

f. In case of mobilization or other emergency, this agreement will remain in force only within supplier's capabilities.

g. Reimbursable support will be billed on SF1080 or a computer generated equivalent, quarterly. Charges for reimbursable support may be accumulated within a fiscal quarter and billed when the value is $500 or more. The receiver should provide the reimbursable costs identified in this agreement on the appropriate resource document. The provider will bill the "receiver" for actual costs by processing Standard Form (SF) 1080, Voucher for Transfers between Appropriations and/or Funds on a quarterly basis. The provider will support the SF 1080 with an itemized list of charges applicable to each AMS account. It is mutually understood and agreed upon by both the provider and the receiver that additional support, not otherwise covered in this agreement, may be requested and furnished provided that it does not interfere with the provider's mission and insofar as it is available. Remittance will be forwarded to the **Garrison Resource Management Office, 39 Normandy Blvd, Fort Campbell, KY 42223-5344.** All transactions will be processed as a "no-check-drawn" transaction. A DD Form 448 will be used for reimbursable support and mailed to **Director, Garrison Resource Management Office, ATTN: IMSE-CAM-RM, 39 Normandy Blvd, Fort Campbell, KY 42223-5344**. Funding documents must cite the complete accounting classification to which such services are to be charged and the total dollar limitation. The supplier will acknowledge acceptance of funds. Reimbursable documents will include a "Subject to availability of funds" (SAF) statement, if applicable. Bills and request for payment associated with support provided in accordance with this agreement are not subject to audit or certification in advance of payment. **If GFEBS Customer, reimbursement will be via direct charge.**

h. This agreement is in accordance with DODI 4000.19, AR 5-16. **The agreement number, W34GM7-110721-FC63____, will be referenced on all billing documents and correspondence.** This agreement is effective upon signature of authorized representatives. The agreement will be reviewed triennially to determine the need for continuation, modification, or termination. This agreement will be revised when changing conditions or costs require substantial alterations. Minor changes that do not exceed 5% of estimated cost are permissible without additional approval as long as a change does not significantly alter the existing agreement. **Any provision of this Agreement may be reviewed and changed upon the agreement of both the Supplier and Customer.** Any requests for review by one party must be forwarded to the other party, in writing, at least 60 days prior to the effective date of each change. Whenever possible, ISSA modifications and terminations should be made with sufficient advance notification to permit appropriate funding adjustments to be made during the budget formulation process. If an ISSA must be terminated or suspended with less than 180 days notice to the other parties, the terminating party may be billed by the non-terminating parties for reimbursement of unavoidable termination and re-procurement expenses incurred during the 180 day period following notification. Support provided under this agreement will be provided by the Supplier based on the availability of assets and/or resources.

i. All tenants of Fort Campbell are required to be in compliance with AR 200-1, 28 Aug 07, Environment Protection and Enhancement. In accordance with Department of Army and IMCOM guidance, Fort Campbell implemented a mission focused ISO 14001 Environmental Management System (EMS) from fence to fence. The Fort Campbell EMS is closely linked to our sustainability program and is titled "Sustainable Installation Management System" (SIMS). As a Fort Campbell tenant, you are responsible to observe the installation environmental policy and SIMS installation-level procedures. The policy and installation level procedures are posted on the Fort Campbell internet "Environmental" page and on the Fort Campbell intranet Knowledge Share page. For additional guidance and assistance for EMS requirements specific to your organization, contact the Fort Campbell SIMS AO, Bldg. 2182, Phone 270-798-9597.

j. Supplier's Mission: To support expeditionary forces by providing equitable services that sustain Fort Campbell and enhance the well-being of the military community.

Receiver's Mission: PROVIDE COOPERATIVE FIRE FIGHTING SERVICES

Manning Strength: Military: NA *Civilians:* NA UIC: **NA** DODAAC: **NA**

Buildings/Square Footage: **Bldg(s):** **NA** **Sq Ft.** **NA**

ADDITIONAL GENERAL PROVISIONS ATTACHED: [X] YES [ ] NO

SPECIFIC PROVISIONS CONTINUED-

Attachment I-Cooperative Fire Protection Agreement

PURPOSE: To provide cooperation in the prevention, detection and suppression of wildland fires within the protection areas of parties signatory to this Agreement while promoting opportunities for joint wildland fire training of personnel in the respective firefighting organizations. The Agreement provides for cooperation only in wildland fire management activities. The US Forest Service shall not respond to structure fires, vehicle fires or traffic accidents in lieu of the FCMR. The US Forest Service may respond to such incidents when adjacent wildlands covered under this Agreement are threatened by fire from such incidents.

Parties agree:

1. Fire prevention efforts will be coordinated to the maximum extent possible, at all levels of both agencies.

2. Each agency will render mutual assistance to the fullest extent practicable.

3. Lookouts and other employees of either agency shall, upon discovering or receiving reports of fires on areas protected by the other agency, report such fires promptly to the other agency in accordance with current practice and instructions as described in the Operations Plan.

4. Equipment owned and used by either agency to suppress fires on lands for which the other is responsible will normally be operated, serviced, and repaired by the owning agency. Both parties, where needed, will agree to, exceptions to this practice, in writing, in advance.

5. Each party will be responsible for damage to its equipment under its laws and rules, except that if equipment is rented without operators, the receiving agency will be responsible under applicable laws of the agency. Both parties, where needed, will agree to, exceptions to this practice, in writing, in advance.

6. Neither FCMR nor the Forest Service shall be bound to make any expenditure under the terms of this Agreement, except as funds are appropriated by the Congress of the United States, or which may otherwise be made available.

7. Agreement pertains only to the parties signed to this agreement.

8. All aircraft and pilots used to transport USFS personnel or directly controlled by U.S. Forest Service shall be certified by a qualified Forest Service inspector prior to Forest Service use.

9. Each agency will be responsible for the training of their respective fire organizations and will invite appropriate representatives of the other agency to attend and participate in training meetings, for the purpose of promoting closer working relations and better acquaintance with the fire organizations.

10. Federal Employment Compensation Act. Any service performed hereunder by any officer or employee of the United States or any member of any Armed Forces of the United States shall constitute service rendered in the line of duty in such office, employment or force. The performance of such service by any other individual shall not constitute such individual an officer or employee of the United States for the purposes of the Federal Employment Compensation Act, as amended.

12. **SPECIFIC PROVISIONS** ***(Supplier and receiver responsibilities, conditions, requirements, quality standards, and criteria for measurement/reimbursement of unique requirements.)***

ADDITIONAL SPECIFIC PROVISIONS ATTACHED: [X] YES [ ] NO

DD FORM 1144, NOV 2001

Support Agreement Number
W34GM7-110721-FC63

11. GENERAL PROVISIONS (Continued)

j. **Identify any peculiarities, i.e., special handling equipment, hazardous materials/activities, unique security requirements and any other requirements above and beyond the standard level of support.**

kj. Method of Payment: **Executed with Military Interdepartmental Purchase Request (MIPR) in accordance with Chapter 26, of the DoD Accounting Manual 7220.9-M.)** Frequency of Payment: **Quarterly, sent to (Director, Garrison Resource Management Office, 39 Normandy Blvd, Fort Campbell, KY 42223. Or if GFEBS customer via direct charge.**

l. Although the DOD requires costs to be reviewed annually to ensure continued accuracy of estimated reimbursement, limiting factors may preclude accomplishment. In these cases, inflation rates designated in the DoD Comptroller's Annual Inflation Guidance rates are applicable to all services and recognized in congressional budget justification. Minor changes, which do not exceed plus or minus 5% of estimated costs are permissible without additional approval as long as change does not significantly alter the existing agreement. Costs in this agreement do not necessarily represent actual reimbursable requirements. Current year-to-date standard levels of service will be the applicable levels of service at a given time.

m. AUTHORITY: The provisions of this ISSA are as a minimum in accordance with the following regulations:
a) Department of Defense Instructions (DODI) 4000.19, Interservice and Intragovernmental Support
b) 31 U.S.C. 1535 (Economy Act) **(APPLIES TO NON-ARMY ACTIVITIES)**
c) AR 5-9, Area Support Responsibilities

n. No additional manpower will be required by the supplier to perform support required in this agreement.

ADDITIONAL GENERAL PROVISIONS ATTACHED: [ ] YES [ ] NO

Appendix C

ENVIRONMENTAL OPERATING PROCEDURE

This document is ***UNCONTROLLED*** when printed or electronically copied from the Fort Campbell LAN san server SIMS folder.

Originating Office: Directorate of Public Works, Environmental Division, Conservation Branch		**Revision Frequency: Annual**
Document Type/Title: Fire Management Operations **Document ID: FOR-003.00**		
Document Owner: **Scott Osborne**	**Approval:** **Ronald Ballard**	**Revision Level: 00** **Revision Date:**
Asst. Wildland Fire Program Mgr.(OPs)	**Wildland Fire Program Mgr.**	**Issue Date: 4 April 2013**

1. Purpose.

This EOP outlines and defines responsibilities and standard operating procedures for fire management operations on Fort Campbell. The intent of the fire management program is to support military training and enhance ecosystem function. Several directives and regulations require Ft. Campbell to conduct wildland fire management. These include the Federal Wildland Fire Management Policy, Jan 01; National Fire Protection Association (NFPA) Standard 295-Standard for wildfire control, Standard 299-Protection of life and property from wildfire; Army Regulation 200-1, Environmental Protection and Enhancement and the Integrated Natural Resources Management Plan (INRMP).

2. Scope.

This EOP applies to all personnel involved with wildland and prescribed fire operations on Fort Campbell. A prescribed fire is defined as a pre planned ignition managed for resource objectives. A wildfire is defined as a non-structure, unplanned ignition that occurs in the wildland.

3. References. Fire Management activities shall follow the guidance contained within the following:

1) DoD Instruction 6055.6, DoD Fire and Emergency Services Program, 10 October 2000
2) Army Regulation 200-1 Environmental Protection and Enhancement, 13 December 2007
3) Army Wildland Fire Policy Guidance, September 2002
4) Federal Wildland Fire Management Policy, 2001
5) Army Regulation 420-90 Fire and Emergency Services, 4 October 2006
6) Fort Campbell Installation Natural Resources Management Plan (INRMP)
7) Integrated Wildland Fire Management Plan (IWFMP)
8) Fort Campbell Policy 15 Memorandum – Composite Risk Management and Risk Decision Authority, 1 October 2009

9) Fort Campbell Sustainable Installation Management System (SIMS) Environmental Operating Procedure FOR-002.00, 31 March 2009
10) National Wildfire Coordinating Group (NWCG) Wildland Fire Qualifications Subsystem Guide, Publication Management System (PMS) 310, 1 April 2010
11) National Fire Protection Association Standard (NFPA) 295 –Standard for wildfire control
12) National Fire Protection Association Standard (NFPA) 299-Protection of life and property from wildfire
13) National Fire Protection Association Standard (NFPA) 1051-Wildland firefighter professional qualification standard
14) Prescribed Fire in Southern Forests, USDA Forest Service Southern Region; Technical Publication R8-TP 11, February 1989
15) Tennessee and Kentucky State Air Quality Program Standards
16) Tennessee and Kentucky State Water Quality Standards
17) Incident Command System; http://www.osha.gov/SLTC/etools/ics/index.html
18) Fort Campbell Installation Safety Office "FC Form 4162", April 2006
19) National Wildfire Coordinating Group Fire Weather Station Standards, PMS 426-3, May 2008

4. Responsibilities.

a. The Incident Command System (ICS) will be used for all activities: wildland fire, prescribed fire and other all risk responses. This system functions well with military style leadership, is flexible, capable of expanding to meet response needs and is used by all other first responders on the installation. The following serves to outline duties specific to Fort Campbell fire management activities.

b. The Wildland Fire Program Manager will:
(1) Provide an updated Integrated Wildland Fire Management Plan (IWFMP) to the Garrison Commander (GC) for approval.
(2) Develop and update annually the prescribed and wildland fire Risk Management Worksheet (FC Form 4162) for GC approval.
(3) Update Garrison senior leaders on the status of wildland fire operations and prescribed burning activities.
(4) Collaborate with Assistant Wildland Fire Program Managers to verify prescribed fire management program goals and objectives are being achieved or actively pursued.

c. The Assistant Wildland Fire Program Manager (Operations) will:
(1) Manage and coordinate all installation prescribed fire requests and the implementation of the proposed action.
(2) Coordinate with the Assistant Wildland Fire Program Manager (Training) for scheduling joint prescribed burn training (Classroom and Field) with DES, DPTMS, Conservation and Forestry.
(3) Manage all Fire Management personnel on the operations and implementation of wildland and prescribed fire activities.

d. The Fire Management Officer (FMO) or Burn Boss will:

(1) Coordinate all installation fire activities and briefs the Assistant Wildland Fire Program Manager (Operations) at the conclusion of every prescribed burn or wildfire.
(2) Disseminate prescribed burning locations and objectives to EOC prior to each burn event. This will provide situational awareness to the installation and the surrounding city and county emergency managers.
(3) Conduct a briefing/debriefing for each fire activity.
(4) Provide EOC the daily Fire Danger Rating category for distribution on the Fort Campbell Intranet web page.
(5) Determine fire weather conditions (Red Flag Warning/Severe Fire Weather Potential) and wildfire response.
(6) Manage competency training requirements for all fire personnel and document in the Incident Qualification System (IQS).
(7) Consult with the Range Fire Coordinator (Range Division) to develop the DPTMS prescribed fire work plan. This will be incorporated with the Installation's fiscal year prescribed fire plan.
(8) Coordinate annual work capacity tests for Fort Campbell personnel.

5. Procedure for prescribed fire (wildland fire activities will follow ICS structure).

a. Wildland Fire Program Manager submits an updated Risk Management Worksheet (FC Form 4162) and proposed FY burn plan map to GC for approval NLT the end of the fiscal year prior to requested prescribed burn actions.

(1) Assistant Wildland Fire Program Manager (Operations) facilitates a fire coordination meeting with all prescribed burn proponents. Fire proponents are requested to begin establishing fire control lines for their requested actions.

b. Fire Management Officer or Burn Boss coordinates with DPTMS, Range Control to schedule land for prescribed fire activities utilizing Range Facility Management Scheduling System (RFMSS).

(1) Coordinates with proponents on land availability and makes adjustments to plan as needed.

(2) Establish co-use status with occupying units if approved by Range Control.

(3) DPTMS Range Division and DPW Forestry finalize the prescribed burn fire plan based upon availability of training land.

c. Assistant Wildland Fire Program Manager (Operations) and FMO or Burn Boss makes determination if fire weather conditions meet prescribed fire prescriptive requirements and adequate wildfire response personnel are available, and then approves/disapproves all daily fire activities.

d. FMO or Burn Boss notifies prescribed fire activities for scheduled areas via e-mail and telephone to EOC. EOC distributes the daily prescribed burn information and weather summary to all concerned parties on Fort Campbell and neighboring governmental emergency managers. The Fort Campbell Intranet web page and CAMP 101 announcements will be the communication tool.

e. FMO or Burn Boss ensures all personnel have proper PPE and equipment.

f. Fire Tower Operator confirms the communication network with the tower and EOC has opened, if tower is in operation. The operator will communicate this message via Motorola radio to the prescribed burn crew and EOC.

g. FMO or Burn Boss completes pre-burn briefing to all participants and establishes goals and objectives. Assign roles and responsibilities to each member for the operation. Crew members will sign the tailgate safety brief checklist to annotate their understanding of their role and duties during the operation.

(1) FMO or Burn Boss supplies maps and instructions for the area.

(2) Fire Tower Operator monitors fire weather and disseminates information to crew members hourly.

h. Crew members perform duties as assigned.

(1) Crew members notify the FMO or Burn Boss of the status of the control lines.

(2) FMO or Burn Boss contacts Fire Tower Operator prior to operations and relays intent. The operator relays this information to the EOC.

i. FMO or Burn Boss contacts Fire Tower at the conclusion of operations.

j. An after action review with all fire participants following cessation of operations.

k. Fire Tower Operator confirms the communication network with the tower and EOC is closing. The operator communicates this message via Motorola radio to the crew and EOC.

l. Personnel are designated to conduct mop-up activities and equipment recovery as required.

6. Smoke Management and Air Quality.

The purpose of smoke management is to minimize public health and safety impacts of smoke from prescribed burns that are managed for natural resource benefit or wildland fire prevention. Fort Campbell Wildland Fire Program Managers must be more cautious with smoke generated from a prescribed burn operation due to the increased liability of intentionally igniting fires and dispersing aerial particulates. Consequently, Forestry generates smoke plume models for every prescribed burn activity. These models aid fire managers with predictive information regarding mixing heights, dispersion (elevation and direction), and airshed effects. Special consideration is given to: airfields, heliports, mission training, logging operations, highways, and surrounding communities. Smoke from prescribed burning operations is an acceptable form of air contaminant as per the Open Burning regulations for the States of Kentucky and Tennessee (401 KAR 36-005 Open Burning and Chapter 1200-3-4 Open Burning respectively).

7. Risk Management.

All fire danger risks will be determined utilizing the Risk Management Worksheet (FC Form 4162), which is reviewed and approved by the GC annually before any prescribed burn operation initiates. Each prescribed fire proponent shall brief a risk management worksheet associated with each treatment area to the associated fire team, incorporating the hazards and controls of that individual operation. This assessment is signed by the appropriate fire team and submitted

with the prescribed burn map. The individual risk assessments supplement the all-inclusive GC approved FC Form 4162 (REF 8).

8. Fire Weather.

Fort Campbell maintains a Remote Automated Weather Station (RAWS) station to forecast fire weather and potential fire danger. The station is maintained to NWCG standards. Fort Campbell Forestry obtains hourly weather observations via the National Fire and Aviation Management Web Applications (FAMWEB) website (https://fam.nwcg.gov/fam-web/). The RAWS located at the corner of On-The-Line Road and Mabry Road (across from Range 37) collects various data observations and automatically syncs to the FAMWEB database. Forestry uses the hourly observations to determine the severe fire behavior potential, wind speed, wind direction, dew point, relative humidity, fuel moisture, probability of precipitation or storms, smoke dispersion indices, atmospheric stability, drought indices, rainfall amounts and other important readings used in the National Fire Danger Rating System (NFDRS). All observations and data are calculated within the Weather Information Management System (WIMS) associated with that RAWS site and then projected on FAMWEB.

a. Forestry obtains spot forecasts electronically from the National Weather Service at Paducah, KY. The information provided in this forecast is associated with grid coordinates and the estimated time of ignition for that particular day. This forecast includes any warnings issued by the National Weather Service for expected fire weather. Immediate stoppage, if safe, of all prescribed burning operations will occur if particular fire weather danger criteria exist.

(1) If the National Weather Service has issued a Red Flag Warning, Forestry delays all burning operations until Red Flag has been lifted.

(2) If wind speed and direction are fluctuating where smoke management has been compromised all burning operations cease.

b. Additionally, the Fire Tower Operator observes fire weather conditions with monitoring equipment and disseminates the information via radio communications to all fire crew members hourly. On site weather may be taken by personnel to update or supplement weather information as needed.

9. Certification, Training, and Fitness Standards for Fire Management Personnel

All civilian, contractor, and emergency services personnel involved in wildland fire management must possess certifications appropriate for their expected level of involvement in the wildland fire organization. All Army personnel must meet the NFPA or NWCG Standards for certification or be certified by the State in which the installation is located as a Prescribed Burn Manager. This certification does not apply to military personnel deployed by orders from the Director of Military Support.

a. Personnel in the GS-081 job series, 51M career paths, and contractors will meet the certification standards specified in NFPA Standard 1051 – Standard for Wildland Fire Fighter Professional Qualifications and NFPA Standard 1002 – Standard for Fire Apparatus Driver/Operator Professional Qualifications. All other Army personnel with jobs requiring wildland fire responsibilities may use the NWCG Wildland Fire Qualification Subsystem Guide

(PMS 310-1/NFES 1414) to attain the required NFPA certification. Personnel who have learned skills from sources outside wildfire suppression, such as agency specific training programs or training and work in prescribed fire, structural fire, law enforcement, search and rescue, etc., may not be required to complete specific courses in order to qualify in a wildfire position. However, position task books must be completed for documentation of certification.

Personnel mobilized to participate in wildland fire management activities on properties not under DoD jurisdiction, either through mutual aid agreement or other means, must be certified for the expected level of involvement under NWCG standards. GS-081 job series, Army contractor, and 51M personnel that seek certifications other than the NFPA Job Levels must comply with the appropriate NWCG criteria.

(1) Position descriptions for new hires that will participate in wildland fire activities will reflect the expected level of involvement and required certifications. Position descriptions with wildland fire management duties must state if the position qualifies the position holder as a primary or secondary wildland firefighter, as described in Chapter 46 of the Office of Personnel Management Civil Service Retirement System and Federal Employees Retirement System Handbook for Personnel and Payroll Offices. Personnel not classified as a primary or secondary wildland firefighter will perform duty in wildland fire management activities as qualified.

(2) Primary and secondary wildland firefighters will be certified, as a minimum requirement, in Cardio-Pulmonary Resuscitation (CPR) and Standard First Aid by the American Red Cross or comparable certification authority.

(3) HQ Air Force Civil Engineering Support Agency/Civil Engineering Fire Protection is the executive agent for the DoD Fire Fighter Certification Program (FFCP) and is responsible for issuing, maintaining, and tracking of NFPA wildland firefighter certifications. The ACSIM, Facilities and Housing Directorate, is responsible for maintaining and annually updating a list of NWCG certified wildland firefighters for the Army. The installation Wildland Fire Program Manager is responsible for issuing, signing, maintaining, and tracking of NWCG Qualification Card/Incident Command System (also known as "Red Cards") for installation personnel.

b. The installation IWFMP will describe a measurable and objective evaluation test (medical exam, step-test, pack test, etc.) that will be used to establish physical fitness standards for personnel that participate in wildland fire management activities. All required exams will be paid for by the Government. DoD 6055.6-M Department of Defense Fire and Emergency Services Certification Program, and NWCG Publications Management System (PMS) 310- 1/National Fire Equipment System (NFES) 1414 – *Wildland and Prescribed Fire Qualification System Guide*, NFES 1596-*Fitness and Work Capacity*, and NFES 2071 – *Fit to Work, Fatigue and the Firefighter* provide guidance for establishing physical fitness standards for wildland fire management activities.

(1) Personnel whose job description requires participation in wildland fire management activities as a primary or secondary firefighter on Army installations will meet the pre-employment medical and physical criteria contained in NFPA 1500 – *Standard on Fire Department Occupational Safety and Health Program* and receive a physical examination as specified in NFPA 1582 – *Standard on Medical Requirements for Fire Fighters.* Medical and physical requirements for personnel not classified as primary/secondary wildland firefighters shall be as specified in the installation IWFMP.

(2) All fire management personnel will be given a Range and UXO class. The class will familiarize personnel with hazards and actions to be taken upon finding unexploded ordnance. All personnel operating All Terrain Vehicles (ATVs) while carrying out activities will complete the ATV Safety Institute's ATV Rider Course (or similar ATV safety training). Competency training requirements are documented in the Incident Qualification System, managed and maintained by the Forestry office.

Appendix D

RISK MANAGEMENT WORKSHEET

(For use of this form see CAM Regulation 385-5. The proponent of this form is Installation Safety)

1. MISSION/TASK	2. BEGIN DTG	3. DATE PREPARED	4. PREPARED BY (Rank, Name, Duty Position)
Wildland and Prescribed Fire Operations of Training Areas, Ranges, and Impact Areas	04 April 2013	04 April 2013	Scott P. Osborne, GS-11, DPW Forestry
	END DTG continual		

5. HAZARDS	6. INITIAL RISK WITH SEVERITY AND PROBABILITY	7. CONTROLS	8. RESIDUAL RISK WITH SEVERITY AND PROBABILITY	10. HOW IMPLEMENTED	11. WHO/HOW SUPERVISED	14. CONTROLS EFFECTIVE
Working in close proximity to fire	HIGH B II	Only certified trained personnel will be allowed to perform fire operations. (All trained in prescribe burn techniques, S-130,S -190). Monitor fire weather on-site. Prompt communication of changes in weather conditions and spotting to ground crews. Fire fighting equipment on-site.	LOW C IV	Certification identified in personnel standards. Training records maintained. PPE checked at tailgate briefing. Fire weather instruments and communication devices maintained and available on-site. Appropriate equipment and tools assessed for each burn event.	Personnel Supervisor: ensures training completed and PPE issued. Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities.	AARs completed for each burn event to document effectiveness and areas of improvement
Erratic fire behavior causing controlled situations to become unmanageable	HIGH B II	Establishment of control lines and suppression actions. Monitor fire weather on-site. Prompt communication of changes in weather conditions and spotting to ground crews. Fire fighting equipment on-site. Ensure fire stays contained. Prescribed Burn-Scheduling based on spot forecast and favorable weather conditions. Wildland Fires-DES/DPTMS/Military Units on stand-by for response during high risk weather conditions.	MEDIUM C III	Establish control lines prior to prescribed fire activities and burn out operations. Fire weather instruments and communication devices maintained and available on-site. Appropriate equipment and tools assessed for each burn event. Utilize proper holding techniques to contain fire.	Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities.	

9. MISSION/TASK RISK AFTER CONTROLS ARE IMPLEMENTED	12. COMMAND REVIEW (Name and Rank)	13. COMMAND APPROVING AUTHORITY
☐ LOW ☑ MEDIUM ☐ HIGH ☐ EXTREMELY HIGH	Ted A. Reece, Acting DPW	Click to Sign

1. MISSION/TASK
Wildland and Prescribed Fire Operations of Training Areas, Ranges, and Impact Areas

5. HAZARDS	6. INITIAL RISK WITH SEVERITY AND PROBABILITY	7. CONTROLS	8. RESIDUAL RISK WITH SEVERITY AND PROBABILITY	10. HOW IMPLEMENTED	11. WHO/HOW SUPERVISED	14. CONTROLS EFFECTIVE
Heavy smoke	HIGH B II	Evaluate fuel type and spot weather forecast prior to burn to anticipate smoke conditions. Utilize NOAA Hysplit dispersion model prior to burn. Monitor fire weather on-site. Utilize road guards for traffic control. Prompt communication of changes in weather conditions. Personnel maintain upwind positions as much as possible.	LOW C IV	Consider predicted smoke conditions in determining feasibility of burn. Inform EOC and other affected activities of predicted smoke conditions prior to burn. Perform periodic updates of fire activity with EOC throughout burn event. Fire weather instruments and communication devices maintained and available on-site.	Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities. Tower Operator: performs smoke observations and communicates with ground crews.	
Wire (barb-razer-concentina.), sinkholes, foxholes, stumps, logs, etc. concealed by vegetation	MED B III	Use properly maintained and equipped ATV's for field transport, minimize foot traffic in high vegetation. Certification training for all personnel utilizing ATVs. Personnel being alert, going slow, and maintaining good communications. Personnel knowledgeable of hazards and equipment capability. Personnel carrying wire cutting and digging tools.	LOW D IV	Personnel utilizing ATVs on burns required to have certification training. Potential field hazards and ATV use covered in tailgate briefing. Personnel trained in use of hand tools.	Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities.	

1. MISSION/TASK
Wildland and Prescribed Fire Operations of Training Areas, Ranges, and Impact Areas

5. HAZARDS	6. INITIAL RISK WITH SEVERITY AND PROBABILITY	7. CONTROLS	8. RESIDUAL RISK WITH SEVERITY AND PROBABILITY	10. HOW IMPLEMENTED	11. WHO/HOW SUPERVISED	14. CONTROLS EFFECTIVE
UXO, Ammo larger than .50 cal., Small-Arms ammo, Flares and other Pyrotechnics	HIGH C I	Avoid entering/traversing areas known to contain UXO, ammo and other incendiary training devices. Use vehicles when traversing areas in close proximity to areas known to have UXO and ammo. (Areas known to contain UXO, ammo and other incendiary training devices include North, South and Small Arms Impact Areas, Demo 39 and Ranges 4, 7, 17, 25, 26, 29, and 42 C) Range Safety Officer screens burn plans for UXO/ammo concerns prior to burn event. Personnel trained to recognize and report UXO and ammo above .50 cal. Personnel using proper firefighting PPE. Personnel attain safe distance from fire upon recognizing detonation of concealed ammo.	MED C III	Maps/plans of burn event available to Range Safety and personnel prior to prescribed fire activities. Hazards specific to burn areas and personnel PPE checked at tailgate briefing. All personnel completed UXO Safety and Awareness training conducted by local EOD unit. All-terrain and utility vehicles equipped with ignition devices and suppression equipment.	Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities.	
Weather	MED B III	Only certified trained personnel will be allowed to perform fire activities. (All trained in prescribed burn techniques, S-130,S-190). Spot forecast generated prior to burn event using Installation's fixed weather monitoring staion. Fire weather monitored hourly on-site. Prompt communication of changes in weather conditions to ground crews. Fire fighting equipment on-site.	LOW B IV	Fire weather spot forecast for burn event reviewed at tailgate briefing. Fire weather instruments and communication devices maintained and available on-site. Fire tower manned for weather observations and communications.	Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities. Tower Operator: performs weather observations and communicates with ground crews.	

1. MISSION/TASK
Wildland and Prescribed Fire Operations of Training Areas, Ranges, and Impact Areas

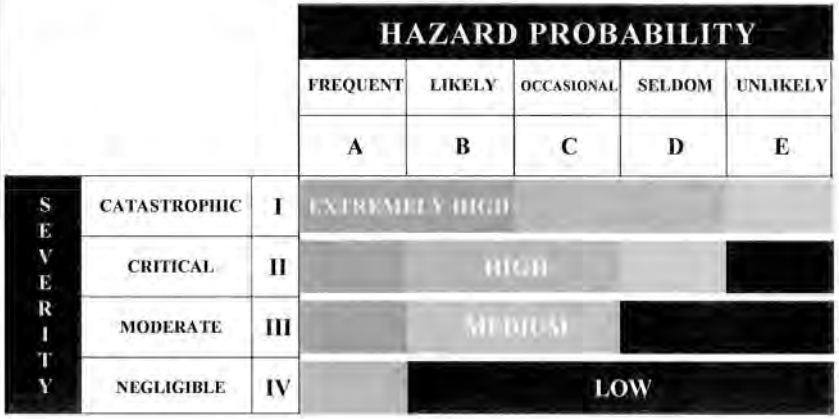
5. HAZARDS	6. INITIAL RISK WITH SEVERITY AND PROBABILITY	7. CONTROLS	8. RESIDUAL RISK WITH SEVERITY AND PROBABILITY	10. HOW IMPLEMENTED	11. WHO/HOW SUPERVISED	14. CONTROLS EFFECTIVE
Environmental Hazards: stinging insects, snakes, snags, low limbs, thick ground cover, etc.	MED C III	Personnel trained in awareness and avoidance of hazardous/nuisance wildlife. First aid kit to include insect sting treatment on site. Personnel with proper PPE and communication devices for emergency. Personnel utilizing situational awareness of surrounding environmental conditions. Snags assessed prior to prescribed fire activities and removed by dozer/certified sawer.	LOW D III	Personnel annually trained on awareness and avoidance of hazardous/nuisance wildlife. Personnel trained on basic first aid application. PPE, equipment, drinking water, communication devices, situational awareness covered during tailgate briefing.	Personnel Supervisor: ensures training completed and PPE issued. Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities.	
Heat injury	MED C III	Personnel trained in awareness and avoidance of heat stress. Personnel with proper PPE, ample drinking water and communication devices for emergency. Qualified personnel on -site with appropriate physical fitness testing.	LOW E III	Personnel annually trained on heat injury awareness and prevention. Several water coolers available for use and ice machine located at Forestry bldg. Physical fitness standards incorporated into installation firefighting qualifications.	Personnel Supervisor: ensures training completed and PPE issued. Burn Boss and/or IC: performs planning of each fire activity, conducts tailgate safety briefings, directs actions during fire activities, completes AAR after fire activities.	

RISK MANAGEMENT WORKSHEET INSTRUCTIONS

(For use of this form see CAM Regulation 385-6. The proponent of this form is Command Safety)

1. Mission/Task - Describe the mission/task to be executed. For example: Platoon Attack by fire:
2. Mission/Task Date Time Group (DTG) - Enter DTG (day, month and time) when the mission/task is planned to begin and it is planned to be completed.
3. Date Prepared - Enter day/month/year the worksheet was completed.
4. Prepared By - Enter the rank, last name, and duty position of the person who prepared the worksheet.
5. Identify Hazards - Identify hazards by reviewing the METT-T. Sources of METT-T facts and historical hazards include: Mission/task instructions, recon, experience of leaders and troops, unit SOP, unit accident history, Risk Management Reference Booklet and NTC Force Protection Study Guide. Objective is to identify hazards that are most likely to result in accidental injury or equipment damage. Enter hazards in block 5.
6. Initial Risk - Determine the risk of each hazard by applying the risk assessment matrix. For each hazard, enter in block 6 risk level with severity and probability. For example: EH, A, I = Frequent Catastrophic or M, D, II = Seldom, Critical.
7. Develop Controls - For each hazard, develop one or more controls to eliminate or reduce the risk. As needed, specify the who, what, where, when, and how of each control. Sources include those listed above for block 5.
8. Residual Risk - For each hazard, use the risk assessment matrix to determine the level of risk remaining after the controls are implemented with severity and probability included. Use example in paragraph 6 to complete this block.
9. Determine Mission/Task Risk - Use procedures outlined in unit SOP. If unit SOP does not include procedures to determine overall mission/task, use the highest remaining residual risk and mark risk level in block 9.
10. Implement Controls - For each control, enter in block 10 how it will be put into effect/communicated to personnel conducting the mission. For example: instructions, tactical/safety/garrison SOPs, rehearsals, and verbally brief.
11. Who/How Supervised - For each control, enter in block 10 how it will be monitored to ensure it is implemented. For example: continuous supervision, spot-checks, situation reports, the buddy or soldier self-discipline, Platoon Leader/Sergeant, Squad Leader.
12. Command Review - Review Risk Management Worksheet to ensure division and unit policies are being followed.
13. Command Approving Authority - Decide to accept or not accept the level of residual risk for the mission. Use Division Policy and Unit SOP to determine who is authorized to accept levels of risk. Enter in block 13 the appropriate command approving authority for the risk level marked in block 9.
14. Controls Effectiveness - After the mission/task is completed, determine the effectiveness of each control reducing the risk of the targeted hazard. In block 13, enter "yes" if the control was effective and "no" if the control was not effective. For each control that was not effective, determine why and what to do the next time this hazard is identified. For example: change the control, develop a different control or change how the control will be implemented.

Catastrophic - Death or permanent total disability, system loss, major property damage.
Critical - Permanent partial disability in excess of 3 months, major system damage, significant property damage.
Moderate - Minor injury, lost workday accident, compensable injury or illness, minor system damage, minor property damage.
Negligible - First aid or minor supportive medical treatment, minor system impairment.



Level of Risk	Authority to Accept Risk
Extremely High	CG or Designated Representative
High	Brigade Commander
Medium	Battalion Commander
Low	Company Commander/First Sergeant

Appendix E

CAM Reg. 385-5: Fort Campbell Fire Prevention Guidelines

Classification	Condition	Restrictions			
		North/South Impact Areas	Small Arms Ranges	Training Areas and Urban Operations sites	Shoot houses, Demo Areas (Including 39, 44G and 51B)
Class I	Burn Index 0-4	None	None	None	None
Class II	Burn Index 5-9	None	None	None	None
Class III	Burn Index 10-19	None	None	None	None
Class IV	Burn Index 20-39, winds less than 10 knots	HE only for indirect fire systems. Ball only except on Rg 28, 29, 31, 41, 42C (CLF), 46, 50, and 55C	Ball only, except Ranges 10, 11, 26, and 36A	Extreme caution when using blank ammunition and pyrotechnics	None
Class V	Burn Index 20-39, winds greater than 10 knots	HE or Ball Only. Powder charges or increments may only be burned on hard surface. Ball only except on Rg 28, 29, 31, 41, 46, 50, and 55C. No 20mm or 40mm HE	Ball only except Ranges 10, 11, 26 and 36A. No 40mm HE.	No open fires. No pyrotechnics. No blank ammunition in Training Areas. (Blanks are authorized in Urban Operations sites)	None
Class VI	Burn Index 40-100, winds less than 20 knots	HE (Indirect fire and Avn Gun) or ball (direct fire) only	No tracers. No 40mm HE	Same as Class V	No Firing on Demo Areas. No restrictions in Shoot houses
Class VII	Burn Index 40-100, winds greater than 20 knots	No Firing	No Firing	Same as Class V	No Firing
AERIAL GUNNERY: All targets will be a minimum of 1 km inside the impact area when firing missiles during Class VI days.					

Appendix F

DEPARTMENT OF THE ARMY
FORT CAMPELL INSTALLATION
2700 Indiana Avenue
Fort Campbell, Kentucky 42223-5656
1 November 2013

Facilities Engineering

FIRE PROTECTION AND PREVENTION

1. Summary
This regulation establishes policies, procedures, and responsibilities for the installation Fire Prevention Program.

2. Applicability
This regulation applies to all Active Duty Army, the Army National Guard (ARNG), United States (U. S.) Army Reserve, members of other uniform services, organizations including tenant, contractors, and privatization civilian personnel assigned, and family members residing or visiting on the installation. This regulation also applies to off-post facilities under the jurisdiction of Fort Campbell.

3. Supplementation
Issuing of supplements to this regulation is prohibited unless specifically approved by Commander, l0lst Airborne Division (Air Assault) and Fort Campbell, Kentucky.

4. Administrative notes
The word "his/her" in this regulation is intended to include both the masculine and feminine genders. The word "shall" in this regulation indicate a mandatory requirement. The word "should" in this regulation indicate a recommendation or that which is advised but not required.

5. Suggested improvements
Users are invited to send comments and suggested improvements on Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) to Directorate of Emergency Services, attn: IMCB-EFS and/or submit DA Form 1045 (Army Ideas for Excellence Program (AIEP) Proposal) to installation AIEP coordinator.

6. Proponent
The proponent for this regulation is The Directorate of Emergency Services, Fire Department, attn: IMCB-EFS.

Contents (listed by paragraph and page number)

This regulation supersedes CAM Reg 420-24 dated 28 December 2010

Chapter 1
Fire Protection & Prevention General Information

1-1. Purpose
To implement Army Regulation 420-1, chapter 25 by establishing an effective fire prevention and protection program to prevent, detect, control and report fires or hazardous conditions or practices that may result in a fire.

1-2. Application
The provisions of this regulation are applicable to personnel, units, activities, operations, and facilities under command or administrative jurisdiction of the Installation Commander. This includes, but is *not* limited to: military personnel regardless of status, military family members, civilian employees both appropriated and non-appropriated, Army and Air Force Exchange Service (AFFES), concessionaires, contractors, vendors, and visitors while on government property. Failure to comply with this regulation may cause pecuniary or liability charges brought against individuals. Military members that are signed for family housing quarters will be held responsible for actions of their family members, guests and domestics. The U.S. Army Reserve Units assigned to Fort Campbell will use this regulation for their respective units. When located on another installation, the regulations of that installation will pertain.

1-3. Summary
a. Cause of fire. Fires are caused by lack of knowledge, carelessness and direct violations of two basic principles of fire prevention:
(1) The elimination of the source(s) of ignition.
(2) The removal of the means of supporting combustion.
b. Responsibility. Fires are preventable unless caused by an act of God. In all cases where competent investigation reveals that a fire was the result of any degree of negligence or failure to exercise normal prudence on the part of an individual or individuals, or is indirectly due to supervisory failure disciplinary measures, if appropriate, will be imposed and action will be initiated to recover loss from the person responsible.
c. Personnel assigned quarters are responsible for compliance with this regulation by members of their families, guests, and domestic employees and are pecuniary liable for any property damage resulting from the acts of failure to act where evidence establishes that the occupant, under the circumstances, failed to exercise due care.

1-4. Action
Each individual will be fully aware of the contents of this regulation for his/her own protection and every supervisor, regardless whether civilian or military, will read and understand those portions pertinent to their assignment. Personnel under these supervisors must be briefed at least quarterly and recorded. This briefing may be done during routine safety briefings. In addition, any person having knowledge that may assist in determining the cause of or responsibility for a fire, is charged with the duty of furnishing this information without delay to the Fire Chief of Fort Campbell regardless of whether or not it was requested.

1-5. Fire prevention assistance/references
Upon request of appropriate individuals, fire inspectors will make courtesy visits of unit areas to assist in resolving problems connected with fire prevention training. The U.S. Army has adopted the most current National Fire Protection Association (NFPA) codes and standards. Referenced publications listed in this regulation are available for review in the Fire Prevention Library at Fire Headquarters Building 1747.

1-6. Individual responsibility

Each individual on the military reservation is responsible for taking precautions and for exercising judgment in the performance of his/her duties. Lack of instruction or warning concerning fire hazards will *not* excuse acts involving conditions, practices, or materials commonly recognized as dangerous.

a. Personnel serving in a supervisory capacity are directly responsible for maintaining the area in which his/her employees operate in accordance with this regulation. Supervisors will instruct employees in safe operating practices, how to recognize hazardous conditions *not* specifically covered in this and other fire regulation, and in removing or reducing the danger.

b. While occupying quarters with minor children, the adult personnel in charge are liable and responsible when it can be shown that reasonable precautions were *not* taken to prevent damage to property by children, or that reasonable discipline and control were *not* exercised.

c. Upon receipt of a **HAZARD/DEFICIENCY INSPECTION REPORT** on a hazardous condition, personnel are required to make the correction, or to deliver the notice to a person authorized to do so. Upon completion of correction on the same form, notify the Fire Department so they may re-inspect. In the event that correction cannot be accomplished within the time specified or the directive is unreasonable or impractical, a request for additional time or an exception to policy, in writing, will be made to the Fire Chief within that time. Once started, corrective work will be diligently carried out.

1-7. Designation of the post Fire Marshal

By order of the Garrison Commander the Fire Chief is the installation Fire Marshal and is assigned full responsibility for fire protection and prevention activities. In matters pertaining to these activities, he will act for, and will be responsible directly to the Director of Emergency Services and the Installation Commander.

1-8. Fire Chief

In addition to the duties stipulated in AR 420-1, chapter 25, the Fire Chief will--

a. Be responsible for firefighting operations and will *not* be interfered with in any manner.

b. Be responsible for changes, deletions, and / or additions to this regulation, and for preparing necessary amendments for approval of the Directorate of Emergency Services.

c. Furnish technical assistance to area / unit building manager / evacuation coordinator.

d. Review fire plans for adequacy and practicality.

e. Coordinate plans for fire fighting and control with other installation elements and for maintaining MOU'S and mutual aid agreements.

1-9. Authority to Commander

The Fire Chief or his senior subordinates in charge at the scene may commandeer any available vehicles, personnel, equipment, and/or materials that may be considered necessary (in an emergency) for the prompt control and safe termination of any incident that deems this action.

1-10. Definitions

a. An act of God/nature: An inevitable accident or an extraordinary interruption of the course of events that no reasonable foresight or care could have prevented (e.g. lightning, windstorm, earthquake, or other natural phenomena).

b. Approved Equipment: Equipment that has been tested and approved by a nationally recognized testing laboratory, such as Underwriters' Laboratories, Inc. (UL); Factory Mutual, Engineering Division Laboratories (FM); Factory Insurance Association (FIA); American Gas Association (AGA); National Bureau of Standards; U.S. Bureau of Mines, and the American Standards Association. Approved equipment will be used, located, and installed in accordance with the stipulation in the listing of the approving laboratory. The listing refers to the inclusion of an item in publications of the approving laboratory, such as the UL Electrical Equipment List.

c. **Class "A"** Fires: Involve the burning of wood, paper, and similar materials. Effective extinguishers for use on Class "A" fires are water and dry chemical.

d. **Class "B"** Fires: Involve the burning of oil, grease and flammable liquids, such as gasoline, kerosene, benzene, naphtha, etc. Effective extinguishers for use on Class "B" fires are dry chemical and CO2.

e. **Class "C"** Fires: Involve electrical current, and are caused in general by electrical short circuits or failure of energized appliances, equipment or wiring. Effective extinguishers for use on Class "C" fires are dry chemical and CO2.

f. **Class "D"** Fires: Fires involving powders, flakes or shavings of combustible metals such as magnesium, titanium, potassium, and sodium require special extinguishers labeled D.

g. **Class "K"** Fires: Involve cooking media; vegetable or animal oils and fats, traditionally for extra (high) hazard. Evolution of high efficiency cooking appliances and the change to hotter burning vegetable shortening has created a more severe fire hazard. Effective extinguishers are wet chemical extinguishers.

h. Classification of Areas/Buildings: The Fire Prevention Branch is responsible in conjunction with other installation offices to classify areas or buildings as to the respective hazard class (i.e., battery charging areas, spray booths, etc).

i. Combustible Liquids: Any liquid, which shall burn but has a flash point in excess of 100 degrees Fahrenheit. Combustible liquids include those such as kerosene, mineral spirits, or diesel fuel.

j. Combustible Material: Any material that can be ignited and will continue to burn. Noncombustible materials in combustible packages or wrappings are considered combustible. Light combustible materials are those easily ignited by momentary exposure to flame, such as cotton fabrics, etc.

k. Director of Emergency Services: Is responsible to the Installation Commander for the fire protection program.

l. Electrical Wiring Systems: Any means of conveying current, except extension and appliance cords connected to the power source by means of standard plugs in receptacles.

m. Fireworks: As used herein, includes a combustible or explosive composition or article prepared for producing a visible or audible effect by combustion, explosion, deflagration, or detonation. Fireworks include, but are *not* limited to, blank cartridges, toy pistols, cannons, canes or guns in which explosives are used. Also included are balloons requiring fire for propulsion, firecrackers, torpedoes, skyrockets, roman candles, and sparklers. Devices using paper caps manufactured in accordance with United States Commerce Commission regulations are *not* included. Pyrotechnics and other devices used in established training programs and military ceremonies are also excluded.

n. Fire Safety Equipment: Includes every type of portable extinguisher, standpipes and hose lines, water barrels and built-in extinguishing systems.

o. Fire Protection System: Any fire suppression or fire detection system that provides early detection, warning, suppression, and notification to all personnel in case of an emergency, to include transmitting a signal to the Central Fire Alarm Panel. A fire suppression system is one that extinguishes a fire, such as sprinklers, halon, and dry chemical systems. A fire detection system is one that provides early warning such as heat and smoke detectors. Both types have additional audible alarms (sounding devices), pull stations, and transmitters.

p. Flammable Liquids: Any liquid with a flash point below 100 degrees Fahrenheit (37.8 degrees Centigrade). Flammable liquids include but not limited to gasoline, alcohol, naphtha, lacquer paints, and thinners.

q. Flammable Material: Any material which can be ignited easily and burns with unusual rapidity.

r. Incident commander (IC): This is the individual in charge of the operation at the scene of an emergency.

s. NFPA: National Fire Protection Association.

t. OSHA: Occupational Safety and Health Administration.

u. Reasonable Care/Reasonable Prudence: The exercise of precautions and the control of actions which would be expected of a normally prudent person under similar conditions.

v. Reasonable Time: The time required to effect correction by diligent and prompt effort, and not necessarily suiting the convenience of the occupant or using service. The Post Fire Chief will determine the time allowed for correction, and this determination is final upon delivery of written notification to parties involved, or to any of their employees.

w. Arson: The crime of intentionally and maliciously setting fire to structures or wild land areas. A willful or malicious burning or attempt to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft, personal property of another, etc. Arson is prosecuted with attention to degree of severity.

x. Fire Play: A low level of intent to inflict harm and an absence of malice.

y. Juvenile Firesetter: Youth under the age of 18 years old who have been engaged/involved in an unsupervised use of fire. The firesetting behavior does not have to result in damage, injury, or death nor does a crime have to be committed. The behavior does not necessarily denote mental illness.

z. Juvenile Firesetter Interventionist: A person certified to the level of Juvenile Firesetter I and/or II that intervenes in a situation or behavior of a juvenile involved in fire play. The purpose of a Juvenile Firesetter Interventionist is to offer the Juvenile and their families help in understanding fire play, what causes the behavior, and how to move on after an incident.

aa. Juvenile Firesetter Intervention Program: A program designed to reach out within the community to educate the youth under the age of 18 and their families about the danger of playing with fire. The purpose of the program is not to punish, but provide an educational outlet about fire behavior to the youth of the community and offer a means for parents or guardians to understand why young people play with fire.

bb. MPI: Military Police Investigator

cc. Surge protectors: A surge protector is an appliance designed to protect your computer and other equipment from voltage spikes. The standard voltage in most outlets in U.S. offices is 120 volts. If the voltage rises above 120 volts, a surge protector helps prevent the increase from ruining your computer and its components. Many power

strips have basic surge protection built in; these are typically clearly labeled as such. However, power strips that do *not* provide surge protection are sometimes erroneously referred to as "surge protectors".

dd. Power strips; A power strip is a strip of sockets that attaches to the end of a flexible cable and allows multiple devices to be plugged in to the same outlet. However, they can very easily create a fire hazard if *not* used appropriately. Power strips are often used when many electrical devices are in proximity, such as for audio/video and computer systems. Power strips do not provide more power to a location, just more access to the same limited capacity of the circuit into which it is connected. The circuit likely also still serves a variety of other outlets and fixtures in addition to the multiple electrical items you might be supplying with the power strip. Power strips often include a circuit breaker to interrupt the flow of electric current in case of an overload or a short circuit.

Chapter 2
Life Safety

Section I
Reporting Procedures

2-1. Actions to take in the event of fire

a. All fires, including extinguished fires, must be reported immediately **via 911**.

b. All personnel must be familiar with fire exits and fire extinguishers in their assigned work area and the procedures outlined in this regulation.

c. Supervisors are responsible to establish a rally point *no* closer than 300 feet from the building being evacuated.

d. The following are the sequence of actions to take upon detecting a fire:

(1) Sound alarm by either verbal or mechanical means.

(2) Dial 911 from any base telephone and give the following information:

(a) Name, building number, and specific location of the fire in the building.

(b) Identify what is burning: electrical, trash, machine, etc.

(c) Report any known casualties. **NOTE:* Caller will stay on the line if feasible until released by the operator.

(3) Personnel may attempt to control the fire using portable fire extinguishers. ****NOTE:* No attempt should be made to fight a fire which is obviously too large to control**.

(4) Wait outside the building to direct responding firefighting crews to the site of the fire.

(5) Security custodians may take action to secure classified material if feasible.

(6) Personnel will immediately leave the building and report to the designated rally location. Exercise caution and keep clear of emergency vehicles.

(7) At the rally point, the senior supervisor will determine if there are any personnel missing. Personnel *not* accounted for will be reported to the Senior Fire Officer (SFO) at the scene. All personnel will remain at the rally point until released by the SFO.

e. Supervisors at all levels must ensure all personnel under their jurisdiction are familiar with the procedures outlined in this supplement.

Section II
Exits

2-2. Restrictive hardware

a. Padlocks and hasps, throw-bolts, and crossbars shall *not* be installed on any door except as permitted by NFPA 101, Life Safety Code.

b. Where either physical or classified security is a major concern, judicious use of a two-point (top and bottom) latching panic hardware, without exterior door operating hardware, is an effective measure. Such doors, particularly when not normally under direct observation by operating personnel, may also be provided with simple effective door alarm devices as an additional control measure.

2-3. Padlocks and/or hasps

a. Are *not* permitted on interior/exterior doors, except for storage or industrial occupancies, unless arranged to be locked in the open position.

b. Occupants of these types of buildings/rooms should be able to unlock doors from the inside without using a key.

2-4. Exit illumination

a. Shall comply with NFPA 101, Life Safety Code.

b. It shall be the building occupants' responsibility to place a service order to DPW for any type of repair.

c. Signs should be numbered for identification for service order purposes.

2-5. Stairs and stairways

a. Stairs and stairways shall comply with NFPA 101, Life Safety Code.

b. Do *not* use stairway enclosures for storage or for any purpose other than a stairway exit egress.

c. Protect opening to stairway enclosures by self-closing doors. Do *not* hold stairway door open by wedging, blocking, or by any other device, which prevents the doors closing automatically unless specifically designed.

2-6. Doors

a. Personnel shall *not* obstruct the normal operation of fire doors.

b. Removal of door closures (i.e. self-closures) shall be *prohibited*.

c. Removal of fire doors shall be *prohibited*.

d. Approved fire doors shall *not* be altered or modified.

e. *No* exit door shall be locked while the building is occupied.

2-7. Emergency Lighting

a. Shall comply with NFPA 101, Life Safety Code.

b. It shall be the building occupants' responsibility to place a service order to DPW for any type of repair.

c. Lights should be numbered for identification for service order purposes.

Section III
Means of Egress for both New and Existing Buildings

2-8. General

a. Means of egress for both new and existing buildings shall comply with NFPA 101, Life Safety Code.

b. A continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of three separate and distinct parts: (1) the exit access, (2) the exit, and (3) the exit discharge.

c. A means of egress comprises the vertical and horizontal travel and includes intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, elevators, enclosures, lobbies, escalators, horizontal exits, courts, and yards.

d. Whenever it is necessary to block, obstruct, or rearrange any existing exit in a manner which destroys or reduces its function, an additional exit or exits designed, located and arranged in strict conformance with NFPA 101, Life Safety Code shall be provided.

2-9. Accessible Means of Egress

a. A means of egress that provides an accessible route to an area of refuge, a horizontal exit, or a public way.

b. A means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

c. *No* furnishings, decorations, or other objects shall obstruct exits, access to, egress from, or visibility of.

d. *No* obstruction by railings, barriers, or gates shall divide the means of egress into sections appurtenant to individual rooms, apartments, or other occupied spaces. Where the authority having jurisdiction finds the required path of travel to be obstructed by furniture or other movable objects, the authority shall be permitted to require that such objects be secured out of the way or shall be permitted to require that railings or other permanent barriers be installed to protect the path of travel against encroachment.

e. A proper means of egress allows unobstructed travel at all times. Any type of barrier including, but *not* limited to, the accumulations of snow and ice in those climates subject to such accumulations is an impediment to free movement in the means of egress.

Section IV
Fire Safety equipment

2-10. Tampering or destroying any Fire Emergency Safety equipment

a. Knowingly tampering with or destroying any Fire Emergency Safety equipment (i.e. smoke detectors, fire alarm pull stations, fire alarm panels, automatic sprinkler system or any part of, fire extinguishers, fire hose, etc.) is punishable by the following laws:

(1) **KY-KRS 512.040**-Criminal Mischief in the Third Degree: Class B misdemeanor punishable by 90 days in confinement and $250 fine.

(2) **TN-TCA 39-14-408**-Class A misdemeanor punishable by 11 months 29 days confinement and $500 fine.

2-11. Smoke detectors

a. Commanders/supervisors shall ensure that all subordinates are knowledgeable in the policy regarding smoke detectors and alarm systems.

b. Fire Prevention Coordinators, Building Managers, and any other responsible individual as designated in writing by the unit commander will be trained in the proper procedure for cleaning, testing and maintaining smoke detection devices.

c. Only trained Alarm Technician's are authorized to repair, or replace smoke detectors. Any unauthorized individuals tampering with, destroying, or causing malfunctions to fire alarm systems will be held accountable for their actions.

d. If a smoke detection device continually malfunctions and efforts to correct the problem fail, a service order should be called in to the **Emergency Service Order Desk at 798-1200**. Units/activities are responsible to ensure keys are available during all hours for each individually locked room to allow Fire Department personnel to perform checks as needed.

e. Fort Campbell Fire Prevention Inspectors will inspect units annually to ensure cleaning and maintenance is being performed. Units should inspect facility smoke detectors at least once a month and clean detectors at least quarterly. It is highly recommended to be cleaned on a monthly basis. Specific instructions on cleaning and testing will be provided in the training sessions. Units/activities are responsible for maintaining records to account for testing, cleaning, and service orders on smoke detection devices. These records will be made available to Fire Prevention Inspectors, upon request.

f. Smoke detectors shall be tested *not* less than once monthly.

g. Where battery operated detectors are used, replace batteries every six months.

h. Submit a work order for repair or replacement when detectors are inoperative.

i. Disabling smoke detectors for any reason is **strictly prohibited**.

Chapter 3
Construction, Alterations, and Modernization

3-1. General

a. No change or alteration shall be made to any building or structure, whether new or existing, without first coordinating with Directorate of Public Works (DPW) and the fire department, through proper channels.

b. Construction projects shall be coordinated with DPW or Corps of Engineers (COE) and reviewed by the Fire Prevention Division during the design phase. This process shall be completed prior to bid advertising or authorization to proceed with construction.

c. All self help projects shall follow the same fire protection criteria as other construction and must be submit on a facility engineering work sheet (DA Form 4283).

d. Sound fire protection engineering is required in all repair and construction projects; this shall limit fire spread and save lives and property. Fire protection systems and construction shall comply with applicable standards, laws, and regulations, Department of Defense fire protection policies, UFC 3-600-01, NFPA standards, Fort Campbell Design Guide, and appendix g of this regulation. To do this, the engineer must work closely with Fire Prevention Division. The Fire Prevention Division, prior to construction / renovation, will review all plans and specifications.

e. Special emphasis shall be placed on providing adequate fire protection in facilities that are highly susceptible to loss of life and those that house high-value or mission-essential processes or equipment.

f. Any work that shall affect the operation of an installed fire alarm system shall be coordinated with the Fire Chief and/or central dispatch.

g. If work requires the disabling of fire protection systems it must be coordinated through the project COR or COE.

h. Subcontractors are subject to the same fire protection requirements as the prime contractor. It is the responsibility of the prime contractor to brief all subcontractors and ensure compliance with all fire protection guidance.

3-2. Guidelines

a. See appendix F, Minimum Fire Protection and Prevention Guidelines for Construction, Alteration, and Modernization Projects.

3-3. Fire Inspections of Construction Projects

a. Periodically during construction, a fire inspector may perform unannounced spot checks to ensure proper fire safety procedures are being followed to safeguard government property and personnel.

b. During these inspections, the fire inspectors will relay any deficiencies to the COR or COE responsible for the project.

c. Fire Inspectors will *not* contact the contractor, unless there is an immediate Life Safety issue.

3-4. Acceptance Inspections

a. Request for acceptance test shall be submitted by the COR 72 hours in advance.

b. The Fire Chief or a designee will attend all acceptance inspections to include both pre-final and final.

c. All systems and features will be tested in accordance with the fire codes and standards set forth.

d. The contractor will conduct functional tests of all fire protection systems and features.

e. A NFPA 72 Fire Alarm and Emergency Communication System record of Completion will be provided by the contractor.

f. The Fire Prevention Division will have the authority to accept or disapprove fire protection systems and/or features prior to final acceptance.

g. The Fire Prevention Division has the authority to deny occupancy until deficiencies are resolved.

3-5. Interior finish materials installed as a part of change

a. Alteration, or modernization projects and movable partitions shall be in accordance with UFC 3-600-01 criteria.

b. Fire retarding chemicals listed by recognized testing laboratories might be considered for treatment of existing interior finish materials.

3-6. Contracting officers

a. Shall include a statement in special contract requirements of construction project solicitations and contracts substantially as follows:

b. Fire protection contractor shall comply with fire protection standards and regulations in performance of work on the job site. A copy of this regulation may be viewed by prospective offers at the contracting office. In case of conflict with contract plans and specifications, nothing contained in this regulation shall be construed as altering them without prior coordination with and approval by contracting officer.

c. Installation Fire Prevention Branch shall be notified in writing of all pre-construction conferences, pre-final inspections, and final inspections.

Chapter 4
Draperies and Decorations

4-1. Furnishings and decorations in building occupancies

Furnishings and decorations shall comply with the requirements of NFPA 101, Life Safety Code.

4-2. Burning candles and/or similar open-flame devices

In all government owned buildings, barracks, bachelor officer quarters (BOQ), Family Child Care, Child Day Care centers and similar sleeping occupancies open flame devises are *prohibited*. Special permission may be granted for special events when submitted in writing to the Fire Chief.

Chapter 5
Care and use of facilities

5-1. Housekeeping

a. To prevent a fire hazard, wastebaskets will be emptied daily or whenever an overflow condition exists. Building occupants having contract janitorial services will also comply.

b. Ashtrays will *not* be emptied into wastebaskets.

c. Rags will be kept in covered metal containers marked **"CLEAN" or "SOILED",** as appropriate. Containers will be emptied as required.

(1) When bundles or boxes of clean rags are opened, the contents will be immediately placed into a covered metal container.

d. Debris, sawdust, sweepings, or trash will be placed in covered metal containers, which will be removed from the building at the end of the day or shift. The cover and side of the trash containers will be marked "**TRASH ONLY**". Under *no* circumstances will sawdust or sweeping compounds be used as an absorbent material for fuels, oils, or other flammable liquids. Only approved absorbents will be used.

e. Only approved type sweeping compounds will be used. Containers of sweeping compound that have been opened for use will be stored in the original containers, with a lid, except bags or sacks, which will be stored in a closed metal container.

f. Materials will *not* be stored under or piled against the buildings or in front of doors and exits, unless approved by the Base Fire Chief or representative.

g. Janitor's closets will *not* be used as trash collection points. Closets will be kept clean and used for janitorial supplies only.

h. Mops, cleaning gear and other material subject to spontaneous ignition shall be kept outside of buildings or stored in metal containers with tight-fitting self-closing lid.

i. Lint will *not* be allowed to accumulate at any time in or around clothes drying units. Lint traps on dryers must be cleaned after each use to preclude excessive accumulation. Dryers will be vented to the outside of the building. Avoid excessive length of vertical runs of vent pipe to reduce lint accumulation in piping.

j. Floors and office furniture will *not* be cleaned with volatile flammable liquids.

k. When storing materials, ensure clear aisles are maintained as approach ways for firefighters and for easy access to firefighting equipment.

l. Maintain a 36-inch clearance around furnaces, water heaters, and other heat producing appliances.

5-2. Rubbish and debris

a. Police working and storage areas, new construction, and repair areas regularly to reduce fire hazards.

b. Dispose of rubbish and scrap materials in properly identified and located in non-combustible cans, bins, or receptacles. Remove rubbish from buildings at the close of the normal workday and take to locations approved for rubbish disposal or for temporary storage. Keep work areas reasonably free of combustible debris accumulation. Remove more often if needed.

c. Use only metal containers or nonmetallic containers that are approved by a nationally recognized testing laboratory for disposal of combustible trash or rubbish inside buildings. Cardboard or wooden boxes are *prohibited*.

d. Store soiled rags in metal containers with tight-fitting, self-closing metal covers until removed from building IAW section 5-1c

e. Store steel wool, and other combustible metals, separately in covered metal containers.

5-3. Trash dumpsters and trash pickup stations

a. Dumpsters will *not* be placed:

(1) So as to block egress from designated exits.

(2) So as to block fire department access.

(3) *No* closer than 15 feet to any combustible structure or building.

(4) Loading doors and lids on dumpsters will be left in the closed position.

5-4. Blue recycle paper dumpster

a. Blue recycle paper dumpster units may be placed inside with the following restrictions:

(1) Dumpsters will *not* be placed in any corridors, paths of egress, or egress accesses.

(2) Dumpsters will *not* be placed in stair wells or under stairs.

(3) Dumpsters will *not* be placed in mechanical rooms, communications closets, or like areas.

(4) Dumpster lids shall be kept closed, except when refuse is being loaded into dumpster.

(5) Empty dumpsters on regular bases to eliminate over flow.

5-5. Personnel service rooms

a. Metal or Underwriters Laboratory listed plastic trash receptacles with self-closing lids shall be used in all restrooms, latrines and in other areas where paper towels and disposable paper or plastic cups are used.

b. Clothing lockers shall be adequately ventilated and kept in a clean and orderly condition. Work clothing in lockers should be regularly aired and cleaned.

c. Flammable liquids, chemicals, paints, paint-soaked rags, and similar materials shall *not* be kept in clothing lockers.

d. Combustible materials shall *not* be placed on radiators, heaters, or steam pipes.

5-6. Building service rooms

Boiler rooms, mechanical equipment rooms, electrical vaults, fire suppression equipment rooms, communications rooms, and machinery rooms will *not* be used for storage or any purpose other than that for which they were designated. These rooms will be kept locked at all times when *not* in use to prohibit unauthorized entry.

5-7. Attics and concealed spaces

a. Attics and concealed spaces shall be kept clean.

b. Attics without sprinklers in other than family quarters shall *not* be used for storage.

5-8. Sleeping areas

a. Using buildings or portions of buildings, other than approved barracks or quarters, as sleeping facilities is *prohibited*, except upon written approval by the Fire Chief or authorized representative. Reserve center buildings are

exempt from this requirements provided areas comply with the requirements of NFPA 101, Life Safety Code and adequate hard wired smoke detectors are provided for early warning detection.

b. Using attic space in any building, including quarters, as a sleeping area is *prohibited*.

c. Using space in any building accessible only by scuttle, hatch, or trap door, or served by other than a standard stairway, as a sleeping area is *prohibited*. The use of below-grade basement areas for living and sleeping is only permitted when there is a second means of escape in compliance with NFPA 101, Life Safety Code.

5-9. Special occupancies

a. Nursery, kindergarten, day care center, or first grade occupancies shall *not* be located in a basement or above the first floor, except under special conditions where the Fire Chief grants approval.

b. Full compliance with NFPA 101, Life Safety Code and AR 608-10 is required.

5-10. Changing occupancy or use

The Installation Fire Dept. and the Fire Chief shall review changes in the use of occupancy of any building, structure, or area. In any building or structure whether necessitating a physical alteration or *not*, a change from one occupancy classification to another, or from one occupancy sub classification to another sub classification of the same occupancy, shall be permitted only if such building or structure conforms with the requirement of NFPA 101, Life Safety Code.

5-11. Securing buildings at close of workday

a. Buildings shall be secured properly at the close of working hours unless accepted in writing by the Installation Commander or authorized representative.

b. The person in charge shall shut off portable electric appliances and heating devices that are *not* required to be kept in operation during the night at the close of work hours.

c. Exit doors shall *not* be secured in any manner that would prevent their use as an exit when the building is occupied.

d. Unused paints, brushes, drop cloths, rags, and like items shall be removed from buildings at the close of the workday. An exception is in paint shops where fill precautions are taken daily to store paints and related supplies. Any material left at the job site shall be placed in a metal container with tight-fitting self-closing lid and placed at least 15 feet from the building. Trash and other waste material shall be removed daily at end of working day.

e. Soiled rags used in connection with repair shops, painting, or other such operations, shall be removed from the building or placed in a metal container IAW section 5-1 c.

5-12. Vacant buildings

a. When using agencies permanently vacate a building, they will promptly notify the Fire Prevention Branch. Fire Prevention Branch will inspect the building to ensure all installed extinguishers are left in place and the building is free of fire hazards.

b. Vacant buildings shall be secured against unauthorized trespass. Doors shall be locked and windows barred with wood or fixed shutters to prevent access, where necessary.

c. Electrical power to vacant buildings shall be shut off by either disconnecting the incoming power lines outside the building, opening main or all distribution power master switches. If possible, secure power switches with padlock. Power for fire alarm systems and support of sprinkler systems shall be maintained.

d. Fuel inlet valves shall be closed and sealed on furnaces, boilers, and other means of heating in vacant buildings where heat is not required to prevent freezing of sprinkler system or plumbing.

5-13. Storage buildings

a. Exposure to Flames. Exposure to flames results from flames issuing from the roof or top of a burning building in cases where the exposed building is higher than the burning building.

b. The minimum separation distances between buildings should be determined using the table below

Distance Table

Number of stories likely to contribute to flaming through the roof	Horizontal separation distance or height of protection above exposing fire	
	m	ft
1	7.5	25
2	10	35
3	12.5	41
4	15	49

5-14. Aircraft /Hangars

a. Refueling or defueling of aircraft in hangars is *prohibited.*

b. Fire lanes will be established in hangars and shop areas, and will remain clear of equipment at all times.

c. Housekeeping will be maintained at the highest level in hangars and shops associated with aircraft maintenance.

d. Electrical motors, switches, fixtures, extension lights, and similar devices used within the hangar will be of approved type in compliance with *NEC (National Electrical Code)*.

e. Approved drip pans will be placed under aircraft in hangars and under other units or parts of aircraft that are likely to drip.

f. Fueled aircraft shall only be authorized in hangars equipped with proper fire protection features and meet all required electrical classifications.

g. Static ground points are located throughout the hangar. The grounding point shall be marked by a yellow circle 18 inches in diameter, the date tested, and the reading in ohms. With a 2 inch black border surrounding it with the words : **"STATIC GROUND CONNECTION"**.

h. Precautions shall be taken to ensure ready access to hangars from all sides. Adequate separation shall be provided to reduce fire exposure between buildings. The clear space of 50ft shall not be used for the storage or parking of aircraft or concentrations of combustible materials, nor shall buildings of any type be erected therein.

5-15. Parking of vehicles

a. Parking of vehicles shall be controlled to ensure free access of emergency response equipment to all sides of buildings, structures, fire alarms, post indicator valves, fire department connections and fire hydrants.

b. Vehicles will *not* be parked closer than 15 feet of any building or structure, except while loading or unloading (Ref. B-2 OFG Security- Homeland Security).

c. Vehicles will *not* be parked between buildings or structures that are *not* separated by a distance of at least 50 feet.

d. Vehicles will *not* be permitted in any building for repairs or storage, except for approved maintenance buildings or with written approval of the Fire Chief.

5-16. Fire Department Access Roads

a. The road or other means developed to allow access and operational setup for fire-fighting and rescue apparatus. Fire department access roads shall be provided and maintained in accordance with NFPA.

b. Fire department access roads shall be provided in accordance with Section NFPA for every facility, building, or portion of a building hereafter constructed or relocated.

c. When there are *not* more than two one- and two-family dwellings or private garages, carports, sheds, and agricultural buildings, the requirements of NFPA shall be permitted to be modified by the AHJ.

d. Fire department access roads shall have an unobstructed width of *not* less than 20 ft (6.1 m) and an unobstructed vertical clearance of *not* less than 13 ft 6 in. (4.1 m).

e. Vertical clearances or widths shall be increased when vertical clearances or widths are *not* adequate to accommodate fire apparatus.

f. The required width of a fire department access road shall *not* be obstructed in any manner, including by the parking of vehicles.

g. Plans for major changes or closing of roadways shall be coordinated with the Fire Chief.

Chapter 6
Smoking

6-1. Prohibited smoking areas

a. DA-occupied workplaces except for designated smoking areas, as authorized by DODI 1010.15, Smoke-Free DOD Facilities. The workplace includes any area inside a building or facility over which DA has custody and control, and where work is performed by military personnel, civilians, or persons under contract to the Army.

b. Military vehicles and aircraft, and in all official vans and buses.

c. CYS facilities and sports fields, except in designated areas out of the presence or view of children/youth.

d. Where it presents a safety hazard, such as at firing ranges, ammunition storage areas, fuel dumps, motor pools, and equipment maintenance shops.

e. Smoking in bed is strictly prohibited

6-2. Designating smoking areas

a. Smoking areas will be designated and approved by the unit commander prior to submission to fire prevention for approval. Request shall be submitted in a memo format and include a sketch showing the proposed smoking area outlined in red. Requests will be returned to the requester either approved or disapproved.

b. Designated areas will be at least 50 feet from common points of ingress/egress and will *not* be located in areas that are commonly used by nonsmokers.

c. Commanders shall indentify in their barracks policy if smoking is *prohibited* or *not prohibited* in individual sleeping rooms.

6-3. Authorized smoking areas will conform to the following

a. The smoking areas must be properly identified as a smoking area.

b. In areas where smoking is permitted, noncombustible ashtrays shall be provided

c. A self-closing metal butt can for proper disposal of smoking material. Place smoking material dispensers at least 10 feet from exits.

d. Empty butt can when half full, and soak contents with water prior to disposal in dumpster.

e. Supervisors will inspect areas at the end of each shift to ensure all smoking materials have been disposed of properly.

6-4. Signage

If locally manufactured signs are *not* in use, DA Form 5560 (No Smoking) and DA Form 5560–1 (Designated Smoking Area) will be used for restricting tobacco use. These forms are available electronically on the APD Web site.

Chapter 7
Common Hazards

7-1. Heat

a. All building heating equipment shall be labeled and/or listed by the AGA, UL, or FM and shall be installed, maintained, and operated under the approval listings, manufacturers operating instructions, and the NFPA.

b. There shall be adequate clearances between heating equipment and combustible material Clearances for listed equipment shall *not* be less than the minimum given in the listings. Existing unlisted equipment shall be governed by the clearances indicated in the NFPA.

c. The use of unventilated hydrocarbon-fueled heating appliances inside buildings is *prohibited*. Hydrocarbon fuels include natural gas, gasoline, fuel oil, alcohol and petroleum based oils and kerosene. Duct-type portable gasoline-fired heaters (e.g., Herman Nelson or similar models) are *not* authorized for heating any building unless prior approval is obtained from the Fire Chief and only if the use is temporary and held to a minimum. These types of heaters are designed for outside operation and are intended primarily for field uses such as heating large tents, maintenance shelters, operator's compartments for tactical vehicles, and preheating aircraft engines or keeping them warm during idle periods.

d. Using open flame heating devices is *prohibited* in areas subject to accumulation of flammable vapors such as gasoline stations, garages, paint shops, and aircraft hangars. Exceptions are the installation of suspended oil furnaces and gas-fired unit heaters when the use, location, and installation of such equipment is permitted by specific provisions of pertinent sections of the NFPA and the unit is specifically listed and/or approved for such installation.

e. Mechanical / equipment rooms, including boiler and furnace rooms, shall *not* be used for offices or storage. Secure rooms from unauthorized entry.

7-2. Space heaters

a. Portable electric space heaters are generally *prohibited* for energy conservation purposes; however, when otherwise permitted, approval by DPW shall be required for heater use.

b. Criteria for space heater use can be found in CAM Regulation 420-5, Energy Conservation and Facility Maintenance Programs. Such heaters, when permitted, shall be listed and shall be of a type in which the electrical circuitry is automatically shut off if unit is tipped over.

d. Power supply cords and plugs shall be in good condition and supply circuit shall be adequate for safe use.

e. Must be plugged into a wall outlet. Extension cords are *not* allowed.

f. Must be unplugged at the end of the shift and/or duty day and shut off when *not* attended.

g. Must *not* be plugged into multiple type outlets such as power strips.

h. Must *not* be used within 3 feet of combustible materials (paper products, etc.).

i. Must *not* be used in hazardous environments or where flammable, chemical, or munitions atmospheres present an explosive or fire danger.

j. Must *not* be plugged into system or modular furniture.

7-3. Electrical requirements

*Note: The current edition of National Fire Protection Association 70 shall be the minimum standard for all electrical wiring and equipment.

a. Only authorized electricians shall install, repair, and charge electrical wiring, fitting, or attachments for electrical appliances.

b. Authorized electricians shall report defective electrical equipment to the work order branch of the Director of Public Works for repair or removal.

c. Use only electrical appliances and devices that bear the UL-label or those listed by other approved testing agency. Appliances or devices that do *not* have the UL-label or other approved listing (e.g., decorative lamps and small electrical appliances acquired in Europe and the Orient) shall *not* be connected to a power source.

d. All electrical wiring equipment and devices shall be UL-listed for the particular hazardous area and comply with National Fire Protection Association 70. Including electrically operated vending machines, water coolers, clocks installed and operated in aircraft hangars, automotive repair shops, and other occupancies where flammable vapors, gases or dusts may be present.

e. Soldering irons, hot plates, coffee makers, office machines, and other unfixed electrical devices shall be turned off when *not* in use. There shall be adequate clearance between all heat- producing electrical devices and combustible material.

f. Fusing of circuits shall be compatible with the safe current-carrying characteristics of the circuit wire (i.e., circuits shall *not* be overused). Ground-fault-circuit interrupters shall be provided for receptacles in accordance with National Fire Protection Association 70.

g. Electric switches, circuit breakers, and fuses in power panels shall be labeled correctly to indicate the circuits or devices they control. Provide continuously clear access to all panels.

h. Materials will *not* be placed or stored within 36 inches of electrical panels, air compressors, or motors.

i. Devices that interfere with the normal operation of a circuit breaker or fuse shall *not* be installed. Whenever a tripped breaker or blown fuse has interrupted a circuit, the source of the disturbance shall be located and eliminated before restoring power to the interrupted circuit. Circuit breakers are *not* to be used as switches, unless the breaker is specifically designed for switching.

j. Circuit breakers will *not* be taped, wired, or blocked in the "on" position.

k. Lamp fixtures in damp or hazardous locations and in areas subject to grease accumulation (such as under hoods over cooking ranges/flyers) shall be of types specifically approved for such locations.

l. Not more than two electrical cords per outlet are permissible.

m. When utilizing electrical outlets attached to system/modular furniture, do *not* exceed the available amperage.

n. The screw-type outlet that fits into light fixtures is *prohibited*.

o. All domestic-type washing machines, clothes dryers, vending machines, portable electric tools, and lights shall be electrically grounded in accordance with National Fire Protection Association 70.

7-4. Extension cords

a. Extension cords shall be without splices and shall *not* be hung over nails, rafters, or in a manner which would constitute a fire hazard. Extension cords shall not be placed under rugs, carpets or other combustible materials.

b. Extension cords shall *not* be used in lieu of permanent wiring and shall not run through walls, ceilings, floors, doorways, windows, or other similar openings. Extension cords shall *not* be equipped with more than one male and one female connection.

c. Do *not* run extension or flexible cords through holes in walls, ceilings, floors, doorways, windows, or similar openings or concealed behind building walls, ceilings, or floors.

d. Do *not* place electrical cords across aisles or places where they may be walked on, unless they are equipped with an approved electrical cover installed in such a way as to prevent friction or rubbing of cord.

e. Extension cords may *not* be plugged into power strips or other extension cords.

7-5. Multiple outlets

a. Surge protectors; A surge protector is an appliance designed to protect your computer and other equipment from voltage spikes. The standard voltage in most outlets in U.S. offices is 120 volts. If the voltage rises above 120 volts, a surge protector helps prevent the increase from ruining your computer and its components. Many power strips have basic surge protection built in; these are typically clearly labeled as such. However, power strips that do *not* provide surge protection are sometimes erroneously referred to as "surge protectors".

b. Remember that surge protectors and power strips are not the same thing.

c. These units must be listed by an approved testing laboratory and serve only low amperage equipment. 'daisy-chaining' of surge protectors is *prohibited*.

d. Appliances shall *not* be plugged into surge protectors.

e. Power strips; A power strip is a strip of sockets that attaches to the end of a flexible cable and allows multiple devices to be plugged in to the same outlet. However, they can very easily create a fire hazard if *not* used appropriately. Power strips are often used when many electrical devices are in proximity, such as for audio/video and computer systems. Power strips do *not* provide more power to a location, just more access to the same limited capacity of the circuit into which it is connected. The circuit likely also still serves a variety of other outlets and fixtures in addition to the multiple electrical items you might be supplying with the power strip. Power strips often include a circuit breaker to interrupt the flow of electric current in case of an overload or a short circuit. Remember that power strips and surge protectors are *not* the same thing. "Daisy-chaining" of power strips is *prohibited*. Appliances shall *not* be plugged into power strips. These units must be listed by an approved testing laboratory and serve only low amperage equipment.

7-6. Air conditioning and air handling

a. Air conditioning and air handling equipment rooms, including boiler and furnace rooms, shall *not* be used for offices or storage. Secure rooms from unauthorized entry.

b. Electrical circuitry supply to air conditioning units shall be in conformance with NFPA 70.

Chapter 8
Special Hazards

8-1. Flammable and combustible liquids

*NOTE: All flammable and combustible liquid storage shall be in compliance with the requirements of NFPA 30.

a. Flammable liquids shall *not* be used for cleaning equipment parts. Nonflammable cleaners or solvents and/or water-solvent detergents shall be used for such purpose.

b. Flammable liquids shall *not* be used to clean or refinish floors, desks, or other furniture and furnishings.

c. Personnel shall observe the following precaution if a combustible liquid (mineral spirits) is used for floor cleaning or refinishing:

(1) Provide all possible ventilation and/or adequate mechanical ventilation to dissipate vapors.
(2) *Prohibit* smoking in the work place.
(3) Keep all open flames and spark-producing devices away from the work area.
(4) Shut off all pilot lights in the vicinity.
(5) Clean only a small area at a time.
(6) Restrict the amount of fluid to that necessary for the immediate operation.
(7) Paste wax will *not* be burned or heated in any manner.

d. Day-to-day stocks of flammable liquids shall be kept only in an approved flammable liquid cabinet. Containers shall be plainly marked to indicate the nature of the contents. Storage shall be arranged to comply with NFPA 30.

e. Gasoline and other flammable liquids shall *not* be kept, stored, used, or dispensed within any building except by means of listed safety cans in good condition, unless in a flammable liquid dispensing room. Glass containers are *prohibited*, except where permitted by NFPA 30 for storage of chemically pure liquids.

f. Gravity discharge of any flammable liquid from tanks, drums, or containers other than listed safety cans is *prohibited* within all buildings.

g. Flammable liquids shall be drawn from or dispensed into tanks or containers within buildings only with the drum in an upright position, using an approved manually- operated barrel pump, and only in locations approved as flammable liquid dispensing rooms.

h. Combustible liquids shall be stored in closed metal containers having an individual capacity of not more than 5 gallons. The use of glass or plastic containers other than listed safety cans is *prohibited*, except where permitted by NFPA 30 for storage of chemically pure liquids.

i. Tanks, hoses, and containers shall be bonded while flammable liquids are being poured or dispensed to prevent static electricity discharge.

j. Fuel tanks and trailers are *prohibited* in hangars or shops and prohibited within 100 feet of any building. Maintenance of refueling vehicles is allowed only in designated areas.

k. Transfer of flammable liquids or purging of tanks or containers by compressed air or gasses is *prohibited*.

l. Gasoline, oil, or any other flammable/combustible liquid shall *not* be discharged into, or permitted to accumulate in, storm drains or sanitary sewers.

m. Flammable liquids shall *not* be stored in any place of public assembly, club, barracks, BOQ, or buildings, which are normally used as a sleeping quarters.

n. Paste wax shall *not* be burned or heated over open flame.

o. The use of gasoline-fueled field ranges inside buildings is *prohibited*.

p. Use gasoline as fuel only. Other uses of gasoline are *prohibited*.

q. Gasoline, oil, or any flammable/combustible liquid shall be stored in an appropriate storage cabinet.

8-2. Storage

a. All flammable and combustible liquids defined as Class I, A, B, C, Class II, and Class IIIA liquids will be stored in a flammable storage cabinet or inside storage room when, *not* in use.

b. Flammable storage cabinets will be constructed of 18 gauge steel, with riveted, welded seams; have a 2 inch catch basin in the bottom for spill containment, and have a three part lock system on the doors (latches on top, bottom, and door handle).

c. Cabinets must have a 1 1/2 inch air space between exterior/interior, and have a visible label on the front stating, "**FLAMMABLE-KEEP FIRE AWAY**."

d. Storage on top of flammable storage cabinets is *prohibited*.

e. Flammable storage cabinets located outside will be vented.

f. Flammable storage cabinets located inside are *not* required to be vented, however, if venting is utilized, it must be vented directly to the outside.

g. If the cabinet is *not* vented, the vent openings must be sealed with the bungs supplied by the manufacturer.

h. Flammable storage cabinets will *not* be located within 10 feet of an exit or physically obstruct a means of egress from the building.

i. Storage cabinets, or any other storage, will *not* be placed under any stairwell.

j. Rags and other combustibles will *not* be stored within cabinets. Exceptions are product labels, tags, and packaging for multiple small containers and inventory lists.

***NOTE: Class IIIB liquids, support equipment such as noncombustible funnels, grease guns, and other mission related noncombustible support equipment may be stored within the cabinet provided it is in good, clean condition, and compatible with required storage.**

k. The rated capacity of flammable storage cabinets will *not* be exceeded. *No* more than 360 gallons capacity of Class IA, B, C, II, or IIA liquids will be stored in cabinets in a single fire area.

l. Industrial areas may exceed 360 gallons, provided a distance of 100 feet separates storage areas, or a 2-hour fire separation.

M . Incompatible substances, which may adversely react with flammable/ combustible liquids, will *not* be stored together.

n. Inside storage rooms will be constructed in accordance with OSHA and NFPA Codes, to include containment, fire protection, proper electrical classification, ventilation, and specified fire resistance construction.

o. Do *not* store flammables and combustibles below grade, or in basements.

p. Compressed gases shall *not* be stored in lockers marked flammable liquids.

q. Propane cylinders for barbeque grills shall be stored on grill mounting bracket with regulator disconnected or stored outside 20 feet away from exit.

r. Bulk flammable and combustible liquids will be stored in designated buildings and be properly labeled and placarded, "**FLAMMABLE-KEEP FIRE AWAY**."

s. Store paints and thinners in a flammable/combustible storage locker or cabinet, separately from other materials such as grease, oil, gasoline, and spare parts. Do *not* store rags, wood, and other similar combustible matter in the same area. Refer to NFPA 30 and 30B Chapter 4.8 and Chapter 8.3 for storage procedures.

8-3. Compressed gas

a. Storage, handling, and use of compressed gases and explosive anesthetic agents will be in conformity with NFPA Codes and DoD Publications.

b. Storage of compressed gases in buildings or compressed gas storage shells will be in strict compliance with DoD 4145.19-R-1 and NFPA 55.

c. Gases will only be stored in authorized locations.

d. Supplies of oxygen and acetylene gas will be stored in areas free of oil and greasy substances.

e. Cylinders will be stored upright and firmly secured with non-spark producing, noncombustible restraints.

f. Cylinders permitted inside buildings will be stored away from combustible material and located where they will *not* be exposed to excessive increases in temperature.

g. Valves on cylinders will be closed and capped in both storage and shipping configuration.

h. Aerosol products need to be stored in a flammable/combustible locker or cabinet separate from other flammable/combustible items (flammable/combustible liquids). Refer to NFPA 30 and 30B Chapter 4.8 and Chapter 8.3 for storage procedures.

8-4. Fueling operations

a. Only authorized and properly trained personnel shall be permitted to operate major fueling equipment. Knowledge of the equipment hazards involved and the regulations for handling flammable liquid shall be required. The operator shall be familiar with nearest equipment.

b. Self-service gasoline stations open to the public shall have a fully qualified attendant in the immediate vicinity of gasoline dispensing operations during all periods that the facility is open for use.

c. Operators of vehicles and mobile equipment shall turn off engine, lights, and radio transmitters before taking on fuel.

d. Vehicle operators, attendants, or others shall *not* smoke or light a match or lighter during fueling, and there shall be no open flame in the vicinity.

e. Latching or locking devices, which restrict or impede the ability to automatically stop the flow of fuel, shall *not* be permitted on any gasoline or other flammable liquid dispensing nozzle. This does *not* preclude the use of listed and approved automatic nozzles.

f. Operating any vehicle leaking fuel or excessive amounts of oil shall be *prohibited* until necessary repairs have been performed.

g. Flammable liquid containers found to be leaking shall be moved to a safe location and contents transferred to serviceable containers. Leaking containers shall be disposed of properly.

h. Glass or plastic containers other than plastic containers listed by a nationally recognized testing laboratory (i.e., UL or FM approved) shall *not* be used for gasoline.

i. Vehicles transporting explosives shall *not* be refueled with gasoline while explosives are in the vehicle, except in an emergency, then only with the engine stopped, all lights and radios off, and static grounding devices properly connected.

j. Defective or leaking fuel-dispensing equipment (e.g., nozzles, hoses, pumps) shall *not* be operated until restored to proper operational condition.

k. Makeshift fuel dispensing or de-fueling arrangements are *prohibited*. Fuel dispensing, storage locations, arrangements, and equipment shall be in conformance with the pertinent requirements of the NFPA or applicable Army technical manuals. De-fueling into open containers is *prohibited*.

l. Automotive vehicles and other spark-producing equipment shall *not* be operated within 50 feet of any fuel spill involving gasoline or fuels or similar characteristics until the spill has been cleaned up and all flammable vapors have dissipated.

m. Fueling of lawnmowers and other gasoline powered equipment or dispensing of any flammable liquid shall be conducted outside of all buildings, including garages, basements, allow equipment time to cool before refueling.

8-5. Parking of flammable liquid transport vehicles

a. Tank vehicles used for transporting flammable or class II combustible liquids shall be grounded (for static electricity) and shall be parked in groups of *not* more than three with a 50-foot separation between groups.

b. Parking locations shall be selected so that the vehicles are accessible from all sides for firefighting operations and so that any of the tank vehicles can be moved (either under their own power or towed) from their location without moving another vehicle.

8-6. Hazardous chemicals

a. Incompatible chemicals and compounds shall be kept separate and precautions taken to prevent accidental contact or contamination with incompatible materials, compounds, and agents.

b. Many chemicals and compounds, which are completely inert under normal conditions, may become violently explosive when in contact with other compounds.

8-7. Welding and cutting/Hot Work

a. A 'Hot Work Permit', signed by fire department representative, shall be issued prior to the start of any operation.

b. A copy of the permit shall be maintained on site and by the fire department.

c. Each separate operation, work site, and day of operation may require an inspection and issuance of a permit.

d. *No* person at any time shall conduct any cutting or welding operation outside of an established authorized shop without an approved permit.

e. Permits for work being completed can be obtained at any fire station on Fort Campbell.

f. Central dispatch must be notified at 270-798-1221, before and after the operation.

g. All welding, cutting, sweating of copper piping or burning operations shall be under the supervision and control of a competent supervisor who shall ensure OSHA 29CFR 1910.252, NFPA 1, and NFPA 51B compliance and appendix D of this regulation.

h. For welding in aircraft hangars, comply with NFPA 410.

i. Portable welding units will be stored in a safe manner, away from smoking areas, public ways, and vehicle routes when *not* in use.

j. Clothing shall be selected to minimize the potential for ignition, burning, trapping hot sparks, and electric shock.

k. Operations deemed unsafe or noncompliant with prescribed standards will be terminated immediately.

l. All floors shall be swept clean. Combustible floors will be kept wet, covered with damp sand, or protected by fire resistant shields.

m. Where floors have been wet down, personnel operating arc welding or cutting equipment will be protected from possible shock.

n. Hot work shall be permitted only in areas that are or have been made fire safe.

o. Hot work shall *not* be permitted in the following areas:

(1) Areas *not* authorized by management.

(2) In sprinkled buildings where sprinklers are impaired, requirements of NFPA 25 are *not* met.

(3) In the presence of un-cleaned or improperly prepared equipment, drums, tanks, or other containers that have previously contained materials that could develop explosive atmospheres.

(4) In areas with an accumulation of combustible dusts that could develop explosive atmospheres.

(5) Within close proximity to large quantities of readily ignitable combustibles.

p. Openings or cracks in walls, floors, or ducts within 35 ft. of the site shall be covered or sealed with listed or approved fire-rated or noncombustible material to prevent the passage of sparks to adjacent areas.

q. Ducts and conveyor systems that might carry sparks to distant combustibles shall be shielded, shut down, or both.

r. Hot work that is performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings, roofs, or other combustibles shall *not* be undertaken if the work is close enough to cause ignition by conduction.

s. Person or company conducting hot works shall stay in the immediate area for at least 30 minutes after the job is completed. This time should be used to extinguish smoldering fires and make a thorough safety inspection of the work area prior to departure.

t. More than one fire watch shall be required if combustible materials that could be ignited by the hot work operation cannot be directly observed by the initial fire watch.

u. Oxygen, acetylene, and other fuel gases shall be handled carefully and cylinders shall be secured by lashing, strapping, chaining, or clamping in an upright position. Cylinders shall be capped during storage or while being transported.

v. Oxygen cylinders shall be kept free of oil and grease at all times. (A high-pressure leak from an oxygen cylinder may cause sufficiently rapid oxidation to ignite gasoline, oil, grease, alcohol, or organic material and result in fire or explosion.)

w. Oxygen and fuel gas systems in use shall be frequently inspected for evidence of leaks in hoses, couplings, valve stems and fittings, and other points in the system.

x. Acetylene and oxygen valves at the cylinders shall be closed whenever the equipment is left unattended or when work is stopped for more than 15 minutes.

y. Operators of electric welding equipment needing to leave or stop work for any appreciable time shall open the power supply switch to the equipment and disconnect the equipment from the source of power.

z. Fort Campbell's Prevention Branch shall be notified whenever any cutting or welding is to be performed outside of an established shop.

aa. A qualified fire department representative shall inspect the work site before starting the operation to determine that all necessary fire prevention precautions are taken, that a properly instructed fire watch equipped with a minimum 10 pound multi-purpose (A, B, C) fire extinguisher is provided, and that the proposed operation does *not* constitute a hazard to life and property.

bb. A minimum 10 pound (A, B, C) fire extinguisher shall be provided from a source other than one assigned to the facility.

cc. The Fort Campbell's Prevention Branch shall set the time frame of the Hot Work Permit. The time frame depends on the type of job, what's being worked on, and equipment being used.

8-8. Tar pots and kettles

a. Kettles for heating tar, asphalt, and similar materials shall be equipped with proper heat controls and means of agitation to assure controlled uniform temperatures throughout the contents to prevent spot heating.

b. Tar pots or kettles shall *not* be operated inside, on the roof, or within 25 feet of any building and shall be attended by a competent operator. A minimum of two 10-pound multi-purpose (A, B, C) dry chemical extinguishers shall be provided at the tar pot and at the area of tar application.

c. When the material is applied within buildings or enclosed areas, the atmosphere shall be free of dust and adequate ventilation provided to completely remove all smoke and fumes

***Note: Hot work permit is required IAW NFPA 1 Chapters 1.12, 16.7, and this regulation (para.8-5a).**

8-9. Cooking appliances

a. Cooking is permitted only in properly arranged and equipped authorized locations and should never be left unattended.

b. *No* cooking or use of hot plates, electric frying pans, and similar small electrical appliances is permitted in private rooms of bachelor enlisted/officer quarters, barracks and similar buildings unless such rooms or areas are provided with kitchens or cooking facilities.

c. Microwave ovens may be authorized in bachelor enlisted quarters (BEQ)/BOQ facilities without kitchens, provided the electrical power supply is adequate.

d. All appliances must be in good repair and be listed by Underwriters Laboratories (UL) or another recognized testing agency.

e. *No* grease cooking allowed unless appropriate hood & suppression system is installed.

f. Refrigerators, microwaves, and other appliances must be plugged into a wall outlet.

g. Coffee making appliances may be used in offices and work areas provided the following conditions are met:

(1) The appliance is placed on a noncombustible surface and kept a minimum of six (6) inches from any combustible materials.

(2) The appliance must bear the testing laboratory seal of approval (U.L.) and be in good working condition. Non-acceptable items will be removed at time of inspection.

h. Hoods and ductwork over cooking surfaces shall be cleaned periodically to prevent excess grease accumulations.

i. Charcoal grills shall *not* be used inside buildings, on porches, or on balconies. Charcoal grills shall be located at least 10 feet away from combustible materials and/or all buildings when in use. When cooking has been completed, hot coals shall be quenched with water or covered with a noncombustible cover to prevent sparks or hot coals from being scattered by the wind.

j. Leaving cooking appliances and equipment unattended while cooking will be considered "unattended cooking."

k. Fires caused by unattended cooking will be the sole responsibilities of the individual causing unattended cooking fire.

8-10. Painting

a. Paint that requires flammable solvents or thinners or flammable cleaners shall *not* be used without first extinguishing or removing all potential sources of ignition in the immediate area.

b. Flammable thinners, solvents, and cleaners shall be handled, stored, dispensed, and used only in accordance with this regulation pertaining to flammable liquids contained in section 8-1 & 8-2.

c. Tarpaulins and drop cloths used with oil based painting operations shall *not* be stored within buildings but shall be folded and stored in metal lockers that are detached at least 15 feet from any building.

d. Spray paint shall *not* be used within buildings unless standard spray booths or rooms constructed and arranged in accordance with NFPA 33 are provided for this purpose.

e. Aerosol spray paint shall be stored IAW NFPA 30B

f. Minor touch-up involving the use of small aerosol or pressurized paint may be conducted outside of a painting standard spray booth, provided all precautions of adequate ventilation are observed. Such operations shall be very limited in scope.

g. Before refinishing floors, eliminate all sources of ignition including pilot lights for water heaters and appliances.

h. Paint should be disposed of IAW Fort Campbell's Environmental Handbook.

8-11. Paint spray booths

a. Equip spray paint booths with an adequate exhaust ventilating system. Fans will be of non-sparking type, with explosive proof fan motors located outside the booth. Install exhaust systems to conform to the standards of the NFPA 33, OSHA 29 CFR 1910. Electric lights, switches, or electrical equipment will be of the types, which meet the requirement IAW NFPA 70.

b. Installed electric equipment and lighting will be approved, explosive proof type conforming to the standards of the National Electrical Code.

c. Do *not* smoke within 50 feet of spray booths.

d. Clean filters and filter rolls will be constructed of noncombustible material. Inspect them after each use, and remove and dispose of clogged filters.

e. Do *not* store combustible materials within 3 feet of spray booths.

f. For additional information on personal protective equipment while spray painting, consult 29 CFR 1910.132 through 29 CFR 1910.138, Subpart I as required.

g. Sprinkler heads should be protected with a cellophane bag having the thickness of .003 or less or thin paper bag will be used. Covering will be replaced frequently so that heavy deposits of residue do not accumulate.

h. The interior of spray booths, exhaust fan blades, and exhaust ducts should be cleaned regularly to avoid the accumulation of residues.

i. Spray booths require an annual airflow test, to be conducted by industrial hygiene. Maintain test results records on file.

8-12. Open fires

a. *No* open fires shall be permitted on the installation at any time without the express approval and permission of the Fire Chief or designated representatives. The only exception is prescribed agricultural burning conducted by the Forestry Division or Range Control.

b. The open burning of classified materials is prohibited. Classified documents shall be destroyed IAW AR 380-5, Department of the Army Information Security Program, par 3-15, approved routine methods of destruction. Make an appointment for the classified document shredder, contact, G2, DPTMS Chief, Security & Intelligence Division, 798-2425.

c. Burnishing of wood by use of a heat or flame-producing device is *prohibited* within any building.

d. The use of open flame devices for removing paint from any structure is *prohibited*.

8-13. Batteries

All batteries shall be handled, stored, and disposed of in strict compliance with Fort Campbell Environmental Handbook.

Chapter 9
Fire Protection Equipment

9-1. Fire hydrants

a. Fire hydrants shall be used only for their intended purposes and shall be operated only by authorized personnel using only standard hydrant wrenches.

b. Parking of vehicles and/or equipment shall not be permitted within 15 feet of any fire hydrant.

c. When no other source of water is available at construction sites and water is required for construction purposes, permission may be granted by the CH2M Hill (contractor) to use hydrant as a source of water. In such cases, immediate written notice shall be given to the fire department and the usage shall be subject to the following limitations:

(1) Connection to a fire hydrant shall be limited to *not* more than one 1½ inch hose.

(2) Only one connection shall be permitted per hydrant.

(3) Each connection shall be by a gated or valve connection to a single 2½ inch outlet of a hydrant. Flow shall not be throttled by means of the main hydrant valve which, when in use, shall be fully opened.

(4) Connection will require a backflow preventer. Such device will have a valid test within the last 12 months. Test record will be furnished to CH2M HILL and kept on site.

(5) Connection will be metered. Total water use will be metered for entire duration of connection. Cost for use of water will be IAW FC Policy at time of connection.

(6) The fire department shall *not* furnish hose, valves, etc.

(7) Any fire hydrant found to be leaking, damaged, or defective shall be reported to the CH2M Hill "Hot Line" 931-431-5677 immediately so that proper repair may be started.

d. Whenever any fire hydrant is placed out of service for any reason, the fire department shall be notified immediately. Out of service hydrants shall be marked with a metal disc approximately 9 inches in diameter painted a conspicuous color, and attached to the hydrant by means of a hole in the center of the disc which shall fit over the hydrant outlet and be held in place by the outlet cap. The fire department shall be notified immediately whenever an out of service hydrant is restored to service.

9-2. Fire lanes and Fire department access

a. *No* vehicle, equipment, or storage shall obstruct a prescribed fire lane or fire department access.

b. Fire Lane markings are required to identify known and common problem areas that need to be maintained clear of obstructions for emergency vehicle use. These uses include vehicle travel and maneuvering areas as well as a base of operation for the fire department.

c. Marking of fire lanes may be required, at any time, if a need is identified by the fire department in the following manner:

(1) 90 degree curbs shall be identified by a 6 inch red (traffic grade paint) stripe on the top and side.

(2) Rolled curbs shall be identified by a 6 inch red (traffic grade paint) stripe to the top.

(3) Roads with no curbs shall be identified by a 6 inch red stripe (traffic grade paint).

(4) The words **"NO PARKING – FIRE LANE"** shall be 18 inches high white stenciled lettering with 3 inch stroke and placed 8 inches as measured perpendicular to the traffic grade red paint stripe. Stenciling must be provided within 3 feet of each end of curbed areas and spaced a minimum of 100 feet apart thereafter. Paint must be traffic grade.

(5) Diagonal red striping across the width of the Fire Lane (8 feet) shall be used when required by the fire department. It shall be used in conjunction with a 6 inch red stripe above. The stripes shall run at a 30 to 60 degree angle and shall be parallel with each other. The stripe shall be a minimum 6 inches in width and a minimum of 24 inches apart. Paint must be traffic grade.

(6) A **"NO PARKING – FIRE LANE"** sign shall be posted at the beginning and end of each fire lane. Signs are to face on-coming vehicular traffic.

d. Signs may be used instead of marking of fire lanes. Signs must be maintained and replaced when damaged. Signs shall read **"NO PARKING FIRE LANE"** or **"NO PARKING FROM THIS POINT TO CORNER"** and shall be 12" wide and 18" high. Signs shall be painted on a white background with letters and borders in red, using *not* less than 2" lettering. Signs shall be permanently affixed to a stationary post and the bottom of the sign shall be six feet, six inches (6'6") above finished grade. Signs shall be spaced *not* more than one hundred feet (100') apart. Signs may be installed on permanent buildings or walls or as approved by the Fire Chief.

9-3. Alternative Fire Lane Surfaces

a. Alternative fire lanes shall meet the NFPA 1 Fire Code Handbook, chapter 18. If approved and utilized, the site plan must indicate the type of alternative all-weather surface being utilized; examples are Tuff track, grass-crete, grass-pave, ritter-rings, invisible structures, etc.

Fire apparatus access roads shall be designed and maintained to support the imposed live loads of fire apparatus (75,000 pounds) with outrigger point loads, maximum tandem axle load of 46,000 pounds and shall be surfaced so as to provide all weather driving capabilities.

Documentation shall include, but *not* be limited to the Following:

(1) Sub-grade soil compaction report

(2) Base material quality, thickness and compaction

(3) Product information to include but *not* limited to installations instructions

The base must meet the current construction standards for a fire lane. A detail of the alternative fire lane surface material must be included within the site plan and the utility sheet of the civil plans. Concrete reinforced curbing shall be installed on both sides of the alternative fire lane surface material to enhance lateral stability. Dirt and sod shall *not* be allowed to be placed over alternative fire lane surface.

The site plan must reflect signage at the entry point of the fire lane utilizing any alternative fire lane surface in order to make responding fire crews aware of the entry points of these types of surfaces. Approved edge boundary identification is also required. The curb shall be painted red or red reflectors shall be installed to define the width of the alternative surface fire apparatus access roads. The reflectors shall be imbedded into bordering curbing at intervals *not* exceeding 15 feet. A detail of the fire lane sign must be provided within the site plan detail sheet.

The drive-on tests are the true test of how the paver will perform under vehicle load. Once the pavers are installed and turf is established, the aerial apparatus will be maneuvered on the installed pavers. The aerial apparatus will set-up with outrigger extended and aerial raised. The pavers must *not* show any signs of movement. The pavers must *not* raise or tilt up in any way, the driving surface must not interfere with the ability of the vehicle to maneuver anywhere on the grass paved area. The fire departments will saturate the area with water, which ensures a true test of how the pavers will perform in an actual emergency situation and all weather situations.

9-4. Sprinkler equipment

a. Automatic sprinkler systems shall be installed in accordance with UFC 3-600-01 and NFPA 13 and 101.

b. Sprinkler systems, which operate during an actual fire, shall *not* be shut off except upon directions of the senior fire officer.

c. Sprinkler systems which operate due to mechanical injury, breakage, or other non-fire related causes, shall be shut off as soon as it is determined that no fire exists. The fire department shall be notified immediately of the sprinkler impairment.

d. Only properly authorized personnel shall maintain and test sprinkler systems.

e. Whenever any sprinkler system is withdrawn from service for any reason, the fire department shall be notified immediately.

f. Storage shall be kept at least 18 inches below all sprinkler heads and/or piping. If facility is *not* sprinkled, storage is required to be 24" from ceiling.

g. All building modification projects in buildings with sprinkler systems shall include provisions for rearranging the sprinkler system as necessary for compliance with NFPA 13.

9-5. Fire department connections (FDC)

a. Vehicles and/or equipment shall *not* block fire department connections or sprinkler system drains. A 15-foot clearance in all directions is required for servicing the fire protection systems.

b. Immediate access to a fire department connection shall be maintained at all times and without obstruction by fences, bushes, trees, walls, gas meters or any other object for a minimum of 15 feet (914 mm).

9-6. Fire hose

c. *No* vehicle shall, without the consent of the Fire Chief or fire official in command, be driven over any fire hose that is laid down on any street or private driveway to be used at any fire or alarm of fire.

d. Driving over fire hose will be considered destruction of fire emergency safety equipment and is punishable by the following laws:

(1) KY-KRS 512.040-Criminal Mischief in the Third Degree: class B misdemeanor punishable by 90 days in confinement and $250 fine.

(2) TN-TCA 39-14-408-Class A misdemeanor punishable by 11 months 29 days confinement and $500 fine.

9-6. Facility fire extinguishers

a. This equipment will be used for extinguishing fires, and will *not* be removed from its location except for that purpose or for inspection, testing, or recharging by authorized personnel. Fire extinguishers shall not be relocated or removed from their assigned locations without Fort Campbell's Prevention Branch approval.

Equipment Installed in Buildings

(1) The building Facility Maintenance Technician / Fire Warden is responsible for monthly inspection of equipment, notifying the fire department of deficiencies, and for instructing occupants in proper use of the equipment.

(2) Fort Campbell Fire Department will not replace missing fire extinguishers. The Directorate of Public Works or user will furnish the initial purchase and installation of fire extinguishers in newly constructed facilities and their replacement in existing facilities.

(3) Distribution of equipment will be in accordance with AR 420-1 chapter 25, and NFPA Standard 10.

(4) Where fire extinguisher cabinets are not provided, there shall be suitable hangers or supports for extinguishers. Fire extinguishers shall be installed so that the bottom of the fire extinguisher is a minimum of 4 inches off the floor with a maximum of 5 feet to the top of the extinguisher from the floor surface.

(5) Facility managers are responsible for keeping extinguisher clean and free of stored material, which might obstruct their use. A 36-inch clearance area is required around any extinguisher.

b. Commanding officers of units using vehicles are responsible for:

(1) Conducting a visual inspection of fire extinguishers either in vehicles or on stationary equipment, portable generators, compressors, etc., each month.

(2) Familiarizing operators, permanently or temporarily assigned, with both maintenance and methods of checking fire extinguishers.

(3) Extinguisher requirements on vehicles transporting explosives or POL products (see the appropriate technical manual or regulation).

c. Do not distribute extinguishers in the ammunition storage areas. Vehicles entering the area will carry the required extinguishers.

d. The Fire Department will inspect and identify fire extinguishers that are in need of repair or recharging during building inspections. The Facility Manager is responsible for repair and recharging of extinguishers, identified by inspection

9-7. Flight line fire extinguishers

a. Garrisons will provide alkaline base (sodium and potassium bicarbonate), dry chemical, 50-pound and 125-pound or equivalents, class B and class C fire types (BC), wheeled extinguishers for the following aircraft.

(1) Every three parked, small, or "medium" helicopters "(UH–60/AH–64 and below) and small "fixed-wing " aircraft (C–12 or equivalent) requires a 50-pound BC, dry chemical or equivalent, wheeled fire extinguisher.

(2) Every three parked, large helicopters (CH–47 or equivalent), requires a 125-pound BC, wheeled, dry chemical or equivalent, fire extinguisher.

(3) Every three parked, medium fixed-wing aircraft (for example, C–20, C–23A&B, C–26 or similar aircraft) requires a 125-pound BC, wheeled, dry chemical or equivalent fire extinguisher.

(4) Every parked, large-frame aircraft (for example, C–17, C–130, C–5, C–141, KC–135, DC–8, B707, KC–10,

DC–10 or similar aircraft) requires a 125-pound BC, wheeled, dry chemical or equivalent, extinguisher.

(5) Every landing strip and helipad without regularly assigned ARFF vehicles requires a 125-pound BC, dry chemical or equivalent extinguisher.

Chapter 10
Range and Forest Fire Prevention

10-1. Policies and procedures

a. Units will report all fires within the Training Area(s) and Impact Area(s) immediately to Range Control (798-3001), Central Dispatch (911), Emergency Operations Center-EOC (798-6160), or Forestry (798-6242). Fires will be reported IAW with the format below. The military live-fire training fire prevention guidelines are listed in figure 3-5, CAM REG 385-5.

b. Units using ranges or training areas will fight fires observed in their areas to the best of their capability. Units undergoing training shall ensure that sufficient fire suppression tools are available to fight fires during field exercises (hand tools or fire extinguishers). Cigarettes shall not be discarded until field stripped and completely extinguished. Burned matches shall not be discarded until completely extinguished and cooled. Cigarettes shall not be thrown from vehicles. NO ONE WILL ENTER THE IMPACT AREA for the purpose of fighting fires.

c. Range Control will notify the EOC and Forestry of all fires immediately. Forestry and or the Installation Range Officer will decide if activation of the Fire Department is required unless DES is the first responders. Then, a unified command structure will be implemented between Forestry and DES personnel at the incident. The OIC of the Range or Training Area will render all possible assistance.

d. Units that report the fire will maintain communications with Range Control until the fire is extinguished or relieved of responsibility by Range Control, Forestry or the Fire Department. If the unit decides to depart the area, they must leave two soldiers behind to monitor the fire in case it gets out of control and the soldiers will notify Range Control of any change.

e. Fort Campbell Forestry retrieves daily weather forecast via the Remote Automated Weather Station (RAWS) located at the corner of On-The-Line Road and Mabry Road across from Range 37. Daily observations are used to determine the burn index, wind speed, wind direction, dew point, relative humidity, fuel moisture, probability of precipitation or storms, smoke dispersion indices, atmospheric stability, drought indices, rainfall amounts and other important readings used in the NFDRS (National Fire Danger Rating System). All observations and data are calculated within the Weather Information Management System (WIMS) associated with that RAWS site. Forestry disseminates the WIMS generated fire danger weather forecast to Range Control, DES, and the EOC. This information is posted on the Fort Campbell Intranet Homepage and various Fire Danger Today signs on the installation.

10-2. Fire Danger Rating and Color Code

a. **Low (L) (Green)** Fuels do *not* ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.

b. **Moderate (M) (Blue)** Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is *not* persistent. Fires are *not* likely to become serious and control is relatively easy.

c. **High (H) (Yellow)** All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.

d. **Very High (VH) (Orange)** Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.

e. **Extreme (E) (Red)** Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

f. A Red Flag Warning is when weather conditions are highly probable for serious, damaging wildfires and the state issues a regional **NO BURN** alert. The Forestry office notifies Range Control and DES for situational awareness when military live-fire training may be impacted.

10-3. Restrictions during Fire Danger Low (L) (Green) and Moderate (M) (Blue)

a. Smoke grenades, flares, and simulators are extremely hazardous and easily start woods and grass fires, even after rains. Special precautions shall be exercised in their use and they shall *not* be used in areas of highly flammable grass and leaves. An area shall be cleared for their use and a responsible individual detailed to watch all devices to ensure they are totally red out.

b. Caution shall be exercised in the use of warming or any other open fires. The area shall be cleared of all flammable materials for a distance of at least 3 feet and fires shall be smothered with water, covered with dirt, and completely extinguished before being abandoned. Fires shall *not* be left burning in drums or in open areas.

c. Burning of trash, debris, leaves, pine needles, grass, etc., or burning off of any area on the installation is prohibited except for controlled burning performed by the Forestry Branch, Directorate of Public Works.

d. It is incumbent upon each individual to ensure all matches, cigarettes, cigars, etc., and ashes are completely extinguished before disposal.

10-4. Restrictions during Fire Danger High (H) (Yellow)

The above restrictions apply except that units scheduled to use fireworks, pyrotechnics, or fires of any description in organized training shall notify the Forestry Branch of DPW at 798-2616 or 798-6242, and provide unit designation, area to be used, and what activities are proposed.

10-5. Restrictions during Fire Danger Very High (VH) (Orange) and Extreme (E) (Red)

a. Anything that has the potential of starting fires, i.e. tracers, explosives, booby traps, simulators, warning fires, flares, blanks (except for M-16), etc., shall not be used.

(1) **Exception 1**: For the conduct of essential and specific firing exercises and only with the prior approval of the Forestry Branch and the Installation Fire Marshal. Approval shall be granted only when firefighting equipment and personnel are immediately available.

(2) **Exception 2**: the Forestry Branch for the firing of tracers grants Permission and use of demolition in areas, which have been controlled, burned.

b. Open fires of any type shall *not* be permitted.

10-6. Action in case of a fire

a. Immediately, upon discovery of a fire, all units in the vicinity of the fire shall cease training and make every effort to extinguish it. All range and training area fires shall, upon discovery, be reported to Range Control and/or the Fire Department.

b. Under *no* circumstances shall individuals or units enter any impact area to extinguish a fire.

c. Unit reporting the fire shall direct the fire fighting units to the fire and remain at the scene until released by the incident commander or authorized representative.

10-7. Fighting fires

a. The Forestry Branch or Fire Chief and/or her or his authorized representative have the authority to use the services of military personnel and equipment within the vicinity and/or request additional troop support to assist as required.

b. Under the terms of the Cooperative Agreement between U.S.D.A., Forest Service at Land Between the Lakes and Fort Campbell, additional trained professional forest firefighting personnel and equipment may be readily available.

Chapter 11
Storage and Warehouses

11-1. General

a. Where automatic sprinkler protection is provided, maintain a clearance of at least 18 inches between storage and sprinkler heads. Do *not* obstruct sprinkler risers at any time.

b. Where automatic sprinkler protection is not provided, maintain a clearance of at least 36 inches between storage and the underside of the lowest beams, girders, or other ceiling constructions.

c. Maintain a clearance of at least 18 inches between storage and electric lights, wiring, and fixtures.

d. Stacks more than 15 feet high or which contain unusually hazardous materials shall not be piled closer than 36 inches to sprinkler heads.

e. Storage will *not* be permitted within 36 inches of heaters, stoves, furnaces, or water heaters.

f. Cross aisles of *not* less than 4 feet in width shall be provided for stacks up to 10 feet in height. Where stacks exceed 10 feet in height, cross aisles shall be at least 5 feet.

g. Combustible materials, such as excelsior, rags, and shredded paper, shall be stored in fire resistant bins with fusible link or self-closing doors.

h. Materials shall *not* be stored under or piled against building doors, exits, or stairways. Materials shall *not* be stored within 25 feet of any structure.

i. A 24-inch space shall be maintained between stored combustible materials and interior finish, firewalls and partitions.

j. Containers, drums, or other approved receptacles containing flammable liquids shall *not* be stored in general storage areas, but shall be stored in locations specifically constructed according to current directives for this type storage. This also applies to empty flammable liquid containers.

k. Packing materials shall be kept in the original bales until used. Broken bales shall be kept in all metal lined bins with automatic self-closing covers. Waste from packing/unpacking or other sources shall not be allowed to accumulate in hazardous quantities. All waste shall be removed outside daily at the end of the workday/shift and disposed of in designated containers.

l. Floor sweeping compound shall be stored in metal containers with tight-fitting self-closing lid. Oiling of floors is prohibited.

m. Boiler rooms, utility rooms, and hot water heater enclosures shall not be used for storage purposes.

n. Storage is prohibited under stairways and in stairwells.

o. Gasoline powered equipment shall *not* be refueled or serviced inside any storage building.

p. Directional arrows will be placed where fire extinguishers are not easily discernible from a reasonable distance in the aisle way.

q. Directional arrows indicating the location of fire exits, which are *not* easily discernible, will be similarly posted. Reference OSHA 1910.145 and DoD 4145.19-R-1.

11-2. Access

a. Storage shall *not* interfere with fire lanes or inhibit access to fire valves, fire hoses, fire extinguishers, fire escapes, fire exits, fire alarm pull stations, or fire doors.

b. Doors and exits shall *not* be blocked.

c. The Fire Department must approve access doors blocked on the inside and will be conspicuously marked on the outside with 3-inch high black lettering on white background reading "DOOR BLOCKED."

d. Access aisles shall be maintained to provide convenient access to all portions of the storage areas. Fire aisles, fire exits, and approaches to fire extinguishers will remain open at all times. Main aisles will be at least 6 feet wide. Access routes to hand fire extinguishers will be at least 36 inches wide.

e. A 24-inch clearance will be maintained between stock and the fire door, except for portion of the fire door near the aisle. For this portion of the fire door a 36-inch clearance will be maintained between stock and the fire door. Reference DoD 4145.19-R-1.

11-3. Outside storage

a. Keep the entire storage site free of unnecessary combustible materials (fuel cans, oil barrels, etc). Keep weeds and grass cut. Remove dry weeds and grass from the storage site.

b. Fences providing closed in areas for outside storage sites will have sufficient gates to permit rapid access of fire apparatus.

c. Storage shall *not* interfere with fire lanes or inhibit access to fire valves, fire hoses, fire extinguishers, fire escapes, fire exits, or fire doors.

d. If using a structure or an open bay a clearance of 18 inches minimum shall be maintained between sprinkler heads, a ceiling, ceiling lights, electrical fixtures, and stored materials.

e. Materials shall *not* be stored under or piled against building doors, exits, or stairways. Materials shall *not* be stored within 25 feet of any structure.

11-4. Vehicles

a. Authorized vehicles operating within warehouses will be maintained in a safe working condition.

b. A complete daily inspection will be made to preclude a fire originating from this source.

c. Vehicles will be parked in designated areas only.

d. Vehicle parking inside facility requires initial approval through the Fort Campbell Fire Department.

11-5. Pallets

a. Wooden pallets will be stored outside or in a detached structure.

b. When stored inside, the building must have a sprinkler system.

c. Wooden pallets will be stored no higher than 8 feet. Each pallet pile shall have no greater than four stacks separated from other pallet piles by at least 8 feet of clear space or 25 feet of stored commodity.

d. Plastic pallet storage will not be higher than 4 feet. At least 8 feet of clear space or 25 feet of stored commodity will separate each pallet pile greater than two stacks from other pallet piles. Reference NFPA 231.

Chapter 12
Motor Maintenance Facilities, Shops, and Hangers

12.1. General

a. Reference chapter 11 storage and warehouses.

b. Inside vehicle maintenance compounds, fire hydrants will have at least 50 feet clearance from any vehicle, portable or temporary structures, connex's, and containers.

c. All gates around vehicle maintenance compounds are classified as **"FIRE LANES."** They will *not* be blocked or obstructed at any time. Signs designating fire lanes are the responsibility of the organization assigned to the compound. Fire lanes will be monitored daily by an assigned member of the organization for blockage or obstructions.

d. When any building any used to store more than five gallons of insecticides the organizations will prepare a list with the type of chemical and amount of each product and forward to the Fire Department. Hazardous pesticides will be identified, handled, and stored IAW AR 420-76, TM 5-632, and NFPA 434.

e. Cylinders containing liquefied gases or acetylene that are stored outdoors will be protected from the direct rays off the sun with a fixed canopy (preferably noncombustible) capable of withstanding all local environmental conditions IAW AR 700- 68

f. Smoking is prohibited within 50 feet of compressed gas cylinder storage areas, and "No Smoking" signs will be posted.

g. Oxygen cylinders will be stored in locations separated from other gases "such as acetylene," will be separated not less than 20 feet or separated by a 1 hour fire rated wall.

h. Oxygen, acetylene, and other compressed gases will be handled carefully. Cylinders will be secured to prevent accidental tip over by lashing, strapping chaining, or clamping in an upright position. Cylinders will be capped during storage and while being transported.

i. Do *not* store anything on top of fencing or cages used for supply, offices, and TA 50 gear (i.e plywood, misc storage, office equipment, construction materials, etc)

Chapter 13
Family Housing

13.1. General

It is expected and required that adult occupants shall exercise ordinary prudence in their own conduct and shall impose reasonable control on minors in their households. The prevention of fires is the paramount objective.
***NOTE: Occupants will be liable for losses by fire caused by the occupants' negligence by burning candles, incense or any other open flames in or around any building on Fort Campbell.**

13-2. Smoking in bed

Smoking in bed is prohibited and individuals are responsible for safe disposal of smoking materials.

13-3. Accumulation of trash

Accumulation of trash on floors or near buildings is prohibited. Outdoor trash containers shall be a safe distance from the building.

13-4. Barbecue grills

Barbecue grill shall not be used indoors, on porches in garages or carports. Barbecue grills shall be under close supervision of an adult at all times when in use. Barbeque grills shall be located at least 10 feet away from combustible materials and/or all buildings when in use. When use has been completed, hot coals shall be quenched with water or covered with a noncombustible cover to prevent sparks or hot coals from being scattered by the wind. Do *not* use grills in front of exits.

13-5. Commercially manufactured fire pits

Commercially manufactured fire pits shall not be used indoors, on porches, in garages or carports. Commercially manufactured fire pits shall be under close supervision of an adult at all times when in use. Fire Pits shall be of a

type approved by the Fort Campbell Fire Department, enclosed on all sides, with a cover. Fire pits shall be located at least 10 feet away from combustible materials and/or all buildings when in use. When use has been completed, hot coals shall be quenched with water or covered with a noncombustible cover to prevent sparks or hot coals from being scattered by the wind.

13-6. Fireworks

Fireworks are *prohibited* in family housing and on Fort Campbell.

13-7. Storage

Storage is *prohibited* in mechanical, alarm, communications, electrical, or boiler rooms.

13-8. Flammable liquids

a. Gasoline storage in family living quarters is *prohibited*.

b. The storage of fuel in containers or in power mowers, outboard motors, and similar equipment with fuel tanks shall be in an outside building, cabinet, or such storage. If storage building is lacking, the following conditions shall be met:

(1) The aggregate amount in the container or equipment shall *not* exceed 5 gallons.

(2) The storage area shall be contain and shall be remote from any possible source of ignition (e.g., water heaters, furnaces, and electrical appliances).

(3) Adequate ventilation of storage area shall be provided to prevent the accumulation of flammable vapors. Storage in below-grade basements and cellars shall be *prohibited*.

(4) Storage area shall *not* be occupied as living space or used as an exit.

(5) Items stored shall *not* be subject to mechanical damage.

(6) All openings from the fuel tank and the supply line to the engine shut off where a valve is provided shall be tightly closed.

(7) Gasoline shall be stored only in a safety can that is listed by a nationally recognized testing laboratory.

(8) *No* refueling shall be conducted inside or within 15 feet of any building, including garages basements, or attached right-of-way.

(9) Occupants shall be liable for losses by fire caused by the occupants' negligence in storage and use of flammable liquids.

(10) Gasoline-fueled lanterns shall be allowed to cool before refilling.

c. Flammable liquids shall be kept in safe containers, away from sources of ignition, and safe from tampering by children.

13-9. Electrical installation

Repair, and change in electrical wiring, fittings, or attachments for electrical appliances shall *not* be permitted except by authorized electricians.

13-10. Fire plan

The plan should be clear and uncomplicated, so that all members can understand and carry out their assignments. The following principles are essential:

a. Immediately upon discovery of fire, all family members shall leave or be removed from the building.

b. Once outside, never let anyone reenter the building.

c. As you leave, close doors behind you.

d. Designate a meeting place outside. If someone is missing, notify the first arriving firefighter.

e. If possible, report the fire to the fire department (dial. 911), but do *not* risk injury to use your own telephone (use a neighbors).

f. Notify all occupants in adjoining quarters or houses.

13-11. Kitchen fires

a. Grease fires in kitchens can normally be safely controlled at the start. Fires in skillets, broilers, and deep fat devices can usually be extinguished by covering with a lid. A lid should be kept conveniently available for this purpose. Turn off the burner control as soon as possible. Do *not* attempt to move any type of container that contains burning grease. **DO NOT** throw flour, water or any other substance into the burning material.

b. Leaving cooking appliances and equipment unattended while cooking will be considered "unattended cooking."

c. Fires caused by unattended cooking will be the sole responsibilities of the individual causing unattended cooking fire.

Chapter 14
Fire Prevention for Contractors/Concessionaires/Vendors

14-1. General

This chapter was created to establish responsibility and procedures for conducting inspections, supervising, and maintaining a safe environment for Fort Campbell soldiers and their families during special events where contractors/concessionaires are conducting business. Refer to the Mobile Food Unit Operation Guide & Checklist in Appendix E &F, and in section 14-2 of this chapter to be in compliance while working on Fort Campbell.

14-2. Contractors/concessionaires/vendors

Contractors/concessionaires/vendors shall comply with this regulation to include the following:

a. Smoking is *prohibited* in all Fort Campbell Buildings as of January 2, 2001. Smoking materials shall be deposited in designated smoking receptacles.

b. Remove debris from buildings or areas before quitting time each day and deposit in accordance with installation disposal requirements.

c. The use of heat producing devices in or adjacent to buildings shall be coordinated with the Fire Chief and/or central dispatch.

d. All structures must be made of quality materials; *no* plywood or tarp structures will be allowed.

e. All materials used in the construction or decoration of any booth used for cooking operations shall be inherently flame retardant or have been treated with an approved flame retardant product that will allow the material so treated to meet the requirements of the Match Flame Test.

f. On job site fire extinguisher(s) shall be the responsibility of the contractor. For Contractors/Concessionaires using deep fry cooking equipment, a Class K fire extinguisher shall be on premises and readily accessible. ABC fire extinguishers will *not* take the place of a Class K fire extinguisher if cooking equipment is being used.

g. A minimum of one 5lb 2A10BC fire extinguishers conspicuously located and readily accessible for immediate use as determined by a Fort Campbell Fire Inspector.

h. Fire extinguishers must have a durable tag securely attached showing the maintenance or recharge date.

i. All employees shall be indoctrinated on methods of preventing and reporting fires.

j. All fires on Fort Campbell shall be reported.

k. In all outdoor assembly events, the Fire Chief or Assistant Fire Chief of Prevention shall determine the number of fire/life safety monitors that are necessary to ensure the safety of the patrons.

l. Contractors/Concessionaire/Vendor shall *not* use or close off water mains or hydrants without approval of the Fire Chief.

m. The contractor submitting the permit application must submit the request to Fort Campbell's Prevention Branch within 20 days of the event. The permit application shall include plans that show all details of the proposed event site. ***No*** event shall proceed without approved plans.

n. The Contractor/Concessionaire/Vendor will provide, install, operate and maintain, at concessionaire's own expense the necessary equipment, supplies, personnel and décor package for the operation of a food concession to industry or company's standards whichever is higher.

o. Contractor/Concessionaire/Vendor will be responsible for all maintenance associated with the use of the premises including dining area and restrooms, concessionaire-installed equipment, fixtures or modifications and concept adaptations to the building.

p. Booths used for temporary food service operations shall be constructed in such a manner to allow adequate room for all the equipment, appliances, apparatus, supplies and other materials used in conjunction with the cooking operation to be contained within the booth/trailer.

q. All temporary food service operations booths shall be constructed in a manner as to allow for immediate accessibility and unobstructed means of egress free of impediments to full instant use in the case of fire or other emergency.

r. All temporary food service operations booths are required to have a minimum of 6 ft. aisles on each side with a 3 ft. aisle in the rear and an exit way of not less than 36 in.

s. All cooking devices shall be isolated from the public by at least 4 ft. or by a barrier between the device and the public.

t. Access and egress routes shall be maintained so that the crowd management, security, and emergency personnel shall be able to move in the event of an emergency.

u. ***No*** obstructions shall be permitted in a means of egress at anytime.

v. All devices used in conjunction with the preparation of food shall be operated to avoid hazard to the safety of the occupants and the public.

w. All devices used in connection with the preparation of food shall be of an approved type and shall be installed in an approved manner.

x. Contractor/Concessionaire/Vendor shall keep premises and surrounding area clean and orderly. All facilities, including equipment and property will be subject to an inspection by a Fort Campbell Fire Inspector for fire and safety hazards; and the Fort Campbell Veterinary Treatment & Preventative Medicine representative(s) for safety and health hazards.

y. Meet health standards prescribed by government regulations, and obtain passes and permits as required.

z. Electrical service shall meet the following:

(1) All cords must be 12-gauge minimum, grounded and approved for outdoor use in a wet location and direct contact with the ground.

(2) Cords must be the correct size for the proper load free from safety and fire hazards.

(3) Vendors are responsible for any necessary ground faults.

(4) All metal trailers must have a supplemental ground rod with a #6 gauge grounding conductor properly bonded to the trailer frame.

(5) All installations must conform to the current NEC (Article 525.20) and the Mobile Unit Operation Guide.

aa. Contractor/Concessionaire/Vendor shall have electrical service inspected by the Fort Campbell Electric Service. This includes the required minimum gauge of extension cords being used. Fort Campbell's Fire Inspector may inspect the electrical service before and during the event to ensure compliance.

bb. Each portable structure shall be free of safety/fire hazards that include but *not* limited to defective or broken fixtures, switches, fixture cords, sockets, outlets, service entrance cables, and splices.

cc. Each portable structure shall be provided with a disconnect switch located within sight of and within 6 ft of the operator's station.

dd. Electrical wiring for lighting shall be securely installed and, where subject to physical damage, shall be provided with mechanical protection.

ee. All lamps for general illumination shall be protected from accidental breakage by a suitable luminary or lamp holder with a guard.

ff. Adequate illumination from a source of reasonably ensured reliability shall be provided for all cooking operations when operating after dusk.

gg Distribution/Terminal Boxes shall be designed so that no live parts are exposed to accidental contact.

hh. If installed outside, the distribution/terminal box shall be weatherproof construction and mounted so that the bottom of the enclosure is not less than 6 in. above the ground.

ii. If the Contractor/Concessionaire/Vendor is using Liquid Petroleum Gas (LPG), it shall be included within the permit request to the FCFD Fire Prevention Branch.

jj. All LPG installations shall meet all requirements of NFPA 58 and current LPG Gases Code.

kk. Combustible materials within the booth shall be limited to a one day supply. Storage of combustible materials behind the booths shall be *prohibited*.

ll. If single and/or multi-well cooking equipment is using combustible oil or solids the following shall apply:

(1) Have lids readily available for immediate use.

(2) Be placed on noncombustible surface materials.

(3) Be separated from each other by a minimum horizontal distance of 2 ft.

(4) Be kept a minimum horizontal distance of 2 ft from any combustible material.

mm. All cooking equipment shall be extinguished at the end of the event each day.

nn. All extinguished ashes and coals shall be placed in an approved metal container with a tight fitting lid and removed from the event site at the conclusion of the event.

oo. Cooking and heating equipment *cannot* be located near exits or combustible materials. Cooking equipment used in tents shall comply with NFPA 10, 17-A, and 96.

14-3. Fireworks/Pyrotechnic permits for contractors and/or special events/holidays.

a. A permit for supervised public display of fireworks and/or pyrotechnics shall be obtained.

b. The permit request must be signed by the Fire Chief and sent to the Division of Fire Prevention for the State of Kentucky.

c. The contractor submitting the permit request must submit the request to the Fire Chief within 20 days of the event.

d. Diagrams shall be prepared and submitted with the permit request to illustrate the general arrangement and size of mortars and the location of shell storage at the discharge site.

e. Description of the termination and emergency procedures shall be included in the permit request that shall contain procedures for inspecting the discharge site and fallout area for any defective or unexploded fireworks and procedures for disposing of defective fireworks and fireworks materials.

f. The Fort Campbell Fire Prevention Branch will provide the fireworks/pyro technician a permit the day before the event.

g. A Fort Campbell Fire Inspector will do a safety/radio check 15 minutes prior to the show, then every five minutes and finally a count down from five before the start of the show.

h. The event coordinator and lead pyro technician will be given a radio with the emergency services frequency in the event there is an emergency or concerns with weather, equipment or fireworks/pyrotechnics. Safety/radio checks will be conducted by the event coordinator and lead pyro technician.

i. The event coordinator and all contractors will adhere to NFPA 1123 for proper distances of outdoor display sites, road closures, and barricades. The event coordinator and/or contractor may adjust the distance to the next hundredth for outdoor display sites, road closures, and barricades.

j. Any areas, roadways, walkways or any other sections will *not* be opened or fencing removed, until cleared for unexploded rounds/fireworks by the lead operator/pyrotechnics company of the display.

k. The AHJ can revoke or restrict any approval to conduct an outdoor display whenever conditions such as site location, weather, traffic, communication, security procedures, available public protection, or other safety precautions make such action necessary to safeguard the health, safety, or welfare of the public.

l. The AHJ will determine the level of fire protection to be provided by the display operator, contractor, or both for any outdoor display.

m. In the event that conditions are deemed hazardous by the AHJ or the operator before or during a display, the display should be postponed until the condition is corrected (i.e. adverse weather conditions or crowd control).

n. Transportation and storage of fireworks, in particular interstate transit, should be done in accordance with the appropriate federal or state regulatory authority.

o. The display operator, contractor, or both shall present verifiable proof of liability insurance of a type and amount deemed appropriate by the AHJ.

p. Fireworks are prohibited except for professional licensed public displays and pyrotechnic shows.

q. See appendix D for procedures and guidelines.

Chapter 15
Public assembly and recreation requirements

These include clubs, theaters, exchanges, concessions, chapels, restaurants and/or cafeterias, hobby shops, gymnasiums, sales stores, and other places where people may congregate for entertainment or recreation. The potential life safety hazards and the possibility of property loss in these occupancies require that extraordinary actions be taken to prevent fire.

15-1. Managers of places of public assembly and recreational facilities

a. Shall establish a sound fire prevention program and shall ensure that employees are trained and understand their fire prevention responsibilities, fire reporting, facility evacuation procedures, and first aid firefighting procedures.

b. Managers of public facilities will post the total occupant load, and ensure it is *not* exceeded, IAW NFPA 101, *Life Safety Code*. If any questions arise, coordinate with the Fort Campbell Fire Prevention Branch.

c. Shall be designated to check fire egress exits daily, prior to entry of patrons, to ensure that doors are unlocked and that panic-type hardware and exit lights are functioning properly.

15-2. Managers or assistants

a. Shall conduct closing inspections. This responsibility shall *not* be delegated to janitorial personnel. Closing inspection checklist shall be prepared by managers and as a minimum shall include the following:

(1) All electrical kitchen equipment switches placed in the OFF position.

(2) Portable electrically operated devices or appliances, including amusement and vending machines, *not* essential for after hour's maintenance, shall have the switches placed in the OFF position.

(3) Trash receptacles are emptied and trash is placed in containers outside of building; in addition, separate cigarette materials from other combustibles in cleanup operations.

b. Managers will notify the Fort Campbell Fire Prevention Branch, 798-7171, when planning events involving temporary decorations, exceptionally large crowds, or any unusual arrangements.

15-3. Inspection by fire prevention personnel

a. The Fire Chief or his representative will perform an unannounced spot check inspection on public assembly buildings.

b. Inspections shall be conducted prior to the start of any social and/or unusual event.

c. These inspections do *not* relieve the management of their required responsibility.

15-4. Managers of facilities in which commercial or restaurant-type cooking is performed

a. Managers of facilities in which commercial or restaurant-type cooking is performed must establish and enforce the following procedures:

(1) Clean grease filters and hoods daily to prevent the accumulation of grease.

(2) Must have exhaust ducts cleaned every 6 months by a licensed contractor. NFPA 96 contains specific guidance. It's highly recommended to have the ducts cleaned more often if there is a high volume of cooking being performed.

(3) Post the following information and make available to the Fort Campbell Fire Inspector during inspections:

(a) Date hood, ducts, and filters were last cleaned.

(b) Name of contractor who serviced/cleaned system.

(c) Date extinguishing system was checked and serviced and by whom.

(d) Date tested and certification of high-limit temperature controls on deep fat fryers. This is a semiannual requirement.

(e) Record of fire suppression training of the employees.

(4) Cooking is *not* permitted when grease filters are *not* installed or exhaust fans are *not* working.

(5) Installation of cooking equipment must be in accordance with NFPA 96.

15-5. Use of candles

And other open flame devices for decorative or lighting purposes in places of public assembly are *prohibited*.

15-6. Carpets, curtains, and draperies

Shall be fire resistant and/or treated for fire resistance. The managers shall maintain certification.

15-7. All decorations

a. Used for special events (i.e., hunting banners, artificial floral designs, lighting, and Christmas decorations) shall be approved by the Fire Chief and inspected by a Fort Campbell Fire Inspector prior to use.

b. Any decoration identified as a fire hazard during the inspection shall be removed.

15-8. No notice inspections

The manager shall conduct *no*-notice inspections of assigned facilities to ensure compliance with this regulation.

Chapter 16
Fire Prevention in Tent Areas

16-1. Tents

a. Tents shall be permitted only on a temporary basis. A temporary basis, according to NFPA and this regulation is considered 180 days or less.

b. An application should be submitted to the Fort Campbell Fire Department for use of a tent.

The applicant shall provide:

(1) Start and finish date of the event/activity.

(2) Venue name, address, and POC.

(3) Size of the tent and the area it will cover.

(4) Description of activities.

(5) Documents showing the flame resistance of the fabric material (certification), electrical installation needs, and heating appliances if used.

(6) A detailed site and floor plan for each tent. This will include placement of tents, fire extinguishers, air conditioning, heaters, etc

Tents shall *not* cover more than 75 percent of the premises, unless approved by AHJ.

e. Tents, other than private tents and camping tents, under 400 ft^2 shall also comply with the requirements of this section.

f. All tent fabric shall meet the flame propagation performance criteria contained in NFPA 701.

g. There shall be a minimum of 10 ft. between stake lines.

h. Adjacent tents shall be spaced to provide an area to be used as a means of emergency egress. The AHJ may adjust this requirement.

i. Tents *not* occupied by the public and *not* used for the storage of combustible material shall be permitted to be less than 10 ft. from other structures if the AHJ deems this set up safe to the general public. If the tent is occupied by the public, the tent shall be no less than 20 ft. from all exits of a structure/building.

j. Tents, each *not* exceeding 1200 ft^2 and located in an open space, shall *not* be required to be separated from each other, provided that safety precautions meet the approval of the AHJ.

k. Smoking is *prohibited* in and around any tent.

l. Heaters and their installation shall be approved by the AHJ. Heating devices shall be labeled.

m. Heaters shall be connected to electricity by electric cable that is suitable for outside use and is of sufficient size to handle the electrical load.

n. Space heaters shall be placed in a box filled with 4 inches of sand. Boxes constructed of 2 by 4s, with the bottom of 1/4-inch plywood shall be permitted. The dimensions shall be a minimum of 36 inches by 36 inches. A drip pan shall be placed under the carburetor of all heaters to collect the overflow of fuel.

o. All stoves shall have a shield installed to protect the stovepipe. The stovepipe shall extend a minimum of 12 inches above the ridgepole.

p. Flammable and/or combustible liquid containers shall *not* be located inside any tent. Gasoline and diesel fuel shall not be mixed for use in heaters.

q. Containers shall be stored in an upright position and a minimum 50 feet from any tent or vehicle.

r. A fireguard shall be posted during operation of heaters.

s. Weeds and vegetation shall be removed from within 10 feet of any tent.

t. The premises shall be kept free from flammable or combustible materials during the period for which the premises are used by the public.

u. Sand shall be maintained free of foreign matters and shall be changed if contaminated with fuel.

v. Portable fire extinguishing equipment of approved types shall be furnished and maintained in tents in such quantity and in such locations as directed by the AHJ.

w. Generators and other internal combustion power sources shall be separated from tents by a minimum of 5 ft. and shall be protected from contact by fencing, enclosure, or other approved means.

16-2. Electrical

a. Not more than two appliances shall be connected to an electrical outlet. Multiple electrical adapters are prohibited.

b. Use of electrical extension cords is *prohibited*.

c. Adding to, tampering with, or repairing of electrical wires by other than authorized electricians *prohibited*.

16-3. Firefighting equipment

A minimum of 5-pound multi-purpose (A, B, C) fire extinguisher shall be located at each tent and where flammable or combustible liquids are used, stored, or dispensed.

16-4. Fire reporting

Anyone discovering a fire shall immediately notify fire department by dialing 911. Regardless the extent of a fire or if the fire was extinguished, the fire department shall be notified. If the fire was extinguished prior to the fire department arrival, the fire scene shall not be disturbed until directed to do so by the Fire Chief or his authorized representative.

16-5. Fire prevention general

a. If unit approves smoking in a tent, a minimum of two metal containers shall be placed in each tent located on the floor away from the tent sides, posts, or combustible materials. The can shall have a minimum of 2 inches of sand or water at all times.

b. Open fires of any type shall not be permitted.

c. Unobstructed fire lanes between tents shall be maintained at all times.

d. All flammable and/or combustible liquids shall be stored a minimum of 50 feet from any tent or vehicle.

Chapter 17
Ammunition Storage

17-1. General

a. Do *not* obstruct the clear spacing between buildings used for storing ammunition by storing combustible items.

b. Electrical facilities within ammunition or explosive storage and maintenance areas will meet the requirements of the NFPA 70.

c. All small arms ammunition storage sites for local ground defense and security purposes may be stored in any magazine, arms room, or other suitable structure provided the following is strictly complied with:

(1) The structure or portion of the building being used for storage is locked and secured to prevent pilferage and unauthorized handling.

(2) The structure will display a proper fire symbol posted on the exterior and on the arms room door. The symbols will be removed when the building *no* longer has active arms room or ammunition storage.

(3) Quantity authorized for storage is limited to the operational needs.

17-2. Unit Arms Rooms

a. Ammunition storage in unit arms rooms requires an approved explosive storage license IAW the Arms Room Explosives Site License SOP which is available from the Installation Safety Office 956-0876.

b. The approved license will be renewed annually and a copy will be provided to the Fort Campbell Fire Prevention Branch by the Installation Safety Office upon completion of all accepted/approved signatures.

17-3. Transportation

a. Military vehicles transporting ammunition and / or explosives will be equipped with a minimum of two 10 pound dry chemical fire extinguishers.

b. The current using organization will supply the fire extinguishers. The vehicle transporting the ammunition will be properly placarded and have military fire symbols 1, 2, 3, 4 IAW Department of Transportation (DOT) guidelines and DA Pam 385-64.

17-4. Waste materials

Keep separate waste materials such as oily rags, combustible scrap, and paper within an explosive area from each other. Place each type of waste material in metal containers with closing tops.

17-5. Matches, flame, or spark-producing devices

Matches, flames, or spark producing devices in any explosive area are prohibited except by written authority of the Fire Chief.

17-6. Smoking

Smoking is not permitted within 100 feet of any magazine or storage pad. Specific designated locations may be established for smoking with approval of the Fire Chief.

17-7. Vehicles

Do not park vehicles within 100 feet of buildings containing explosives.

17-8. Cleaning

Do not use gasoline or other flammable liquids within an explosive area for cleaning purposes.

Chapter 18
Holiday and Facility Decorations

18-1. Combustible decorations

a. Combustible decorations are *prohibited*. Only fire resistant materials will be used and may be subject to burn tests.

b. Paper, flowers, tinsel, streamers, scenery, candles, incense etc. shall not be used in any buildings. Decorations shall have the UL approval and be marked 'Flameproof' prior to the installation of any special decorative materials, approval shall be obtained from the Fire Chief. In all cases, decorations should be kept to a minimum to prevent the possibility of fire.

c. All seasonal or special decorations will be taken down immediately following the holiday or occasion and properly stored.

d. Candles and other open flame producing devices will *not* be used for any occasion except for religious functions held at the Base Chapel or in designated areas approved by the Fort Campbell Fire Prevention Branch.

18-2. Natural Christmas trees

a. Keep the tree outside of the building until ready to install a few days before Christmas.

b. Cut the bottom of the tree at an angle about 1 inch above the original cut, set in water or wet sand and brace securely. Water should be added daily.

c. *No* attempt will be made to fire proof natural green trees.

d. Keep the tree away from radiators, stoves, and other sources of heat. The tree shall *not* be located near entrance or exit doors, nor near any elevator or stairwell.

e. Use only UL approved electric lights that are in good condition and *not* worn or frayed.

f. Do *not* leave the tree lights burning when no one is in the building or after retiring at night.

g. If lights are desired in windows, curtains and other combustible materials should be at least 6 inches from the lights.

h. Maximum wattage for decorations shall be 1500 watts per household.

18-3. Artificial Christmas trees

a. Artificial Christmas trees and decorations will be flame retardant and approved by a recognized testing laboratory.

b. Christmas trees made of aluminum are conductors of electricity. The use of tree lighting sets on aluminum trees is prohibited.

c. Requirements of section 18-2 apply

18-4. Haunted house

a. See appendix B Minimum Fire and Life Safety Guidelines for Haunted Houses

b. See appendix C Application for Haunted House Permit

18-5. Concerns

Any concerns with decorations should be referred to the Fort Campbell Fire Prevention Branch, 270-798-7171/7172/6191.

Chapter 19
Juvenile Firesetters Intervention Education Program

19-1. Purpose

In Juvenile Firesetters Intervention education is critical in understanding why a child acted the way he or she did and teaching him or her why their actions can harm others. What's most important to us is the success of the child and family involved in the firesetter incident. Our purpose is *not* to punish, but provide an educational outlet about fire behavior to the youth of our community and offer a means for parents or guardians to understand why young people play with fire.

19-2. Program

The Fort Campbell Fire Department Firesetter Intervention Education Program was developed to reach out to the community of Fort Campbell to educate the youth between 5 and 17 years old and their families about the danger of playing with fire. The majority of youth involved in fire setting incidents don't think about the consequences if someone is hurt or if property is loss because of their misuse.

19-3. Referrals, Questions, and/or Concerns

Any questions or concerns about referrals, agencies, the process, or the Firesetter Intervention Program contact the Fort Campbell Fire Prevention Division, 798-7171/7172.

MARK R. STAMMER
Brigadier General, USA
Commanding

Official:

JEFFREY W. JAEGER
Director, Mission Support Element

DISTRIBUTION:
INTRANET

Appendix A
References

AR 200-1
Environmental Protection and Enhancement

AR 380-5
Department of the Army Information Security Program

AR 385-64
Ammunition and Explosives Safety Standards

AR 420-1
Army Facilities Management

AR 420-4
Quality Assurance (Electrical) Inspection Standards

AR 608-10
Child Development Services

AR 600-63
Army Health Promotion

AR 700-68
Storage and Handling of Liquefied and Gaseous Compressed Gasses And Their Full And Empty Cylinders

CAM Reg 190-3
Juvenile Offender Program

CAM Reg 190-5
Fort Campbell Motor Vehicle Traffic Regulation

CAM Reg 385-2
Investigation of Serious Accidents

CAM Reg 420-6
Fort Campbell Exterior Signage and Markings

CAM Reg 608-3
Supervision of Minor Children on Fort Campbell

CAM Reg 700-2
Conventional Ammunition

DA Pam 385-64
Ammunition and Explosives Safety Standards

DoD 4145.19-R-1
Storage and Materials Handling

DoDI 6055.9 STD
Ammunition and Explosives Safety Standards

TB 43-0134
Battery Disposition and Disposal

TM 5-632
Military Entomology Operational Handbook (Incl C 1- 2)

UFC 3-600-01
Fire Protection Engineering for Facility

Factory Mutual Approval Directory
(This directory may be purchased from the following source: Order Processing Factory Mutual Engineering, 1151 Boston-Providence Highway, Norwood, MA 02062-9102.)

Gaining an Understanding of the National Fire Danger Rating System
(This is a publication of National Wildfire Coordinating Group sponsored by United States Department of Agriculture, United States Department of the Interior, and National Association of State Foresters. This publication can be gained from National Interagency Fire Center, ATTN: Great Basin Cache Supply Office, 3833 South Development Avenue, Boise, Idaho 83705. Order NFES # 2665) This document is also available in PDF format at the following website: http://www.nwcg.gov

National Fire Protection Association Codes and Standards
(These codes and standards, published by the National Fire Protection Association, may be purchased from the following commercial source: NIEPA, ATTN: Publication Sales Department, 1 Barrerymarch Park, and P.O. Box 9146, Quincy, MA 02269-9 146.)

Underwriters Laboratories (UL) Fire Resistance Directory
(This index may be purchased from the following commercial source: Underwriters Laboratories, Inc., Publications Stock, 333 Pfingsten Rd., Northbrook, IL 60002-2096.) Web address: www.ul.com

APPENDIX B
Minimum Fire and Life Safety Guidelines for Haunted Houses

B-1. Purpose
The purpose is to establish minimum fire and/or life safety guidelines for the use and operation of Haunted Houses on Fort Campbell. All haunted houses will be permitted see Appendix C.

B-2. Application
a. The following guidelines are intended to apply to Haunted Houses which typically operate during the Halloween season at special community or local events. They may also apply to similar commercial activities such as carnivals and other seasonal amusement activities.

b. These guidelines have been updated to include requirements prescribed in the NFPA 1 Uniform Fire Code, and the NFPA 101 Life Safety Code, both of which are incorporated by reference as part of the AR 420-1, chapter 25 Fire Prevention and Protection Regulation. These guidelines are necessarily general in scope and should be applied with appropriate professional judgment and common sense in consideration of the overall fire and life safety situation.

B-3. General
a. By nature, many of these types of facilities are unique; thus, the fire safety concerns are unique and must be evaluated accordingly. Special attention should be given to overall exit arrangement, exit travel distance, exit and emergency lighting, use of flammable liquids, combustible interior finish, construction materials, use and operational condition of fire detection, alarm and extinguishing equipment, use of special effects, adequate trained and supervised staff, established emergency procedures, and readily available means to notify local fire, police and emergency medical services. For added safety, it may be necessary to limit occupant load, add additional emergency exits or establish other special precautions to minimize a potential risk due to some unique circumstance. In any event, every effort should be made to provide an enjoyable but fire safe environment as determined by the local fire inspection authority.

b. Such facilities shall comply with the provisions of the Fire Prevention Code and shall be classified as a "Special Amusement Building" as defined in the NFPA 101 Life Safety Code. New facilities are addressed in chapter 12 and existing facilities are addressed in chapter 13. In addition, all Special Amusement Buildings, regardless of occupant load, shall meet the requirements for Assembly Occupancies. (chapter 12 and 13).

c. Every special amusement building, other than buildings or structures *not* exceeding 10 ft. in height and *not* exceeding 160 sq.ft. in horizontal projection, shall be protected throughout by an approved automatic sprinkler system. Where the special amusement building is movable or portable, the sprinkler water supply shall be permitted to be provided by an approved, temporary means. (Note: In some instances, such as older facilities, this may present significant practical hardships for temporary occupancies. As an alternative, consideration may be given to the overall fire and life safety risk, on a case-by-case basis, to determine if additional safety precautions such as additional exits, limited occupant load, additional staff to perform "fire watch" duties, etc. will provide a reasonable level of safety as determined by the local fire authority).

d. Any organization wishing to facilitate a haunted house must fill out a Application for Haunted House Permit appendix C. The Fort Campbell Fire Department shall be contacted and advised of the precise site location and address of the activity and the proposed dates and hours of operation so they may have the opportunity to make any appropriate pre-plan arrangements.

e. A written emergency action plan to include, evacuation plan, written diagram, and risk assessment shall be submitted to the Fire Prevention Branch with the permit application.

B-4. Egress
a. Each occupied floor shall be provided with at least two (2) approved means of egress, located as remote as possible from each other. For small facilities, the second means of egress may be an approved "*means of* escape" such as a window or escape hatch which leads to a safe area outside the building. Each exit and the access to reach it shall be clearly indicated and marked by directional exit signs as necessary so that every occupant can readily see the direction of escape from any point.

b. Unoccupied floors or areas *not* allowed to be occupied by the general public shall be appropriately secured against unauthorized entry.

c. All staff shall be trained and drilled in the duties they are to perform in case of fire, panic or other emergency to effect orderly exiting. This shall include personnel specifically assigned to notify the fire department and other appropriate emergency services. Staff shall be specifically instructed to devote their immediate attention to the safe evacuation of occupants and notification of the fire department before attempting to fight a fire, in order to prevent possible injury or delayed alarm.

d. Where mazes, mirrors or other layouts are designed to confound the egress path, approved directional exit marking that will become apparent to the occupant in an emergency shall be provided.

e. For added safety, the fire authority may limit the occupant load to a small group of people at a time to be "ushered" through a display with proper supervision. Also, the general public shall be restricted to only those floors or areas which are provided with sufficient exits as prescribed by the NFPA Life Safety Code.

B-5. Exit

a. Any doorway or passageway that is *not* an exit or a way to reach an exit, but may be mistaken as an exit, shall be identified with a "*No Exit*" sign to prevent occupant confusion with designated exits. Every effort shall be made to prevent occupants mistakenly traveling into dead-end spaces in a fire emergency.

b. All required exits shall be kept unlocked and readily accessible at all times when the building is occupied.

c. Exits shall be identified by approved self-luminous or electrically illuminated exit signs, permanently or temporarily wired in a satisfactory manner. Exit signs may be externally illuminated by a reliable power source. The size of the letters in the word "Exit" shall be large enough to be seen but *not* less than 6-inches high and ¾-inches wide. The exit sign shall be of a distinctive color on a contrasting background (eg: red or green letters on a white background or vice-versa) and shall be readily apparent with respect to nearby decorations, interior finish, or other signs.

d. If necessary, low level exit signs located at or near floor level shall be provided in accordance with Section 7.10.1.6. Consideration may also be given to special floor proximity egress path marking such as special internally illuminated wiring, reflective tape or other acceptable product.

e. All interior stairs and other openings between floors shall be properly enclosed, sealed or otherwise protected against possible fire spread, as considered necessary in accordance with the NFPA Life Safety Code.

B-6. Decorations

No decorations, furnishings or equipment shall be allowed to obstruct, impair or otherwise detract attention from the visibility or use of an exit. Under no circumstances shall an exit be part of a mirrored wall. **NO PLASTIC SHEETING IS ALLOWED.**

B-7. Construction

a. Construction of interior partitions, cubicles, mazes and the like shall be of non-combustible materials such as gypsum wallboard on wood or metal studs, brick, concrete block, plaster, etc.

b. Under *no* circumstances shall the extensive use of exposed plywood, wood paneling or wood frame partitions be allowed where such material would substantially contribute to the ignition, spread or intensity of a fire.

c. Use of fire retardant treated materials shall be restricted since may such products tend to produce unacceptably high levels of smoke when exposed to fire. In any case, interior construction materials shall be consistent with the general type of construction of the building.

d. Special attention shall be given to the permitted types of construction for Assembly Occupancies for new or existing construction as prescribed by the NFPA Life Safety Code, Sections 12 and 13 respectively. Where such existing construction requirements cannot be met, consideration may be given to restrict the occupant load to not more than fifty (50) persons.

f. Interior finish of walls and ceilings shall be Class "A" throughout (flame spread 25 or less) in accordance with Section 10.2.

g. **NO BLACK PLASTIC SHEETING IS ALLOWED.**

B-8. Displays

a. Use of draperies, cardboard and flammable vinyl materials for use as interior finish or display purposes shall *not* be used unless they are inherently flame resistive, self-extinguishing or otherwise fire retardant treated in an approved manner as per NFPA 701.

b. Under *no* circumstances shall the use of exposed urethane foam, foam rubber or similarly highly combustible "cushion" or "molded" material be allowed, unless such material is covered or otherwise protected by gypsum wallboard, plaster or other non-combustible covering providing at least a 15 minute fire resistance rating.

B-9. Fire Protection

a. Where the nature of the special amusement building is such that it is operated in reduced lighting levels, the building shall be protected throughout by an approved automatic smoke detection system in accordance with Section 9.6.

b. Actuation of any smoke detection system device shall sound an alarm at a constantly attended location on the premises. Actuation of the automatic sprinkler system, or any other suppression system, or actuation of a smoke detection system having an approved verification or cross-zoning operation capability shall provide the following:

(1) Cause illumination in the means of egress to increase to that required by Life Safety Code, Section 7.8.

(2) Stop any conflicting or confusing sounds and visuals.

(3) ***Note**: As an alternative to the above, consideration may be given to use of a master lighting switch under the direct control of an attendant at a constantly attended location that would illuminate the total area in the event of emergency or activation of smoke alarms. This should be limited to small or temporary facilities.

c. An adequate number and type of portable fire extinguishers shall be provided on the premises for use by the staff. At least one 2A:10BC (10-lb. multi-purpose) rated fire extinguisher shall be provided within 75 ft. travel distance to all areas. Extinguishers shall be properly mounted and located near an exit. All staff shall be familiar with the location and use of such fire extinguishers.

d. Where deemed necessary by the fire authority, an automatic smoke detection system shall be provided to warn occupants of a fire, especially in a building where a fire may not be immediately obvious to provide adequate occupant warning. Use of battery operated smoke alarms may be considered for this purpose on a temporary basis if acceptable to the fire authority.

B-10. Emergency Lighting

Emergency lighting is required along all means of egress and in all assembly areas. Battery packs are acceptable as well as emergency generators if the building is to be occupied on a temporary basis. Consideration may be given to the use of flash lights or other portable battery operated hand lights under certain circumstances provided an adequate number of such devices and assigned supervisory personnel are available as directed by the fire official.

B-11. Electrical

All wiring and electrical appliances must comply with the National Electrical Code, NFPA 70. A licensed electrician shall install all wiring. Special attention should be given to assure adequate clearance is provided between electrical appliances subject to heated surfaces and nearby combustible materials. All electrical wiring and electrical appliances shall be subject to inspection by an approved electrical inspection agency.

B-12. Smoking, Pyrotechnics, Open Flame

Smoking and the use of pyrotechnic devices (fireworks) or open flame devices such as cigarette lighters, candles, canisters, kerosene lamps, kerosene heaters, flash powder, shall be strictly *prohibited* inside or around the outside of special amusement buildings or display areas. Signs shall be conspicuously posted for this purpose.

***Note**: Those personnel requiring further assistance or advice concerning these guidelines should contact the Fort Campbell Fire Prevention Branch at 270-798-7171.

APPENDIX C
Application for Haunted House Permit FC FORM 31

HAUNTED HOUSE PERMIT

(For use of this form see CAM Reg 420-24. The proponent of this form is DES)

1. Application for Haunted House Permit **Date:** _____

(a) Name of Unit/Organization: _____

(b) Applicant's Name: _____

(This is the person responsible for compliance and any corrective actions)

(c) Applicant's Phone Number: _____

(d) Applicant's E-Mail: _____

(e) Building Hand Receipt Holder: _____

(f) Building Hand Receipt Holder's Phone Number: _____

(If different from applicant)

(g) Location of Haunted House: _____

(h) Dates of Operation: _____

(i) Hours of Operation: _____

(j) On-Site Supervisor Name: _____

(k) On-Site Supervisor Phone Number: _____

(l) Number of Personnel On-Site During Operations: _____

(m) On-Site Pre-Construction Consultation Date: _____ **(n) Time:** _____

(o) Pre-Opening Inspection Date: _____ **(p) Time:** _____

2. Requirements For Haunted Houses:

(a) All Haunted Houses must conform to the CAM Reg 420-24, appendix B, Minimum Fire and Life Safety Guidelines for Haunted Houses, and with any Fire Prevention Division recommendations, as well as all applicable codes.

(b) No fire protection systems (alarms or sprinklers) in any building shall be obstructed or disabled by the construction or operation of this Haunted House.

(c) No readily combustible materials can be used for construction or decoration in the Haunted House unless it is treated with flame retardent chemical. NO PLASTIC SHEETING IS ALLOWED.

(d) When approved, this permit will be posted on the front of the Haunted House.

(e) In case of emergency call 911.

I hereby acknowledge the information presented is correct and that I will comply with CAM Reg 420-24, Minimum Fire and Life Safety Guidelines for Haunted Houses, and with any Fire Prevention Division's recommendations, as well as all applicable codes. Fire Prevention Division 798-7171

Appplicant's Name: _____ / _____

Click above to sign

Inspector's Name: _____ / _____

Approved or Disapproved: _____

Click above to sign

FC FORM 31, MAY 2013

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APPENDIX D
Supervised Public Display of Fireworks and Pyrotechnic Show

D-1. Purpose

a. To establish minimum fire and/or life safety guidelines for the use and operation of public display of fireworks and pyrotechnic shows on Fort Campbell.

b. All public display of fireworks and pyrotechnic shows will be conducted IAW the most current edition of NFPA 1123, Code for Fireworks Display and NFPA 1126, Standard for the Use of Pyrotechnics before a Proximate Audience.

D-2. General

a. The following guidelines are intended to apply to public display of fireworks and pyrotechnic shows which typically happen during the 4th of July or approved by the Garrison Commander. They may also apply to similar commercial activities such as carnivals and other seasonal amusement activities. These guidelines are necessarily general in scope and should be applied with appropriate professional judgment and common sense in consideration of the overall fire and life safety situation. Flame effects are considered pyrotechnic displays and fall under these same requirements and the most current edition of NFPA 160.

D-3. Application

a. In accordance with KRS 227.710, a permit must be obtained for the public display of fireworks, which includes the use of pyrotechnic devices or pyrotechnic materials before a proximate audience, whether indoors or outdoors.

b. The permit for public display of fireworks and pyrotechnics is issued by the Fire Chief. A copy of the issued public display of fireworks and pyrotechnics permits shall be filed with the State Fire Marshal's Office at least fifteen (15) days in advance of the date of display.

c. Applications and permit procedures may be obtained from Fort Campbell's Fire Prevention Division, 1747 Kentucky Ave. or by calling 270-798-7171 or 7172.

APPENDIX E.
Mobile Food Unit Operation Guide

E-1. Purpose
The purpose of this guide is to provide minimum fire prevention standards regarding function, design, and operations of mobile food units operating on Fort Campbell.

E-2. Application
This guide is to be used in conjunction with CAM REG 420-24 and applies to Class II, III and IV mobile food units only.

E-3. Definitions
a. A mobile food unit is any vehicle that is self-propelled, or can be pulled or pushed down a sidewalk, street, highway or waterway. Food may be prepared or processed on this vehicle, and the vehicle is used to sell and dispense food to the consumer.

b. **Class I** Mobile Food Unit: These units can serve only intact, packaged foods and non-potentially hazardous drinks. *No* preparation or assembly of foods or beverages may take place on the unit. Non-potentially hazardous beverages may be provided from covered urns or dispenser heads only. *No* dispensed ice is allowed.

c. **Class II** Mobile Food Unit: These units may serve foods allowed under Class I and provide hot and cold holding display areas from which unpackaged foods are displayed. Self-service by customers of unpackaged food is not allowed. Preparation, assembly or cooking of foods is not allowed on this unit.

d. **Class III** Mobile Food Unit: These units may serve any food item allowed under Class II, and may cook, prepare and assemble food items on the unit. However, cooking of raw animal food on the unit is not allowed.

e. **Class IV** Mobile Food Unit: These mobile food units may serve a full menu.

E-4. General requirements
a. Class II, III & IV mobile food unit operators shall have an inspection and be issued a permit from the Fort Campbell Fire Prevention Office prior to operating on Fort Campbell. This permit must be affixed to the windshield (passenger's side) of the vehicle. Failure to comply with this standard will result in revocation of the permit for a time determined by the AHJ.

b. Mobile food units shall be constructed of non-combustible materials so as to prevent the buildup of grease and the spread of fire.

c. The electrical supply is limited to a quick connect electrical service. The electrical line from the mobile food unit shall be insulated and *not* of the ROMEX type wiring. The following requirements shall also be adhered to:

(1) Feeder conductors supplying power to this 15, 20, 30 ampere disconnect means shall originate from an approved distribution or branch circuit panel board located on the same property that the mobile unit is to be parked.

(2) Cord with adapters and pigtail ends shall *not* be permitted.

(3) All cords shall be listed type with three wire 120 volt or four wire 120/240 volt conductors one of which shall be identified by a continuous green color or a continuous green color with one or more yellow stripes for use as the grounded conductor.

(4) Where the flexible cords are used as means of supplying power from the unit to the disconnect, the cord shall be UL listed for extra hard usage (minimum #12 cord) or equal to the amperage of the disconnect and *cannot* be subjected to physical damage.

(5) All 125/230 volt 15, 20 & 30 ampere receptacle outlets mounted at the disconnect shall have a listed ground fault circuit-interrupter protection for personnel.

(6) All electrical work must be completed by a licensed electrician.

(7) Refer to CAM REG 420-24 and most current NEC for complete requirements of electrical services while on Fort Campbell.

(8) ROMEX wiring used on the interior of the mobile food unit must be placed in conduit.

(9) Electrical wiring shall be protected against damage from foot and vehicle traffic in an approved manner. Protection methods shall prevent physical damage and shall allow electrical wiring to dissipate heat. The placement of rugs, tape and other similar items are *not* approved for this use.

E-5. Lighting
a. Light bulbs and tubes shall be covered and completely enclosed in plastic safety shields or the equivalent.

b. Light fixtures shall be installed so as not to constitute a hazard to employees.

c. Adequate electrical power shall be provided to power accessories or appliances.

E-6. Appliances

a. Appliances must be in good repair and meet applicable Underwriter's Laboratory standards.

b. Thermocouples shall be installed and in proper working order.

c. Propane tanks

(1) Enclosures shall be free of any source of ignition.

(2) Shall be securely placed and should *not* be located on the bumper of a trailer mounted vehicle. The only appropriate placement on the exterior of the mobile food unit is on the front (tongue) of the trailer.

(3) Shall have a safety shut off valve.

(4) Gas fired appliances shall meet applicable standards that are ANSI certified.

(5) Certification shall be indicated by a decal on the appliance.

d. A closing lid shall be required on fryers with latching mechanisms that secure it in the open and closed position. ***NOTE**: if a latching mechanism is *not* available, oil in fryers shall be allowed to cool prior to moving the unit. Fryers should never be over-filled.

e. Crock pots or other heating units may *not* be used unless they are designed and fit to your unit.

f. All grills, burners, and cooking equipment must be installed on or to your unit. All cooking surfaces must have a lid or cover.

g. Refrigerators, microwaves, coffee pots and all other cooking appliances shall *not* be plugged into a power strip or surge protector. These appliances shall be plugged directly to an outlet.

E-7. Fire prevention

a. Each mobile food unit must have at least one 5lb. 2A10BC fire extinguisher and one class K fire extinguisher. Class K fire extinguishers are required, within 30 ft from the hazard, for hazards where there is a potential for fires involving combustible cooking media (vegetable or animal oils and fats). Each fire extinguisher shall be mounted so as to be easily located and accessed during the event of an emergency.

b. Fire extinguishers shall comply with the most current edition of NFPA 10. Fire extinguishers shall be inspected by a certified fire extinguisher company with their tag and date of service affixed to the extinguisher.

c. All propane tank use and storage shall comply with CAM REG 420-24, NFPA 1 and NFPA 58.

d. Mechanical exhaust hoods shall be provided over any grease producing cooking equipment to remove smoke, steam, and grease-laden vapors. The hood must extend at least six inches beyond the front and sides of the cooking equipment, unless hood is installed against the side wall. Mechanical exhaust hoods shall comply with the most current edition of NFPA 96.

e. Hoods and ductwork over cooking surfaces shall be cleaned semi-annually to prevent excess grease accumulations.

f. Each mobile food unit shall be equipped with a fire suppression system complying with the most current NFPA 17 or 17A.

g. Grease traps and grease filters shall be cleaned on a daily basis.

h. Mesh type filters shall *not* be used in the hood system.

i. All compressed gas cylinders, including propane or CO2 cylinders used for beverage service shall be secured against falling and protected from physical damage. Cylinders containing flammable gas shall be placed outside of the stand and are *not* allowed in a tent or under a canopy.

E-8. Mobile Food Unit Operation

a. Cooking is *prohibited* while the mobile food unit is in motion.

b. Mobile food units shall *not* park or operate in front of an exit, exit discharge, fire hydrant, PIV or fire department connection.

c. Mobile food units shall *not* operate or park within 10 feet of any non-combustible structure and 20 feet from any combustible structure to include any overhang, awning or projection from the building.

APPENDIX F.
Mobile Food Unit Pre-Inspection Checklist

F-1. Construction

☐ Mobile food unit is constructed of non-combustible materials so as to prevent the buildup of grease and the spread of fire.

F-2. Electricity

☐ The electrical line from the mobile food unit shall be insulated and not of the ROMEX type wiring

☐ Feeder conductors supplying power to the 15, 20, 30 ampere disconnect means originates from an approved distribution or branch circuit panel board located on the same property that the mobile unit is to be parked.

☐ Cords with adapters or pigtails are not used.

☐ All electrical cords are listed with three wire 120 volt or four wire 120/240 volt conductors.

☐ Flexible cords used for supplying power from the unit to the disconnect, is UL listed for extra hard usage (minimum #12 cord) or equal to the amperage of the disconnect and is not subject to physical damage.

☐ GFCI's are installed for all 125/230 volt 15, 20 & 30 ampere receptacle outlets mounted at the disconnect.

☐ ROMEX wiring used on the interior of the mobile food unit must be placed in conduit.

☐ All electrical work has been completed by a licensed electrician and complies with CAM REG 420-24 and NFPA 70.

F-3. Lighting

☐ Light bulbs and tubes are covered and completely enclosed in plastic safety shields or the equivalent.

☐ Light fixtures are installed so as not to constitute a hazard to employees.

F- 4. Propane tanks

☐ Enclosures are free of any source of ignition.

☐ Tanks are securely attached to the vehicle (shall not be located on the bumper of a trailer mounted vehicle).
***NOTE** The only appropriate placement on the exterior of the mobile food unit is on the front (tongue) of the trailer.

☐ Safety shut off valve present.

☐ Gas fired appliances meet applicable standards that are ANSI certified.

☐ Certification is indicated by a decal on the appliance.

F- 5. Appliances

☐ Appliances are in good repair and meet applicable Underwriter's Laboratory standards.

☐ Thermocouples shall be installed and in proper working order.

☐ A closing lid with latching mechanisms is used for fryers. ***NOTE**: if a latching mechanism is not available, oil in fryers shall be allowed to cool prior to moving the unit. Fryers should never be over-filled.

☐ Crock pots or other heating units are not be used unless they are designed and fit the unit.

☐ All grills, burners, and cooking equipment are installed on or to the unit. All cooking surfaces have a lid or cover.

☐ Refrigerators, microwaves, coffee pots and all other cooking appliances are not plugged into a power strip or surge protector.

F- 6. Fire Prevention

- ☐ Mobile food units have at least one 5lb. 2A10BC fire extinguisher and one class K fire extinguisher. Each fire extinguisher is mounted so as to be easily located and accessed during the event of an emergency.
- ☐ Fire extinguishers have been inspected by a certified fire extinguisher company with their tag and date of service affixed to the extinguisher.
- ☐ Mechanical exhaust hoods are provided over any grease producing cooking equipment to remove smoke, steam, and grease-laden vapors. The hood extends at least six inches beyond the front and sides of the cooking equipment, unless hood is installed against the side wall.
- ☐ Paperwork is provided to show that hoods and ductwork over cooking surfaces has been cleaned semi-annually to prevent excess grease accumulations.
- ☐ Fire suppression system complies with the most current NFPA 17 or 17A.
- ☐ Grease traps and grease filters are cleaned on a daily basis.
- ☐ Mesh type filters are not used in the hood system.

APPENDIX G
Minimum Fire Protection and Prevention Guidelines for Construction, Alterations, and Modernization Projects

1. Purpose
This appendix reinforces established policies, procedures, and responsibilities for construction projects that have been coordinated with Directorate of Public Works (DPW) or Corps of Engineers (COE) and reviewed by Fire and Emergency Services Division during design phase and prior to bid advertising or authorization to proceed with construction.

Section G-1. Vehicular Circulation

Section G-2. Water Distribution System

Section G-3. Interior Building Signage Requirements

Section G-4. Fire Protection
Sprinkler System • 4-1
Standpipe System • 4-2
Fire Pumps • 4-3
Kitchen Suppression System • 4-4
Fire Alarm System Authorized for Installation • 4-5
Mass Notification System • 4-6
Fire Alarm System • 4-7
Kingfisher Transmitter • 4-8
Installation Drawing of Record • 4-9
Manuals and Information • 4-10
Preliminary Test • 4-11
Electromagnetic Door Holders • 4-12

Section G-5. Knox Box

Section G-6. Portable Fire Extinguishers

Section G-7. Heating, Ventilation, Air Conditioning (HVAC)

Section G-8. Elevator Hoist Ways and Machine Rooms

Section G-9. Emergency Lighting

Section G-10. Exit Signage

Section G-11. Attic Access

Section G-12. Roof Access

Section G-13. Stairs

Section G-14. Doors

Section G-15. Fire Safety Symbols

Section G-16. Life Safety Plan

Section G-17. Outdoor Storage, Parking, and Loading and Unloading Areas

Section G-1
Vehicular Circulation

1-1. Emergency Vehicle Access:
Provide emergency access lanes with all-weather accessibility to accommodate the Fort Campbell Fire Trucks and Emergency Vehicles in accordance with NFPA, UFC, and AT/FP requirements.
Provide fire vehicle access as a minimum to two sides of each facility

1-2. Aerial Access:
Provide aerial vehicle access as a minimum to two sides of each facility and a minimum of three sides of all sleeping quarters.

1-3. Apparatus Dimensions:

Vehicle ID	GVW	Height	Length	Width	Turning Radius
ENGINE 1	40,000 lbs.	10'	31'3"	8'6"	
ENGINE 2	40,450 lbs	10'	29'9"	9'9"	
ENGINE 3	39,800 lbs	8'4"	32'5"	9'6"	
ENGINE 4	43,540 lbs	9'8"	30'6"	9'4"	
ENGINE 5	39,800 lbs	9'	30'9"	9'	
LADDER 1*	66,000 lbs	11'4"	42'	10'5"	39.2'
LADDER 5*	54,920 lbs	11'4"	40'2"	9'2"	39.2'
RESCUE 1	39,800 lbs	11'5"	38'8"	8'3"	
CRASH 2**	32,100 lbs	10'8''	27'	8'	87'
CRASH 3**	82,500 lbs	11'9''	38'7''	9'11''	117'
CRASH 33**	47,000 lbs	12'8"	31'1"	9'6"	87'
CRASH 4**	69,000 lbs	12'11"	36'3"	9'2"	117'
CRASH 5	43,540 lbs	10'5"	29'7"	8'6"	75"
HAZMAT 1	35,000 lbs	10'2"	30'3"	7'11"	
TANKER1	43,000 lbs	9'10"	25'6"	8'5"	
* 16-feet with out-riggers extended					
**ONLY for airfield operations					

1-4. Fire Lanes Dimensions:
Fire Lanes shall be a minimum width of 20 feet measured edge of roadway to edge of roadway not including storm gutters and curbs.

1-5. Alternative Fire Lane Surfaces:
a. Alternative fire lanes shall meet the NFPA 1 Fire Code Handbook, Section 18. If approved and utilized, the site plan must indicate the type of alternative all-weather surface being utilized; examples are Tufftrack, grass-crete, grass-pave, ritter-rings, invisible structures, etc.

b. Fire apparatus access roads shall be designed and maintained to support the imposed live loads of fire apparatus (75,000 pounds) with outrigger point loads, maximum tandem axle load of 46,000 pounds and shall be surfaced so as to provide all weather driving capabilities.

c. Documentation shall include, but not be limited to the Following:
(1) Sub-grade soil compaction report
(2) Base material quality, thickness and compaction
(3) Product information to include but *not* limited to installations instructions

d. The base must meet the current construction standards for a fire lane. A detail of the alternative fire lane surface material must be included within the site plan and the utility sheet of the civil plans.
Concrete reinforced curbing shall be installed on both sides of the alternative fire lane surface material to enhance lateral stability.

e. Dirt and sod shall *not* be allowed to be placed over alternative fire lane surface.

f. The site plan must reflect signage at the entry point of the fire lane utilizing any alternative fire lane surface in order to make responding fire crews aware of the entry points of these types of surfaces.

g. Approved edge boundary identification is also required. The curb shall be painted red or red reflectors shall be installed to define the width of the alternative surface fire apparatus access roads. The reflectors shall be imbedded into bordering curbing at intervals not exceeding 15 feet. A detail of the fire lane sign must be provided within the site plan detail sheet.

h. The drive-on tests are the true test of how the paver will perform under vehicle load.

i. Once the pavers are installed and turf is established, the aerial apparatus will be maneuvered on the installed pavers.

j. The aerial apparatus will set-up with outrigger extended and aerial raised.

k. The pavers must *not* show any signs of movement.

l. The pavers must *not* raise or tilt up in any way, the driving surface must *not* interfere with the ability of the vehicle to maneuver anywhere on the grass paved area.

m. The fire departments will saturate the area with water, which ensures a true test of how the pavers will perform in an actual emergency situation and all weather situations.

1-6. Fire Lanes Marking:

Marking of fire lanes may be required, at any time, if a need is identified by the fire department in the following manner:

a. 90 degree curbs shall be identified by a 6 inch red (traffic grade paint) stripe on the top and side.

b. Rolled curbs shall be identified by a 6 inch red (traffic grade paint) stripe to the top.

c. Roads with *no* curbs shall be identified by a 6 inch red stripe (traffic grade paint).

d. The words "**NO PARKING – FIRE LANE**" shall be 18 inches high white stenciled lettering with 3 inch stroke and placed 8 inches as measured perpendicular to the traffic grade red paint stripe. Stenciling must be provided within 3 feet of each end of curbed areas and spaced a minimum of 100 feet apart thereafter. Paint must be traffic grade.

e. Diagonal red striping across the width of the Fire Lane (8 feet) shall be used when required by the fire department. It shall be used in conjunction with a 6 inch red stripe above. The stripes shall run at a 30 to 60 degree angle and shall be parallel with each other. The stripe shall be a minimum 6 inches in width and a minimum of 24 inches apart. Paint must be traffic grade.

f. A "**NO PARKING – FIRE LANE**" sign shall be posted at the beginning and end of each fire lane. Signs are to face on-coming vehicular traffic.

1-7. No Parking Signs:

a. Signs may be used instead of marking of fire lanes.

b. Signs must be maintained and replaced when damaged.

c. Signs shall read "**NO PARKING FIRE LANE" or "NO PARKING FROM THIS POINT TO CORNER**" and shall be 12" wide and 18" high.

d. Signs shall be white background with letters and borders in red, using *not* less than 2" lettering.

e. Signs shall be permanently affixed to a stationary post and the bottom of the sign shall be six feet, six inches (6'6") above finished grade.

f. Signs shall be spaced *not* more than one hundred feet (100') apart.

g. Signs may be installed on permanent buildings or walls or as approved by the Fire Chief.

h. Sidewalks dimensions that support emergency vehicle traffic

i. Sidewalks designed to support emergency vehicle traffic shall be a minimum of 20' wide (16' paved with 2' structural turf both sides). Coordinate with Fire Chief for location requirements. Reference Apparatuses Dimensions for Emergency Vehicle design loads.

Section G-2
Water Distribution System

2-1. Fire service mains, hydrants, and appurtenances

a. Install, test, and document fire service mains and their appurtenances in accordance with Unified Facilities Criteria (UFC), Unified Facilities Guide Specification (UFGS), National Fire Protection Association (NFPA), and applicable codes

b. Private and public water supply systems shall be installed, tested, and maintained in accordance with NFPA 24 and NFPA 25.

c. Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets

d. Fire hydrants shall be located a minimum of 40-feet from facility.

e. Hydrants shall be located *not* less than 40-feet from building being protected
f. Hydrant spacing shall *not* exceed 450-feet around facilities
g. Hydrant spacing shall *not* exceed 600-feet in open air parking areas
h. Hydrant spacing shall *not* exceed 1000-feet along undeveloped roadways

2-2. Existing Fire Hydrant
Existing fire hydrants shall *not* be relocated. New fire hydrants shall be installed when existing fire hydrants are required to be relocated.

2-3. Fire hydrant protection
All fire hydrants located in areas where subject to vehicular damage shall be protected with barriers.

2-4. Water flow test
The contractor shall perform a water flow test in accordance with NFPA 291.

2-5. Working Plans
Working plans and final as-built drawings shall comply with NFPA 24 paragraphs 4.1.3 and 4.1.4.

Section G-3
Interior Building Signage Requirements

3-1. Signage Review
Coordinate review of signage with Fire Prevention Division at the 100 % design phase. Fire Prevention shall review the correct placement, quantity of signage and the proposed path of egress that will be graphically illustrated on the sign.

Section G-4
Fire Protection

4-1. Sprinkler System
a. Install sprinkler systems in accordance with UFC 3-600-01, NFPA 13, and International Building Code (IBC) except as modified herein.
b. Provide separate fire sprinkler service connection for each facility.
c. Install vane type water-flow alarm switch with adjustable retard monitored by building fire alarm system. Set main riser waterflow switch retard adjustment for a delay between 50 and 60 seconds. Main riser waterflow switch is required on all Standpipe suppression systems.
d. Install floor control valve assembly as illustrated in UFC 3-600-01, figure 4-1 for each riser on each floor. Set water flow switch retard adjustment for a delay between 30 and 40 seconds.
e. Main riser and floor control valve assembly vane type water flow alarm switch with a maximum delay of 90 seconds, to include a minimum 20 second delay difference between main riser and floor control.
f. All tampers and water flow switches shall be monitored by fire alarm system via the Signal Line Circuit (SLC). Set water-flow switch retard adjustment for a delay between 30 and 40 seconds.
g. Install floor control valve assembly for each space separated by floors, partitions, and barriers regardless of separation orientation (vertical or horizontal)
h. Install a remote inspector test valve on the end of the most remote branch line on each floor or space with control valve assembly. Locate inspector test valve in an accessible location *not* over 7-feet off the floor that is *not* exposed to freezing. The test drain shall terminate outdoors with appropriate splash guard protection as required. Refer to NFPA 13 figure A.8.16.4.2 (a).
i. Install backflow preventer devices on the inlet (suction) side of water protection systems.
j. Test backflow preventer to verify check valves are fully functional and operate in accordance with manufacturer specifications. Certified technician shall perform and post test results alone with certification certificate in waterproof enclosure on the backflow preventer.
k. The backflow preventer shall be tested for full forward and test documented before sprinkler system can be accepted.
l. Backflow preventer test connection shall terminate to the exterior of the building in a similar manner as the Fire Department Connection (FDC) located *not* less than 5-feet away from the FDC. Provide signage using the words "**TEST HEADER**" in similar manner as for FDC. The test header should be located near the sprinkler backflow preventer.

m. Electrically supervise all sprinkler system water control valves to include sectional control and isolation valves and floor control valves. Electrically supervise backflow preventer test connection water control valves in the closed position.

n. Locate fire department connection (FDC) at readily accessible location from the street or fire lane. FDC must be mounted directly to the facility.

o. Install the "KNOX" company stainless steel 2.5-inch male NST locking FDC caps on each fire department connection. The contractor shall submit "KNOX" FDC locking caps keys to post fire department the day the FDC caps are installed.

p. Install a Post Indicator Valve (PIV) with a tamper switch monitored by fire alarm system in accordance with NFPA 24 and NFPA 72. PIV shall be manually secured with fire department lock.

q. The use and installation of plastic pipe is prohibited.

4-2. Standpipe System

a. Install standpipe system in accordance with UFC 3-600-01, NFPA 14, NFPA 101, and IBC

b. Install combination standpipe and sprinkler system in building with four or more stories

c. Install combination standpipe and sprinkler system in any building regardless of height when the length or width of the building is 200-feet or more

(1) Install Class 1 standpipe riser in every stairwell with cabinets of adequate size to accommodate 100-feet of (2 ½ inch, NST) fire hose.

(2) Install water-flow switch on main riser and adjust retard delay between 50 and 60 seconds.

(3) Provide FDC in accordance with NFPA 14 requirements based on number of standpipe risers.

(4) Installing contractor shall provide all necessary equipment to properly test standpipe system in accordance with NFPA 14.

4-3. Fire Pumps

a. Install fire pumps when required by hydrostatic calculations in accordance with NFPA 20, NFPA 13, and UFC 3-600-01, all applicable codes, except as modified herein.

b. Permanently install necessary equipment to adequately test fire pump in accordance with NFPA 20, NFPA 25, and UFC 3-600-02.

c. Install backflow preventer devices on the inlet (suction) side of fire pump.

4-4. Kitchen Suppression System

a. All kitchenette and commercial cooking hood and suppression systems shall be installed in accordance with all applicable codes and standards to include NFPA 96, NFPA 17A, UFC 3-600-01, Mechanical Code, manufacturer recommendations and modifications herein.

b. Provide a complete pre-engineer "Wet Chemical" suppression system to protect all grease vapors producing equipment.

c. Wet automatic spray nozzle type suppression system is *prohibited*.

d. De-energize all electrical receptacles within three feet of the hood.

e. Connect the suppression system to the building fire alarm system and generate a general evacuation signal upon suppression system activation.

f. Provide two means of manual activation where there are two or more means of egress from the area for each system.

g. Provide minimum two-liter wet chemical portable fire extinguishers mounted in recess or semi-recess cabinets in all commercial and kitchenette cooking areas.

h. Provide minimum ten pound Class ABC portable fire extinguishers mounted in recess or semi-recess cabinets in commercial and kitchenette cooking areas for fires other than cooking fires.

i. Exhaust fans shall be accessible for cleaning and maintenance.

j. Complete drawings of the system installation, including the hood(s), exhaust duct(s), and appliances, along with the interface of the fire-extinguishing system detectors, piping, nozzles, fuel shutoff devices, agent storage container(s), and manual actuation device(s), shall be submitted to Fort Campbell Fire Department Inspection Section, the authority having jurisdiction. The responsibility for their preparation shall be entrusted only to trained persons

k. Drawing and plans shall be drawn to an indicated scale and shall be reproducible.

(1) 1/8 inch = 1-foot is the smallest drawing scale accepted

(2) Illustrate all appliances on drawing

(3) Illustrate all nozzles and lines such as plenum, duct, and appliance nozzles including supply and branch lines with dimensions

(4) Illustrate all access panels

(5) Illustrate all heat links and manual pull stations
(6) Illustrate all fuel shut-off valves and or electrical circuit breakers
(7) Illustrate reset button and system cylinders
(8) All symbols shall be in accordance with NFPA 170

4-5. Fire Alarm Systems Authorized for Installation

Notifier®, Fire-Lite®, QuickStart®, and General Electric® are the fire alarm systems authorized for new installation.

4-6. Mass Notification System

a. Fire alarm and mass notification will be two separate systems which is authorized by UFC 4-021-01.

b. The MNS shall provide the capability (either internally as a design feature, or with an approved or listed external controller) to temporarily deactivate the facility's fire alarm system audible and visual notification appliances. This is intended to allow the MNS to provide intelligible voice commands inside an individual building during simultaneous fire and terrorist events.

c. The two systems will work independent of each other except to override the fire alarm audible signal in mass notification emergencies.

d. Combination Fire Alarm and Mass Notification System NOT Authorized for Installation.

4-7. Fire Alarm Systems

a. Provide a fire alarm system with Kingfisher transmitter.

b. All programming codes, passwords, equipment, cables, and plugs required to access, update, modify, and maintain the fire alarm system shall be provided to Fort Campbell with training no later than the date of final system acceptance.

c. Design and install the fire system in accordance with NFPA 72, 70, 101, and UFC 3-600-01, and Unified Facilities Guide Specification (UFGS) 28-31-76, and UL 864, except as modified herein.

(1) The components of system includes addressable control panel (FACP), autonomous control unit (ACU), notification appliance network (strobes and speakers), water flow switches, valve tamper switches, supervisory devices, monitor and control modules, duct detectors, heat detectors, smoke detectors, combination heat and smoke detectors, Kingfisher transceiver, and other equipment as required by code or Fort Campbell.

(2) Provide a complete addressable microprocessor-based fire alarm system.

(3) Provide remote annunciation panel when fire alarm panel and or associated panels are installed in remote area or closet.

(4) Provide manual pull stations at all exterior entrances/exits to include such rooms as mechanical, electrical, and communication rooms. Provide notification appliances network in such like rooms.

(5) All panel boxes shall be "red" in color.

(6) Whenever possible, all associated panel boxes shall be keyed alike.

(7) Detection devices that operate independent from fire alarm system are prohibited.

(8) The Signal Line Circuit (SLC) shall be Class A, Style 6 and the performance capabilities under abnormal conditions in accordance with NFPA 72 Section 6.

(9) The Notification Appliance Circuit (NAC) shall be Class A, Style Z and the performance capabilities under abnormal conditions in accordance with NFPA 72 Section 6.

(10) The Speaker Circuit shall be Class A, Style Z and the performance capabilities under abnormal conditions in accordance with NFPA 72 Section 6.

(11) Audio each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual amplifier trouble indicator on the control panel.

(12) All administrative areas shall have both strobes and speakers with a minimum audio level of 70-dba or 15-dba above the normal ambient sound level or 5-dba above the peak sound level; whichever is greater; with a CIS score of 0.80. All measurements are collected with all doors closed.

(13) All sleeping rooms shall have both strobes and speakers will provide a sound level of at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having duration of at least 60 seconds or a sound level of at least 75 dB, whichever is greater, measured at the pillow level in the occupy-able area, using the A-weighted scale (DBA).

(14) All components of the fire alarm shall be located near the facility main entrance. When the fire alarm panel and or panels associated with fire alarm system are installed in a remote area such as an electrical room, the system is required to have remote fire panel annunciation panel located near the facility main entrance and other entrances as deemed necessary by Fort Campbell Fire Department.

(15) All fire conductors shall be housed in "red" conduit. Junction (pull) boxes and covers shall be "red" in color.

(16) Vertical and horizontal conduit and cables separation shall be in accordance with NFPA 72-2002, paragraph A.6.4.2.2.2

(17) Conductors shall go from device to device and appliance to appliance without splices.

(18) Use terminal boards when wire splices are unavoidable, electrical wire nuts are prohibited.

(19) Only solid copper conductors are authorized for installation. Stranded conductors may be installed between fire alarm panel and Kingfisher transmitter.

(20) All panels and associated equipment shall operate on the secondary power source for 72-hours in (supervisory) state and 15-minutes in alarm. It is the contractor responsibility to coordinate battery test with Fort Campbell Fire Department Fire Prevention Section.

(21) Smoke detectors shall be addressable photoelectric type.

(22)Locate smoke detectors a minimum of five feet away from air intake, diffusers, ceiling fans, and vapor and steam producing rooms or areas, such as bathrooms and kitchens.

(23) Smoke detectors shall be connected to the building fire alarm panel via the SLC loop.

(24) Sleeping Rooms, Dwelling Units, and Suite Rooms Smoke Detectors

(a) Provide smoke detectors with a sounder base that produces a minimum sound pressure of 75-dba measured at the pillow.

(b) Provide signals for sleeping areas, they shall have a sound level of at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds or a sound level of at least 75 dB, whichever is greater, measured at the pillow level in the occupy-able area, using the A-weighted scale (DBA).

(c) If any barrier, such as a door, curtain, or retractable partition, is located between the notification appliance and the pillow, the sound pressure level shall be measured with the barrier placed between the appliance and the pillow.

(d) The alarm shall sound only within an individual sleeping area and shall *not* actuate the building fire alarm system notification appliances.

(e) Alarm activation shall annunciate at the fire alarm panel and transmitted to the fire department via the Kingfisher transmitter.

(f) Smoke detectors shall be connected to the building fire alarm notification system.

(g) Smoke alarms that receive their operating power from the building electrical system are *prohibited*.

(25) When emergency back-up generators are provided for the facility and the fire alarm system with all its peripherals are connected to the back-up generator, the battery secondary power source maybe reduced to 24-hours in (supervisory) state and 60-minutes in alarm. It is the contractor responsibility to coordinate battery test with Fort Campbell Fire Department Fire Prevention Section.

(26) Maintenance Facilities, where practical, ceiling mount all notification appliances giving consideration for vehicle type and height.

4-8. Kingfisher Transmitter

a. Install Government provided Kingfisher transmitter with the associated hardwire and components for fire.

b. Install a Kingfisher transmitter for each facility.

c. It is the contractor responsibility to coordinate fire alarm system zone points programming with Fort Campbell Fire Department Fire Prevention Section.

d. The transmitter shall operate for a minimum of 72-hours plus 15-minutes on secondary (battery) power source.

e. When the Kingfisher transmitter is connected to an emergency back-up generator, then the secondary (battery) power source maybe reduce to 24-hour in the non-alarm (supervisory) state and 15-minutes in alarm.

4-9. Installation Drawings of Record

As-built drawings, at a minimum shall include the following information

a. Drawing shall be to an indicated scale 1:8 is the smallest acceptable scale

b. All conduit runs

(1) All conduits shall be illustrated as installed overlaid on a floor plan to scale

(2) Identify all cable circuits within each conduit and direction of travel from "B" side (output) side of the circuit to "A" side (return) side of the circuit.

c. Device and Appliance Locations

(1) Show all devices and detectors with addresses overlaid on a floor plan(s) to scale

(2) Show all notification appliances (strobes and speakers) with addresses and labels overlaid on a floor plan(s) to scale

(3) All floors plans shall be to scale with correct room numbers and nomenclatures.

(4) Physically label each appliance (speaker and strobe) and devices as labeled on as-built drawings
(5) Labeling shall be on clear or white tape with black letters
(6) All symbols shall comply with NFPA 170

d. Wiring Drawing

(1) Show all external wiring connections inside all panels to include fire alarm control panel, notification appliance panels, audio control unit, transmitter, and etc.

(2) Show wiring connections illustration for each device, appliance, module, etc. installed in the system. Example: all incoming wiring connections on a smoke detector and or duct smoke detector, when a module is added to a panel it shall include all the wiring connections between the module and the panel.

e. Point to Point Wiring Diagram

(1) The point to point wiring diagram illustrates the exact wiring connections between device to device, appliance to appliance, panel to device and appliance, panel to panel, and etc.

(2) All drawings and diagrams shall illustrate exactly the structure and the installation of the system.

(3) Each drawing shall have the signature and certification number of the Fire Protection Engineer or NICET level IV technician.

f. All symbols shall conform to NFPA 170 Standard Symbols

g. A complete accurate set of as-built drawings, preliminary test results, and installation, owner, and maintenance manuals are required to perform initial fire alarm and mass notification acceptance test. It is the contractor responsibility to coordinate and provide these documents to Fort Campbell Fire Department Fire Prevention Section seven days prior to test date.

4-10. Manuals and Information

a. Installation manual
b. Operation manual
c. Maintenance manual
d. Troubleshooting information
e. Program instruction
f. Battery calculations
g. All drawings on CD
h. One complete hard copy set of accurate as-built drawings

(1) All individuals involved in the design, installation, programming, and testing of the system shall certify all drawings, manuals, and test results are accurate.

i. Preliminary test results
j. Inspection and testing results document
k. Copy of Certification of persons responsible in the design, installation, programming, and testing of the system
l. Copy of Certificate of Calibration for each piece of test equipment
m. Record of Completion

4-11. Preliminary Test

a. Perform and record all test results and what is required by all applicable codes and manufacturer to include but *not* limited to NFPA 72 Section 10, UFC 3-600-01, UFC 4-010-01, UFC 4-021-01, UFGS 28-31-76 (13859), and applicable codes and standards except as modified herein.

b. All as-built drawings, Manuals and Information, and Preliminary test results shall be provided to Fort Campbell Fire Department Prevention and Inspection Section seven days before Final Test and Inspection to be witnessed by this section.

4-12. Electromagnetic Door Holders

a. Where indicated on drawings, provide magnetic fire door hold open devices. The electromagnetic holding devices shall be designed to operate on 24-VDC and require *not* more than 3-watts of power to develop 25-psi of holding force.

b. Under normal conditions, the magnetic shall attract and hold the doors open.

c. The initiation of any fire alarm shall cause the release of the electromagnetic door holding device permitting the door to be closed by the door closer. Operation shall be failed safe with no moving parts. Electromagnetic door hold-open devices shall *not* be required to be held open during building power failure. The device shall be UL listed based on UL 228 tests.

Section G-5
Knox Box

5-1. Ordering Information

a. Provide 3200 series, dark bronze, hinged door recess or surface mounted, depending on the application, "Knox Box" manufactured by "The Knox Company".

b. The box can be purchased online at www.knoxbox.com.

5-2. Installation

a. Box shall installed on the exterior of the building within 10 feet of the entrance door normally used by the Fire Department to access the building.

b. The top of the box shall be installed *no* higher than 6 feet nor lower than 5 feet from the adjacent ground level.

c. The box must be installed in such a manner as to be clearly visible and free from any obstruction (including trees, bushes, etc.)

d. The box shall *not* be painted, as this hampers and in some cases, *prohibits* entry into the box. Boxes that have been painted must be replaced.

e. The red reflective KNOX-BOX® decal shall be placed on the entrance door of the site normally used by the Fire Department, 5 feet above the adjacent ground level.

f. Variances to location, due to obstacles, may be approved by the Fire Prevention office.

Section G-6
Portable Fire Extinguishers

a. Install portable dry chemical (Class ABC) fire extinguishers in accordance with all applicable NFPA, UFC, and IBC code criteria including the manufacturer recommendations.

b. Provide ten-pound portable dry chemical fire extinguishers with flush or semi-mounted approved cabinets in accordance with NFPA 10 and UFC 3-600-01.

c. Fort Campbell *preference* for extinguishers is AMEREX or Badger.

d. Fort Campbell color *preference* for fire extinguisher cabinets is red or white.

e. Install fire extinguishers along the path of egress in clear view.

f. Where visual obstructions *cannot* be avoided, provide signage to indicate the extinguisher location.

g. Provide minimum two-liter size wet chemical portable fire extinguishers mounted in recess or semi-recess cabinets in all commercial and kitchenette cooking areas.

h. Provide minimum ten pound Class ABC portable fire extinguishers mounted in recess or semi-recess cabinets in commercial and kitchenette cooking areas for fires other than cooking fires.

i. Install all portable fire extinguishers with the top of the fire extinguisher 42-inches from the finish floor.

Section G-7
Heating, Ventilation, Air Conditioning (HVAC)

a. Install smoke detectors, dampers, doors, and other equipment in accordance with NFPA 72, 90A, manufacturer recommendation and specification, and all other applicable codes and or standards, except as modified herein.

b. Install smoke detectors listed for use in air distribution systems shall be located as follows:

(1) Downstream of the air filters and ahead of any branch connections in air supply systems having a capacity equal to or greater than 2000-CFM's.

(2) Prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air systems having a capacity equal to or greater than 15,000-CFM's.

(3) At each story prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air systems having a capacity equal to or greater than 15,000-CFM's and serving more than one story.

(4) Duct smoke detectors shall be furnished by the fire alarm company.

c. Hardwire all duct smoke detectors to the air handler unit that the duct detector is monitoring.

d. Where duct smoke detectors are installed in concealed locations, more than 10-feet above the finish floor or in arrangement where the detector's alarm or supervisory indicator is *not* visible to responding personnel, provide the detector with remote indicator and test switch in location acceptable to AHJ.

e. Shut down all HVAC units on any fire alarm utilizing the hardwired duct smoke detector and the HVAC computer program.

f. Shut down all HVAC units on any fire alarm or required manual shut down, regardless of size; and/or distributes outside air within a facility.

g. Provide smoke detection in room(s) and or areas where air handler unit(s) less than 2000-cfm's are located. Smoke detection activation shall shut-down all air handler units located within that room or area. Detection

activation shall *not* activate the building general evacuation notification appliances; however, it shall generate a special supervisory alarm that is transmitted to Central Station.

h. "Emergency HVAC Shut Down" Switch

(1) Shut down all HVAC units that distributes outside air within a facility when "Emergency HVAC Shut Down" switch is activated.

(2) Close all required dampers in accordance with UFC 4-010-01 when "Emergency HVAC Shut Down" switch is activated.

Section G-8
Elevator Hoist Ways and Machine Rooms

a. Install all types of elevators in accordance with ASME A17-1, NFPA, UFC'S, UFGS, and all applicable codes and standards except as modified herein.

b. All hoist ways and machine rooms will be 2-hour fire rated.

c. When sprinklers are required to be installed in elevator machine room and hoist way in accordance with UFC 3-600-01, provide heat detector within 2-feet of sprinklers.

d. Heat detector shall have both a lower temperature rating and a higher sensitivity as compared to sprinklers.

e. Heat detectors shall activate prior to sprinkler activation and shut down elevator power.

f. Program a time delay equal to the amount of time for the elevator to travel from the top of the hoist way to the lowest recall level before activation of the power shunt trip in conjunction with heat detector activation.

g. Water flow or pressure switch shall shut down elevator power immediately upon activation. The use of devices with time delay switches or time delay capability shall *not* be permitted.

Section G-9
Emergency Lighting

a. Install emergency lighting in accordance with NFPA 101, UFC 3-600-01, and all applicable codes except as modified herein.

b. Provide emergency lighting in all windowless locations to include but *not* limited to restrooms, mechanical rooms, and elevator machine rooms.

c. Provide exterior emergency/egress lighting, with backup power to illuminate the pathway to public way.

d. Install emergency lighting in all facilities regardless of occupancy.

Section G-10
Exit Signage (Means of Egress)

a. Provide Exit signs and Directional signs in accordance with NFPA 101, UFC 3-600-01, and all applicable codes and standards except as modified herein.

b. Install Exit signs at main exterior exit doors that are readily visible from any direction of exit access.

c. Install Exit signs at all exit access and exterior doors leading to public way.

d. Provide Directional signs showing the direction of travel to main exterior exit doors where the direction of travel to reach the main exit is *not* apparent.

Section G-11
Attic Access

a. Provide attic access in accordance with UFC 3-600-01 and International Building Code (IBC) and all applicable codes and standards except as modified herein.

b. Must have 30" or more of head clearance at point of access into attic space.

c. Access Hatch *not* less 20" by 30" in size.

d. Access Hatch must be 2-hour fire rated, self closing and self latching with propped opening position and it can open up or down.

Section G-12
Roof Access

a. Provide roof access in accordance with UFC 3-600-01 and International Building Code (IBC) and all applicable codes and standards except as modified herein.

b. Stairways shall have handrails on at least one side. At least one handrail shall extend at least 34 inches above the roof surface. Such handrail may be attached to the underside of the operable hatch so that it is in the correct position for handrails when the hatch is in the open position, or it may be secured to the roof or other construction. Minor breaks in the continuity of the handrail are permitted; handrail sections must be generally aligned.

c. The curb at the roof opening for the roof hatch on the side where the stairs emerge from the interior shall extend above the roof surface *no* more than nine inches, the curb at the roof hatch on other sides of the hatch shall

not exceed 24 inches above the roof surface, and the maximum height of any portion of the hatch in a closed position shall not exceed 36 inches above the roof surface.

d. The rise and run of stairs to the roof shall meet regular code requirements.

e. The width of a stairway to a roof and the clear width of a roof hatch in its open position shall be *not* less than 32 inches. Handrails, lifting mechanisms and other equipment may encroach into the required width up to 1 1/2" when the roof hatch is in a fully open position.

f. Stairways with roof hatches that do *not* meet these requirements must be labeled as **"NO ROOF ACCESS".**

Section G-13
Stairs

Stairs and handrails shall comply with NFPA 101 Life Safety Code.

Section G-14
Doors

Doors and self-closure appliances shall comply with NFPA 101, NFPA 80, UFC 3-600-01, and applicable codes and standards.

Section G-15
Fire Safety Symbols

Symbols used on all shop and as-built drawings shall comply with NFPA 170.

Section G-16
Life Safety Plan

a. Provide Life Safety Plan to scale to include:

(1) Means of egress

(2) EXIT and directional exit signs

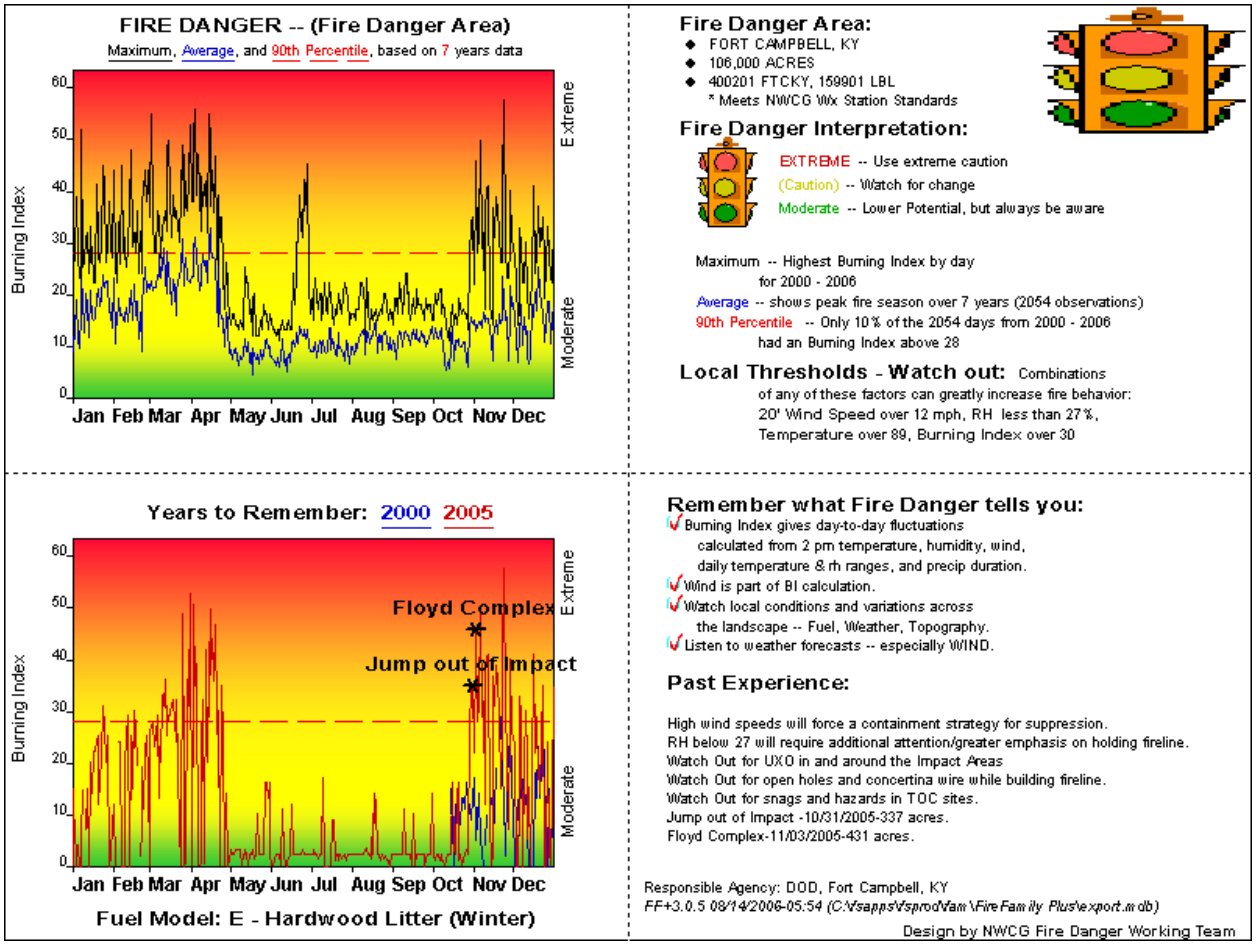
(3) Fire extinguishers to include cabinets and extinguisher type and size.

Section G-17
Outdoor Storage, Parking, and Loading and Unloading Areas

Provide fire hydrants spaced at 300 feet maximum intervals around the perimeter. Provide addition hydrants to protect facilities within the perimeter according to UFC 3-600-01.

Appendix G

Fort Campbell Pocket Danger Card



Appendix H

Smoke Management Standard Operating Procedures

1. Purpose.

This document outlines and defines the responsibilities and standard operating procedures for Smoke Management on Fort Campbell. The intent of smoke management is to support military training by minimizing the public health and safety impacts from wildland fire activities. Smoke Management is conducted in accordance with the Integrated Wildland Fire Management Plan (IWFMP) and State Open Burning regulations.

2. Scope.

This SOP applies to all personnel involved in wildland and prescribed fire operations on Fort Campbell.

3. References.

Smoke management activities shall follow the guidance contained within the following:

1. Fort Campbell Integrated Natural Resources Management Plan (INRMP)
2. Fort Campbell Integrated Wildland Fire Management Plan (IWFMP)
3. Kentucky Regulation 401 KAR 36-005 Open Burning
4. Smoke Management Guide for Prescribed and Wildland Fire, NFES 1279, 2001
5. Tennessee Regulation Chapter 1200-3-4 Open Burning
6. Interagency Prescribed Fire Planning and Implementation Procedures Guide, July 2008

4. Responsibilities and Procedures.

4.1 Prescribed Fire Operations.

The prescription proponent has the initial responsibility regarding smoke management for prescribed fire operations. The prescription should be written so that all smoke sensitive areas are identified for each individual operation, as well as various weather and fuel conditions. Properly utilizing firing techniques can be used to keep smoke away from sensitive areas.

1. Obtain and utilize weather forecasts. Weather information and fire weather forecasts can be obtained through WIMS RAWS site, National Weather Service at Paducah, KY, and on-site, field-based weather readings throughout the operation. Such information is needed to determine the effects of smoke and determine potential fire behavior.
2. Utilize Smoke Dispersion Models to determine the direction and volume of smoke. The Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) Dispersion Model through the

NOAA Air Resources Laboratory and VSMOKE-GIS and VSMOKE computer programs are available for use.

3. Use extreme caution when near or upwind of smoke-sensitive areas. Prescribed fire operations should take place only when mixing heights and transport winds will carry the expected smoke up and away from heavily traveled roads, airfields, and/or populated areas.
4. Utilize test fire to confirm smoke behavior. Set test fire in the area proposed for prescribed fire operations, away from roads and/or other "edge" effects.
5. Burn in smaller blocks if necessary to reduce smoke impact. Larger burn blocks produce larger amounts of smoke that have a higher impact on visibility downwind.
6. Burn out and/or start mop-up operations along road edges as soon as possible to reduce the impact on visibility and vehicular traffic.
7. Have emergency procedures in place in the event of changing wind directions and/or erratic fire behavior. Be prepared to control traffic on affected roads in the event of impacted visibility. Be prepared to stop prescribed fire operations if the fire is not burning according to plan, weather conditions change unexpectedly, and/or shifting smoke conditions adversely affect military training operations in the area.

4.2 Wildland Fire Operations.

Smoke from wildland fires is managed in similar ways as prescribed fire operations, though there is less control through the process.

1. Burn out and/or start mop-up operations along road edges as soon as possible to reduce the impact on visibility and vehicular traffic. Any time smoke from a wildland fire is impacting a roadway where visibility is less than 1,000 feet, or any impact on the airfields is noted, additional suppression resources and/or personnel may be required.
2. In the event of smoke affecting sensitive areas off the installation, the Incident Commander will contact the proper offices. Air quality, MP's and the Environmental Division will be notified, as needed, for the proper response. Off post notification of law enforcement for hazardous road conditions can be made through the Emergency Operations Center (EOC) or 911 on Fort Campbell.

Appendix I

Fire Tower Standard Operating Procedures

1. Purpose. This document outlines and defines the responsibilities and standard operating procedures for Fire Tower operations on Fort Campbell. The intent of tower operations is to support military training and enhance fire response by detecting and locating fires before they become unmanageable. Ft. Campbell is required to conduct fire tower operations, as well as follow the installation's Integrated Wildland Fire Management Plan (IWFMP).

2. Scope. This SOP applies to all personnel involved in Fire Tower operations on Fort Campbell.

3. Responsibilities of the Fire Tower Operator:

a. Man the Fire Tower during prescribed fire operations, days of high fire danger (Class IV or higher), Red Flag Warnings, and on an as needed basis.

b. Report sightings of smoke, suspected wildland fires, and range fires on the installation to the Forestry Office, Range Control, and/or EOC.

c. Inspect the tower for maintenance needs, wear and tear, and safety concerns.

d. Maintain the weather reading devices and safety lights on the roof of the tower, repairing and/or replacing as needed.

e. If the tower is not in use, run the tower generators twice weekly (for at least one hour) in order to properly maintain the system.

4. Procedure.

a. General Maintenance

(1) Before running the generator, the fire tower operator will inspect the generator for proper oil and anti-freeze levels, and ensure that an adequate amount of diesel fuel is present to run the generators.

(2) Generator room doors will be propped open while running the generator to prevent accidental closure that could result in a buildup of hazardous fumes.

(3) When starting the generators, hold the engine primer for 5-10 seconds before hitting the starter. Hold starter down for approx 1-2 seconds, until generator is running.

(4) Switch the power converter level into the 'on' position corresponding to the generator that is being run. Ensure that the light on the gauge box is lit to ensure that the batteries are being charged.

(5) Inspect the condition of the tower while climbing and descending, watching for loose, broken, and/or missing steps, handrails and/or beams.

(6) Prior to shutting off the generators, switch the power converter level into the 'off' position.

(7) When shutting off the generators, hold down the off switch until the engine has completely shut down.

b. Opening the Fire Tower

(1) Upon arriving at the cab of the fire tower, the fire tower operator will notify EOC via phone, informing them that the fire tower is being opened.

(2) The fire tower operator will notify Range Control via the Safety frequency on Ft. Campbell's Motorola Network, informing them that they are opening up the fire tower on the Safety Network.

c. Detecting and Reporting Fires

(1) The fire tower operator will scan the Forestry and Safety frequencies throughout the entire operational period, remaining alert for any smoke and/or fire reports.

(2) The fire tower operator will remain alert for smoke and will be able to differentiate between dust from vehicular travel, impact plumes and smoke from suspected wildland fires.

(3) Upon initial detection of suspected smoke, the fire tower operator will utilize the Osborne Fire Finder (Alidade device mounted on the table) and mounted map with compass rose and intercept line to locate the approximate location of the suspected wildland fire by azimuth (directional bearing) from the fire tower, as well as identifiable landmarks and operator experience.

(4) Upon locating the approximate location, the fire tower operator will alert Range Control via the Safety frequency and/or the Forestry Office via Forestry frequency or phone. Personnel in the vicinity will investigate suspected wildland fire.

d. Wildland Fire Operations

(1) Upon confirmation of wildland fire, the fire tower operator will alert EOC, the Assistant Wildland Fire Program Manager (Operations) and/or designated Fire Management Officer.

(2) The fire tower will serve as a relay point for communication between first responders as needed.

(3) The fire tower operator will observe fire weather conditions with monitoring equipment and disseminate the information via Motorola radio to all first responders hourly and/or as needed.

(4) The fire tower operator will remain alert for any additional smoke, flare ups and/or erratic fire behavior.

e. Prescribed Fire Operations

(1) During prescribed fire operations, the fire tower operator will be the primary lookout, remaining alert for spot fires, slop overs, flare ups and suspected wildland fires.

(2) The fire tower will serve as a relay point for communication between personnel as needed.

(3) The fire tower operator will observe fire weather conditions with monitoring equipment and disseminate the information via Motorola radio to all personnel hourly and/or as needed.

f. Operations Log

(1) The fire tower operator will update the Operations Log upon each visit to the fire tower.

(2) Upon opening/closing the fire tower, the date and time will be entered (opening time under 'Time Reported', closing time under 'Time Concluded').

(3) For each incident (suspected smoke, prescribed fire operation, etc.) the fire tower operator will enter required data into the Operations Log.

g. Closing the Fire Tower

(1) Prior to departing the cab of the fire tower, the fire tower operator will notify EOC via phone, informing them that the fire tower is shutting down operations.

(2) The fire tower operator will notify Range Control via the Safety frequency, informing them that the fire tower is being taken off the Safety Network.

5. Hazards and Hazard Mitigation.

a. Climbing and descending.

(1) One hand will remain in contact with the handrails at all times.

(2) Do not run, jump or skip stairs

b. Weather

(1) Tower will not be operated during inclement weather (i.e., heavy rains, ice, or snow), unless there is an extreme necessity.

(2) In the event of visible lightning, tower operations will cease immediately and the tower will be evacuated. All power equipment will be turned off.

(3) During electrical storms, personnel will stay a minimum of 100 feet from the tower.

(4) Extra precautions will be taken while operating, climbing and descending the tower during high winds and/or gusty conditions.

c. Height (Vertigo)

(1) Individuals who are prone to vertigo should remain on the ground.

(2) Remain within tower cabin or use proper safety protocols (i.e., climbing harness) if maintenance must be conducted outside

d. Flying and Stinging insects

(1) All personnel who are sensitive to stinging insects should not be on or close to the tower during fall and early spring conditions due to heavy concentrations of bees, wasps, hornets, and yellow jackets.

(2) Avoid wearing bright colored clothing (i.e., yellow, red, and/or white) during seasons of high insect concentrations.

e. Maintenance

(1) Be alert for and report any loose, broken or missing steps, handrails, bolts and/or beams.

(2) Keep steps and platforms clear of debris.

Fish and Wildlife Management Plan

Developed by:
Fish and Wildlife Program
DPW, Environmental Division

2018 Update

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Table of Contents

1.0 Purpose and Scope

The purpose of the Fish and Wildlife Management Plan (FWMP) is to provide specific direction to Fort Campbell's fish and wildlife conservation and management. The scope of the plan is funded through the 21X Wildlife Program Reimbursable Account which is funded by the sale of hunting and fishing permits. The INRMP establishes goals and objectives to support fish and wildlife conservation and management. This FWMP (or "the plan") is a component plan of the INRMP and contains a portfolio of species specific plans that provide strategic direction and guidance regarding game and non-game as well as biological communities and ecosystems. Species specific plans include population trends, challenges, opportunities, management actions, and major issues that may influence the accomplishment of INRMP goals and objectives. This plan outlines specific actions to ensure the long range goals and objectives of the installation are met; ultimately reaching a sustainable multi-use resource environment that provides a high quality training and natural environment.

2.0 Fish and Wildlife Program Mission, Vision, and Values

2.1 Our Mission

The Fort Campbell Fish and Wildlife Program is dedicated to ensuring mission success by providing resource management necessary to meet the needs of the 101st Airborne Division and tenant units, as well as, the Fort Campbell and surrounding communities. Our Mission is to:

Professionally and scientifically manage fish and wildlife resources to:

- *Support and enhance military training*
- *Provide for consumptive and non-consumptive use of natural resources*
- *Maintain compliance with applicable laws, policies, and regulations.*

2.2 Our Vision

The Fish and Wildlife Program's mission will be accomplished utilizing science-based information, open communication, and collaboration with other resource professionals. The policies and guidance developed and implemented will foster trust, partnerships, and installation teamwork to ensure mission success. The Program's vision supporting fish and wildlife management on Fort Campbell is:

Through management and protection of fish and wildlife resources and habitats, the Fish and Wildlife Program will enhance realistic training opportunities and ensure sustainability of these resources.

2.3 Our Values

In meeting the INRMP goals and objectives, and carrying out the actions of this plan, we will build upon the following values as a philosophy for how we do business.

Manage Natural Resources as Ecosystems. We recognize the synergy of air, land and water and how each contributes to defining the ecosystems in the region and on Fort Campbell. We consider the needs of local and regional ecosystems in all our decisions, to assure the highest possible natural resource quality.

We strive to set a good example by the way we protect and manage all living things in or on the air, land and water under our stewardship.

Work Together. We appreciate the power of collective knowledge. People from different disciplines share their expertise, skills and the best available scientific knowledge to search for sound solutions and make informed decisions. We respect the work of our peers, and support and value each other as colleagues who share in the great endeavor of understanding and protecting our ecosystem.

Prevent Environmental Harm. We anticipate and prevent damage to the environment and develop processes and policies to protect our resources and the well-being of the public. We help people and Fort Campbell Directorates to ensure that their activities will not harm the environment.

Assure Quality Management. We use continuous quality improvement techniques in implementing our plans and policies: We plan, implement, check for problems and opportunities for improvement, and incorporate needed changes, knowing that flexibility is needed to accommodate the changing issues and needs of the people and resources.

Adapt to Future Needs. We must adapt and respond to the Army's future needs and will accomplish that in part by making this component Plan a living, breathing document that we refer to often and evolve as natural resources and environmental needs and the will of the people direct.

3.0 Species Plans

The following plans reflect the Wildlife Program's approach to carrying out its mission and vision by promoting open and collaborative relationships among those who value Fort Campbell's natural resources; protecting the wildlife and natural communities that depend on those resources; and promoting opportunities to enjoy and benefit from natural resources in ways that are consistent with protection of the environment. In this section of the plan, species specific plans will include population trends, challenges, opportunities, management actions, and major issues that may influence the accomplishment of INRMP goals and objectives.

3.1 Eastern Wild Turkey

3.1.1 Introduction

The eastern wild turkey *(Meleagris gallopovo)* was found by early explorers to be abundant, was nearly extirpated and now is one of the most sought after game species in the southeast. On Fort Campbell (FC) the eastern wild turkey (turkey) is the second most pursued game species after white-tailed deer *(Odocoileous virginiana).*

At the time of European settlement of the region, the land that is Fort Campbell was a portion of a 2-3 million acre grassland referred to as the Big Barrens that stretched from north central Kentucky through northwest Tennessee (Baskin etal. 1994). Turkey thrived in the landscape that burned regularly and had scattered fire-tolerant oaks in the uplands more substantial forest in the riparian zones. Early explorers recorded encounters with turkey and used them for food and other uses. Market hunting and habitat changes left turkey in remnant flocks mainly in inaccessible areas.

Between 1900-1930 turkey were scarce throughout its range. It is likely that there were not any tracts remote enough on what is now FC to have turkeys at that time. In 1939 when the Army began acquiring the land to make FC it was approximately 80 percent open and in small family farms. Over time the farms began to revert creating excellent turkey habitat. Local populations along the Cumberland River probably emigrated to FC as habitat became suitable. Turkey were also stocked on FC by Tennessee Wildlife Resources Agency (TWRA). An area known as the "Birdcage" was a large fenced area used for military purposes but was suitable for establishing a turkey flock. That flock was later used to trap and stock other parts of the reservation as well as other parts of Tennessee.

Turkey hunting records on FC date only to 1980 (table 1). Prior to that records of turkey seen by deer hunters were used to assess the size of the turkey flock. Spring hunting only was allowed until 1987 when fall hunting began. In 2002 a winter "unbearded only" hunt was initiated in an attempt to balance out sex ratios and provide an additional recreational opportunity on an increasing population. It should also be noted that harvest numbers year-to-year on FC do not always reflect population density they often reflect intricacies in military training cycles.

3.1.2 Habitat Conditions

Currently FC is a mixture of habitat types and seral stages. The installation is approximately 105,000 acres, with about 65,000 that is huntable. The remainder is impact areas that are off-limits (10,500ac) and developed areas and air fields (12,000ac). Open areas consist of native grass barrens, old fields, and agriculture leases both hay and row crops. Wooded land consists of typical western mesophytic types dominated by oaks and hickories. Loblolly pine *(Pinus taeda)* and black walnut *(Juglans nigra)* plantations were planted on approximately 14,000 acres for various reasons mostly around 1970. The habitat types are in relatively small blocks that are well distributed across the installation (figure 1).

3.1.3 Management Goals

Management of wildlife on FC presents several challenges unique to military installations and to Fort Campbell specifically. Access to areas for management or for hunting is limited sometimes, funding is limited sometimes and wildlife management is not the primary focus of land like it is in some places. Recreation is a key component of wildlife management on FC and it is geared towards active and retired soldiers but civilians are also welcome. Long-term goals are designed to be realistic, compatible with military training and other land management.

3.1.3.1 Provide Quality Hunting Experience

Wildlife managers know what works with one group of hunters does not necessarily work with another. Turkey hunters have specific ideas about what make a hunt good or not. Game abundance, presence of trophy animals and low hunter pressure seem to be universal desires for all hunters.

3.1.3.2 Establish Hunter Survey

In order to more accurately identify hunter desires a turkey hunter survey will be established. Population levels, flock sex and age structure, and ideas about "quality" animals will be determined in the survey. Additional hunter demographic characteristics will also be assessed in the survey to better enable managers to satisfy customers.

3.1.3.3 Limit Hunter Access

Hunter access to FC is limited in several ways. Certain areas are off-limits and training cycles limit availability of some areas. Managers also limit access actively by controlling the number of hunters allowed in an area. Currently hunters are allowed 250 wooded acres per hunter. The turkey hunter survey will be used to evaluate the effectiveness of this standard and adjust it if necessary.

3.1.3.4 Population Objectives

Turkey population on FC is estimated to be approximately 5000 birds or 30 birds/mi2. After a period of rapid growth the population has become more static. At this level hunters seem to be satisfied with the ability to find and harvest game. Managers believe this level is sustainable and healthy.

3.1.4 Establish Effective Data Management Strategies

In order for managers to scientifically manage game populations good data is a necessity. Surveys are used to evaluate demographics and size vital to setting seasons and bag limits. Harvest data is valuable to track hunter success and evaluate past management. Long term spatial data can identify areas that need special attention.

3.1.4.1 Surveys

Turkey populations continue to be difficult to count. Many studies have shown harvest/effort indices are the most accurate indices for estimating turkey numbers (Healy 1999). Summer poult counts will also be used to evaluate hatch success and survival. Efforts to count poults have been used in the past with mixed results. In recent years limited sightings have reduced the usefulness of the counts. An effort will be made to increase the sample size by giving survey sheets (Figure 1) to game wardens and other field personnel. Additionally TWRA collects poult data that is applicable to FC and will be incorporated with our data.

Rainy day surveys will be conducted by driving around the training areas on rainy days when turkeys tend to congregate in open areas. These counts will be valuable as an index of the population and an indication of the sex and age structure of males. These counts will not yield a population estimate. Rainy day counts will be recorded in birds/mi of driving.

3.1.4.2 Harvest Data Collection

Since turkey are hard to census, harvest data is important to evaluate flock dynamics. Research indicates that about 10% of the overall spring population is removed through spring seasons (Healy 1999). Unfortunately harvest data comes after the fact, so closely monitoring harvest levels will be important if limiting harvest becomes necessary.

During the 2006 fall either-sex season the season bag limit was removed allowing hunters to take two birds per day. While participation in the fall season is very light, harvest data will need to be closely monitored to avoid over harvesting an area. Research indicates that fall harvest should not exceed 5% of

Figure 1. Fort Campbell Turkey Brood Count Sheet.

Fort Campbell Turkey Brood Count Sheet

Recorder Name: _____ Year: _____

Date	Training Area	Hens	Poults/ Broods	Est. Age	Other Turkeys	Comments

Visual Notes: At 2 weeks poults are 6-7" tall and can fly to low limbs; 3 weeks poults can fly well; 4 weeks poults have down on head and neck only.

the population (Vangilder and Kurzejeski 1995). Current interest levels preclude danger to the overall turkey population however it be important locally.

Harvest data will also be important to track success of any "quality" turkey program. Several states have undertaken the idea of quality in their regulations including Mississippi and Missouri. One method to increase the percentage of older aged gobblers is to limit the harvest of males in the spring to 30% of the adult gobbler population (Vangilder 1992). Current harvest percentage is probably higher. This would mean ending the season earlier, at least in some areas and may not be desired by hunters.

3.1.4.3 GIS Data

Harvest data along with survey data will be entered into Geographic Information System (GIS) database. Training area boundaries will be used as management units. Spatial analysis of other base data like forest covertype or soil type with turkey data may yield information concerning turkey habitat or trends in the harvest.

3.1.5 Provide Quality Turkey Habitat

Eastern wild turkeys are habitat generalists. Once thought of as needing wilderness or heavily wooded areas we now know turkey can thrive in habitats with as little as 15% woodlands.
Current habitat on FC is considered good. Ideal turkey habitat is described as 40-70% wooded with a high percentage of that in mature hardwoods, 20-40% grassy openings and 10-20% cropland distributed across the landscape in tens to hundreds of acre tracts (Lewis 1992). While post-wide averages fit into the ideal range, some areas are lacking some components. Habitat analysis using GIS and habitat models will identify areas that need attention. Prescribed burning will be used to keep grassy areas open and open the understory in pine plantations. Water is normally not a limiting factor for turkey however ample water is required in for ideal habitat. Identifying areas that need small watering holes added will be investigated.

3.1.6 Support the Military Mission

While FC provides excellent wildlife habitat and game populations the primary function is military training. Any land management will have to be compatible with the desires of the trainers.

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3.2 Cottontail Rabbit

3.2.1 Introduction

The number of rabbit hunters in Tennessee has declined from a peak in 1955 of 2,228,019 to 95,000 today. The drop in hunter numbers has been caused by declines in farm game populations, loss of farmland, and loss of access to farmlands with huntable populations (TWRA farm game strategic plan). Densities of cottontail rabbits (*Sylvilagus floridanus*) have decreased substantially over the years on Ft. Campbell based on personal communication with local citizens and hunting success. Hunters were bringing in 300-1,500 rabbits a year in the 1970s and 80s (Table 1). In the 2002-03 hunting season, only 96 rabbits were harvested and only 54 were harvested in 2003-2004. Low bag rates can be partly attributed to the decreased number of hunters participating in Ft. Campbell hunts (Table 1). However, the success rate for these hunters was fairly low, insinuating low population densities. Rabbit hunting parties had a 35% and 28% success rate in 2002-03 and 2003-04, respectively. Nine walking transects and 19 headlight surveys completed in 2003 to determine rabbit densities provided poor results. Only 2 rabbits were found during the walking transects and 1 rabbit / 19 miles was observed on the driving transects, also indicating low densities.

One cause of the rabbit decline is a severe drought that occurred from 1984 – 1989 sending rabbit numbers to an all time low, from which they have yet to recover (TWRA farm game strategic plan). However, the primary cause of the decreased population densities is assumed to be habitat degradation. When the post was purchased in the 1940s, 80% of the land was open either in crops or grass, and forested areas were limited to fence rows and small woodlots. This cover mixture provided excellent habitat for cottontails. Now the cover mixture is 80% forested and 20% open. Rabbits are considered habitat generalists, but the densest populations are found on farmland, field, and fence row habitat which is now sparse on Ft. Campbell. Bond et al. (2002) found that woody and shrubby land cover types are less important than grasslands. However, Althoff et al. (1997) found that shrubby-woodland habitat was very important during winter and early spring for cover. Rabbits are most abundant in middle and western Tennessee where areas are dominated by grain row crop agriculture (TWRA farm game strategic plan). As Ft. Campbell has changed from an intensively farmed area to a wooded area, rabbit numbers have dropped. Tennessee loses 250 acres of farmland every day (Tennessee Agricultural Statistics Service 1998). This loss of private farm habitat makes the use of public land for hunting even more important now than before. It is Ft. Campbell's responsibility to create the best possible rabbit habitat for the hunters of Kentucky and Tennessee to enjoy.

3.2.2 Natural History

Cottontail rabbits are found from southern Canada to South America and from the Great Plains to the east coast. Females have 3-7 litters per year (Bruna 1952 and Sheffer 1957) and 3.1-5.6 young per litter (Ecke 1955 and Pelton and Jenkins 1971). Trent and Rongstad (1974) reported an adult annual survival rate of 20% and the average life span is 15 months (Bruna 1952). Rabbits can be found in all habitats but they prefer dense brush for cover. Adult male

Table 1. Historic rabbit harvest data for Ft. Campbell.

Year	Number of Trips	Number Harvested	Percent Success
1976-1977	341	341	1.0
1977-1978	853	1514	1.77
1978-1979	1814	1431	0.78
1979-1980	1698	930	0.54
1980-1981	727	1341	1.84
1981-1982	1458	528	0.36
1982-1983	1160	772	0.66
1983-1984	899	500	0.55
1984-1985	889	669	0.75
1985-1986	1057	849	0.80
1986-1987	1268	1133	0.89
1987-1988	1550	1390	0.89
1988-1989	779	1182	1.51
2002-2003	73	96	1.31
2003-2004	92	54	0.58

home ranges vary from 0.95-2.8 ha and adult female home ranges vary from 0.95-1.2 ha (Lord 1963 and Trent and Rongstad 1974). Diurnal activity is bimodal with most activity at dawn and dusk (Janes 1959).

3.2.3 Cottontail Rabbit Habitat Management

3.2.3.1 Removal of Pine Plantations

Habitat diversity is the key to establishing large rabbit populations. Cottontails were found in heterogeneous, patchy landscapes with moderate amounts of row crops and grassland and abundant woody edge (Roseberry 1998). Roseberry (1998) found that harvest density was highest in area with 30-60% row crop, 15-30% grassland, and >30m/ha of woody edge. Presently, Ft. Campbell has only 4% row crops and 15% grasslands in trainable areas. Both categories need to be increased to improve cottontail habitat on post. At present, the amount of agricultural fields is being increased by converting tier 3 and 4 barrens into agriculture lease acreage. At the same time, this conversion is decreasing the number of grasslands on post. The only way to increase open fields is to remove forested areas, primarily the pine plantations. Hardwoods need to be maintained for fox squirrel habitat. Pine plantations have been a source of controversy for some time. The extremely thick understory make training in these stands

impossible as well as being of low value for wildlife. The Training Division has shown an interest in the removal of pine stands in order to create more open areas for airborne training. However, the removal will most likely not occur for several years and will take even longer to be completed. Another option to pine removal is to manage the pines intensively to create pine savannahs. Row thinning the stands allows light to reach the forest floor allowing grasses and forbs that have been shaded out to grow. Annually burning the stands will cause native grasses to develop, creating excellent habitat for both rabbit and quail. The decreased competition among the pines will increase the diameter of the remaining trees creating better quality timber.

3.2.3.2 Field Management

Suitable cottontail habitat includes well-distributed cover, such as briars and honeysuckle, interspersed with an early-successional grassland community that contains abundant forbs (Chapman et al. 1982). The need of this habitat type creates a dilemma on Ft. Campbell. Early successional communities contain sumac and other pioneer species saplings, which create dangerous landing situations for helicopters. Although the military desires fields with no woody vegetation, that is not a possible scenario. Within the past few years, the wildlife and fisheries section has begun to actively manage fields on post using prescribed burns and mechanical clearing. Prior to this, fields have been allowed to grow up into old fields and become overgrown. Recent studies have shown that prescribed burning is beneficial to increasing rabbit populations (Lochmiller et al. 1991 and Lochmiller et el. 1995). Lochmiller et al. (1995) found that the annual productivity of grasses and forbs increased greatly with disturbance and that the productivity was greater in early seral stages. They also reported that kidney fat index increased 36% in rabbits harvested in disturbed areas. These benefits that come with burning are only temporary. Burning must be continued on a regular cycle to continue to provide the forbs needed for nutrition. Unfortunately, fire will not contain the woody growth. Fire needs to be used every other year or every 3 years at the most and mechanical clearing with a bush hog needs to be conducted whenever woody encroachment becomes to too dense.

Another way to create rabbit habitat is to create herbaceous field borders and woody corridor strips (5-10m) around row crop fields (Bond et al. 2002). Field borders should be disturbed by rotational fall-winter disking to stimulate legumes and ragweed germination. However, these practices are generally used on smaller, private farms and probably could not be effectively implemented on Ft. Campbell. Current agriculture lease practices require farmers to have a 10 ft grassy border around row crop fields and they are mowed once a year. The primary reason for the border is to give soldiers a travel corridor around the field instead of driving through the crops. Disking the borders is not an option because the disking would cause the ground to be too rough for travel as well as the opposition to ragweed by the farmers.

Another option to create habitat is to plateau and burn grassy areas that are set aside at several agriculture fields to generate native grasses. A total of 127 acres of fescue fields are laying fallow as an incentive for soldiers to train in the grass rather than crops. Some of these agriculture fields that have grassy areas are surrounded by forest. A mixture of grain crops, grasslands, and woody edge need to be in close proximity so that all types are encompassed within the home range of a rabbit (2-7 acres). If native grasses are created, a better mix of habitat types is available within a home range and more likely to be used by rabbits. With the application of fire and pesticides, these areas could become quality rabbit habitat.

Rabbits provide a significant browse pressure on woody growth in open areas on the installation. If the decline in rabbits harvested is an indicator of an actual declining rabbit population, there may be significantly less browsing pressure on woody growth (thereby accelerating succession). An increase in rabbit density will assist the wildlife section in keeping woody growth under control.

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3.3 Fox and Gray Squirrels

3.3.1 Introduction

Three species of tree squirrels are indigenous to Arkansas. They are the southern flying squirrel (*Glaucomys volans*), the fox squirrel (*Sciurus niger*), and the gray squirrel (*Sciurus carolinensis*). The fox squirrel and the gray squirrel are the two species of squirrels that are hunted as game animals on Fort Campbell. This plan will only deal with the two species (fox and gray squirrels) that area managed as game species on Fort Campbell.

The gray and fox squirrel have been a primary game species on Fort Campbell for almost 60 years. There have been periods recorded of extremely dense squirrel populations and then substantial declines from year to year throughout their ranges (Holder, 1951). This suggests that, historically, populations have always experienced great fluctuations due to the abundance of food and climatic conditions and not loss of habitat, although today the decline in hardwood forests and habitat modification plays a major role in population densities in many parts of the state. Direct correlations are found between squirrel population levels and the previous year's mast production. Historical records show a tendency of the gray squirrel to prefer dense contiguous blocks of hardwood and pine-hardwood forests and the fox squirrel to prefer more open upland woodlots, both species will co-exist in similar habitat conditions (Schwartz, 1981). In this case, one or the other will tend to dominate the site. Being arboreal mammals, the distribution of squirrels throughout the installation is primarily dependent upon the amount of suitable forest acreage within a given location.

Although little has been done to actually manage squirrels in the past, Installation biologists have set seasons and bag limits, conducted population inventories, and analyzed hunter success rates in accordance to the wildlife management plan. However, it remains unclear just what actually can be done to manage squirrels besides providing mature hardwood or pine-hardwood stands and the retention of active or potential den/cavity trees within a forest.

3.3.2 Natural History

Fox and gray squirrels are found throughout the eastern half of the United States to the Canadian border. There are generally 2 breeding seasons with 1 peaking in December and the other in June (Moore 1957). Litter size ranges from 1.97 to 3.35 (Harnishfeger et al. 1978). Fox squirrels are most common in small forest patches <40 ha with an open understory (Nixon and Hansen 1987) with gray squirrels preferring large closed forested areas. Squirrels are most common when several different mast producing trees such as hickories (*Carya* spp.), oaks (*Quercus* spp.), and beech (*Fagus grandifolia*.; Nixon and Hansen 1987)

are present. Annual mortality rates are 34% for males and 37% for females with an annual survival rate usually >60% (Hansen et al. 1986). Nixon et al. (1974) reported that populations can only sustain a hunting loss of <40%. Immigration is required to sustain a population with an 80% loss. Diurnal activity is bimodal with most activity occurring near sunrise and sunset in spring-fall. In winter, squirrels are most active at mid-day (Geeslin 1970 and Adam 1984).

3.3.3 Population Status

Population densities of squirrels have decreased substantially throughout their range over the past few decades due to a decrease in available habitat (Taylor 1973). Ft. Campbell hunters were harvesting 300-1,500 squirrels a year in the 1970s and 80s (Table 1). In the 2002-03 hunting season, only 84 squirrels (gray and fox) were harvested. In 2002-03, squirrel hunters had only a 21% success rate and success was even lower in 2003-04 with 17%. TWRA's goal is to maintain an average harvest of 2.4 squirrels per trip, however Ft. Campbell's 2002-03 season yielded only .33 squirrels per trip, well below the state goal. Determining the cause of the decreased hunter success is difficult because several variables are involved. There are fewer squirrel hunters in general and several hunters that are signed out as squirrel hunting are actually scouting deer or hunting quail. Therefore, using bag rates to determine squirrel populations is not feasible.

3.3.4 Squirrel Management

3.3.4.1 Introduction

Since the post was purchased, the repression of fire has allowed forest succession to encroach on fields creating mature forests covering about 57% of post. The majority of these forests have a dense mid- and understory, while appropriate for gray squirrels, is not suitable for fox squirrels. In addition to oak forests, approximately 4,700 ha of loblolly pine were planted throughout the post in the 1960's and 70's. This also reduced the amount of habitat available for fox squirrels. Most of the pine stands have extremely dense understories, again unsuitable for fox squirrels. The primary method in increasing fox squirrel populations is to create oak dominated woodlots with open understories. Most of Ft. Campbell's forests are oak dominated; however, once they are harvested, competing species such as red maple and yellow poplar are becoming prominent. If oak forests continue to be replaced, the acorn crop so important to wildlife will be nonexistent, as well as the future of oak harvesting.

3.3.4.2 Effects of Fire on Oak Regeneration

In the past, foresters believed fire would harm hardwoods by splitting the bark, allowing diseases to invade the tree. Recent research has proven that fire actually increases the dominance of oak in regeneration. Fire benefits oak by 1) creating favorable conditions for acorn caching by squirrels and blue jays, 2) reducing the number of insects that prey on acorns, 3) xerifying moist sites by exposing the ground to solar radiation, and 4) reducing competition from fire-intolerant species (Van Lear and Watt 1992). Yellow poplar readily germinates following a single burn (Shearin et al. 1972). However, frequent fires will eventually eliminate the seedlings as well as any seeds remaining in the duff. Summer burning is more effective in changing species composition, but winter burns are also helpful in oak regeneration (Van Lear and Watt 1992). Summer burns kill root stocks of all hardwoods, but mortality of other species is greater than oak, giving oak seedlings the advantage. Hardwood sprouting is more vigorous following periodic

Table 1. Historic squirrel harvest data for Ft. Campbell.

Year	Number of Trips	Number Harvested	Percent Success
1976-1977	1134	1144	1.0
1977-1978	1328	1081	0.81
1978-1979	1095	1220	1.11
1979-1980	1642	942	0.57
1980-1981	959	1544	1.61
1981-1982	1209	772	0.63
1982-1983	1170	760	0.64
1983-1984	930	332	0.35
1984-1985	933	420	0.45
1985-1986	910	628	0.69
1986-1987	1369	895	0.65
1987-1988	864	495	0.57
1988-1989	1236	651	0.52
2002-2003	230	84	0.36
2003-2004	139	52	17

winter burns because of greater carbohydrate reserves (Hodgkins 1958). Thor and Nichols (1974) found that oak stems increased after periodic and annual winter burns. Sanders et al. (1987) found a low intensity winter burn resulted in little or no cambium damage to large crop trees.

3.3.4.3 Methods for Restoring Habitat

Frequent understory burns, both in summer and winter, completed 5 to 20 years before a harvest should promote oak seedling establishment and allow sprouts to dominate advance regeneration (Van Lear 1991). Once an adequate number of oak seedlings are present (1,074 stems/ha over 1.4 m tall (Sander et al. 1983)) fire should be withheld to allow the advance regeneration to outgrow other species, which germinate after the harvest is completed (Van Lear 1991). During the burning stage of harvest preparation, the fire will create an open understory and provide suitable fox squirrel habitat for several years.

Although an open understory is important, fox squirrels prefer woodlots < 100 acres. Initially, burns should be focused on training areas that already contain smaller woodlots dominated by oaks such as 2, 5,

6, 8A, 10, 27, 28, 40, 42B, and 43A. Once those training areas have become open, burning efforts should be shifted to areas that have larger tracts of forest (TA 19, 24, 25, 30, 32, 35, and 45) but not necessarily the contiguous tracts found in the western portion of post (TA 43B, 44, 49, 50, and 51).

In the future, as pine stands are removed to create fields, large hardwood woodlots will be formed (TA 10, 11, and 22). These lots need to be burned as soon as they are created to produce fox squirrel habitat. Another option to pine removal is to manage the pines intensively to create pine savannas. Row thinning the stands and annually burning the stands will create an open understory. Fox squirrels have often been seen in pine trees on the post golf course. Perhaps they will use pine savannas in the wild as they do in developed areas.

Gray squirrels prefer larger contiguous blocks of mature seed bearing forests. Their preference for a closed forest conflicts with the fox squirrel. Maintaining suitable habitat throughout each training area is required to create viable populations on Fort Campbell.

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3.4 Bobwhite Quail

3.4.1 Introduction

Bobwhite quail were once abundant throughout the training areas of Fort Campbell. However, over the past 40 years, bobwhite populations have plummeted to the point that now only small, fragmented

populations currently exist within areas that provide suitable cover and space. Existing populations on Fort Campbell are confined to fragmented habitat patches generally associated with managed native grasslands, fallow and agricultural fields located throughout the installation.

The bobwhite decline over the past 40 years is a result of a combination of many factors, some of which include; conversion of native grasslands to loblolly monocultures, brush control practices, clean farming practices, and succession. All of the factors mentioned above eliminate critical nesting, brooding, and protective cover that bobwhites need in order to survive. Over the years these land management practices have fragmented the landscape to the point that suitable habitat now only occurs in isolated patches that are either too small to support a self sustaining population, or they are only large enough to support small populations that struggle to persist from year to year.

Despite considerable interest and effort directed toward quail population restoration during the past 20 plus years, the population has continued a steady decline. Harvest data collected between 1982 and 2007 indicates a fluctuating downward trend consistent with similar trends across the southeastern United States. Bobwhite quail suffered a 62 percent reduction in their population across the Southeast from 1966-2005 (Figure 1) (Capel, 1996). Fort Campbell's population trend, utilizing harvest data (Figure 2), is similar to that of the southeast. The main cause of the decline in Fort Campbell bobwhite populations has been loss of habitat associated with advanced plant succession.

Developing bobwhite quail habitat takes time and ample resources. Success will require patience and persistence, as management actions will need to be a work in progress. Restoration of quail populations will only occur through management techniques that support habitat. The answer to Fort Campbell's problem is not simple, and quick-fix remedies will have little, if any, long-term, benefit. This management plan outlines a strategy to increase, and eventually stabilize, bobwhite quail populations within the training areas of Fort Campbell.

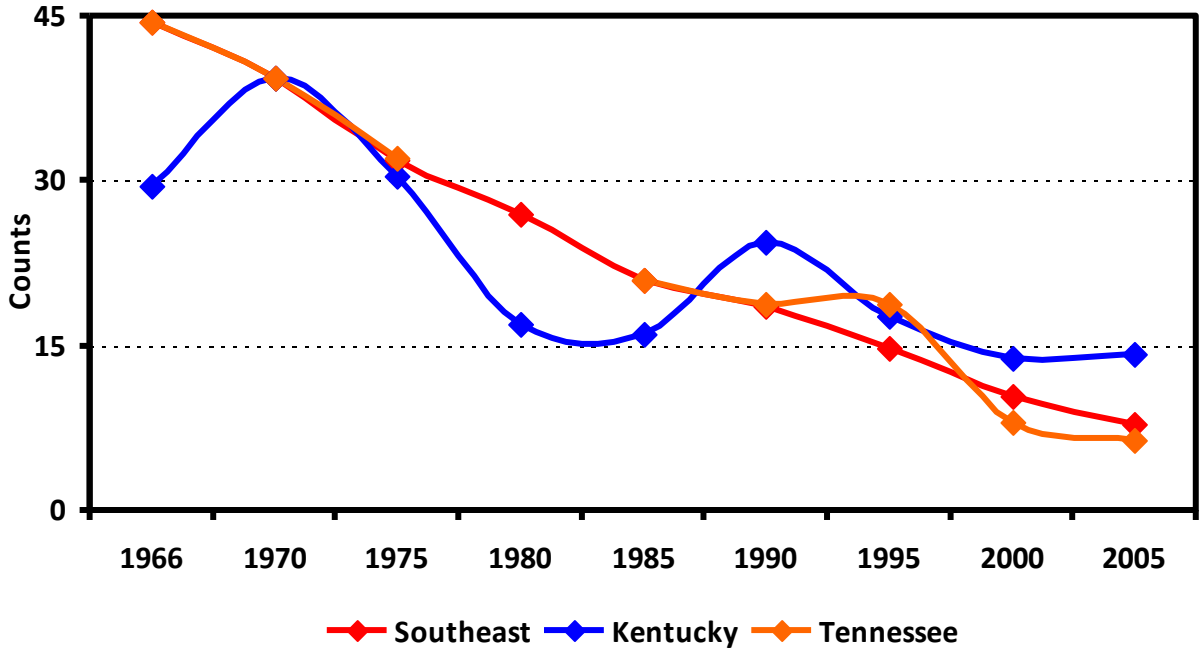

Figure 1. Northern bobwhite breeding bird survey data for the southern United States, Kentucky, and Tennessee. The population has declined 62% since the survey began in 1966.

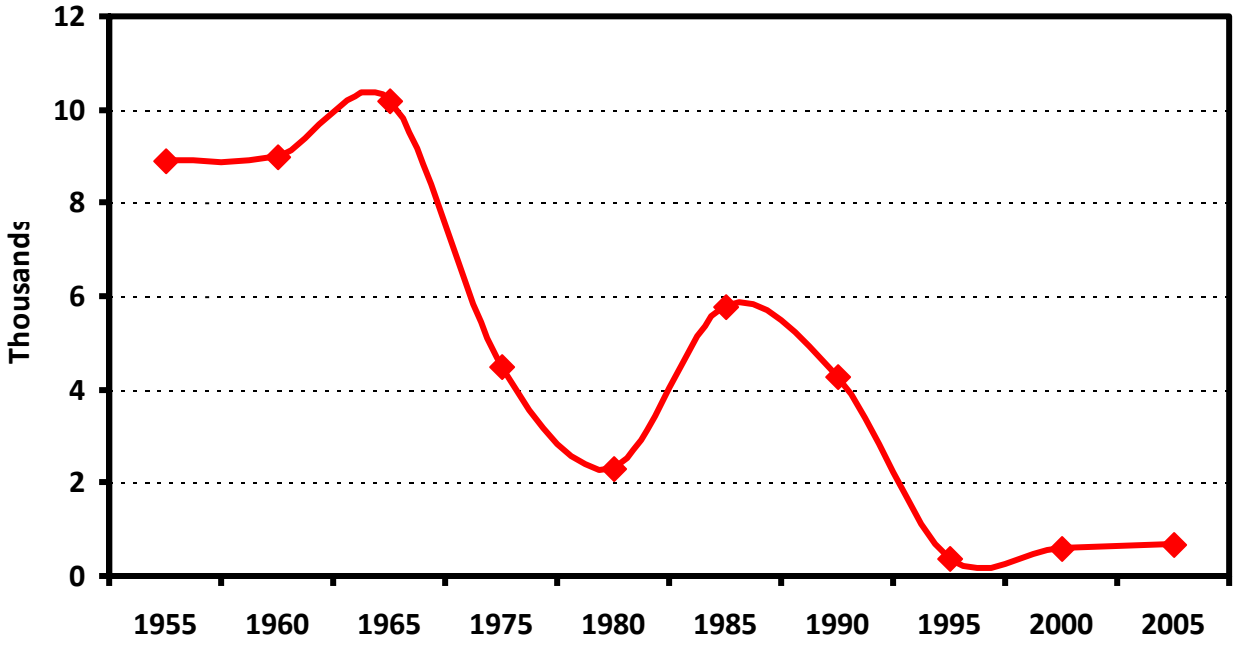

Figure 2. Fort Campbell harvest numbers from 1955 to 2005. Hunters bagged an average of 3 birds/trip between 1955-1965 compared to 1.5 birds/trip in 2005. Large-scale conversion of open areas to pine stands occurred during the 1960's. The subsequent decline of quail numbers is attributed to this habitat loss.

3.4.2 Northern Bobwhite Ecology

3.4.2.1 Life History

Bobwhite quail are predominantly reddish-brown, with lesser amounts of white, brown, gray and black throughout. Both sexes have a dark stripe that originates at the beak and runs through the eye to the base of the skull. In males, the stripe above and below the eye is white, as is the throat patch. In females, this stripe and throat patch are light brown or tan. Typical weights for bobwhites range from 160 to 180 grams (5.6 to 6.3 ounces). Overall length throughout the range of the species is between 240 and 275 millimeters (9.5 and 10.8 inches) (Rosene 1984). The northern bobwhite is a non-migratory, year-round resident species.

3.4.2.1.1 Courtship and Nesting

Courting pairs are initially formed in March and April; however, pair bonds will form and break, then re-form throughout the breeding season, which runs from May to September. During a given breeding season, individual bobwhites may mate and initiate nesting attempts with as many as three different mates. Nests are incubated by the male or the female, but bobwhite rarely alternate incubation duties. This complex social structure allows multiple nesting attempts during the breeding season and contributes to the bird's high reproductive potential.

Bobwhites usually select a nest site where grasses are the predominant vegetative type. Bobwhites prefer knee-high cover for nesting, near an edge that adjoins an opening or bare ground with

scattered woody vegetation. The male constructs the nest on a slight depression in the soil, using available dead grasses and stems, which often include broomsedge and pine straw. Construction takes about a day. The hen lays about one egg daily until the clutch of 12 to 15 eggs is produced. This usually requires from 15 to 20 days following completion of nest construction, often with a slight delay between construction and the onset of egglaying. The average clutch is 14 eggs. Within 2 to 5 days of the last egg laid, the hen or cock will start incubation.

Females incubate three-fourths of the nests and, thus, are most susceptible to nest predators, which take their toll. Fifty-five to 70 percent of the nests are destroyed by predators, mowing activities, or weather events. The attending adult is killed in about 25 percent of nest failures. After 23 days of incubation the eggs hatch. Once hatching begins, most chicks emerge within an hour or two. As soon as the precocial chicks are dry, the hen uses her leads them away from the nest. Those not hatching or hatching late are left behind.

3.4.2.1.2 Brood Rearing

Reproductive attempts may require from 44 to 53 days, and peak hatch is around late-July. About one-third of the birds are successful with the first nesting attempt, and quail may renest two to three times attempting to bring off a brood. Through repeated renesting, about 75 percent of those birds surviving the breeding season ultimately hatch a nest. Double clutching/brooding does occur but is so rare the impact on populations is insignificant.

Newly-hatched chicks are covered with natal down, weigh about one-quarter of an ounce, and are not much larger than bumble bees. They are very alert, move around on the ground quite readily, and are flightless for the first 2 weeks. Parents watch the chicks closely, and the brood may cover from 2 to 100 acres during the flightless period. Hens take the chicks to open, insect-rich “bugging” habitat that provides the right amount of protection from predators, intense heat, or wet conditions, yet allows the small chicks to move freely around and through vegetation. The first 2 weeks are the most critical, because loss to predation and bad weather may take 50 percent or more of the hatch.

Brooding of chicks at night and during much of the day is accomplished by one or both adults. During the first 14 days after hatch, the flightless chicks are quite vulnerable to predators. Bobwhites are tenacious parents and hesitate leaving the flightless chicks, even when attacked by a predator. Although predation is high during incubation, attending flightless chicks is twice as risky as incubating a nest.

Between weeks 2 and 6, chicks develop juvenile plumage and flight abilities; by 6 weeks of age, the chick’s diet shifts partially from insects to seeds and berries. At 12 to 16 weeks, juvenile size closely resembles that of adults. By the age of 21 weeks, bobwhite have the plumage that will be worn into the next breeding season. At 2 months, hens are readily identified from cocks by the brown feathering in the throat patch, whereas cocks have a white throat patch and a black eye stripe and collar.

Juveniles can still be identified from adults for a full year by the more-pointed ninth and tenth primary wing feathers and buff-colored tips of the greater primary coverts. Some broods may hatch in early October, but most are complete by mid- to late summer. Summer life for birds of all ages consists of daytime activities of traveling, feeding, dusting to clean feathers, and loafing. They may feed during early morning, rest during midmorning, loaf, sleep, and dust during the middle of the day, and feed during the 2 to 3 hours before dark.

3.4.2.1.3 Covey Structure

By late summer, bobwhites begin to exhibit the characteristic night roosting habits of forming a circle on the ground with tails together and heads pointing out. This may have important social, escape, and heat conservation implications. The bobwhite's preferred mode of travel is by foot. Flying is energetically expensive and exposes birds to avian predators (e.g., hawks and owls).

During late summer and early fall, birds begin to intermix from brood to brood and form "coveys" or social groups of birds that band together in groups of 20 to 30. These groups ultimately may be reduced to coveys of 10 to 15 as birds settle into their winter ranges. This period of transition and increased movement is often called the "fall shuffle," and populations
have reached their peaks for the year. As fall and winter arrive, food is most abundant, bird movements can be reduced, and the tight-knit coveys are composed of 75 to 80 percent juvenile birds. A covey will not normally mix with another covey, although covey ranges may overlap. Depending on habitat quality, coveys may require from 20 to 160 acres or more each to meet their needs.

As much as 80 percent of the early fall population may be lost to natural mortality by the following spring. As winter progresses, cover and food conditions deteriorate. Food is at an all-time low in late winter, just before spring green-up. Environmental and other factors take their tolls on populations. As spring gets closer, longer days and better weather trigger the gradual breakup of the coveys. The bobwhite calls begin in earnest, and pairing begins again as the breeding season arrives.

3.4.3 Habitat

Quail occupy a wide variety of early successional habitats, including active and fallow crop fields, pastures, old fields, native grasslands, hedgerows, brushy fencerows, woodlands with grass and forb ground cover, cut-over timber-lands, and wooded riparian areas. The role of regular habitat disturbance in maintaining productive bobwhite habitat is extremely important. Disturbances, such as fire and disking, are necessary to maintain the early successional habitats utilized by bobwhites.

A principle aspect of these early successional habitats is the presence of grasses and forbs that provide ground cover while allowing birds to move along the ground easily. A variety of early successional communities growing adjacent to one another and containing defined edges among them provide the bobwhite with ideal nesting, brood-rearing, feeding, loafing, travel, and escape cover. Diversity in habitat types within an area is among the greatest factors affecting northern bobwhite populations. Conserving and properly managing grasslands, woodlands, and other cover types as well as the edges between cover types can help boost bobwhite populations and benefit other wildlife species that rely on similar habitat. The combination of these provide the annual requirements for the population (Table 1).

3.4.3.1 Nesting Cover

Native prairie bunch grasses, such as big and little bluestems, switch grass, Indian grass and broom sedge provide the most preferred nesting cover for northern bobwhites. These grasses grow into dense vegetation communities with open, passable alleyways near the ground. These bunch grasses provide the best habitat architecture for nesting quail, as nests are built at the base of grass tufts. Other grasses and forbs that grow in bunches or clumps are also used by bobwhites for nesting. Sod-forming grasses, such as fescue and brome grass, form

Table 1. Northern Bobwhite Habitat Requirements

Habitat Component	Habitat Requirements
General	Early successional habitats subject to regular disturbance.
Food	Legumes, sorghum, wheat, buckwheat, corn, lespedezas, blackberries, grapes, plums, acorns, and a variety of insects.
Cover - nesting	Grasses and forbs with overhead protection and open travel lanes near the ground. Native bunch grasses or other vegetation that grows in clumps is preferred. Woodlands with herbaceous groundcover, piles of brush, woodland and grassland edges, and thickets.
Cover - brooding	Recently burned grasslands, old field communities, weedy field borders, legume plantings, and small grain fields with a diversity of low-growing green foliage and insects.
Cover - winter	Shrubby or woody cover, tall grasses, and weed patches.
Cover - escape	Tangles thickets, dense grasses and briers, shrubs, and other dense vegetation.
Interspersion	Complex of cover types that provide suitable foraging, nesting, brooding, loafing, escape, and travel cover each located in close proximity to one another.
Minimum Habitat Size	Covey activity generally occurs on 20 to 40 acres of land and a covey rarely ranges more than one quarter mile in good quail habitat.

matted, dense vegetation that is of little habitat value to bobwhites. Residual cover (vegetation left standing from the previous growing season) is an essential element of productive bobwhite nesting habitat. One- or two-year-old residual clumps of grass are preferred over younger or older stands as they provide necessary overhead cover for nest concealment and commonly do not contain much ground litter (matted grasses) that hinders ground travel. Matted grasses also encourage the build-up of rodent populations (e.g., cotton rats in the southeast) which are major predators of bobwhite nests.

Bobwhites use shallow depressions lined with dry grasses located in grass clumps that range from 6 to 18 inches in height. Nests are usually established within 30 feet of a brushy, woody, or other edge component where habitat types change, and within 50 feet of bare soil. This edge serves as a corridor along which birds can travel between cover types. Nesting sites are commonly found in brushy corners of old fields, along the edges of woodlands, and in windbreaks, thickets, and other areas providing suitable cover.

3.4.3.2 Brood-rearing Cover

Brood-rearing cover differs from nesting cover because it is generally more open at ground level to enable movement of quail chicks. As much as 70 percent of brood-rearing cover can be open, bare ground. Whereas good nesting habitat has generally not been disturbed for two or three growing seasons, the best brood habitat occurs within the first year following disturbance of an area through burning, disking, timber harvest, or other means. Overhead concealment, diversity of low-growing green foliage, and abundant insects are required brood-rearing cover characteristics. Recently burned grasslands, old field communities, weedy field borders, legume plantings, and small grain fields provide good brood-rearing cover.

3.4.3.3 Loafing and Winter Cover

Loafing cover provides protection from predators and adverse winter weather during daylight hours when bobwhites are not feeding. Shrubby or woody cover is preferred for loafing, but tall grasses and weed patches may be adequate when available. Thickets of blackberry, American plum, sumac, honeysuckle, wild cherry, and dogwood growing from 3 to 6 feet in height provide loafing cover. Wild grape, greenbrier and other vines growing to create dense overhead cover and open, passable ground cover make up good loafing cover as well. Small patches of bare ground on which individuals can dust to remove parasites and excess oils from feathers increases bobwhite use of loafing cover. Loafing cover needs can be generally met with a 30- to 50-foot wide, irregularly-shaped plot of land containing clumps of grass and overhead cover.

3.4.3.4 Escape Cover

Tangled thickets, dense grasses, shrubs, and other vegetation that conceals quail from predators are used as escape cover when located close to travel lanes and nesting, brood-rearing, and loafing cover.

3.4.3.5 Habitat Area

Under optimal habitat conditions one covey of northern bobwhites can occupy as little as 4 acres, but typical covey activities generally occur on 20 to 40 acres of land. Intensively managed areas can average one covey per 15 acres, whereas less intensively managed lands may require 50 acres or more to support a covey. Optimum carrying capacity - the number of birds an area can support and remain in good condition - is generally one quail per acre. However, depending on habitat quality and diversity, more than one individual can inhabit an acre of land. A covey rarely ranges more than one quarter mile when inhabiting areas containing all habitat components necessary for survival. A smaller area that contains a mixture of each of the necessary habitat components will attract and satisfy a covey of quail before a larger area lacking adequate edge components between habitats or missing one or more needed habitat component. This aspect of bobwhite habitat ecology can potentially make managing for northern bobwhite on fragmented fields easier and more practical than some other wildlife species.

3.4.4 Food

Northern bobwhites forage in the early morning after sunrise and more heavily in the two hours prior to sunset. Bobwhites rely on a multitude of food items, consuming a variety of wild and cultivated seeds, fruits, leaves, stems and insects. Roughly 85 percent of a juvenile bobwhite's diet consists of

insects and other animal matter, and chicks feed almost exclusively on insects during the first two weeks of life. In contrast, 85 percent of an adult bird's diet consists of vegetation. In fall and winter months, the seeds of native annual plants, such as ragweeds, sunflowers, panicgrass, foxtail, spurges, beggar's ticks, partridge pea, are consumed, as well as the seeds of oaks, black locust, pines, and ash. Cultivated plants consumed include soybeans, grain sorghum, wheat, buckwheat, millet, rye, corn, lespedezas (bicolor, Kobe, and Korean), and cowpeas. Wild fruits, such as mulberries, raspberries, blackberries, strawberries, hackberry, grapes, plums, pokeberries, persimmons, and the berries of dogwood, poison ivy, sumac, greenbrier and many others are consumed in spring and summer. Leaves and stems of succulent green plants are also consumed. Invertebrates, such as grasshoppers, leafhoppers, flies, mosquitoes, aphids, spiders, and ants comprise over 20 percent of the summer diet of adult females, while adult male summer diets include only about five percent animal matter. However, bobwhites are opportunistic feeders and will consume available or abundant food items before searching for scarce and more preferred foods.

3.4.5 Management Strategy

The major goal of this management plan is the offsetting of the adverse long-term trends of habitat loss. Quail require three distinct habitat conditions throughout their lifecycle to reach their population potential. Lack of one creates population instability, reduction in population size, and eventually loss of the population. The Fort Campbell strategy will achieve its intent by implementing actions in the following areas 1) population monitoring, assessment, and management, 2) habitat restoration and enhancement, 3) supplemental food plantings, and 4) hunting season management. A 5-year action plan is located in Appendix A.

3.4.5.1 Management Goals and Objectives

Goal 1: Maintain and enhance native quail populations.

Objective 1: Analyze current population data.

Objective 2: Increase and maintain a minimum of 1 covey per 30 acres of suitable habitat per management unit.

Objective 3: Implement monitoring techniques to project annual population trends, annual reproductive success, and long-term habitat changes.

Sub-objective 1: Implement spring and fall call counts utilizing volunteers to provide much needed population density data for each management unit and allow management unit trend comparisons. Train observers in the call count protocols.

Sub-objective 2: Utilize fall covey count data and flush counts to determine population estimates for all management units.

Objective 4: Develop predictive models of bobwhite quail occurrence and density based on land cover.

Objective 5: Evaluate patch size and on bobwhite nest success and brood survival.

Objective 6: Review current bag limits and season length to limit additive mortality to existing populations.

Objective 7: Evaluate bobwhite quail colonization rate and population response to habitat enhancement.

Objective 8: Continue to review literature and research studies to determine most effective monitoring techniques and adopt those techniques as needed.

Goal 2: Provide ample hunting opportunities that allow continued population stability or growth.

Objective 1: Implement a sound harvest management system that provides for the harvesting of no more than 25-40% of the estimated management unit population size (this number includes cripples).

Objective 2: Annually recommend and evaluate quail season and bag limits to optimize recreational opportunities without limiting the growth of quail populations.

Sub-objective 1: Develop decision-making criteria for setting season lengths.

Sub-objective 2: Utilize fall covey count data to set bag limits and management unit (training area) quotas.

Sub-objective 3: Monitor harvest with management unit quotas and close season once harvest goals are met or average covey size is below 6 birds.

Objective 3: Develop a quail management group consisting of biologist and stakeholders for cooperative management of the species.

Goal 3: Create a better balance of habitat types.

Objective 1: Create optimal habitat and/or minimize loss of suitable quail habitat throughout the rear training areas.

Sub-objective 1: Conduct Habitat Suitability Studies (HSI) to determine habitat conditions in every training area.

Sub-objective 2: Develop habitat restoration/enhancement projects for each management unit.

Sub-objective 3: Annually evaluate habitat conditions and develop or modify annual work plans.

Sub-objective 4: Eradicate fescue in all fields managed by the Wildlife program. Re-establish NWSG on all appropriate sites.

Sub-objective 5: Actively manage existing bicolor stands in 15'x100' blocks.

Sub-objective 6: Mow to control woody vegetation at a minimum height of 10 inches.

Sub-objective 7: Increase acreage of early successional vegetation within existing native warm season grasslands in conjunction with edge.

Objective 2: Develop and apply GIS technologies for assessing trends in quail habitat.

Objective 3: Evaluate agricultural field borders (row crops) for the potential development of suitable bobwhite habitat.

Objective 4: Develop scattered patches of shrubby cover on 10-20% of existing native grasslands. Developed patches should be 100-300 yards apart.

Goal 4: Develop and implement supplemental food program that encourages perennial plantings for reduced costs.

Objective 1: Develop and implement supplemental food program that encourages perennial plantings for reduced costs.

Sub-objective 1: Continue the food strip program in conjunction with the prescribed fire program.

Sub-objective 2: Develop permanent plantings at all firing points to reduce maintenance costs and provide supplemental food for wildlife.

Sub-objective 3: Develop small irregular shaped food plots (maximizing edge) next to areas with good escape cover or shrubby thickets.

Sub-objective 4: Develop rotational plantings on all established food plots and strips. Plant each years strip adjacent to the previous planting.

Sub-objective 5: Implement seasonal strip-disking to promote establishment of bobwhite friendly vegetation. Light disking (one to three passes with the disk set at three to five inches deep) shall occur between October through March.

Sub-objective 6: Implement rotational strip-disking on a two- to three-year rotation, disking half to one third of fields each year in a strip pattern.

Goal 5: Implement pine forestland habitat management for quail.

Objective 1: Reduce pine stand densities to between 30-60 sq. ft. basal area and incorporate prescribed fire on a two- to three-year rotation.

Objective 2: Implement woodland light disking on approximately one half to a third of the stand on a two- to three-year rotation.

Goal 6: Implement a quail translocation study in Training Areas 17, 19, 24, and 25.

Objective 1: Implement a HSI study to determine habitat conditions within the study area.

Sub-objective 1: Complete HSI field study and analyze data for habitat conditions.

Sub-objective 2: Collect spring and fall call count data from within the study area.

Sub-objective 3: Develop management actions and 5-year work plan to restore or enhance habitat conditions. Work plan should include timeline and measurements.

Sub-objective 4: Implement work plan and document results.

Sub-objective 5: Collect post-action call count data and determine the need for quail translocations.

Sub-objective 6: If needed, develop and implement a translocation plan for the study area.

3.4.6 Management Approach

Management actions that support increasing native quail populations will be implemented within incremental time blocks to facilitate monitoring of the success of those actions and the species response to the actions. Quail management is more art than science. Science provides the baseline information used in planning management goals and actions; whereas the implementation of the plan is more art as changes made to the overarching plan will be site specific. Management unit specific actions are considered living plans and may change from year to year. As such, Appendix A is updated annually.

3.4.6.1 Management Units

Thirty-eight training areas (Table 2) are designated as quail management units on Fort Campbell. Each unit contains habitat in various conditions and supports numerous native coveys. Fort Campbell's strategy will focus on restoration or enhancement of habitat within these units. Action plans are specific to each unit and will include at a minimum current and desired future habitat conditions, current and future population densities defined as population goals, project implementation plan, and monitoring and measuring methods. Site specific plans are located in Appendix B.

3.4.6.2 Survey Methods

Habitat management techniques such as prescribed burning and habitat "sculpting" are often used to try to increase quail abundance. Monitoring surveys must be implemented to gauge the effectiveness of the management effort. Quail populations exhibit seasonal and annual fluctuations, making accurate population estimates difficult. Standard methods provide a way of estimating quail populations and monitoring population fluctuations over time. The goal of quail management should be to maximize quail abundance in good years and minimize the decline in bad years. Tracking the magnitude of fluctuations can aid in making management decisions.

Table 2. Summary table for training areas (management units) supporting quail populations or habitat. These areas encompass the quail management emphasis on Fort Campbell.

TA	Total Acres	Covertype Acres			Edge Acres[1]
		Forest	Field	Ag Lease	
2	1,287	896	391	302	108
3	1,275	886	389	0	81
4	1,598	1,489	109	33	39
5	901	402	499	151	162
6	1,257	613	644	364	183
8A	688	196	492	0	76
9A	1,919	1,487	432	146	147
9B	1,109	981	128	56	32
10	2,119	1,463	656	65	269
11	1,815	1,287	528	0	139
12	199	173	26	0	9
13	1,013	721	292	136	41
14	1,863	805	1,058	727	114
17	1,520	823	697	287	95
18	341	323	18	0	7
19	2,396	1,421	975	98	213
20	2,601	1,768	833	291	209
21	3,383	1,910	1,473	784	65
22	1,816	1,791	25	0	8
23	1,961	1,614	347	131	86
24	807	498	309	98	58
25	2,449	1,471	978	549	149
27	876	282	594	116	91
28	928	437	491	237	90
30	985	473	512	84	73
31	2,181	1,712	469	156	97

32	2,198	1,751	447	213	87
33	1,132	989	143	81	27
34	1,451	1,149	302	205	43
35	407	140	267	165	35
40	652	177	475	245	52
41	866	542	324	63	75
42B	942	365	577	0	72
43A	562	188	374	52	50
44	2,497	2,046	451	254	66
46	1,108	1,020	88	0	9
48	1,064	689	375	0	49

[1] Edge acres calculated using field and forest borders, excluding those along paved and graveled roads, with a 60' buffer.

Several options for assessing quail population trends are available. None of the techniques described are completely accurate, but when done consistently for several years the results can indicate the trends of quail populations and how they respond to management. Survey methods vary from direct to indirect counts and in their degree of difficulty. Direct counts provide data based from direct observation of quail, whereas indirect counts rely on quail behavior and only provide indices.

3.4.6.2.1 Direct Counts

Hunter Covey Flush Rates. Hunting success is positively correlated to the population densities of bobwhites. When using hunting success to estimate population trends over the years, hunting methods should be standardized, including factors such as the presence or absence of dogs, the daily start and finish times. Habitat conditions should remain relatively constant and the sample period should be short. On Fort Campbell, quail season lasts 2 ½ months, but comparisons should be made only early in the season and from the same time period each year (e.g., during the month of November). The entire management unit should be hunted to generate an accurate estimate. Hunting only the best areas (i.e., "honeyholes") will bias estimates of abundance.

The important variable to be recorded is the number of coveys flushed per hour, not the number of birds harvested. This number can then be compared with the size of the area covered to generate an estimate of coveys per unit of area. Estimates obtained from flush rates are likely conservative, as several studies have found that bird dogs typically detect
only about two-thirds of the quail on any given day.

Drive Counts. Drive counts are conducted by several observers walking abreast (sometimes with the aid of dogs) and counting all quail that flush. Observers must be careful not to count the same birds twice. This method assumes the unlikely premise that all coveys are flushed and counted. The more observers

there are the less space there will be between them and the more accurate the count will be. At least 15 to 25 percent of the management unit should be sampled. An estimate of the management unit population density can be extrapolated from this data, however, these counts generally underestimate populations and are resource intensive.

Line-transect Counts. Line-transect counts (sometimes referred to as distance sampling) are a labor-intensive method of estimating quail abundance, but they may yield the most accurate results. Accordingly, distance sampling is usually restricted to research projects. An observer walks along a straight line (or transect) and counts the number of birds flushed. The right-angle (perpendicular) distance from the transect line to the point where the quail flush is measured. The measurement must be taken from the point where the bird(s) were initially sighted. These distances allow the observer to determine the likelihood of a covey flush as the distance from the transect increases. A computer program, DISTANCE, can be used to make these calculations and produce a population estimate.

Guidelines for increasing the accuracy for the count are 1) establish four transects, each 1 mile long, per square mile or section (640 acres) of habitat, 2) conduct counts during the first 3 hours of daylight, 3) record only the birds flushed by the observer(s), 4) sample each line equally and repeat the counts three to five times, 5) an estimate of average covey size can be obtained from the birds counted on the transect as well as from the number of coveys flushed along roads or during incidental field activities. With the average covey size you can use the number of coveys per acre to estimate the number of birds per acre.

3.4.6.2.2 *Indirect Counts*

Call counts. Call counts are simply counts of whistling quail. There are two types of call counts for bobwhites, spring (mating) and fall (covey) call counts. To conduct these calls, permanent listening posts should be established at certain intervals (1-mile intervals are suggested). Calls may be heard up to 600 yards away, so all stations should be at least 1/2 mile from each other. Data sheets with concentric circles are a helpful aid for recording the locations of calling cocks or coveys. Counts should not be conducted when it is raining or when the wind is blowing more than 10 miles per hour. Survey protocols are found in Appendix C.

Spring Call Counts. Spring call counts are conducted in spring and early summer. During this time, bobwhite cocks give the familiar “bob-white” whistle to attract a mate. Quail make other calls, such as the assembly call, but only the mating call is recorded for spring call counts. Cocks calling at this time are generally thought to represent the bachelor males (those not paired) in the population, although this assumption has not been tested. Peak calling is typically observed in May and early June, so surveys should be conducted during this time period.

Call counts should begin about sunrise and continue for 1 to 1 ½ hours after sunrise. Note the time (a stopwatch is recommended), and then count (a) the number of different cocks heard, and (b) the total number of calls heard. Marking the location of various cocks calling on a data sheet will help you determine if a bird you hear calling has been identified previously. Spring call counts are fairly accurate until the number of calling cocks is greater than eight birds per listening post. Each station should be monitored for at least 3 minutes, preferably 5 (monitor for the same length of time at each listening station). Then proceed directly to the next station and repeat the procedure until all stations have been completed. The surveys should be conducted at least three times. These counts provide an index of breeding “capital.”

Fall Covey Counts. Covey calls of bobwhites are often called "wake-up calls." Covey calls are typically heard during the fall and winter (October to March) in the early morning, about 30 minutes before official sunrise. Calling sessions are generally brief, lasting from 30 seconds to several minutes. Go to a listening post at least 45 minutes before official sunrise and listen for a total of 20 minutes after you hear the first covey call, as sometimes calling commences a second time. There is usually a chorus effect as one covey begins to call and surrounding coveys join in. Use the same permanent listening posts as for the spring call counts, but realize that you can record call counts at only one listening post per morning. Use the same type of data sheet as for spring call counts to help locate individual calling coveys. This survey also should be conducted at least three times.

Age Ratios (Quail Wings). The increase in the annual quail population from reproduction is an indicator of management success and the influence of other environmental factors. Keeping stringent harvest records provides an indication of population change over the years. The ratio of adult to juvenile quail in the hunter's bag is a measure of productivity and survival since the breeding season. Productive breeding seasons yield a higher percentage of juveniles in the bag. On Fort Campbell, adult-to-juvenile ratios for bobwhites have ranged from 1:0.6 (poor reproduction) to 1:11.8 (outstanding reproduction). This data is easy to collect from harvested birds. Collected data measures habitat and environmental conditions that can be used to determine the effectiveness of management efforts.

3.4.7 Management Techniques

Perhaps the most critical aspect of northern bobwhite management is creating good habitat interspersion, or mixture of different cover types. Suitable foraging, nesting, brood-rearing, loafing, and escape cover, each located within close proximity to one another, is essential to attract bobwhites to and maintain existing populations in an area. A complex of crop fields and fields containing native bunch grasses, odd areas, hedgerows, overgrown fencerows, and woodland edge comprise a mixture of quality bobwhite habitat components. Likewise, a multitude of differing habitats within one area that are not connected by a well-defined edge component is of less value to northern bobwhites than an area with a minimum of necessary habitat requirements growing adjacent to one another and containing many distinct edges between cover types. The following sections describe actions, when employed correctly, that will greatly enhance existing conditions in support of quail and other grassland species alike. More detailed descriptions of the grassland management techniques are found within the Fort Campbell Grassland Management Plan (Zirkle, 2005).

3.4.7.1 Strip Disking

Strip disking is simply disturbing the soil with a disk harrow to encourage native plants to grow. By disking at various times of the year, different plant communities prevail. Strips can be rotated to avoid disturbing the same ground each year, either in strips or blocks. Insects are attracted to disked strips more readily than farmed fields making them better brood habitat. Disking should be done from September 15-April 31 (in areas not planted) to avoid disrupting nesting. Disked strips will be a minimum of 15 feet width. Additional advantages of strip disking include: not using pesticides, less equipment operation time; lower fuel and manpower costs; and minimization of disturbance to escape cover.

3.4.7.2 Prescribed Burning

Prescribed burning is one of the most economical procedures for manipulating wildlife habitat. Burning is used to reduce plant competition, prepare seed beds, stimulate regeneration of sprouts and seedlings, and create openings in dense stands. Low intensity fires increase both the quality and quantity of forage plans, seed-bearing plants, and insects. Burning should be completed between January and April.

3.4.7.3 Mowing

Mowing sets back succession and stimulates new plant growth. The openings created provide travel lanes and sunning sites as well as shooting lanes for hunters. Strips mowed through brush create more edge by providing openings for sunning, dusting, and feeding. Mowing will be done before or after the nesting season.

3.4.7.4 Hunting Seasons

Much has been written about quail survivability and hunting pressure. Early management concepts held that there was a doomed-surplus of quail each winter and that harvest up to a threshold did not reduce breeder abundance. The current management perspective holds that harvest mortality generally adds to natural mortality from the start to the end of the hunting season (Guthery, 2002). Several studies (Roseberry 1979, Pollock et al. 1989, Robinette and Doerr 1993, and Williams et al. 2004) determined that harvest mortality adds to natural mortality because absolute mortality and the timing of harvest mortality is additive. Timing and basic population management is necessary to reduce additive impacts to reduced populations.

Research on the timing of quail harvest determined that harvesting birds during January and February added to natural mortality, and subsequently lowered breeding numbers. Williams et al. (2004) determined in order to reduce hunting specific additive mortality harvest should occur in early winter with a minimal season length. Harvest studies showed increased mortality due to reduction of a population during periods of high natural mortality caused by predation, cold, disease, and limited food and cover. Roseberry (1979) indicated a higher potential for additive mortality for January hunts due to increased pressure caused by diminished cover and those birds not killed, but flushed would suffer energy losses and an increased potential for higher mortality. Burger et al. revealed hen mortality was highest during January. Liberal harvest seasons have the potential to reduce population densities and effectively reduce quail abundance over time.

Reduction of additive mortality to Fort Campbell populations is as important as habitat restoration efforts to support higher quail densities. The Fort Campbell season is not fixed but, rather based on seasonal quail population densities by management unit. Each unit is management to support an annual harvest limit of 40% of the total population density calculated from field data collection during the spring and fall call counts. Areas reaching the quota threshold are closed for the season. Areas not reaching the quota are closed by January 15th or the 2nd Sunday on the month. The policy provides for recreational use while ensuring population stability for the spring breeding season.

3.4.8 Literature Cited

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APPENDIX A
5-year Action Plan

APPENDIX B
Management Unit Action Plans

Training Area

Habitat Conditions (Figure with HSI values for all fields)

Current & Desired Future Conditions

Population Status (Table outlining population goals per year)

Current & Desired Densities (define as population goals)

Management Actions (Table showing implementation of projects; description of each action) – desired future conditions

Monitoring and Measuring Methods

Measures

1: Population response to habitat management will be monitored on selected sub-sample tracts using the fall covey count technique and other techniques as appropriate.

2: Effects of landscape-level changes will be monitored using the Breeding Bird Survey data and spring call count survey data in comparison to Kentucky and Tennessee Wildlife Agency's data.

3: Management-oriented research projects will address bobwhite population dynamics and habitat enhancement techniques.

APPENDIX C
Call Count Survey Protocols

Spring Call Counts

Participants will record the number of individual cocks heard calling during the early morning as a means to assess 1) relative abundance, and 2) spatial distribution of bobwhites. All counts will be repeated at least three times during May through June.

Materials

Watch, clipboard, data sheets, compass

Procedure

1. Counts should be conducted during the months of May and June. Counts should begin at official sunrise and proceed until all stations are counted (about 1.5 hours).

2. Counts should be conducted a minimum of 3 times during the sample period. Alternate starting/ending points between successive counts (i.e if you started at sample point 1 for count one, start at the last end count).

3. Conduct call count at least 25 yards away from roads to minimize background noises. Note your start time and time continuously for a total of 5 minutes.

4. Count, and note the approximate location of all individual calling males on the Call Count Plot diagram heard within the 5-minute span. Use a separate data sheet for each station.

5. When a station is completed, proceed directly to the next consecutive station and repeat until all stations have been monitored.

6. Weather variables can affect calling rates, and also the observer's ability to hear calls. Counts should not be conducted if 1) its raining, and 2) when winds exceed 10 mph.

7. Submit data sheets to the Wildlife Program Manager at the completion of each day.

Fall Call Counts

Participants will record the number of coveys heard calling during the early morning as a means to assess 1) relative abundance, and 2) spatial distribution of bobwhites. Covey flush counts will be completed following call counts to assess covey size. All counts will be repeated at least four times from October through November.

Materials

Watch, clipboard, data sheets, compass

Procedure

1. The covey call only lasts for 20 to 30 seconds per covey so all participants must be at the listening station at least 30 minutes prior to official sunrise.

2. Record each covey call using the covey call data sheet. Count only the separate coveys heard not the individual calls.

3. Make note of the heading and approximate distance of the covey from your assigned station.

4. Submit data sheets to the Wildlife Manager at the completion of each morning count.

5. Wildlife Manager will utilize adjusted covey estimate formula to more accurately reflect the number of coveys occurring within in call station area. If only one covey is heard, divide 1 by 0.53; for 2 coveys, divide by 0.85, for 3-4 coveys, divide by 0.87; and if 5 or more coveys are heard, divide by 0.94.

6. Wildlife Manager will utilize count data to determine the number of afternoon flush counts to determine average covey size.

7. Flush counts consist of flushing 10% of the recorded covey call locations to determine actual covey size.

8. Covey size data is then utilized to develop a management unit season harvest quota and provide a baseline of the success or failures of management actions.

Covey Call Count Data Sheet

Site: _____ Observers: _____ Date: _____

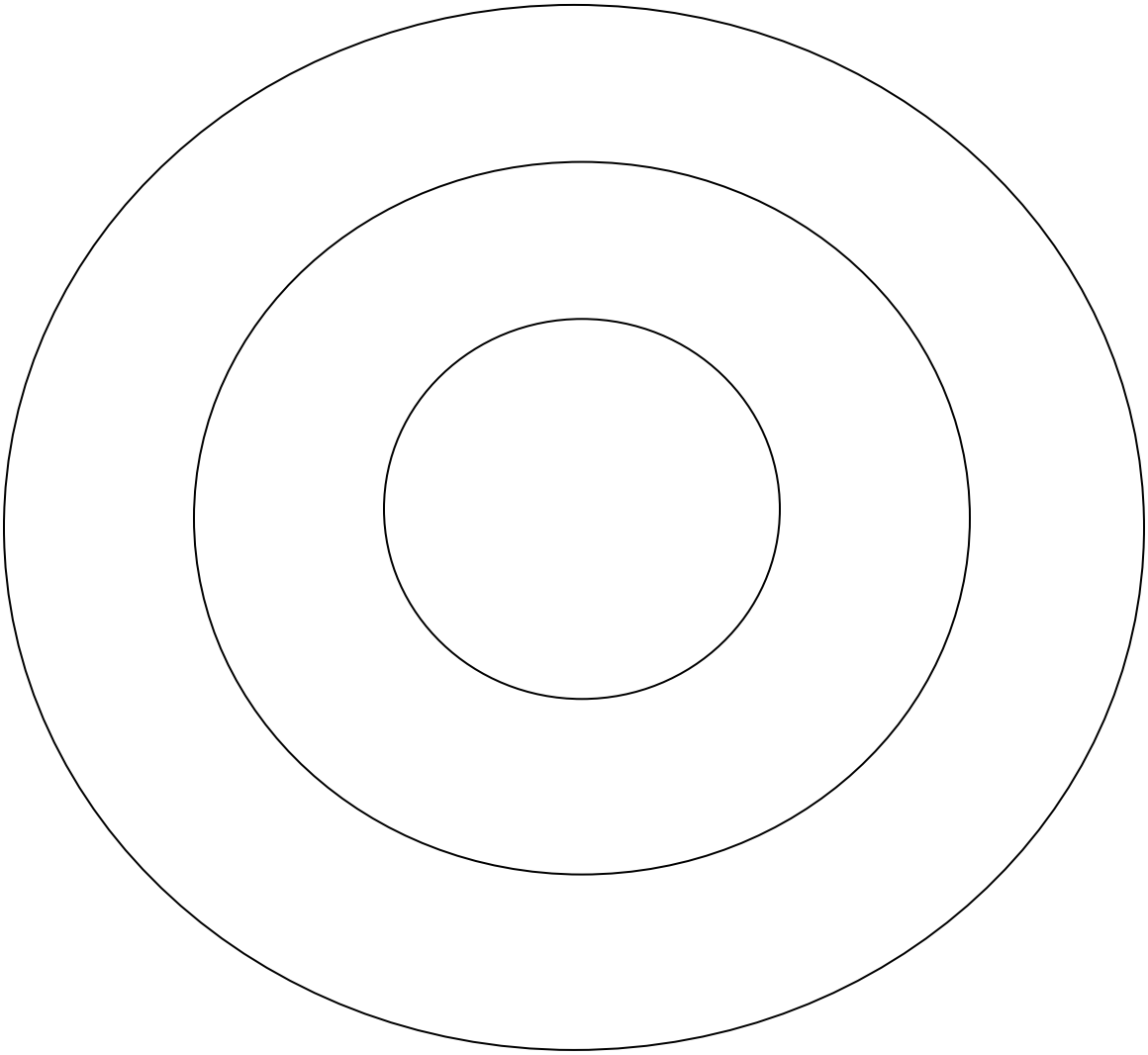
Weather Conditions[1]: _____ Cloud Cover[2]: _____ Official Sunrise: _____

Covey No.	Heading	Distance	Comments[3]

[1] Windspeed: 0=calm; 1=less than 5 mph; 2=5 to 10mph; 3=over 10 mph
[2] Cloud Cover: 0=clear; 1=scattered clouds; 2=mostly cloudy; 3=total clouds
[3] List time when coveys begin calling

Call Count Plot Diagram

Site: _____ Observers: _____ Date: _____



Each ring represents 200 yards. Place an “x” at the approximate location of the bird. Tally the total number of calls heard.

3.5 Waterfowl

3.5.1 Introduction

North American waterfowl are admired by conservationists, hunters and bird-watchers alike. Populations have see-sawed over the years, prompting management strategies from species level to habitat levels. Most populations have varied with habitat loss and degradation, whether it is breeding habitat, wintering habitat, or in the migration corridors that connect them.

3.5.1.1 Migratory Bird Treaty Act

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) as amended by: Chapter 634; June 20, 1936; 49 Stat. 1556; P.L. 86-732; September 8, 1960; 74 Stat. 866; P.L. 90-578; October 17, 1968; 82 Stat. 1118; P.L. 91-135; December 5, 1969; 83 Stat. 282; P.L. 93-300; June 1, 1974; 88 Stat. 190; P.L. 95-616; November 8, 1978; 92 Stat. 3111; P.L. 99-645; November 10, 1986; 100 Stat. 3590 and P.L. 105-312; October 30, 1998; 112 Stat. 2956. The Act provides for "the establishment of a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." (16 U.S.C. 703). Migratory waterfowl are included in the list of species protected by the MBTA.

3.5.1.2 North American Waterfowl Management Plan

The North American Waterfowl Management Plan (NAWMP) was developed by Canada and the United States in 1986, and was later joined by Mexico in 1994. The Plan was fueled by plummeting waterfowl populations around 1985. Its purpose is "to recover waterfowl populations by restoring and managing wetland ecosystems, to conserve biological diversity in the western hemisphere, to integrate wildlife conservation with sustainable economic development, and to promote partnerships of public and private agencies, organizations and individuals for conservation". The Plan was updated in 1994, 1998 and 2004.

The DoD was a signatory member of the NAWMP Cooperative agreement with the United States Fish and Wildlife Service (USFWS), and therefore agreed to aid in the research and restoration of declining waterfowl populations and their habitats. Fort Campbell Military Reservation (Figure 1) is among the installations given this duty.

3.5.1.3 Fort Campbell Waterfowl Management Plan

Fort Campbell is located in the Mississippi Flyway (Figure 2). Historical winter waterfowl surveys and biologist accounts have recorded 21 species of ducks and geese utilizing Fort Campbell land at some point during their migration (Table 1). Wood ducks (*Aix sponsa*) and Canada geese (*Branta canadensis maximus*) utilize Fort Campbell year-round.

The Fort Campbell Fisheries and Wildlife Program was tasked to construct a management strategy for waterfowl utilizing Fort Campbell. Little more has been done to manage waterfowl populations on Fort

Campbell than the implementation of winter waterfowl surveys and the erection of wood duck boxes throughout the installation.

The purpose of the Fort Campbell Waterfowl Management Plan is to outline projects and recommendations to support the international effort of the NAWMP. Per the Fort Campbell Integrated Natural Resources Management Plan (Tetra Tech 1995) Fort Campbell initiated a more intensive waterfowl management effort. Besides wood ducks, management efforts for waterfowl on the installation will be concentrated on winter migrants, and more specifically on habitat.

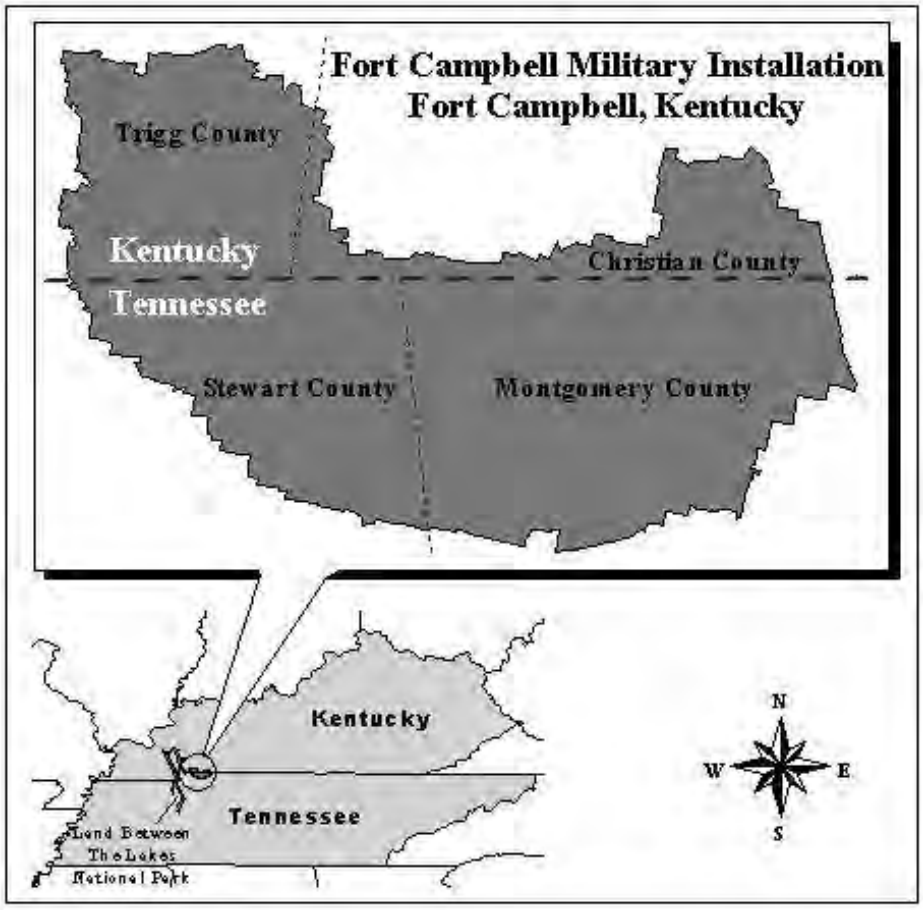


Figure 1. Fort Campbell Military Reservation.

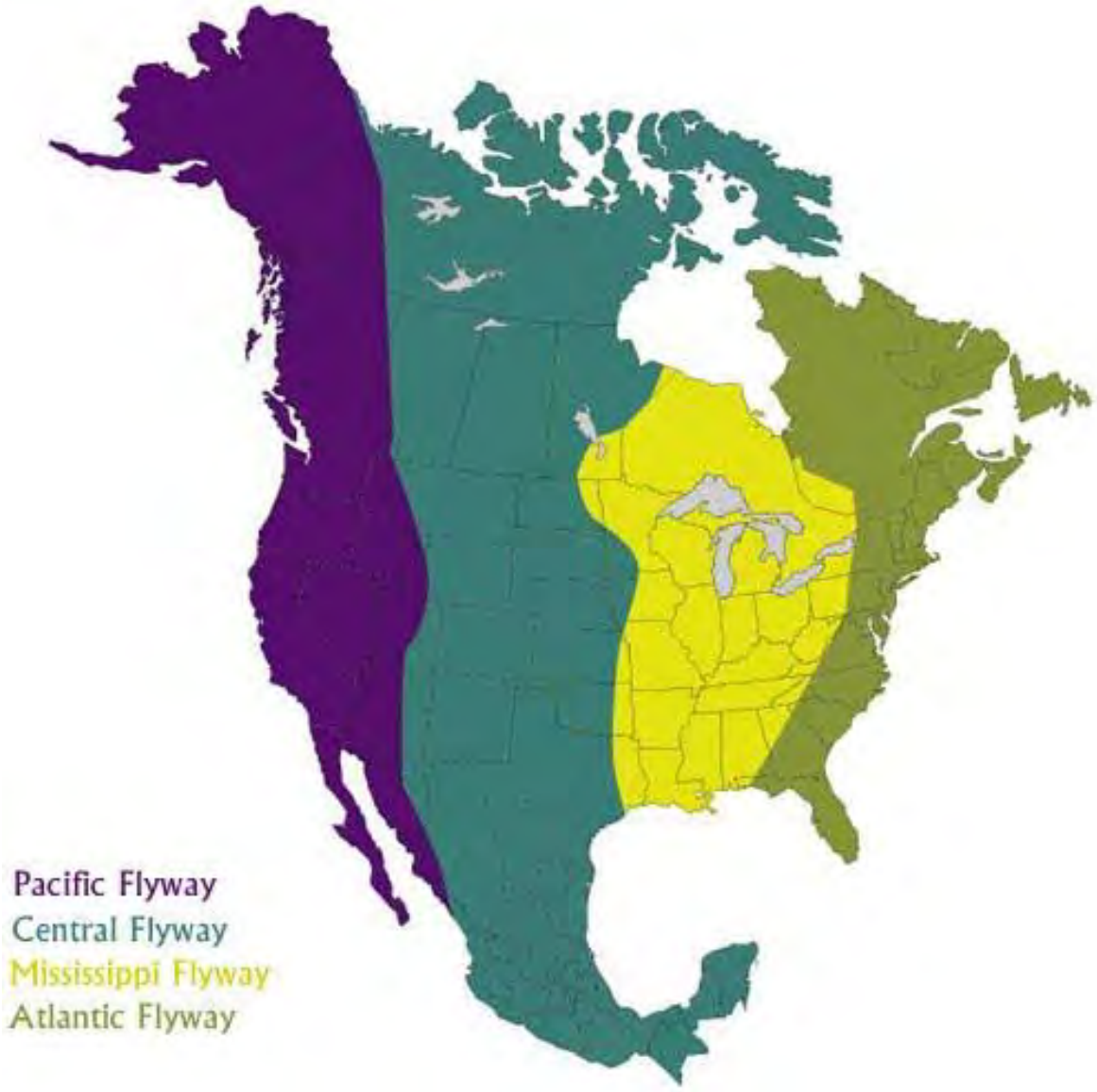


Figure 2. North American Migration Flyways.

3.5.2 Species Information

3.5.2.1 Dabbling Ducks

Dabbling ducks are those that feed primarily in shallow water or on land. Dabbling ducks "tip up" to feed, and typically eat aquatic plants, seeds, invertebrates, grass, small aquatic animals, and often crops.

Ten species of dabbling ducks have been recorded utilizing Fort Campbell during migration (Table 1).

3.5.2.2 Diving Ducks

Diving ducks often feed by diving. They typically eat plants and small aquatic animals; species that breed, winter, or migrate through coastal areas also eat mollusks and crustaceans.

Five species of diving ducks have been recorded on Fort Campbell (Table 1).

3.5.2.3 Other Ducks

Species of waterfowl recorded on Fort Campbell, but not classified as dabblers or divers include the Ruddy duck (*Oxyura jamaicensis*), Common merganser (*Mergus merganser*), Hooded merganser (*Lophodytes cucullatus*), and Red-breasted merganser (*Mergus serrator*).

3.5.2.4 Geese and Swans

Resident and migratory flocks of Canada geese are a common site on Fort Campbell lakes, as well as a few flocks of migrating snow geese (*Chen caerulescens*).

3.5.3 Conservation Goals

It is the intent of the Fort Campbell Fisheries and Wildlife Program to adhere to the goals set forth in the NAWMP, to conserve and protect local habitats conducive to migration stop-over points for waterfowl, and to manage for those species of waterfowl that utilize the reservation year-round.

3.5.4 Management Actions

3.5.4.1 Habitat Management

Fort Campbell Military Reservation is composed of 104,267 acres of land. Of this, 46,436 acres is forest, 19,262 acres is open-field habitat, 2,612 acres is wetland habitat, and 110 acres is open water. Some of the habitat is conducive to winter and resident waterfowl utilization as is, and some remaining habitat could be manipulated by the Fort Campbell Fisheries and Wildlife Program to be more conducive to waterfowl usage.

3.5.4.2 Winter Waterfowl Counts

Fort Campbell biologists currently conduct winter weekly waterfowl counts at predetermined sites on the reservation (Figure 3). These counts are designed to monitor trends in waterfowl usage within installation boundaries. Winter counts will continue in order to monitor usage trends on the reservation. Counts will be entered annually into an Arc View GIS layer.

Table 1. Waterfowl species recorded on Fort Campbell Military Reservation.

COMMON NAME	SCIENTIFIC NAME
Dabbling Ducks	
Bufflehead	*Bucephala albeola*
Duck, American Black	*Anas rubripes*
Duck, Wood	*Aix sponsa*
Gadwall	*Anas strepera*
Mallard	*Anas platyrhynchos*
Pintail, Northern	*Anas acuta*
Shoveler, Northern	*Anas clypeata*
Teal, Blue-winged	*Anas discors*
Teal, Green-winged	*Anas crecca*
Wigeon, American	*Anas americana*
Diving Ducks	
Canvasback	*Aythya valisineria*
Duck, Ring-necked	*Aythya collaris*
Goldeneye, Common	*Bucephala clangula*
Redhead	*Aythya americana*
Scaup, Lesser	*Aythya affinis*
Other Ducks	
Duck, Ruddy	*Oxyura jamaicensis*
Merganser, Common	*Mergus merganser*
Merganser, Hooded	*Lophodytes cucullatus*
Merganser, Red-breasted	*Mergus serrator*
Geese and Swans	
Goose, Canada	*Branta canadensis*
Goose, Snow	*Chen caerulescens*

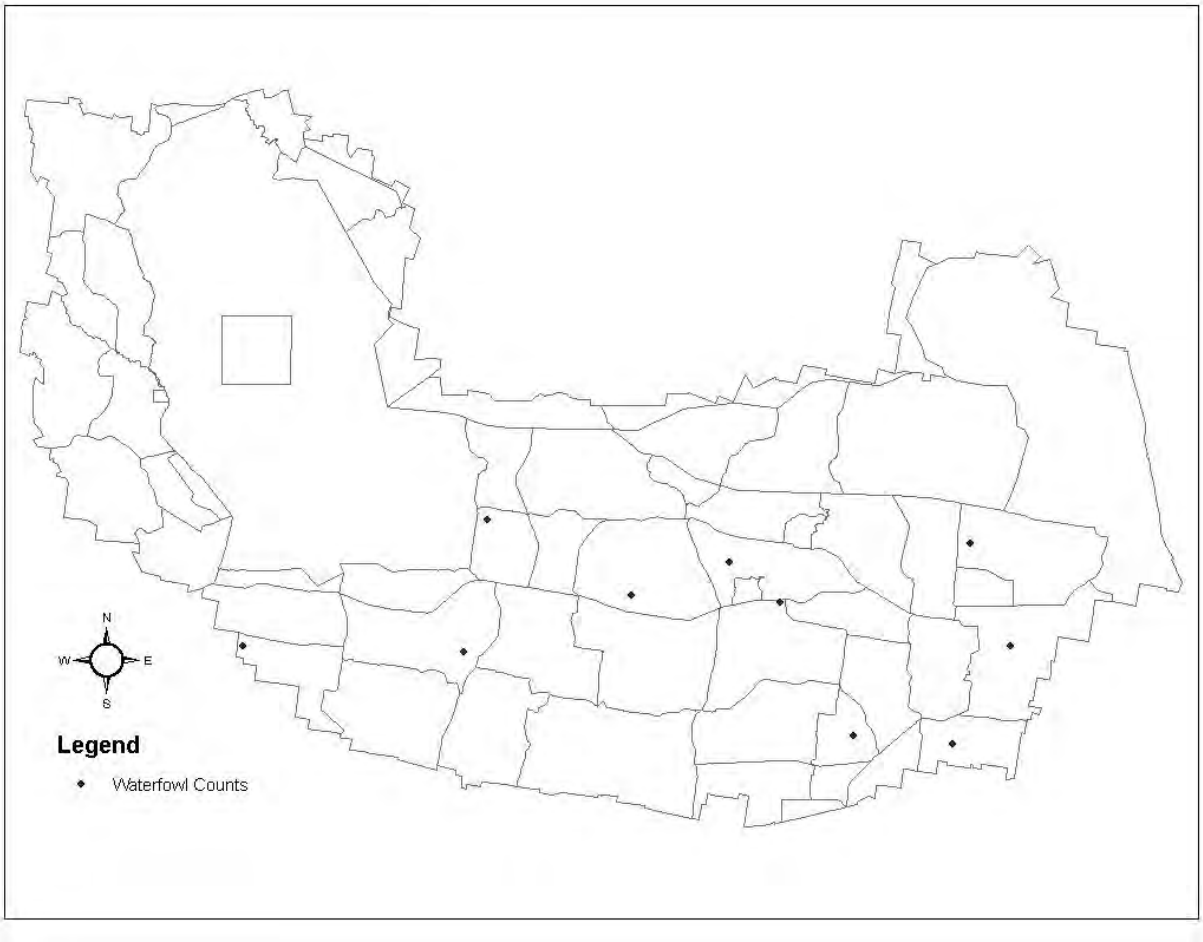


Figure 3. Fort Campbell winter waterfowl survey points.

3.5.4.3 Moist Soil Management Units

Waterfowl will readily feed on crops, and although many crops are not an adequate source of fat and energy, they often offer a food source to migrating and wintering waterfowl. The Fisheries and Wildlife Program with work with other installation programs (Wetland Manager, Ag Outlease, ITAM, etc.) to set aside areas to be managed as moist soil units. Water levels and food crops will be determined by the Fisheries and Wildlife Program on an annual basis. Units will be updated annually in an Arc View GIS layer.

3.5.4.4 Wood Ducks

Wood ducks remain on Fort Campbell throughout the year, indicating that the reservation encompasses or is within proximity to adequate breeding, nesting, wintering, and feeding habitat.

3.5.4.4.1 Nest Boxes. Wood ducks readily use Fort Campbell wetlands, lakes and streams throughout the year. A few boxes were installed in the 1990's, but were dilapidated. Several more boxes were installed in 2004 as a result of a graduate research project. These boxes are maintained and monitored by installation

biologists, and added to, removed or moved as deemed necessary by the biologists. Locations and usage will be updated annually in an Arc View GIS layer.

3.5.4.4.2 Mast surveys. As wood ducks feed primarily on acorns in the summer, mast surveys will be conducted as time and personnel permit.

3.5.4.4.3 Banding. Fort Campbell will set up a wood duck banding program, in cooperation with Tennessee and Kentucky state agencies and the U.S. Fish and Wildlife Service.

3.5.5 Canada Geese

Canada geese are observed throughout much of the year on Fort Campbell, and are known to nest near Lake Kyle. Few other management activities will be employed to manage this species on the reservation as they will likely benefit from construction of moist soil management units, existing habitat conservation. Population surveys will also monitor usage trends.

3.5.6 Waterfowl Management in Light of Military Training

The primary goal of Fort Campbell Military Reservation is to support readiness training of military troops. No management actions prescribed in this management plan will adversely affect or hinder military training.

3.5.7 Literature Cited

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Migratory Bird Treaty Act (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) as amended by: Chapter 634; June 20, 1936; 49 Stat. 1556; P.L. 86-732; September 8, 1960; 74 Stat. 866; P.L. 90-578; October 17, 1968; 82 Stat. 1118; P.L. 91-135; December 5, 1969; 83 Stat. 282; P.L. 93-300; June 1, 1974; 88 Stat. 190; P.L. 95-616; November 8, 1978; 92 Stat. 3111; P.L. 99-645; November 10, 1986; 100 Stat. 3590 and P.L. 105-312; October 30, 1998; 112 Stat. 2956.

50 CFR Part 21, Migratory Bird Permits; Take of Migratory Birds by Department of Defense

3.6 White-tailed Deer

3.6.1 Introduction

Ft. Campbell is home to the White-tailed Deer (*Odocoileus virginianus*). The whitetail is a very adaptable species. With the removal of natural predators, they have the potential to multiply almost exponentially. Urban deer create special management problems. Urban deer can soon outstrip the available food supplies in the small niches they inhabit. Deer that are constantly around humans soon learn that they have little to fear. As food supplies diminish or the populations grow, deer move into fringe habitats. The demand for food causes deer to search for food in close proximity to urbanized areas. In urban environments, searching deer invariably cross roads. Deer running across roads or bolting from car headlights often collide with vehicles. Car-deer collisions pose serious safety problems. Deaths have resulted. Injuries occur from direct impacts, or by swerving to miss deer and losing control of the vehicle. Vehicles colliding with deer cause thousands of dollars of damage each year, just on Ft. Campbell where

there are in excess of 60 car-deer collisions each year. Deer also promote a variety of diseases by being host to ticks, fleas and other parasites. Populations of parasites can become quite high in proximity to humans. Deaths and chronic illness occur in housing areas and adjacent areas due to tick borne diseases. Promoting and allowing high deer densities in close proximity to humans is unacceptable.

Ft. Campbell cannot be complacent. The recent impact of an experimental aircraft at Campbell Army Airfield resulted in the over 1 million dollars of damage to that one aircraft. Deer on the installation west of Range Road receive hunting pressure. This herd is in good shape and provides many thousands of recreational hours for soldiers. Within the cantonment area, however, over population jeopardizes the entire population on the installation. Hemorrhagic fever, a disease of stressed deer, occurred on Fort Campbell in 2008 with the resulting loss of hundreds of deer. These deer die in conjunction with water sources and could contaminate drinking water and other areas. Also, over population could reduce the population by 90% over the entire installation and large areas of the surrounding counties when disease occurs. This infectious disease is extremely lethal to deer. Ft. Campbell does not want to be the source of this disease to the surrounding areas.

Recent additions of more units required the infrastructure to expand. The Woodlands Housing area and the 2nd BCT construction area were placed in prime deer habitat. These animals have been displaced and will eventually return to these areas with the resulting impacts.

3.6.2 Current Status

Ft. Campbell has a deer problem. Deer have silently become a nuisance within the cantonment area. Hunting keeps the population manageable in the rear areas, but not within the cantonment area. No single method of deer control will work. Integrated Pest Management guidelines identify how management will take place. Combinations of techniques will work to control deer in any given area. Areas needing attention are identified in this document. As determined by biological site survey techniques, certain areas have excessive deer numbers. The populations have reached a point where long-term damage to the habitat, and an increased risk of the spread of parasite borne diseases could occur. Starvation and disease could result from this damage. To have a healthy herd, population reduction in several areas must occur soon.

3.6.3 Control Levels

Deer have the potential to increase drastically without control measures. Urban environments provide perfect habitat for deer numbers to exceed the carrying capacity of area. Numerous car-deer collisions (deer searching for food), destruction of ornamentals and shrubbery, and poor condition of animals indicate high deer numbers. Setting guidelines for urban environments is difficult. The following deer population levels determine when to initiate action to control deer numbers in the cantonment area. Certain areas are excluded by how crucial they are. (i.e.airfields)

Level 1. Populations under 5 deer per square mile require no action other than monitoring.

Level 2. Population levels between 5 and 10 deer/square mile: Sport Hunting should be initiated. Exclusion measures like fencing are installed to prevent deer from becoming nuisances. Habitat manipulation should occur to promote deer remaining in certain areas and preclude them from using others.

Level 3. Population levels between 10 and 15 deer/square mile: Sport Hunting should be used with an increased emphasis on the harvest of does. Construct fences to exclude or eliminate nuisance deer whenever possible. Certain areas may require baiting and expert removal to reduce high concentrations of deer.

Level 4. Population levels higher than 15 deer per square mile: Employ Sport Hunting with total emphasis on removal of does. Construct fences to eliminate nuisance deer problems. Bait high concentrations of deer and remove quickly to keep deer within the carrying capacity of that area.

Ft Campbell Conservation staff will survey the deer during August, and as needed in highly sensitive areas, to determine population levels. High concentrations monitoring shall occur on an as needed basis to determine control efficacy. Conservation staff shall brief the Installation Pest Management Coordinator on deer numbers, areas requiring control and harvest goals.

3.6.4 Control Plan

During August, spotlight counts throughout the cantonment area will determine population levels. Selected routes throughout the installation focuses on the highest concentrations of deer. Cantonment area has the least to no population of deer. After biological evaluation, population density determinations will highlight areas that will be controlled.

The control measures strive to keep deer under control or to eradicate them. Acceptable levels are: Zero tolerance for the airfields, Zero to five deer/square mile in populated areas (housing) and five to ten deer /square mile in areas such as AB-9, Railroad Yard, etc. Control actions listed in the previous section dictate how the deer management takes place.

3.6.5 Control Methods

3.6.5.1 No Action. The results of doing nothing could have far reaching effects. Car-deer collisions will continue and most likely increase. High populations of deer may pose serious health and safety risks to people. Also, when populations become stressed, disease may become a factor. Ft. Campbell may experience a major deer die off. A disease such as blue tongue may start in the cantonment area, but will not stop at Range Road. This method may be acceptable in areas with low deer numbers, but must be evaluated on a case by case basis.

3.6.5.2 Fencing. This method can be very effective, but has a high price tag. In areas where deer are not posing health and safety issues, this is probably the preferred method. Long-term fencing may be the most cost-effective control of deer. Key to fencing is maintenance of fences after installation.

3.6.5.3 Sport Hunting. This method is the preferred means of controlling deer. It incurs little or no cost to the government, and enhances the image of the installation with the surrounding community by providing increased outdoor recreational activities. The hunters use all the animals. A drawback is getting hunters to harvest the does helps decrease the population of the deer, instead of trophy hunting. Management schemes and incentives can promote the harvest of does. Allowing bonus does for hunters who harvest deer inside the cantonment area is one way of increasing the take of female deer. Another challenge of hunting close to populated areas is the method of deer removal. Bowhunting usually the preferred method. The possibility of a wounded deer lying in the housing area can raise the ire of some members of the

community. Education of the Ft. Community is key to implementing limited hunting within the containment area.

3.6.5.4 Trapping. Trapping can reduce deer to manageable numbers in certain areas. Trapping is limited in application due to the resource requirements for trapping. This method becomes very expensive. The cost of materials needed to successfully reduce deer numbers can be quite high. A favorable feature of trapping is the public relations benefit of relocating deer to the rear area.

3.6.5.5 Professional Removal. This method can be expensive in work hours. This method lends itself to extremely sensitive areas. Behind the Commanding General's quarters is a good place to employ this method. It usually is unobtrusive and highly effective in rapidly reducing deer numbers to acceptable levels. The added benefit of having USDA, Animal Damage Control work with Ft. Campbell personnel is they have the specialized equipment needed to work in urban areas. Also, these people have years of experience with this type of work.

3.6.6 Special Control Areas

3.6.6.1 Airfields. Deer and aircraft are a potentially deadly combination. There can be zero tolerance for deer living on the airfield. The possibility of deer causing a plane crash is great. The possibility of loss of life can be tremendous with troop transport planes. A comprehensive approach of fencing, hunting and removal has reduced the number of deer inside the airfield to zero. One buck still remains within the secondary fence. Control measures initiated were: First, all fencing was repaired to stop relocation of deer from the surrounding areas. Cover is being removed from the perimeter to promote deer staying farther back from the fences. Hunting was maximized in areas that could be hunted. Also, hunters may take bonus deer within the airfield areas. During Christmas holidays, 120 deer were removed from close proximity to the airfield. The final phase of the plan includes hunting the Small Arms ranges on the north side of the Small Arms Impact Area to stop relocation of deer. The airfield is now in a maintenance mode. When deer are seen on the airfield, Ft. Campbell staff can remove them before they are a problem. All deer taken from the airfield were given to needy families after biological data was collected.

3.6.6.2 Golf Course/Recreational Areas. Deer in the Cole Park Golf Course area are creating a problem. Deer are being very destructive to the golf course itself and this area has a very high rate of deer/car accidents. The proximity to Gardner Hills presents some challenges. Deer should be removed from this area to reduce the deer/car accidents, decrease damage to the golf course, and lower the populations of disease carrying ticks in the area. Other park areas are of concern, but do not have the numbers of deer present.

3.6.6.2.1 Options for management:

1. Construct a high fence along creek to inhibit deer from crossing creek.

2. Bait and trap deer on north side of creek.

3. Professionally remove deer.

3.6.6.3 Housing Areas. Deer within housing areas create special management problems. Public visibility along with the presence of large numbers of people precludes the use of hunting within these areas. Exclusion of deer from large areas becomes cost prohibitive. The large areas involved quickly rule out fencing as a means of keeping out deer. Professional removal usually presents the best alternative. Through controlled removal population reduction occurs.

3.6.6.3.1 Options for Management:

1. Construct Fencing

2. Baiting and Trapping

3. Professional Removal

3.6.6.4 Range Areas/Small Arms Impact Area. The Small Arms area can safely support the deer within it. The Small ranges are a source of deer to the cantonment area. Without comprehensive control, deer will migrate from range areas back into areas with reduced populations. A deterrent must be introduced to keep deer within the range/small arms areas. A critical area for management is the north side of Small Arms Impact Area. Deer move from this area back into the airfield area.

3.6.6.4.1 Options for management

1. Introduce some form of hunting into improved ranges. A plan already has approval from G3, Command Safety Office, DPCA, and SJA and can be implemented this hunting season.

2. Professional removal if hunting cannot remove deer.

3. Bait and trap within Small Arms Impact Area.

3.6.6.5 Commanding General's Quarters. The small 12 acre tract behind the commanding general's quarters must be addressed. Normal populations allow 10+/- deer per square mile. This area now has 40+ deer within 12 acres. Browse in this area has been destroyed. Honeysuckle has been eaten up to 5 feet above the ground. Deer are even eating cedars, a non-preferred deer food, within this area. Removal must occur to prevent a disease outbreak. Due to the sensitive nature and the visibility of this area, professional removal is advised.

3.6.6.5.1 Options for management

1. Bait deer into safety zones. Remove deer using specialized equipment.

3.6.6.6 Son DZ. Son DZ and the surrounding areas are havens for deer. They use these areas for bedding areas and then feed on the DZ and around the airfield. Like small arms this area must be controlled to stop relocation of these areas that cannot tolerate deer. These will always have deer. The goal is to keep populations in check, not to eliminate them.

3.6.6.6.1 Options for management

1. Hunt all areas that can be hunted.

3.7 Mourning Dove

3.7.1 Introduction

The mourning dove is one of the most abundant and widely distributed game birds in North America. The breeding range of the mourning dove extends from southern Canada, throughout the United States and into Mexico. Doves may winter throughout most of their breeding range, but many migrate south to winter in the southern U.S., Mexico, and Central America to western Panama (Basket, et al., 1993; Mirarchi and Baskett, 1994; U.S. Department of Agriculture, 2006).

Mourning doves are medium-sized birds in the pigeon family. They have a stream-lined appearance, with a relatively small head and a long, pointed tail. They are overall grayish blue to grayish brown on their backs with black spots on their wings and behind their eyes. There are white tips on the tail. They have a small, black bill and red legs and feet. Males are larger than females and are slightly brighter in color, males have a bluish crown and a rosy breast. (Basket, et al., 1993; Mirarchi and Baskett, 1994; U.S. Department of Agriculture, 2006)

3.7.2 Natural History

3.7.2.1 Habitat Requirements

Mourning doves are highly adaptable and use a variety of habitats including coniferous forests, deciduous forests, and residential, urban, and agricultural landscapes. They are more common in open woodlands and forest edges near grasslands and fields. They are most abundant in agricultural and suburban areas where humans have created large areas of suitable habitat. (Basket, et al., 1993; Mirarchi and Baskett, 1994; U.S. Department of Agriculture, 2006). Habitat needs include trees for nesting and roosting, a food source, and a source of water.

3.7.2.1.1 Nesting Cover

Mourning doves are best adapted to and most closely associated with agricultural habitats, but will nest in many different habitat types. They typically nest along the edges of fields, pastures, or clearings; nests are seldom found in densely wooded areas. Nests are built in both coniferous and deciduous trees, shrubs, and vines. Tree nesting is most common, but they will nest on building ledges, chimneys, and the ground in the absence of trees or shrubs. Nesting habitat is not usually a limiting factor for mourning doves. However, it is important to have an interspersion of vegetation types for nest site selection.

Mourning doves are notoriously poor nest constructers. Nests are often no more than a platform of small twigs, grasses, pine needles, or similar materials found around nest sites. They will frequently use previously constructed nests (of mourning doves, other birds, or squirrels).

3.7.2.1.2 Roosting Cover

Like nesting cover, roosting cover is provided by various habitat types. These include coniferous and deciduous trees, brushy thickets, dead snags, and power-line right-of-ways. Hedgerows and shelterbelts also provide excellent roosting sites for mourning doves. Mourning doves will often sit in roosting sites before flying down into a field to feed.

3.7.2.1.3 Water

Mourning doves require fresh surface water for drinking on a regular basis. Puddles, ponds, and stream edges are suitable water sources. Doves will alight on unvegetated or lightly vegetated spots where visibility is good and where predators cannot easily hide, and where they can walk easily to the water's edge. Sandbars, gravel bars, and mud flats provide such drinking sites.

3.7.2.2 Reproduction

In the Fort Campbell area, the mourning dove reproductive cycle begins with egg laying in late April/early May, and continues until fledging ends in early September. Doves build scant nests of twigs and grass within trees or shrubs 10 to 30 feet above ground. In wooded areas, elms and maples are preferred. In open areas, coniferous shelterbelts and windbreaks are preferred.

Mourning doves are monogamous, some pairs stay together through the winter. Males perform a number of displays, along with a courtship "coo", on a display perch. They will drive other males away from their display perch but do not otherwise establish a territory until after mating. Females land near the male on his display perch, causing the male to begin an elaborate series of courtship maneuvers. If a pair bond is formed, the male and female remain together for a few days before starting to build a nest. After finding a mate, males begin selecting a nest site. Nest construction takes over ten hours and covers a span of three to four days. (Basket, et al., 1993; Mirarchi and Baskett, 1994; U.S. Department of Agriculture, 2006)

Mourning doves lay two white eggs per clutch and raise between two and five clutches per year. Both parents take part in incubation and brood-rearing activities. Young mourning doves are fed regurgitated food by both parents. For the first 3 to 4 days after hatching the young are fed only crop milk, an energy rich substance that is produced in the crops of both male and female parents. After that time, parents begin to add more seeds to the regurgitated food until they are fed only regurgitated seeds by the time the young leave the nest. Female mourning doves feed the young most during the first 15 days after hatching but after that males take over the responsibility for feeding the young. Young doves, or squabs, hatch featherless and grow rapidly, increasing their weight by 14 times within 15 days of age. Young can survive on their own 5 to 9 days after leaving the nest and most leave the nest area within 2 to 3 weeks of fledging.

3.7.2.3 Life Span

The natural mortality rate for mourning doves is high; approximately 6 out of 10 birds do not survive from one year to the next. Mourning dove mortality is caused by a variety of factors including nesting failure, predators, disease, accidents, hunting, and weather extremes.

3.7.2.4 Food Habits

Ninety-nine percent of the mourning dove diet is comprised of weed seeds and grains. Preferred weed seeds include pigweed, foxtails, wild sunflower, and ragweed. Preferred grains include corn, sorghum, and millet. Insects make up a very small proportion of the dove diet. Doves travel an average of two to eight miles for food.

3.7.2.5 Migration Patterns

Doves that breed in Tennessee migrate to wintering grounds in Louisiana and Mississippi or to wintering grounds in Alabama, Georgia, and Florida. During migration these birds may fly over 1000 miles to reach their winter resting spot.

3.7.3 Mourning Dove Management

Maintenance of mourning doves in a healthy, productive state is a primary management goal. To this end, management of mourning doves includes assessment of population status, regulation of harvest, and habitat management.

3.7.3.1 Population Management

Annual population counts are completed in late summer prior to the scheduled dove season. Counts are included within the annual migratory bird census that occurs at selected points throughout the training areas. No nest censuses are completed on Fort Campbell.

3.7.3.2 Harvest Management

Harvest seasons and bag limits are regulated by the USFWS and States. Fort Campbell strictly adheres to the seasons and bag limits imposed by the USFWS. However, should population counts indicate the population size is too small to support a viable hunting season, seasonal limits may be imposed by the Fort Campbell wildlife Program to reduce population impacts to a sustainable level.

3.7.3.3 Habitat Management

Feeding fields (dove fields) are created to attract mourning doves, primarily for hunting purposes. Fields that are most used by mourning doves are characterized by an abundance of small seeds scattered on the surface of relatively bare ground with little horizontal cover. Seeds that will attract mourning doves include wheat, millet, sunflowers, corn or grain sorghum, peanuts, buckwheat, barley, and annual rye. Fields vary in shape and location and area normally 2-5 acres in size. Dove fields are rotated during the hunting season to ensure doves remain at the site.

Fields with natural vegetation (those not used for agricultural purposes) are managed for multi-species purposes. Soil disturbance, such as light discing, mowing, or burning, prior to or early in the growing season is completed to stimulate seed-producing annuals and produce early successional habitat.

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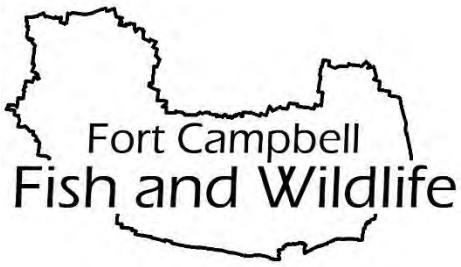
Summary of FY18
Northern bobwhite Management Plan



Proposed changes and reiterations of Northern bobwhite (*Colinus virginianus*) habitat and population management on Fort Campbell Military Reservation in FY18 that hold potential to improve bobwhite populations and facilitate military training.

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Introduction

Bobwhites have been on a range-wide decline for the past several decades. Researchers contribute most of this decline to land-use changes and loss of appropriate habitat. Bobwhites have been an important game species both economically and socially since European settlement (Rosene 1969). Decline in bobwhites has resulted in a decline in bobwhite hunters, in turn, causing a negative economic impact to many rural communities in the southeast United States (Burger et al. 1999). Like much of the southeast, bobwhites have been a highly pursued game species on FCMR, and hunting effort has plummeted in response to declining bobwhite densities on FCMR. Annually, bobwhite declines in Kentucky and Tennessee have been upwards of -2.2% and -4.2% annually from 1980-1995 (Burger et al. 1999). Rate of decline at FCMR is mostly unknown, but it is apparent to biologists and hunters that bobwhites have declined at an alarming rate. Today, FCMR is one of few options to hunt wild bobwhites in Kentucky and Tennessee. Other bobwhite hunting opportunity in Kentucky and Tennessee occurs on private lands, a handful of public hunting areas, and shooting preserves where pen-reared bobwhites are released. Even though decent wild bobwhite hunting can be found at FCMR, the decline in hunters and hunting effort (which generates funding) is drastic.

Beyond their social and economic importance, bobwhites are also indicators of a habitat type that too is in drastic decline across southeastern United States. During European settlement, FCMR was a portion of a 2-3 million acres grassland referred to as Big Barrens that extended from north-central Kentucky through parts of northwest Tennessee (Baskin and Baskin 1994). These grassland habitats are often referred to as early-successional habitat. Bobwhites need this habitat type for nesting, chick rearing, feeding, and evading both ground and aerial predators. Managing for early-successional habitat is not difficult, but does require manpower, continuous effort, and must be done correctly to produce positive results that will benefit bobwhites and countless other species of wildlife including, but not limited to, white-tailed deer (*Odocoileus virginianus*), eastern wild turkey (*Meleagris gallapavo*), and countless species of songbirds, small mammals, and reptiles and amphibians.

Declines in bobwhite density on FCMR are revealed through various long-term trends detected in call counts and hunter surveys. Range-wide declines are mostly due to lack of early-successional habitat management. Management actions such as prescribed fire, disking, herbicides, and others are used to promote early-successional habitat. One of the most limited of these management actions at a landscape level is prescribed fire. In many cases prescribed fire is viewed as dangerous and destructive, but contrary to some belief is beneficial to vegetation communities and countless species of wildlife. Prescribed fire on FCMR has lessened over the past decade (Figure 1). Fires to enhance wildlife habitat and military training are prominent at FCMR, and are probably one contributor to remaining bobwhite densities. Increase in prescribed fire would likely aid in increasing bobwhite density, but emphasis on correcting the prior three land practices is much more important. Therefore, it is important to begin working towards a future of better land stewardship that supports habitat management (for bobwhites and all other wildlife) and military training together.

Like range-wide declines, changes in land-use practices and lack of appropriate habitat management at FCMR have likely contributed to decline in bobwhites. Summer field clearing (mowing and mulching), lack of nonnative invasive species control, and

planting of nonnative cool-season grasses are likely three of the most detrimental land practices occurring at FCMR to bobwhites, early-successional habitat quality, and countless other species of wildlife.

Methods for Estimating Bobwhite Density

Two survey techniques commonly used for monitoring bobwhite populations are spring bobwhite call counts (recording number of singing males) and fall covey call counts (recording calling coveys prior to sunrise). These two surveys may not produce 100% accurate counts, but they tend to provide useful data for monitoring trends in populations and providing an approximation of population density which is important for managing habitat and hunting.

Spring bobwhite call counts are used to provide a breeding index for bobwhites, and number of calling male bobwhites per listening location can be monitored from year to year as an indication of breeding activity. Calling male bobwhites have been recorded during breeding bird surveys conducted May-June annually on FCMR since 1997. Data from these surveys suggests an overall upward trend, with slight variation from year to year (Figure 2). Additionally, spring bobwhite call counts were conducted in select locations within proposed QFAs resulting in an average number of calling male bobwhites of 2.4 per listening location (slightly higher than FCMR-wide averages) during June 2015. These surveys will be conducted again in June 2017 to monitor any changes in breeding activity following habitat management in 2016 and spring 2017.

Fall covey call counting is a popular population census method for bobwhites that provides general understanding of bobwhite density. Understanding bobwhite density may allow FCFW make appropriate management decisions to improve and monitor bobwhite populations on FCMR. Decisions may include, but are not limited to, hunting seasons and bag limits, habitat improvement needs, and responses to changing habitat caused by military training and needs.

Historical quail densities in ideal habitat conditions have reached 1.0 or more (birds per acre). Densities at this level were more prominent during the 1950s and 1960s. In recent years densities around 0.5 are viewed as targetable quail densities. Although fall covey counts were not conducted during times when densities were near 1.0 or more, it is likely that those densities did exist in the many open areas (agriculture, grasslands, and barrens) on FCMR. Available records indicate that fall covey counts were conducted during the early 2000s (2001, 2002, 2005, 2007, and 2008; see Table 1) on FCMR. There were 32 predetermined survey locations likely developed in 2001 and used for each year this survey was conducted. For 2001-2008, only some of these points were visited each year likely due to inclement weather and/or insufficient manpower.

From 17 October to 15 November 2016 FCFW biologists and technicians conducted covey call counts at 32 listening positions. Many of the survey locations used in 2001-2008 surveys were revisited in 2016, while some points were removed and/or added. From these 32 listening positions in 2016, 50 total quail coveys were detected within 25-45 minutes prior to official sunrise resulting in an average bobwhite density of 0.08 (Table 1). This estimate is based on approximately 200 acre coverage (within hearing distance of listening position) and each covey having an average of 10 birds. Covey

sizes can be greater prior to season (15 or more birds), but for purposes of these data a covey size of 10 was used. These data are more reflective of trends than true numbers of quail.

Implementation of Quail Focal Areas

In response to drastic declines in bobwhite densities, scientists, biologists, and land managers have contributed a great deal of research and benefit towards bobwhite recovery. Fort Campbell Fish and Wildlife (FCFW) biologists began in the late-1990s and early-2000s with closer population and hunting effort/success monitoring along with an increase in habitat management practices to promote early-successional habitat. Implementation of call surveys (both spring and fall call counts), mandatory hunter data reporting, and prescribed fire plans to benefit bobwhite habitat began around 2000. In more recent years, bobwhites have been identified as a species of concern by FCFW and additional steps towards producing more nesting and brood-rearing habitat began in 2013. During a planning phase from 2013-2014, FCFW identified target areas to be used as experimental areas for habitat management and population monitoring viewable to other land managers and FCMR visitors. These areas have been deemed “Quail Focal Areas” (QFA; see Figure 2). Habitat management in these areas will not only benefit bobwhites, but will benefit countless other species of wildlife and compliment military training activities. These smaller areas (5 areas ranging 40-440 acres in size) will be used as “model” areas for conduction land management practices to increase early-successional habitat, reduce woody encroachment (military benefit), and increase bobwhite production and benefit other wildlife species. Planned management practices in these QFAs, if adopted widespread at FCMR, hold potential to increase bobwhite densities while enhancing military training.

Habitat Surveys and Management

In 2015 FCFW technicians sampled 676 randomly generated points in 5 QFAs to estimate ground coverage of herbaceous plant species (forbs), graminoids (grasses, sedges, rushes), woody vegetation, bareground, thatch/debris (dead plant litter), rock/gravel, and permanent water. Coverage estimation data were analyzed using non-metric multidimensional scaling to provide a visual explanation of ground coverage (Figure 3). Majority of sampled points consist of greater percentages of woody vegetation and plant thatch/debris. For nesting and chick rearing purposes, bobwhites need more bareground, native bunch grasses, and forbs. Bareground allows mobility for small chicks and adult birds to evade predators, native bunch grasses provide ideal nesting structure, and forbs provide excellent chick rearing habitat and provide both food sources throughout the year.

Achieving early-successional habitat consisting of bareground, native grasses, and forbs can be done through various management actions. Prescribed fire, disking, use of herbicides, mowing, and mulching are all currently being used to promote open areas to facilitate military training. Additionally, these open areas will benefit bobwhites if the appropriate management actions are used. Below is a list of management actions recommended by FCFW biologists as being beneficial to military training and to the future of bobwhites on FCMR:

1. Prescribed fire – very beneficial to bobwhite nesting and brood rearing habitat. These planned fires can be conducted safely and cost-effectively if carried out

appropriately. Prescribed fire year after year, on a 2 year rotation, or 3 year rotation can maintain stands of native warm season grasses, bareground, and forbs needed by bobwhites and other wildlife. Additionally, prescribed fire can minimize woody encroachment which negatively effects military training.

2. Disking – very beneficial to bobwhite brood rearing habitat, spring/summer food, and fall/winter food. Disking promotes growth of important canopy forbs that produce excellent spring/summer cover and food sources (insects, seeds, and vegetation). Disking also promotes bareground which is crucial to the survival of young quail. On average, 25% bareground will allow young bobwhite chicks to maneuver through the understory of canopy forbs to evade most predators, ultimately increasing chick survival/recruitment and bobwhite density. If occurs during the correct time of year and location, erosion issues can be eliminated, and the need for reseeding to prevent erosion control is not needed. On a rotational scale, disking can produce a mosaic of early-successional habitat that can benefit all life stages of bobwhites while maintaining excellent areas for military training.

3. Mulching – can be beneficial when vegetation is unsafe for prescribed fire and/or too advanced for mowing/disking. Mulching produces more bareground, has a greater impact on woody encroachment, and allows clearing of land for subsequent action such as fire, disking, or herbicide application. Mulching is often the only feasible initial action for producing bobwhite habitat and areas to facilitate military training. Mulching followed immediately (within 60 minutes) by selective herbicides (targeting woody species) can drastically reduce woody encroachment. Once cut, tree sapling stumps will intake herbicides prior for upwards of 60 minutes. Applying herbicide during this time will result in direct intake to root systems and provide a much more effective kill than foliar application.

4. Herbicides – herbicides can be very beneficial in reducing woody encroachment and/or reducing amounts of non-native, invasive species. Herbicide use needs extensive pre-planning to achieve desired outcomes. If used incorrectly, herbicides can cause a huge economic loss and produce minimal results.

5. Mowing – mowing can be beneficial for bobwhites only if used to facilitate disking or herbicide use and done at appropriate times of year, otherwise mowing produces the poorest conditions for bobwhite nesting, brood rearing, overall survival, and can cause direct mortality. Thick layers of thatch produced by mowing inhibit bobwhite mobility and reduce likelihood of survival. Mowing can, however, facilitate military training, but in attempting to increased stewardship of land managers at FCMR reducing amounts of mowing will increase wildlife habitat, especially for bobwhites. Like mulching, mowing can be followed by herbicide application within 60 minutes for additional control of woody species.

It is good practice to conduct some form of habitat sampling before and after management action is taken to be certain that appropriate action was taken and expected results occurred. Without this type of checks and balances, land management on FCMR can be costly and ineffective. A simple day in the field prior to mulching, mowing, disking, spraying, or burning can verify selection of action and provide some insurance that desired results will be achieved. Additional habitat sampling will occur in

QFAs and throughout training areas at FCMR by FCFW in conjunction with bobwhite management and grassland management. These surveys will continue to provide information needed for biologists and other land managers at FCMR to make appropriate decisions when managing open areas for military training and wildlife habitat.

Non-native Invasive Plant Species

Within habitat management practices to benefit bobwhites, non-native plant species seriously threaten the future of bobwhites on FCMR. There are 3 species of nonnative invasive plant species present on FCMR that are currently consuming bobwhite nesting and brood rearing habitat and impeding military training in many areas. These 3 species are listed below along with their threats to bobwhites and military training. Management recommendations for each species to benefit bobwhite habitat and military training lands are provided.

1. Shrubby lespedeza (*Lespedeza bicolor;* also called "bicolor lespedeza") – this perennial species is very invasive and can grow in dense stands 3-10 feet in height in a single growing season (Miller 2007). Without appropriate management shrubby lespedeza can consume large areas of open lands and cause significant financial costs to control. If managed in small patches or to field edges, shrubby lespedeza can provide some added benefit to bobwhites in terms of food and cover and not interfere with military training as much. Many training areas on FCMR have been consumed by shrubby lespedeza (especially TAs 05, 06, 08A, 09A, 10, and 11) to the point that bobwhite nesting habitat has been displaced by this species and military maneuvering is difficult.

   Management of shrubby lespedeza is difficult, but is feasible if appropriate actions are taken. Prescribed fire is not a good method to control shrubby lespedeza because fire encourages germination of seed and spread of patches (Miller 2007). To successfully manage shrubby lespedeza a combination of mowing and herbicide or mulching and herbicide should be used for best results. Mowing or mulching shrubby lespedeza alone will not produce positive results without immediate follow-up management with herbicides.

   Repetitive disking may also assist in allowing other vegetation to temporarily replace shrubby lespedeza patches, but without herbicide application long-term control will be costly. More research by FCFW will be conducted on use of disking to help control shrubby lespedeza in 2017.

   In all shrubby lespedeza control, awareness that equipment used to control may also unintentionally spread seed and ultimately cause more problems. It is important to either control lespedeza prior to seeding or clean equipment before leaving infested areas after seed maturity is reached. Recommended months for shrubby lespedeza management are June-September for herbicide. Early mowing to increase access with equipment should be completed by May to allow appropriate growth for an effective kill (6-8 inches). Patches of shrubby lespedeza may be disked in early- to late- spring to encourage growth of other species.

2. Tall fescue (*Schedonorus arundinaceaus*) – this perennial cool-season grass has likely caused bobwhites more grief than any other nonnative invasive species in the southeastern United States. Tall fescue grows in a manner that forms dense layers of thatch which make mobility for bobwhites impossible. Additionally, tall fescue has zero food value for bobwhites. Tall fescue can also host fungal growths dangerous to many species of wildlife (Miller 2007). From a military training perspective, tall fescue is a poor choice due to its inability to hold soils and prevent soil erosion. Tall fescue is a shallow-rooted sod grass that is easily uprooted leaving exposed ground following military training exercises. Continuous training in tall fescue dominated areas will result in increased soil erosion for years to come unless controlled.

   Repetitive early-spring prescribed fire can inhibit tall fescue growth (Miller 2007). Use of herbicides such as glyphosate or Plateau® during spring and early-summer can assist in controlling tall fescue (Miller 2007). Disking can also temporarily reduce coverage of tall fescue.

3. Sericia lespedeza (*Lespedeza cuneata;* also called "Chinese lespedeza") – this species is very similar to shrubby lespedeza, but does not grow quite as tall (upwards of 6 feet). Sericia lespedeza causes similar problems to bobwhites as shrubby lespedeza, except it has zero food value for bobwhites. Like tall fescue, sericia lespedeza is a poor erosion control species compared to native warm season grasses making it a poor ground coverage in military training areas. Control methods for shrubby lespedeza should be followed for control of sericia lespedeza.

Future of Bobwhite Hunting on FCMR

Hunting effort and success can be an indicator of population trends in many game species. Three important trends FCFW monitor in bobwhite hunting are coveys detected per hunting trip (covey/trip), coveys detected per hour of hunting (covey/hour), and bobwhites harvested per hunting trip (harvest/trip). Total number of harvested bobwhites can be monitored, but is subjective in understanding population trends.

Bobwhite hunters on FCMR have been reporting information for each hunting trip (per hunting party) for over two decades (Figure 5). These data are used to reveal bobwhite coveys/trip, coveys/hour, and harvest/trip. Trips are defined as a single individual's or hunting parties' (limited to 3 hunters per party) entry into a hunting area. Coveys/trip, coveys/hour, and harvest/trip are based on this single entry into a single area. Since 2000, harvest/trip, coveys/trip, and coveys/hour have all slowly decreased on average with variation among all years (Figures 6-8). These overall downward trends may be reflective of fewer coveys across the landscape which further supports fewer bobwhites per acre (Table 1).

To ensure future bobwhite hunting at FCMR hunter surveys will continue. Rotational hunting in training areas will be used to reduce overall hunting pressure on bobwhites until an increase in bobwhites is observed. Party limits have been reduced from 18 to 12 in 2016 while individual daily bag limits remained 6 for solo hunters. Allowed number of hunting parties per training area were reduced in 2016 to also decrease hunting

pressure. Future changes will prohibit multiple hunting parties' entry into training areas limiting only 1 hunting party per hunting area per day. Managing bobwhite hunting on FCMR will be conducted in an adaptive manner year-to-year. The ultimate goal of FCFW is to not only increase bobwhite densities, but increase quality and opportunity of bobwhite hunting. In order to benefit both bobwhites and bobwhite hunters, initial action and restraint must be carried out until downward trends in population cease.

Bag limits were again reduced in 2017 to 5 per person and 10 per party. Furthermore, hunting areas were allocated through a random draw and reentry into areas following initial hunting party were reduced. Therefore, hunting pressure, overall, was reduced during 2017-2018 hunting season.

Literature Cited

Burger, L. W., D. A. Miller, and R. I. Southwick. 1999. Economic impact of northern bobwhite hunting in the southeastern United States. Wildlife Society Bulletin 27(4):1010-1018.

Rosene, W. 1969. The bobwhite quail: its life and management. Rutgers University Press, New Brunswick, New Jersey, USA.

Miller, J. H. 2007. Nonnative invasive plants of southern forests: a field guide for identification and control. Southern Research Station, Auburn University, AL, USA.

Tables and Figures

Table 1. Bobwhite densities based on fall covey call counts conducted on FCMR. Year, number of listening positions per year, and estimated bobwhite densities based on observed number of calls at each listening position are featured in this table.

Yearly Average (Bobwhites/Acre)		
Year	No. Listening Positions	Bobwhites/Acre
2001	10	0.14
2002	16	0.20
2005	17	0.20
2007	6	0.20
2008	14	0.13
2016	32	0.08

Figure 1. Acres of prescribed fire in open fields (majority native warm season grasses) and late-rotation loblolly pine (*Pinus taeda*) plantations at Fort Campbell Military Reservation between 2001 and 2010.

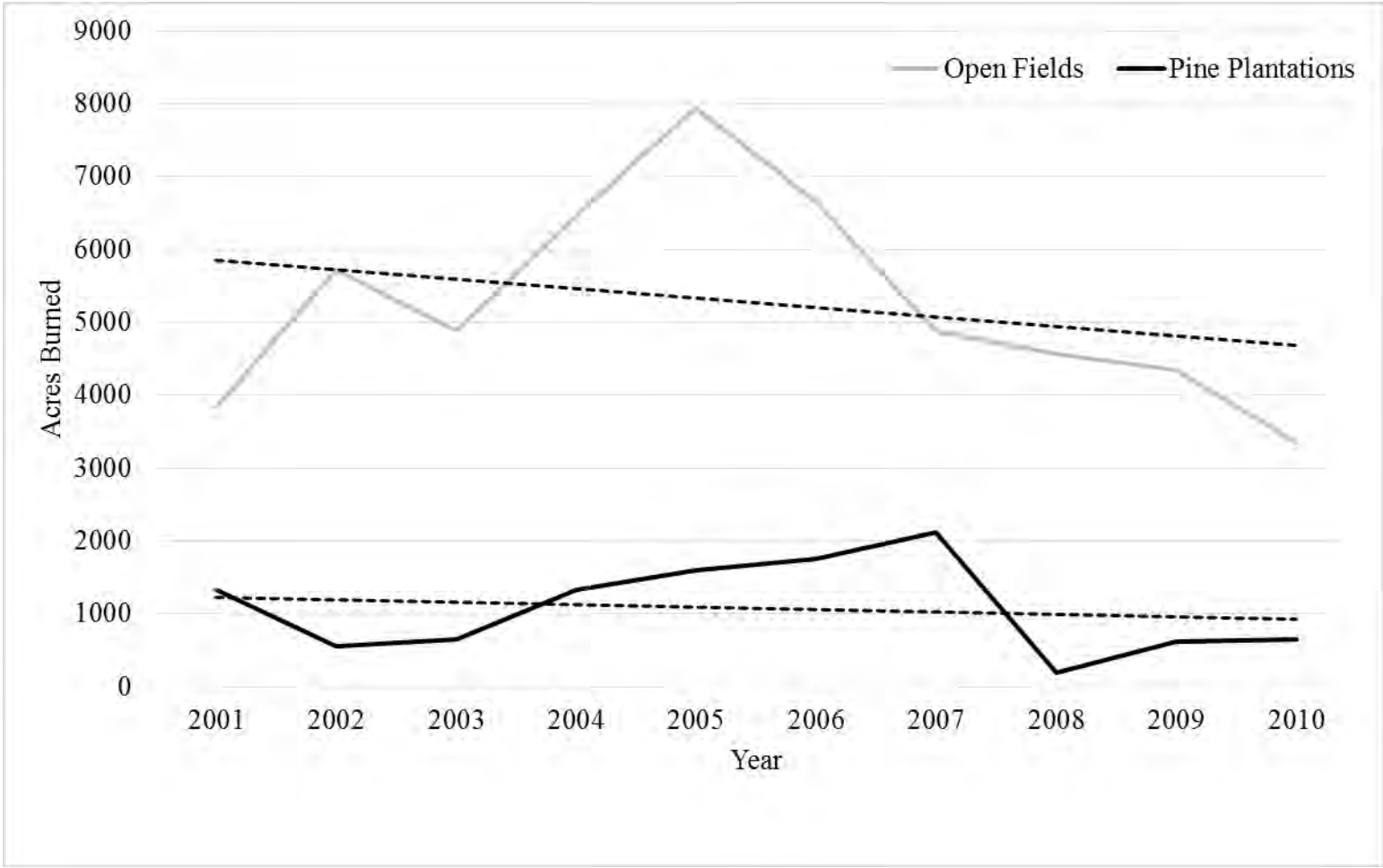


Figure 2. Quail Focal Area (QFA) signs posted around each designated QFA at Fort Campbell Military Reservation. These areas will be used as model areas to conduct both research and monitor Northern bobwhites (and other grassland species of wildlife) to determine best suited management approaches to creating and maintaining early-successional habitat while enhancing military training.

Figure 3. All quadrats sampled (n=676) in 2015 vegetation survey within 5 Quail Focal Areas (QFA) at Fort Campbell Military Reservation. Percent ground coverage of permanent water, bareground, rock/gravel, plant thatch/debris, woody plant species, herbaceous plant species (forbs), and graminoids (grasses, sedges, and rushes) were visually estimated using 1-m^2 quadrats. Ground coverage in most quadrats sampled were more closely associated with plant that/debris, and woody plant species. Very few quadrats exhibited ideal Northern bobwhite habitat with majority graminoids, herbaceous plant species, and bareground.

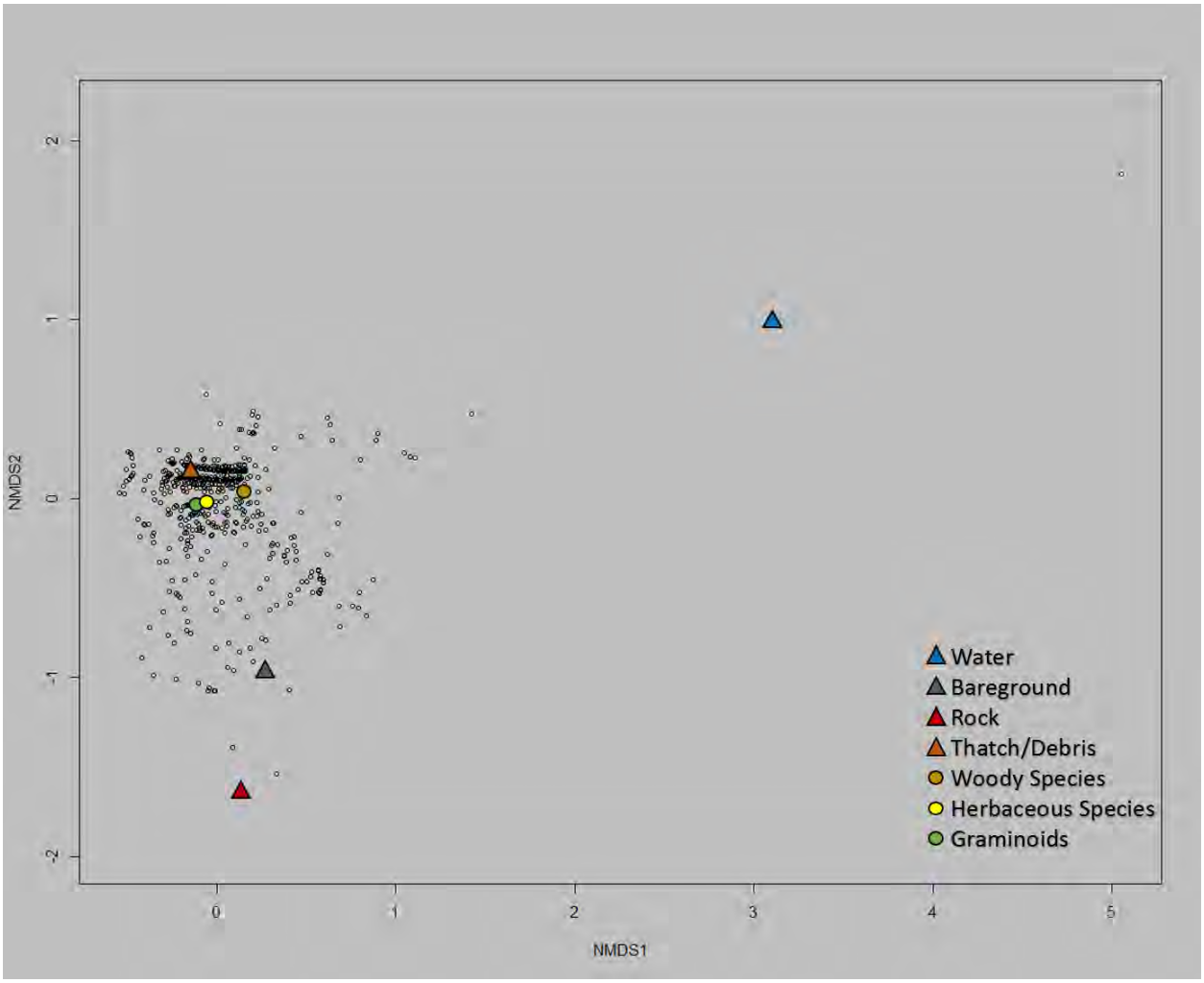


Figure 4. Average number of calling male Northern bobwhites recorded during annual breeding bird surveys on Fort Campbell Military Reservation. These surveys have been conducted using predetermined point count locations May-June annually since 1997. All surveys were conducted at same listening locations by same observer.

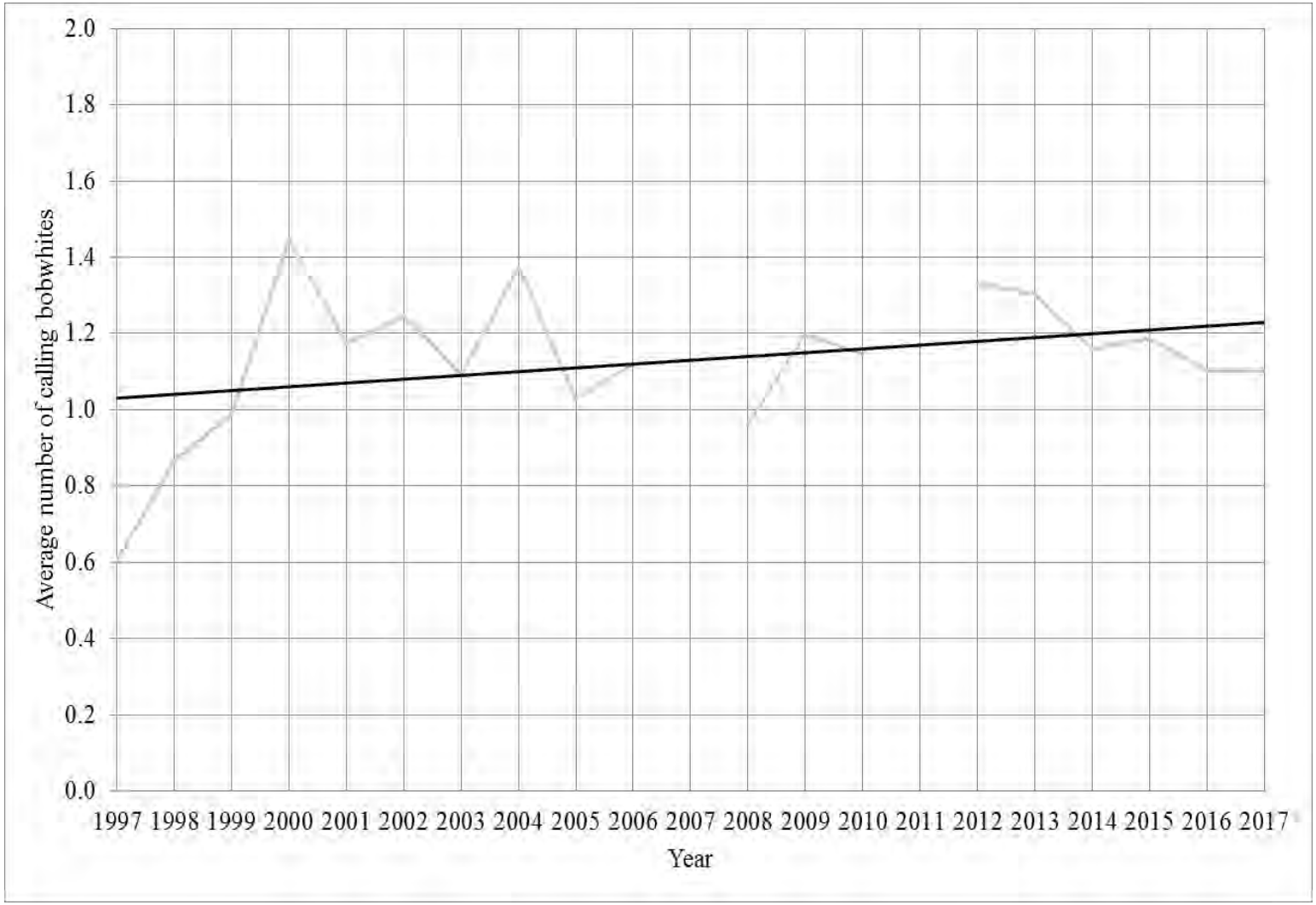


Figure 5. Average number of calling male Northern bobwhites recorded during annual breeding bird surveys on Fort Campbell Military Reservation compared to coveys detected per hour of hunting.

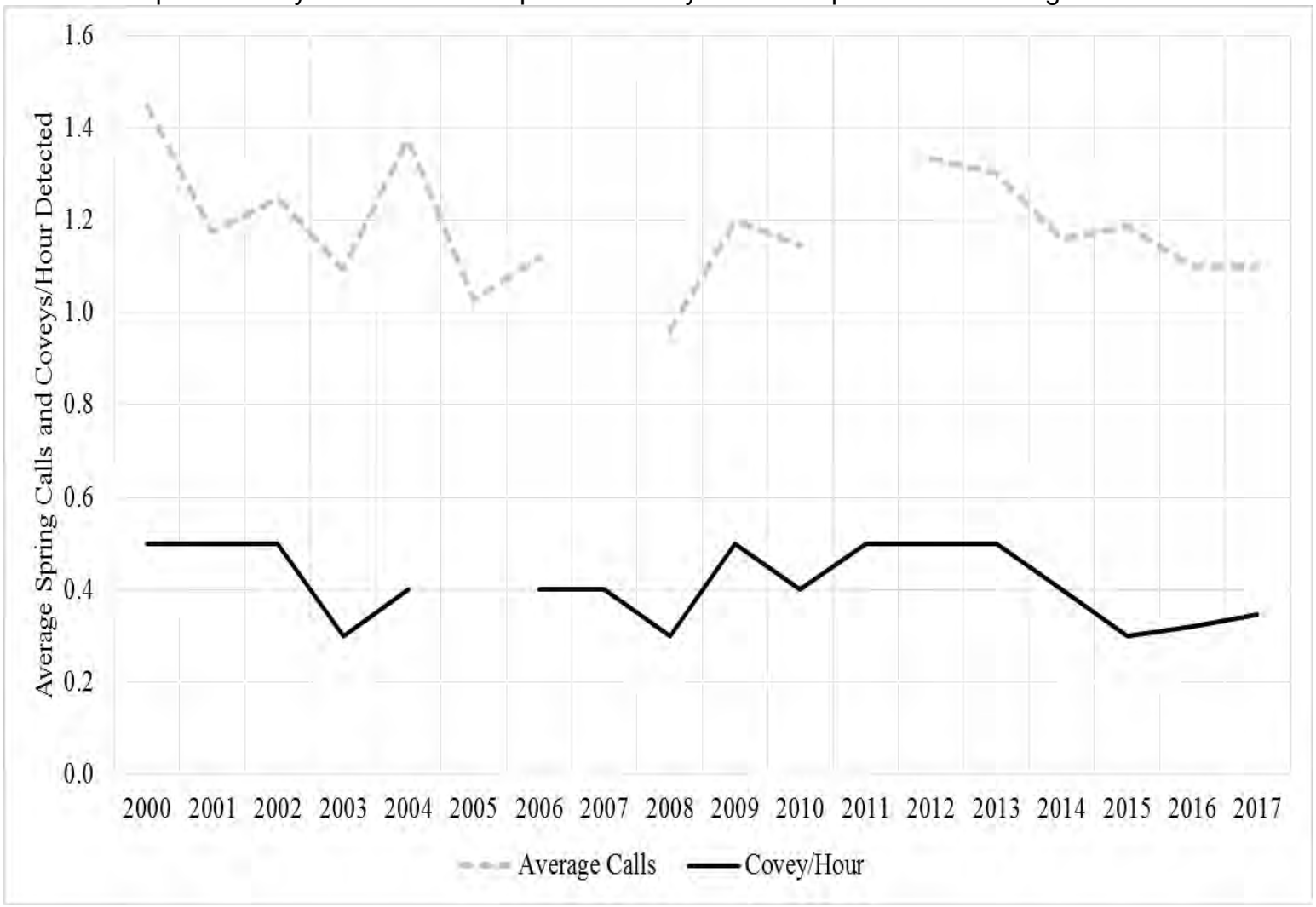


Figure 5. Example of hunter survey sheet that Northern bobwhite hunters return to Fort Campbell Fish and Wildlife after each hunting trip. If bobwhites are harvested, a single wing from each bird is returned for ageing and determining juvenile to adult ratios for each season.

Northern bobwhite
HUNT DATA SHEET

Completion of this harvest data sheet is required for all northern bobwhite quail hunters for each hunt trip. A hunt data sheet is required for each Training Area hunted. These data will be used by Fort Campbell's Wildlife Biologists for making appropriate management decisions for northern bobwhites, therefore it is important that all information from each hunt is provided fully and accurately.

Please use printed sheet to report hunt data if no birds are bagged. Only use envelopes for successful hunts.

DIRECTIONS:

- Only one member of each hunting party needs to fill out a hunt data sheet.
- Fill out a hunt data sheet for each hunt trip. If multiple Training Areas are hunted in a single day, fill out a new hunt data sheet for each Training Area hunted individually. Be sure to record only the time spent on each individual hunt trip.
- If quail were harvested, first separate males from females (see figure). **Clip left wings from males and right wings from females** (clip wings at shoulder). Place wings in envelope and seal the envelope. Do not wrap wings in plastic (causes spoilage).
- Completely fill in all hunt data below.
- Place sealed envelope in receipt box located at the Outdoor Recreation Office.

Record hunt data below:
(*fill in all information*)

Date of Hunt: _____

Training Area: _____

Hunters in Party
(first and last names required)

1._____

2._____

3._____

Were dogs used: YES____NO____

Hours hunted: _____

Number of coveys found: _____

Number of bagged birds (each sex)

MALE____FEMALE____

Number of cripples lost: _____

Were singles hunted: YES____NO____

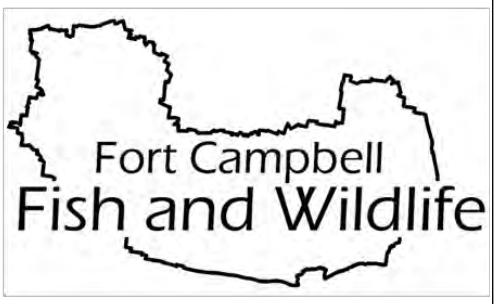


Figure 6. Number of Northern bobwhites harvested per hunting trip by hunters at Fort Campbell Military Reservation. All hunting seasons between 2000 and 2017 (except 2005) are shown below.

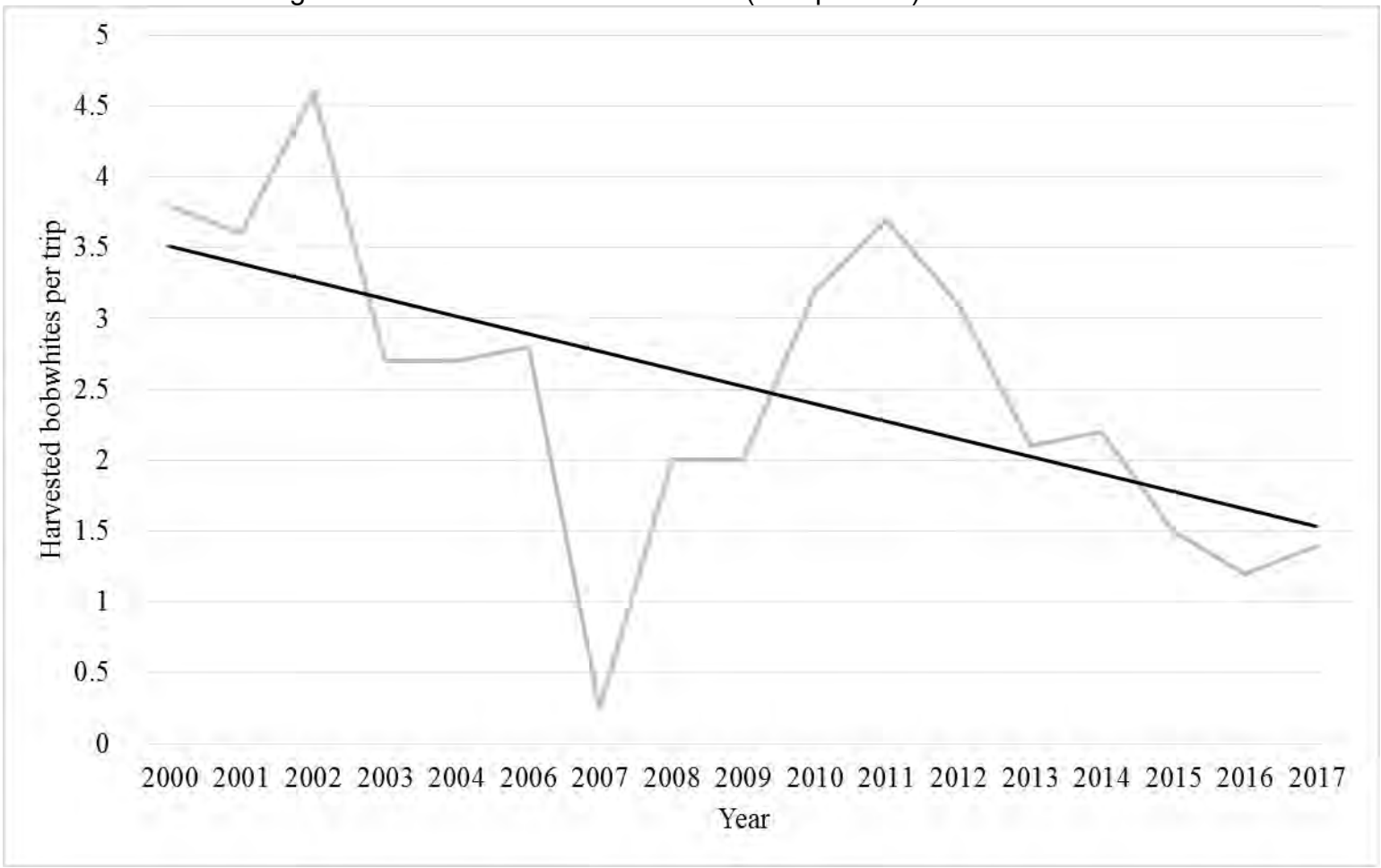


Figure 7. Northern bobwhite coveys detected per hunting trip by hunters at Fort Campbell Military Reservation. All hunting seasons between 2000 and 2017 (except 2005) are shown below.

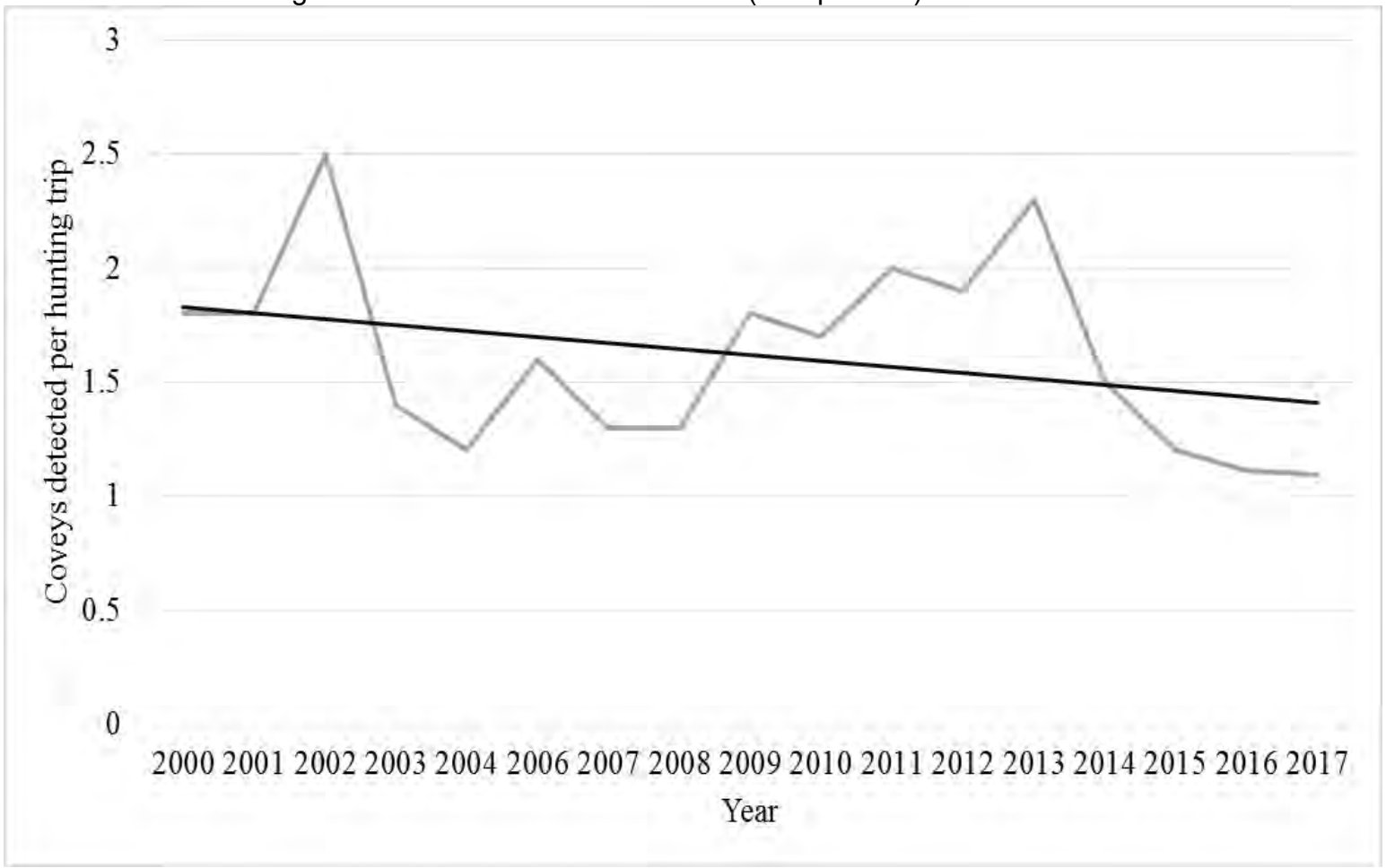
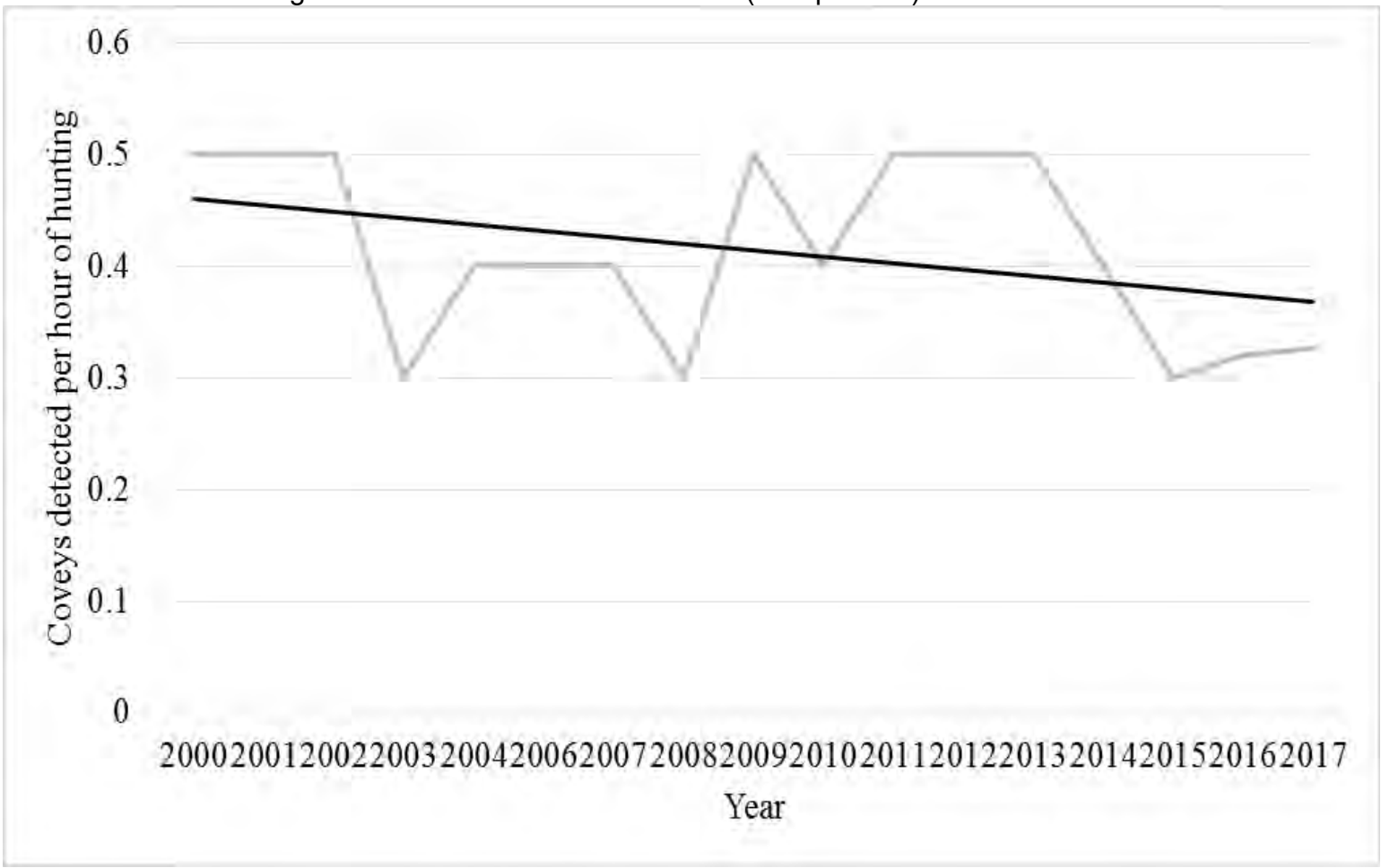


Figure 8. Northern bobwhite coveys detected per hour of hunting by hunters at Fort Campbell Military Reservation. All hunting seasons between 2000 and 2017 (except 2005) are shown below.



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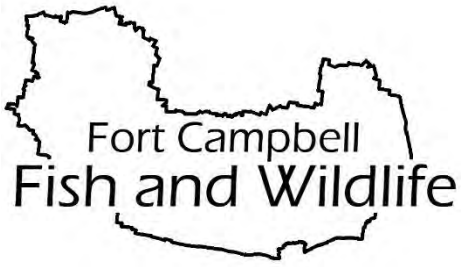
Fort Campbell White-tailed deer Management Plan



This document is a summary of a 3-phase management plan implemented in 2014 by Fort Campbell Fish and Wildlife biologists. Initial surveys and results leading up to updated management along with current population status and response from current management are included.

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Updated:
16 August 2017
02 January 2018

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Introduction

Fort Campbell Fish and Wildlife (FCFW) implemented a white-tailed deer management strategy to mirror many Quality Deer Management (QDM) practices. This management strategy was designed to increase sustainability and ensure healthy deer populations on Fort Campbell Military Reservation (FCMR). A 3-phase management plan was designed to appropriately manage different aspects of deer population structure: 1) balance adult sex ratios, 2) increase age structure of harvested bucks, and 3) maintain ratios and age structure. To date, expectations of this management strategy have complemented expectations of FCFW and have been successful in achieving current desired conditions.

Phase 1: Balance Adult Sex Ratios

An average adult sex ratio of 1:6 (buck to doe) was revealed with localized ratios as skewed as 1:11 in 2014 surveys (see Appendix A for survey details). Many of these localized populations were likely facing overpopulation with signs of limited resources and malnutrition (e.g. browse lines, below normal body sizes, poor physique). Annual harvest of adult deer made up predominately of males from 2000-2013 likely explains imbalanced adult sex ratios detected during 2014 surveys (Figure 1). A program requiring hunters to harvest an antlerless deer prior to harvesting an antlered deer, “Earn-a-Buck” (EAB), was implemented in expectation of increasing doe harvest, especially in localized areas with greatest doe densities. Harvest quotas for bucks were applied for installation-wide harvest and harvest in specific areas. An adult sex ratio between 1:2 and 1:3 was selected based on QDM guidelines suggesting these ratios are more manageable than 1:1.

Harvest numbers in 2014 revealed an increase in doe harvest, a reduction in antlered buck harvest, and an increase in juvenile buck harvest compared to 2000-2013 seasons (Table 1). Following this increase in doe harvest in 2014, surveys in 2015 revealed an adult sex ratio of 1:4. Therefore, EAB remained in effect through the 2015 hunting season resulting in an adult sex ratio of 1:2 by summer 2016. Adult sex ratios remained 1:2 in summer 2017. See Table A.1 for complete details regarding changes in adult sex ratios from 2014 to 2017.

Phase 2: Increase Age Structure of Harvested Bucks

The second phase of population management set by FCFW was to increase age structure of male deer (i.e. restrict harvest of 1.5 year old bucks). Buck harvest quotas were continued, antler restrictions (see Appendix B) were implemented, and EAB was suspended for the 2016 hunting season. As a result, doe harvest decreased, juvenile buck harvest decreased, and average age and size (except antler spread; see Figures 2-5) of bucks harvested increased. Average ages of harvested bucks for 2014, 2015, and 2016 was 2.5, 2.4, and 3.0, respectively. Percent harvest of 1.5 year old bucks was reduced in 2016 compared to 2015 along with slight changes in other age classes (Table 2). Although doe harvest decreased, male and female harvest was nearly

equivalent (1:0.99). Average age and size of harvested bucks continued to increase in 2017 with body weight as an exception which experienced a slight decline.

Phase 3: Maintain Adult Sex Ratios and Age Structure

To maintain adult sex ratios between 1:2 and 1:3, FCFW will continue to monitor changes to deer populations via summer surveys (as explained in Appendix A) and make appropriate management decisions to manipulate ratios. Implementation of “doe only” hunts and hunting areas will be used in 2017 to explore additional pathways (i.e. alternative to EAB) to reach desired annual doe harvest. The purpose of EAB was to create an abrupt reduction in doe densities and create some balance to adult sex ratios. Although EAB was successful at achieving this goal, other negative impacts (e.g. increased harvest of juvenile males and additional manpower needed to operate hunter check stations) leave reason to explore additional methods for maintaining an adult sex ratio between 1:2 and 1:3. If other options of reaching desired doe harvests are not successful, EAB may be used periodically to once again achieve increased doe harvest.

Current antler restrictions (Appendix B) were successful in minimizing harvest of 1.5 year old bucks. This restriction will continue in 2018 to further increase age structure of harvested bucks and potentially allow more bucks to reach sexual maturity.

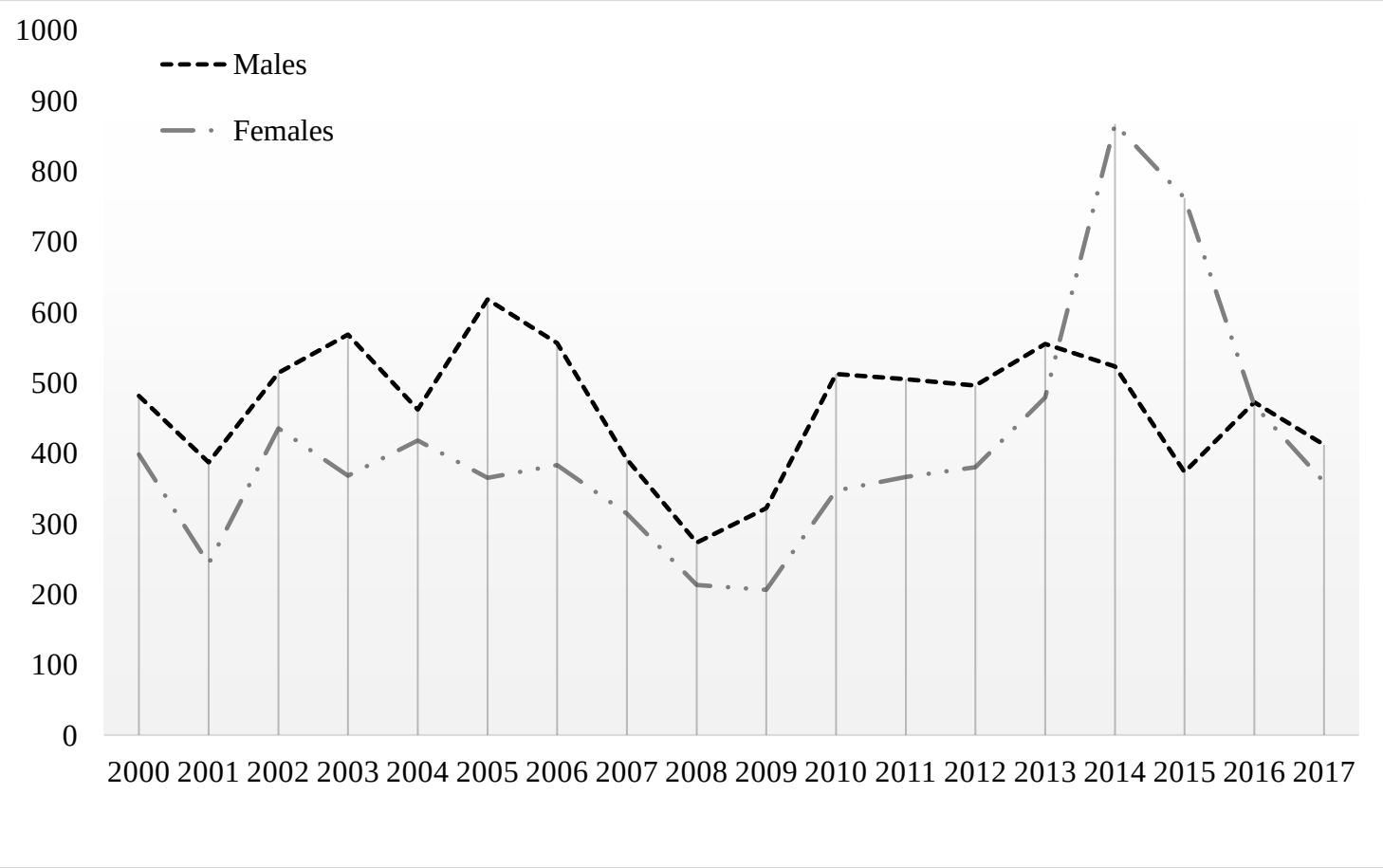
Table 1. Average annual white-tailed deer harvest at Fort Campbell Military Reservation from 2000 to 2013 compared to 2013-2017 harvest.

Year	Adult Males	Juvenile Males	All Males	All Females	Total Harvest
2000-2013	409	65	474	351	825
2014	348	175	523	867	1390
2015	231	142	373	762	1135
2016	402	70	472	468	940
2017	349	64	412	359	772

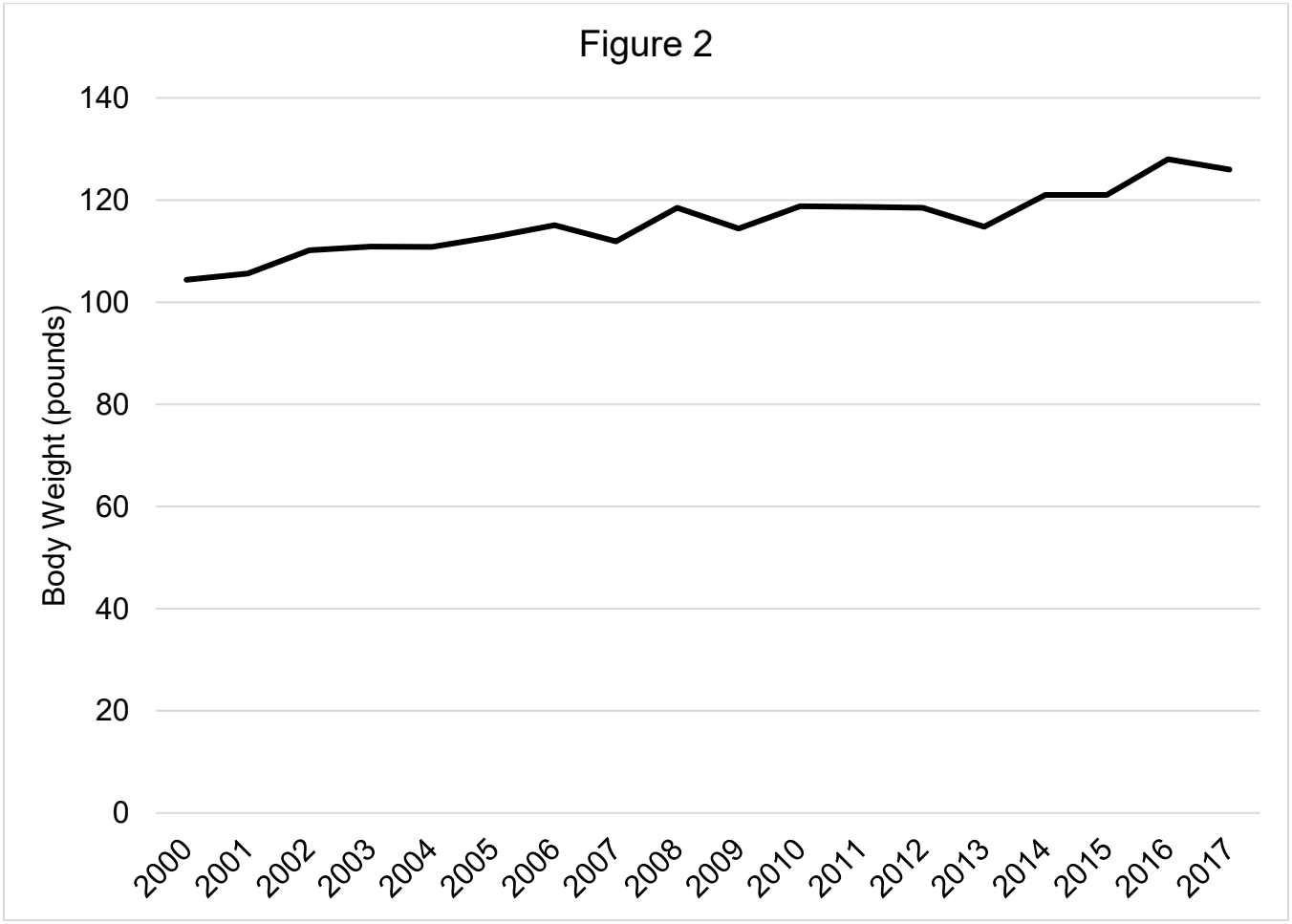
Table 2. Percent harvest of antlered deer on Fort Campbell Military Reservation in 2015 and 2017 for each age class. These percentages are based only on total numbers of antlered bucks (at least 1.5 years old).

Age	Percent Harvest in 2015	Percent Harvest in 2016	Percent Harvest in 2017
1.5	38%	6%	8%
2.5	40%	55%	49%
3.5	18%	28%	28%
4.5	3%	9%	9%
≥5.5	1%	3%	7%

Figure 1. Annual harvest of adult male and female white-tailed deer at Fort Campbell Military Reservation from 2000 to 2017. This figure reveals the effects of implementation of an “earn-a-buck” program in 2014 and suspension of that program in 2016.



Figures 2-5. Long-term averages of biometrics taken from antlered white-tailed deer harvested at Fort Campbell Military Reservation. These biometrics include field dressed weight, outside antler spread, longest main beam length, and number of antlered points at least 1” in length.



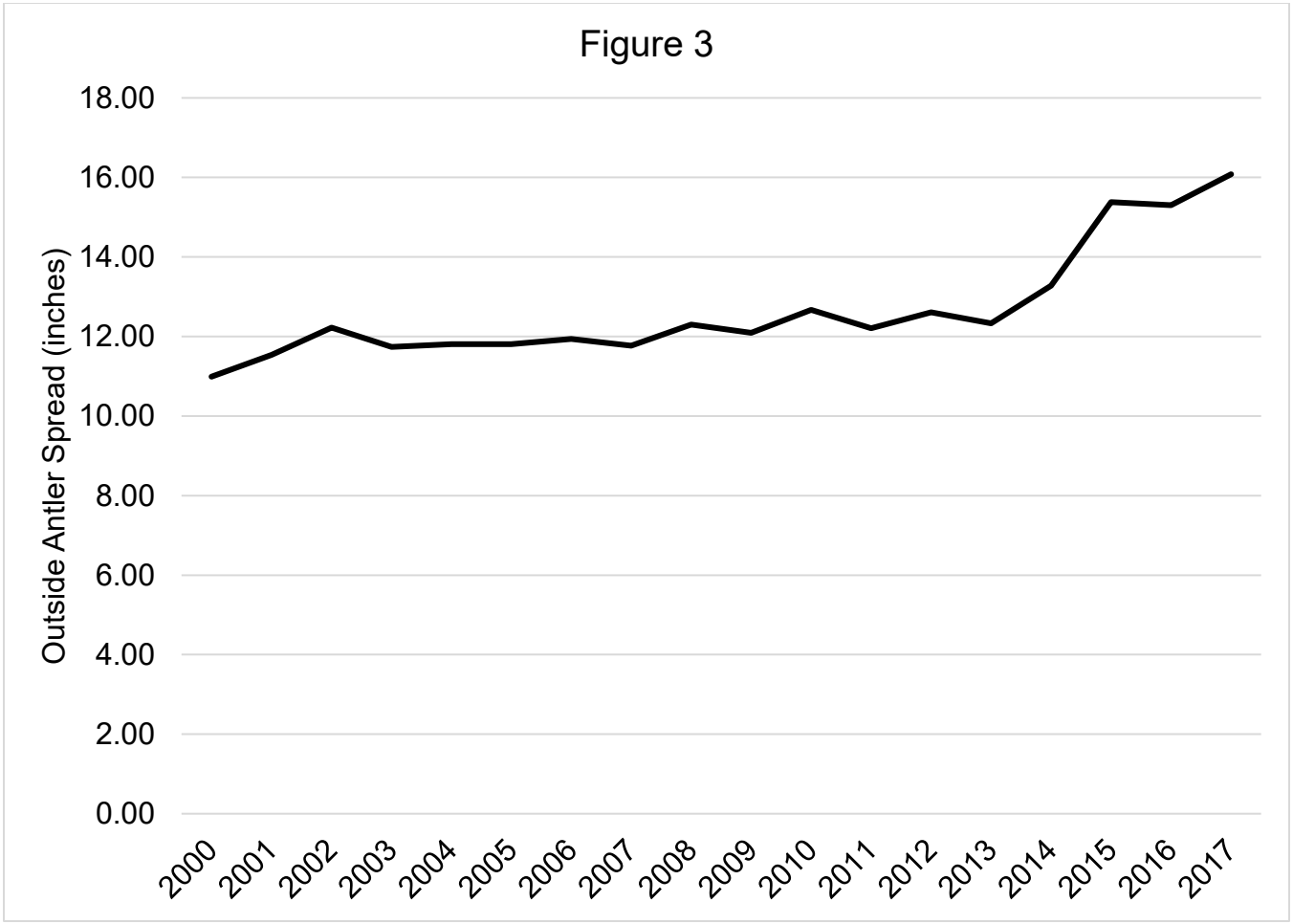


Figure 3
Outside Antler Spread (inches)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

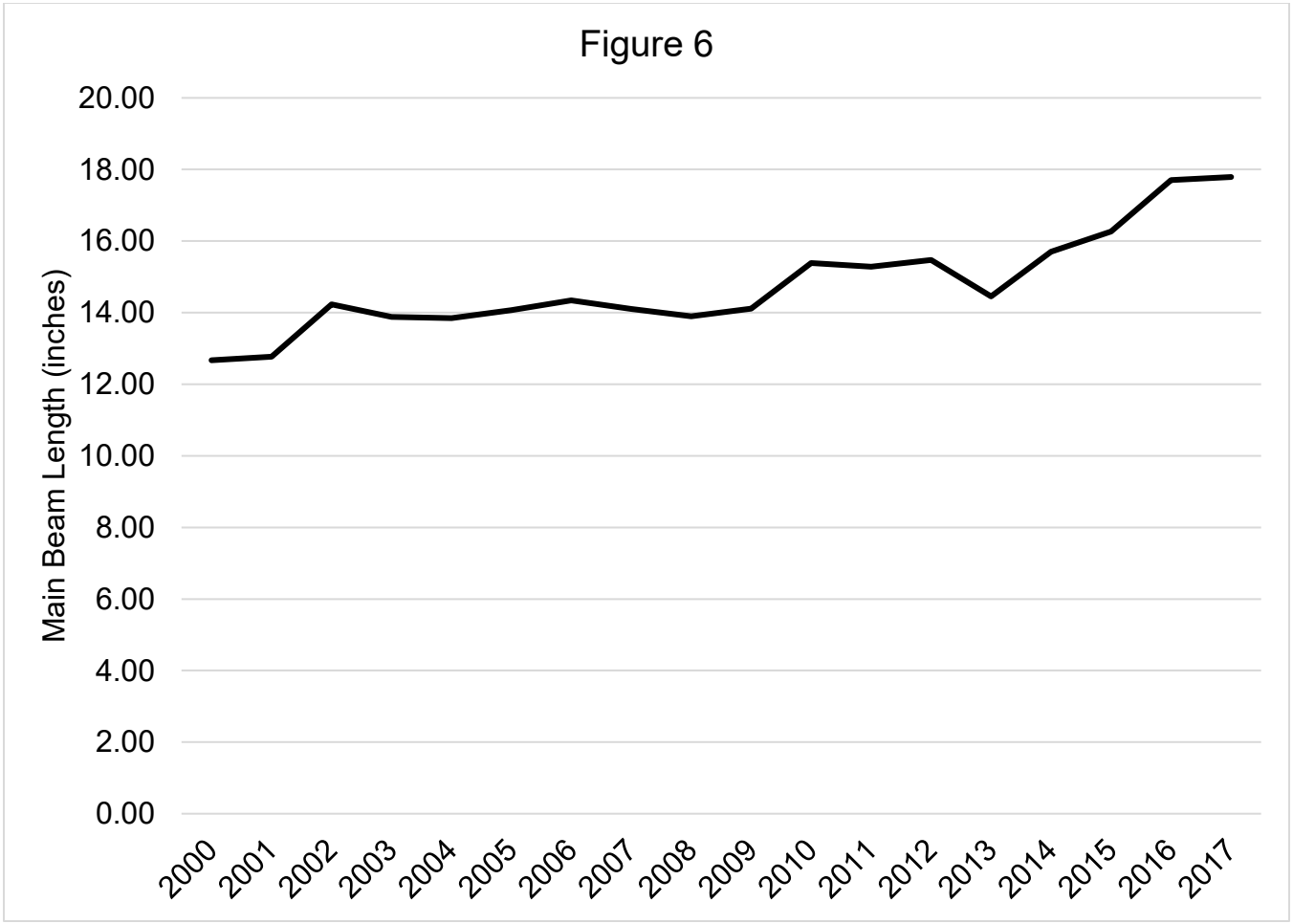


Figure 6
Main Beam Length (inches)
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

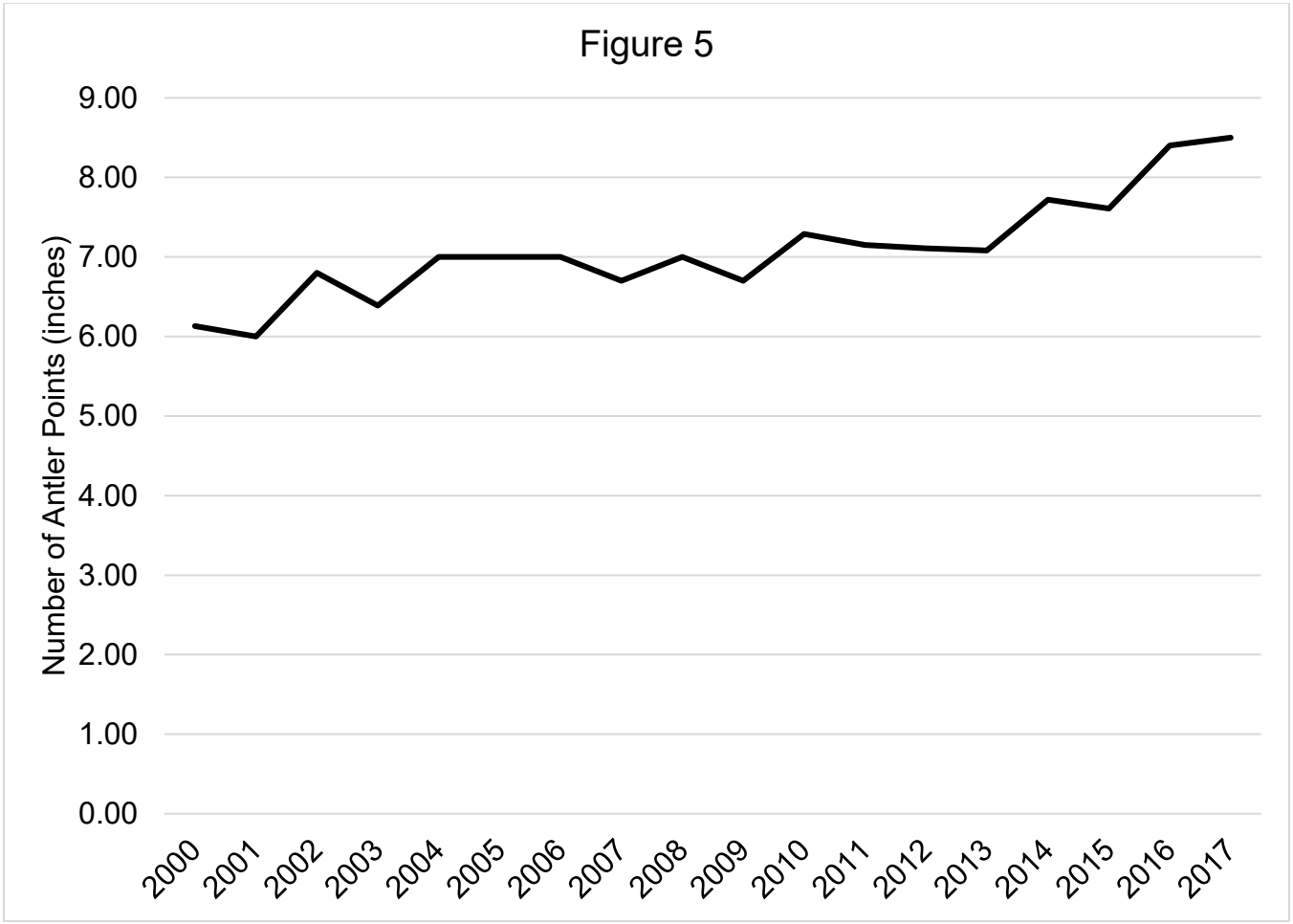


Figure 5
Number of Antler Points (inches)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

Appendix A. Summer Spotlight Surveys

Summer spotlight surveys have been used on FCMR prior to and post-implementation of QDM (2014-2017). Survey data are used mostly to provide FCFW biologists with adult sex ratios and localized deer densities. Methods and results of these surveys can be found in this appendix.

Methods

Spotlight routes were predetermined (prior to 2014 surveys) and accounted for most training areas with open areas such as agricultural fields, pastures, and grasslands. The 5 survey routes totaled 86.5 miles resulting in 4,122 surveyed acres. Acreage was estimated by using an average distance of visibility on each route. Average visibility was estimated in meters every 0.1 mile along each route. Spotlight surveys began 45 minutes post-sunset and were conducted through the months of August and September prior to deer season. Surveys were conducted on clear nights with relative humidity ≤70%. Deer were counted and summed by sex and age class during each survey. Both male and female fawns were grouped together due to difficulty distinguishing sex from far distances in low-light conditions. Adult males were separated into two classes by antler spread. Males with antler spreads beyond each ear were considered at least 2 years of age, whereas males with antler spreads within each ear were considered <2 years of age. Spotlight surveys were expanded in 2017 to encompass 6,427 surveyed acres on 142.6 miles of survey routes. See survey results in Table A.1.

Additional data may be viewed in Figures A.1-A.

Table A.1. White-tailed deer adult sex ratios (average, maximum, and minimum) detected during summer spotlight surveys from 2014-2017 at Fort Campbell Military Reservation.

Year	Male:Female Ratio	Minimum Male:Female	Maximum Male:Female
2014	1:6	1:3	1:11
2015	1:4	1:2	1:13
2016	1:2	1:1	1:6
2017	1:2	1:1	1:4

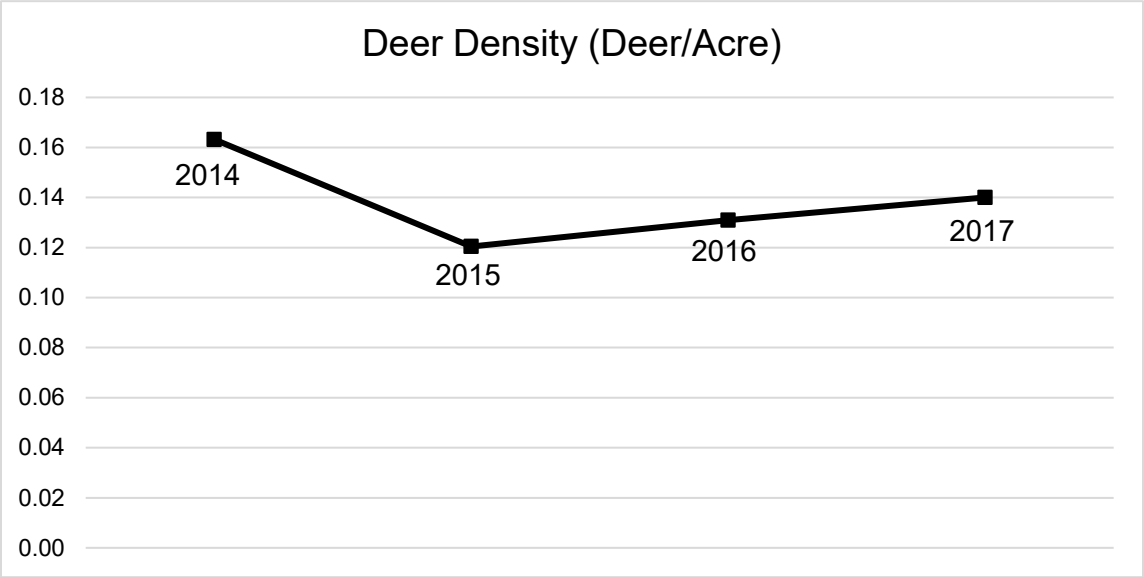


Figure A.1. Deer per acre estimates detected during summer spotlight surveys from 2014-2017 at Fort Campbell Military Reservation.

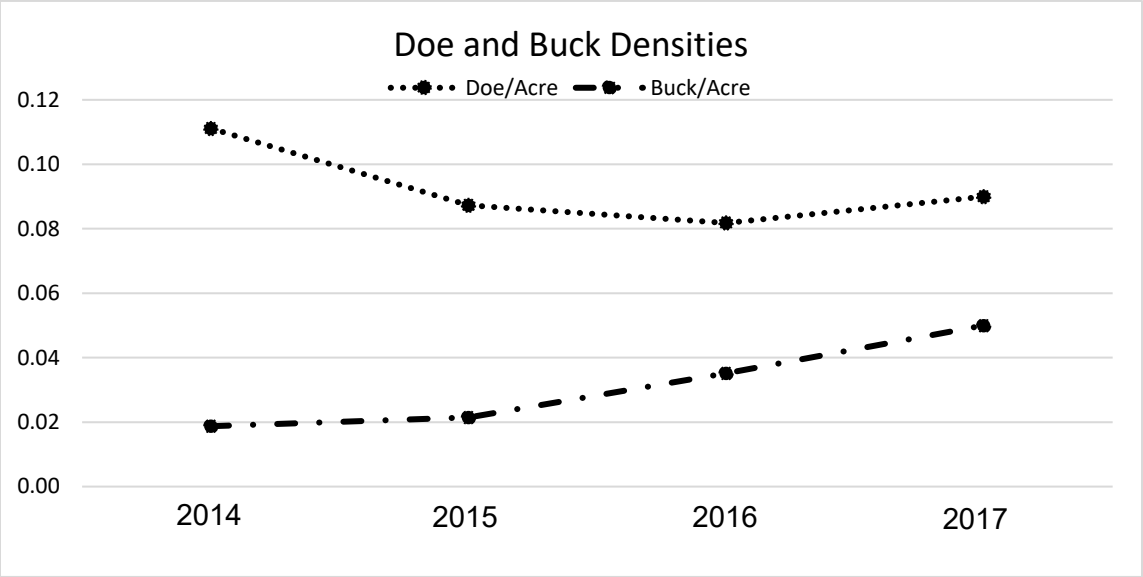


Figure A.2. Average number of adult male and female deer per acre estimated during summer spotlight surveys from 2014-2017 at Fort Campbell Military Reservation.

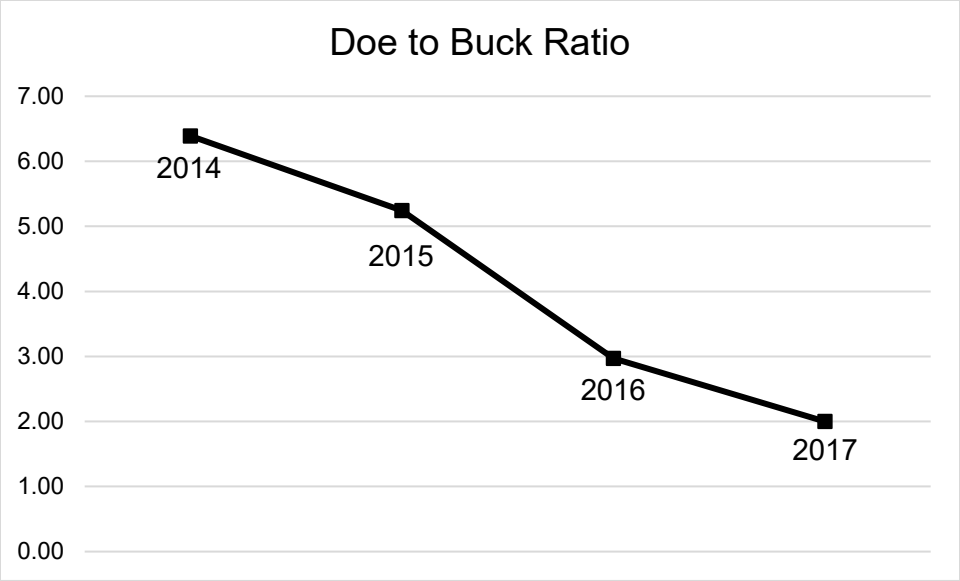


Figure A.3. Average annual adult sex ratios estimated during summer spotlight surveys from 2014-2017 at Fort Campbell Military Reservation.

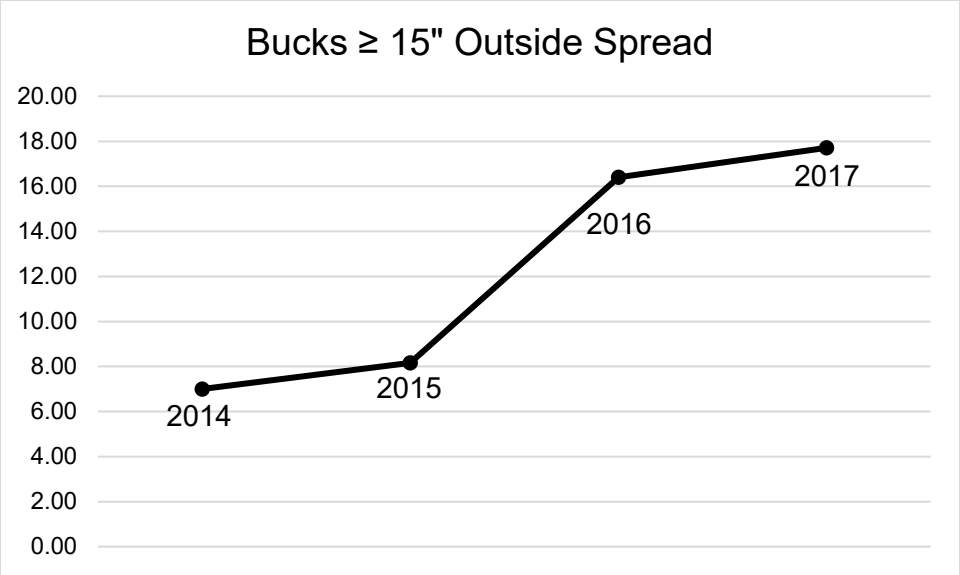


Figure A.4. Average number of adult males counted per night with an outside antler spread ≥15 inches during summer spotlight surveys from 2014-2017 at Fort Campbell Military Reservation.

Appendix B

2016 WHITE-TAILED DEER SEASONS

Regular Deer Season (Archery, Shotgun, and Muzzleloader): 17 September through 31 December 2016. Crossbows are permitted on archery hunts only. Daily bag limit is 3 deer (season limit of 1 legal antlered deer – see regulations on legal antlered deer on next page). The harvest of spotted fawns is prohibited.

"Earn-a-Buck" has been suspended for the 2016 Deer Season. Hunters are not required to harvest a doe prior to harvesting a legal antlered deer. We do encourage hunters to harvest does to prevent the reimplementation of this program in future seasons.

Definition of legal antlered deer for 2016

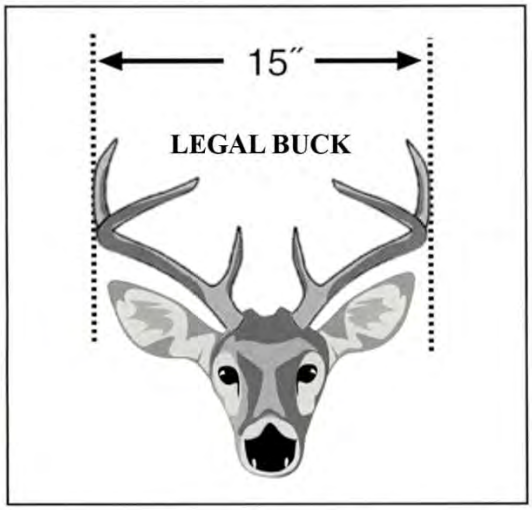
A legal antlered deer is defined as having 4 points on one antler OR an outside spread of 15 inches. A point must be at least 1" long to count towards the 4 points on one side.

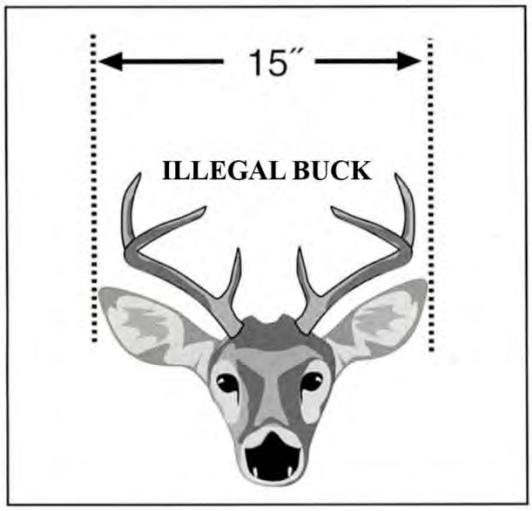
A buck with less than a 15 inch outside spread can be harvested IF that buck has at least 4 points on one antler.

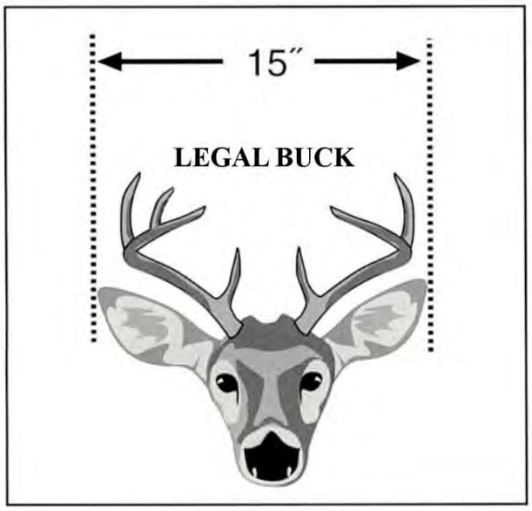
A buck with less than 4 points on both antlers can be harvested IF that buck has an outside spread of at least 15 inches.

A 15 inch outside spread will extend just outside each ear (see photos on page of this page).

Harvest of any illegal buck will result in a 2 year suspension of all hunting privileges on Fort Campbell.







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Fort Campbell
Integrated Pest Management Plan

Prepared by
DPW, Environmental Division
U.S. Army Garrison, Fort Campbell, Kentucky

Prepared for
DPW, Maintenance Division
U.S. Army Garrison, Fort Campbell, Kentucky

October 2017 Update

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Approval

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	Patrick J. Appelman Director Directorate of Public Works	Signed	Date
Approved by:	KUCHAN, JOSEPH P. COL, U.S. Army Commanding	Signed	Date

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Executive Summary

Fort Campbell (FC) consists of approximately 105,000 acres located on the state line between Kentucky and Tennessee. The installation is located in southwestern Kentucky and north-central Tennessee just north of the Cumberland River. The topography consists of rolling hills with forested tracts of land used primarily for military training exercises. Fort Campbell is home to the 101st Airborne Division (Air Assault) with approximately 34,000 personnel with accompanying structures and housing for the division.

The information contained in this Pest Management Plan pertains to all personnel and activities on the installation. At no time will pest management operations be done in a manner that will cause harm to personnel or the environment of Fort Campbell. Pest management responsibilities will begin with those individuals that occupy or maintain buildings or grounds of the installation. Nonchemical controls will be used to the maximum extent possible, in keeping with the Integrated Pest Management concept, before any pesticides are used. This plan will be a working document and will be continually updated to reflect actual pest management practices.

This Integrated Pest Management Plan (IPMP) describes pest management requirements, resources necessary for surveillance and control, and all legal requirements necessary to conduct pesticide operations on the installation. The people conducting pesticide operations on the installation are government certified. Campbell Crossing LLC shall have Integrated Pest Management Activities accomplished under contract with the contractor supplying the appropriate certifications. Pests included in the plan are weeds and other unwanted vegetation, termites, mosquitoes, crawling insects (ants, crickets, cockroaches, etc.) and spiders, mice, birds, and other vertebrate pests. Control of these pests is essential to overall effectiveness of the facility and the quality of life for the installation community. Actual pest management procedures are found in the Integrated Pest Management Outlines included as Appendices A and B.

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1.0 BACKGROUND

1.1 Purpose

This plan describes a comprehensive Integrated Pest Management (IPM) program for Fort Campbell. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. Federal Agencies are mandated by Federal Law (Section 136 r-1 of Reference N (1)(a) to use IPM. This plan is a guide to reduce reliance on pesticides and to enhance environmental protection; it reflects current DOD/Army policies, procedures and standards and incorporates the requirements of the Environmental Protection Agency (EPA) and the States of Kentucky and Tennessee.

1.2 Authority

a. 7 USC 136 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

b. DoDI 4150.07 DoD Pest Management Program

c. DoDD 4715.1E Environment, Safety, and Occupational Health (ESOH)

d. AR 40-5 Preventive Medicine

e. DA PAM 40-11 Preventive Medicine

f. AR 420-10 Management of Installation Directorates of Public Works

g. AR 385-10 The Army Safety Program

h. AR 210-50 Housing Management

i. AR 200-1 Environmental Protection and Enhancement, Chapter 5

1.3 Program Objectives

This plan provides guidance for operating and maintaining an effective pest management program. Principles of Integrated Pest Management (IPM) are stressed in the plan which consists of the use of both chemical and nonchemical control techniques to achieve pest management. Adherence to the plan will ensure effective, economical and environmentally acceptable pest management and will maintain compliance with pertinent laws and regulations.

1.4 Plan Maintenance

This management plan is maintained by the Installation Pest Management Coordinator (IPMC). Pen and ink changes are made to the plan throughout the fiscal year. The plan is reviewed and updated annually to reflect all changes made in the pest management program during the fiscal year. Annual updates of this plan are sent to AEC for review and technical approval no later than 1 October each year.

2.0 RESPONSIBILITIES

2.1 Commander

a. Designate a Pest Management Coordinator for oversight of all pest management activities.

b. Approve and support the Pest Management Plan.

c. Ensure installation personnel performing pest control receive adequate training, and achieve certification as required.

d. Ensure that all pest management operations are conducted safely with minimal impact on the environment.

2.2 Director, Directorate of Public Works

a. Determine the pest management requirements for the installation.

b. Request and monitor contract pest management operations.

c. Provide overall control of pest operations conducted on Fort Campbell.

d. Initiate requests for aerial application of pesticides when necessary.

e. Obtain and maintain adequate supplies of pesticides and pesticide dispersal equipment, and ensures that equipment is properly maintained.

f. Maintain records in accordance with pertinent regulation of pesticide operations.

2.3 Director, Family and Morale, Welfare and Recreation

a. Obtain and maintain adequate Golf Course supplies of pesticides and pesticide dispersal equipment, and ensures that equipment is properly maintained.

b. Ensure that Golf Course personnel performing pest control receive adequate training and achieve pest management certification.

c. Maintain and submit pesticide application records and inventory monthly to IPMC.

2.4 Director of Health Services

a. Preventive Medicine Service

1. Conduct surveillance for pests that could adversely affect the health and welfare of installation personnel.

2. Coordinate with local health officials to determine the prevalence of disease vectors and other public health pests in the area surrounding the installation.

3. Evaluate the health aspects of the pest management program.

b. Veterinary Services

1. Conduct surveillance for pests that destroy or contaminate food stored in Commissary and TISA facilities.

2. Provide advice to pet owners concerning pests that may adversely affect their animals.

3. Evaluate animals and animal tissue samples for diseases and disease vectors and provides input to the Pest Management Coordinator.

2.5 Pest Management Coordinator

a. Prepare, monitor and update the IPMP.

b. Determine the pest management requirements for the installation

c. Monitor the sale and distribution of pesticides on the installation.

d. Function as the point of contact for all pest application and pesticide storage for the installation.

e. Oversee the technical aspects of the self-help program with respect to pest control items and training of troops.

f. Coordinate with activities conducting pest surveillance or control to ensure all applicable information is recorded and reported as required by this plan.

g. Monitor certification and pest management training for pesticide applicators on the installation.

h. Verify all personnel involved with pest control hold current certification in all categories related to any pest controlling activities.

i. Serve as Contact Officer Representative (COR) for pest application or control contracts.

j. Coordinate with local, State and Federal agencies, as necessary, for implementation of the Installation's Pest Management Program.

2.6 Building Occupants

a. Apply good sanitary practices to prevent pest infestations.

b. Use all non-chemical and chemical pest control techniques available through the self-help program fully before requesting further assistance from the FCFH or Pest Control Activities.

c. Cooperate fully with Public Works and FCFH personnel and contractors in scheduling pest management operations, to include preparing the areas to be treated.

d. Apply only those pesticides approved by Public Works.

2.7 Pest Management Personnel

a. Use integrated pest management techniques to the maximum extent possible.

b. Control pests according to the provisions of this plan.

c. Operate in a manner that minimizes risk of contamination to the environment and personnel.

d. Ensure that superiors are kept informed of changes in pest management requirements.

e. Request pest management supplies and equipment in a timely manner.

f. Maintain effective liaison with installation health and environmental officials.

g. Maintain good record keeping for all applications associated with Fort Campbell.

2.8 Fish and Wildlife Program Personnel

a. Responsible for coordination and control of large vertebrate pests (deer, beaver, and feral hogs) utilizing integrated pest management techniques between DPW Pest Management and DPTMS Range Control.

b. Ensure installation leadership is informed of lethal pest management actions occurring within the cantonment area.

c. Maintain administrative record for all large vertebrate pest management actions.

d. Serves as liaison for Interagency Support Agreements with USDA Wildlife Services for large vertebrate control.

e. Request purchase of herbicides in support of wildlife management objectives.

3.0 GENERAL SITE DESCRIPTION

The IPMP incorporates natural resource information from the Fort Campbell Integrated Natural Resources Management Plan (INRMP) by reference (Campbell, 2014). Detailed discussions for each area are found within the referenced document.

3.1 General Location

Fort Campbell is located in southwestern Kentucky and north central Tennessee. The installation includes portions of four counties - Montgomery and Stewart Counties in Tennessee, and Christian and Trigg Counties in Kentucky. Fort Campbell is located southwest of Interstate Highway 24 (I-24), adjacent to Clarksville, Tennessee, and 17 miles south of Hopkinsville, Kentucky. The surrounding area is predominately rural and undeveloped. The nearest large urban area is Nashville, Tennessee, 55 miles to the southeast. Louisville, Kentucky, Memphis, Tennessee, and St. Louis, Missouri, are within 200 miles of the installation (Lockwood Greene, 1994).

Fort Campbell is a 105,069-acre military installation located mostly (67 percent) in Tennessee. Approximately 26,156 acres are designated small arms and artillery impact areas and are off limits to all but select military personnel. Another 14,158 acres are devoted to cantonment areas, schools, shopping areas, recreation areas, and airfields. The remaining 67,142 acres are available for military training activities (BHATE Environmental Associates, Inc., 2004).

Detailed environmental site descriptions (geology, hydrology, climate, major soil associations, wildlife and vegetation) for Fort Campbell are recorded in the 2014-2018 Integrated Natural Resources Management Plan (INRMP). The document is maintained within the DPW, Environmental Division, Conservation Branch. The information contained within this document is used periodically by certified pest applicators to evaluate the potential fate and impact on natural-resources.

3.2 Inventory of Land Use and Layout of Facilities

There are two categories of grounds, improved and unimproved, on Fort Campbell. All Real Property information is maintained by the DPW, Master Plans Division.

3.2.1 Improved Grounds

Improved grounds include acreage on which intensive maintenance activities are planned and performed annually as fixed requirements. These activities include pest management, mowing, dust and erosion control, drainage, planting for landscape effect and other intensive practices.

The Fort Campbell cantonment area supports approximately 4437 permanent and temporary buildings totaling 21,887,870 square feet. The cantonment area is approximately 14,158 acres of developed land which requires intensive annual maintenance.

3.2.2 Unimproved Grounds

Unimproved grounds include the rear training areas. There are 67,879 acres of unimproved land at Fort Campbell. Activities on unimproved grounds do occur, but not on a regular basis, and are generally unpredictable depending upon mission activities.

The rear training areas consist of 67,879 acres of military maneuver land. The landscape consists of forest and field habitat. Training areas comprise approximately 70% of Fort Campbell's acreage and includes 65 ranges. There are four parachute drop zones that are regularly maintained by the Agriculture Outlease Program.

4.0 PRIORITY OF PEST MANAGEMENT

All pest management activities incorporate an integrated methodology to resolve pest issues on Fort Campbell. Current manpower and resourcing requires the development and implementation of a priority based service system. Installation pest control personnel are required to complete pest management actions within 30 calendar days; however, many pest management actions may take longer than 30-days to resolve the pest issue. Management priorities supporting pest management on Fort Campbell are:

Priority 1 - Disease vectors
Priority 2 - Real property pests
Priority 3 - Nuisance pests

4.1 Disease Vectors and Medically Important Arthropods

a. Mosquitoes. Mosquitoes are significant pests from March to late October. Depending on rainfall, fogging may be required until early winter. Several mosquito borne illnesses are found within the region, West Nile (WNV) and Zika virus (ZV). No conclusive cases of either illness have been found on the installation. However, three cases of West Nile virus have resulted in the death of one individual from the local community. Preventive Medicine has developed monitoring procedures and educational programs to detect any incidence of WNV and ZV on the installation.

b. Ticks. Tick species are abundant on the installation. Species of primary concern are those capable of spreading Rocky Mountain Spotted Fever and Lyme Disease. Ticks of primary concern are the American Dog Tick, *Dermancentor variablis*, Lone Star Tick, *Dermacentor americanum*, Gulf Coast Tick, *Ablyomma maculatum* and the Deer Tick, *Ixodes dammini*. One soldier died during May 1999 from Human Monocytic Ehrlichiosis. Two cases of Ehrlichiosis have been reported recently on the installation, but the origination is inconclusive. Recent test of the Gulf Coast Ticks identified the presence of the *Rickettsia parkeri* bacteria that has caused deaths in the southeastern states. Increased monitoring of ticks and tissue samples of deer are being used to do research on the incidence of the tick vector. Increased emphasis on limiting deer hosts around inhabited areas should help solve this problem. USCHPPM is assisting in various tick collection efforts by Fort Campbell personnel.

c. Spiders. Black Widow and Brown Recluse spiders are common on the installation. They are primarily found in older, little used buildings. They do present a hazard. Very few cases are reported on an annual basis. These spiders typically inhabit family housing units and work environments (administrative and warehouse space) posing a threat to humans. Some specific quarters have had significant problems. All IPM controls are used to keep these spiders under control.

d. Bees, Wasps, and Hornets. Honey Bees, Paper Wasps, Cicada Killers, Hornets, and Yellow Jackets inhabit the installation. The stings are painful and can cause allergic reactions in certain individuals. Swarms of bees or hornet's nests are removed from areas that may promote contact with humans. These pests are primarily a nuisance. Local beekeepers help remove swarms when possible.

e. Flies. Flies can carry diseases; therefore, they are controlled inside dining facilities using mechanical means. Flies that are not indoors are controlled with baits. The riding stables and dog kennels for MWR have significant amounts of fly control.

4.2 Quarantine Pests

A monitoring program is conducted each year for Gypsy moth infestation. So far only one male moth has been collected. This program is conducted by placing pheromone sticky trap attractors throughout the installation.

4.3 Real Property Pests (Structural/Wood Destroying Pests)

Subterranean termites cause damage to wooden buildings and other structures on the installation. Some facilities have experienced extensive damage and are treated to stop re-infestation. New construction design includes application of termiticides in the construction plan. Specific information on USACE Specifications is included at Appendix L. These specifications are included in new construction contracts on Fort Campbell. Campbell Crossings LLC is responsible for control of termites within the housing community.

4.4 Stored Products Pests

Fort Campbell does not have a significant stored product pest problem. Areas that typically have problems include the Commissary, CIF, TISA, AAFES stores, and warehouses. Pests that are most prevalent and must be treated include: Indian meal moths, Saw tooth grain beetles, and Confused flour beetles. Very little work is done to control these pests. Due to the small lots of products infested with these type organisms, most products are returned to manufacturer or destroyed.

4.5 Ornamental Plant and Turf Pest

Fort Campbell has significant problems with bagworms. Most service orders for ornamental pests deal with bagworms. The Golf Course treats for grubs (Japanese Beetle and June Beetles) in the turf areas on a consistent basis. Tent caterpillars are present on the installation. Most infestations occur in areas that are not significant.

Most infestations found in the cantonment area are handled by building occupants. Building occupants physically remove bagworm infestations from limited ornamentals. Other pests include army worms, cutworms, sawflies, algae (turf), the diseases brown patch, Anthracnose, *Helminthosporium*, and dollar spot. Plant problems include: algae, crabgrass, goose grass, nutsedges, dandelions, clover, knotweed, and chickweed. Moles, groundhogs and deer are vertebrate pests. Integrated Pest Management Outlines for the Golf Course are located at Appendix B.

4.6 Undesirable Vegetation

Chemical control of unwanted vegetation is done throughout the installation. Due to the large acreage that is mowed each summer, weed control is accomplished through mowing. In addition, chemical control along with mechanical controls is used to control noxious weeds and grasses. Privet, Oriental Bittersweet, Johnson, Grass, Kudzu and other invasive species have been found in the cantonment area. Johnson

grass is a big problem in agriculture fields. Parrot Feather has been released in one of the trout ponds located in Clarksville Base. Renewed efforts are being put in place to proactively manage Johnson grass, Tree of Heaven and Sericia Lespedeza.

4.7 Animal Pests.

a. Rodents. Mice present the bulk of vertebrate pests on the installation. Mice are found throughout the area and tend to migrate towards buildings during the early fall. Damage caused by these rodents can be significant.

b. Birds. Pigeons, English sparrows and starlings present the main bird problem. Extensive work has been done to alleviate problems with birds. Fort Campbell has employed mechanical controls and trapping to reduce bird populations in buildings, stadiums and hangars. Pyrotechnics are used to move starling roosts as necessary when large numbers of birds congregate. Pigeon trapping is used to quickly reduce large concentrations of pigeons. Starlings continue to roost on the installation in large numbers. The Gander Newfoundland Memorial is seasonally infested with roosting birds. Large numbers of birds tend to roost there during the late summer/early fall time frame and must be moved using pyrotechnics. Removal of birds by lethal means is utilized when all other techniques have been exhausted. Lethal control is conducted by trained and certified pest management personnel utilizing an air rifle.

c. Mammals. A comprehensive vertebrate management plan is included in appendix P. Stray domestic animals present a constant problem. Stray cats and dogs are managed under a Directorate of Public Works contract for collection, transportation, and Veterinarian care. Pest Control staff may assist when needed but, employee time and government equipment use must be reimbursed by the contractor. Small and medium sized mammals, skunks, raccoons, opossums, squirrels, and groundhogs, may require lethal removal will be dispatched by installation Pest Control personnel. Installation Pest Control staff have the primary responsibility for removal of dead animals. Fort Campbell's cantonment area deer population may impact the Fort Campbell community through vehicle collisions, disease vectors, and browsing on ornamental plants. Deer animal issues are referred to the Fish and Wildlife Program for resolution. Feral Hog issues are addressed by the Fish and Wildlife Program with support from the game wardens. Feral swine have tested positive for Swine Brucellosis and Pseudorabies. Both diseases can affect either domestic animals or humans. A comprehensive feral swine management plan is included in Appendix M.

Deer present some special problems on the installation. Due to their high visibility, they offer special challenges in controlling them. Significant deer problems routinely occur within the cantonment area of Fort Campbell. The Golf Course has significant problems which are alleviated by live trapping, netting, and lethal means when necessary. Surveillance techniques are utilized to determine when deer are on the airfield and lethal removal is schedule to reduce the chance of an air strike. An active cantonment area depredation program administered by the Fish and Wildlife Program has been effective in reducing overall deer numbers and continuance of the program is necessary to maintain the cantonment area herd at a reasonable number. A comprehensive plan for deer control is included in Appendix L.

Fort Campbell is home to numerous groundhogs. The introduction of coyotes in the late 70's has practically eliminated groundhogs from being significant pests to agricultural crops. This is not the case in the cantonment area. Groundhogs cause problems by burrowing and undermining roads, facility foundations, and burrowing in the Golf Course. Control methods include trapping and gas bombs.

Beavers cause significant problems on the installation. The economic damage to standing timber is increasing. The most significant problem that beavers are causing is the stopping of drainage tiles. Water then flows over roads cutting the road surface and making access difficult. Control methods include tiles to reduce water flow in beaver ponds, relocation, and trapping only in areas where roads may be damaged by beaver activity. Beaver control is conducted as needed throughout the installation to reduce the impacts to infrastructure.

A standard operating procedure for lethal removal of vertebrate pests in included in Appendix N.

d. Reptiles. Snakes pose a minimal problem. The only poisonous snake commonly encountered is the copperhead. Habitat conditions in the housing areas are usually not conducive for this snake. Most snake service calls involve non-poisonous common species.

e. Bats. Bats are not a significant problem on the installation. Very few service orders to control them are generated. Bat roosting boxes are encouraged by FC wildlife biologist for their beneficial control of winged insects. Surveys for Indiana bat and gray bat, both endangered, indicate these bats are present; however none have been recorded within the cantonment area. All work orders associated with bats are coordinated with installation biologists before any action is taken.

4.8 Household and Nuisance Pests

Fort Campbell has significant problems with crawling insects. As long as housing areas, warehouses, office structures and billets are on the installation, cockroaches, spiders, ants, crickets, etc. will inhabit them. Insect management is the primary responsibility of the entomology section. Sanitation and exclusion are stressed in all insect control work.

5.0 INTEGRATED PEST MANAGEMENT (IPM)

Fort Campbell subscribes to the IPM concept. By using a variety of techniques, personnel are able to suppress or prevent major problems from pests. Chemical controls are the last avenue for treatment. Preferred treatments involve cultural, mechanical, or biological methods to control pests. Surveillance is crucial to the success of IPM. To effectively apply mechanical or biological controls, they require precise spot treatments.

5.1 IPM Principles

IPM is based on four basic principles. Each method may solve a pest problem in and of itself. The IPM concept uses several approaches to accomplish long term control in the most efficient and cost effective way. By applying IPM concepts, pesticide application may be used as the last step of control preceded by several nonchemical controls to provide a lasting solution to a pest problem.

a. Mechanical and Physical Control. This type of control utilizes exclusion devices, traps, and/or alters the environmental where the pest species is found. Examples of this type control include: harborage elimination through caulking or filling voids, screening, mechanical traps or glue boards, and nets and other barriers to prevent entry into buildings.

b. Cultural Control. Strategies involve manipulation of environmental conditions to suppress or eliminate pests. For example, eliminating breeding areas for mosquitoes by improving drainage of rainwater or by eliminating items that hold water for extended periods of time would eliminate the environment that mosquitoes rely upon. Customer education may be required to change a workplace or facility workforce behavior in response to a pest problem.

c. Biological Control. In this control strategy, predator, parasites or disease organisms are used to control pest populations. Sterile flies may be released to lower reproduction. Viruses and bacteria may be introduced to kill eggs, larvae or other life stages. Biological control may be effective in and of its self, but often works with other control methods. Biological controls may be costly initially and do not provide immediate results. Control is usually long-term and is more cost effective.

d. Chemical Control. Pesticides kill living organisms, whether they are plants or animals. At one time, chemicals were considered the most effective control available. Long-term use of chemicals has lead to pest resistance making many types of pesticides ineffective. Persistent residual pesticides are no longer being used. Frequent applications plus special handling cost associated with chemicals has greatly increased the cost. Chemical use for long-term control is usually the highest cost alternative to the other methods listed above. Use of chemical is typically the last step in the integrated pest process and should only be utilized if 1) other pest management actions were ineffective, 2) it was planned as part of the pest control process, and 3) no other nonchemical controls exist for the pest problem.

All pesticides and herbicides used in the Pest Management Program, will be registered with the EPA, and approved for use by the AEC, Pest Management Consultant, on a Pesticide Use Proposal (PUP), or an Out of Cycle Pesticide Use Request (OCPUR). The PUP and OCPUR's will be available for review by all applicators before chemicals are applied.

5.2 IPM Outline

IPM Outlines detailing each major pest or category of similar pest is addressed by site in separate outlines. New outlines will be added to Appendices A and B as new pests or sites are encountered that require surveillance or control.

6.0 Health and Safety

6.1 Medical Surveillance of Pest Management Personnel

All personnel who apply pesticides on the installation (excluding self-help pest management) are included in a medical surveillance program. This program consist of an initial physical examination to ensure that the new applicator can properly wear a respirator, is physically capable, and to establish baseline data for later reference. Each person receives annual physicals to determine pesticide expose or damage. People who exhibit symptoms of long-term exposure to pesticides will receive checkups that are more frequent. No one who exhibits a 25% reduction in their baseline CIS (Cholinesterase Inhibiting Substances) will be allowed to apply pesticides.

a. Personnel who handle or otherwise encounter wild animals on the installation may receive rabies prophylaxis. This includes military police, wildlife biologists, and pest management technicians.

b. USACHPPM Technical Guide No. 114 (Reference 3j) is used as a guide for medical monitoring of pesticide applicators.

c. The Occupational Health Section at Preventive Medicine, MEDDAC, medically monitors all Government Pesticide Applicators.

6.2 Hazard Communication

a. Installation pest management personnel are given hazard communication training, to include hazardous materials in his workplace. Following initial hazard communication classes, additional training is given to new employees and when new hazardous materials are introduced into the workplace.

b. Safety Data Sheets (SDS) are kept in each facility where pesticides are stored or handled. This includes the Entomology Shop (Building 5112), Roads and Grounds mixing facility (Building 5161) and the Golf Course maintenance facility (Building 1568). Copies of SDS are kept on each pest control vehicle for pesticides used that day.

6.3 Personal Protective Equipment

Approved masks, respirators, chemical resistant gloves and boots, and protective clothing (as specified by applicable laws, regulations and/or the pesticide label) are provided to pesticide applicators by the Government. These items are used as required during the mixing and application of pesticides. Pesticide contaminated protective clothing is not laundered at home. The clothing is laundered commercially. Severely contaminated clothing is not laundered, but is considered a pesticide related waste and disposed of by the Defense Reutilization and Marketing Office (DRMO) in accordance with current Environmental Office requirements.

6.4 Fire Protection

Building 5160 is Fort Campbell's primary pesticides storage facility. This facility has been renovated with updated fire protection equipment. This facility is curbed and provides good protection from contamination in case of a fire. This building has approximately 300 square feet and is used to store herbicides. A storage locker has been placed at the Golf Course. This locker was placed there to eliminate travel by road with bulk chemicals and to provide adequate storage of chemicals adjacent to the using site. In addition, pesticide inventories are sent to the fire department quarterly. The FC Fire Chief will determine, based on his pre-fire plan, which fire control efforts to employ depending on the size and type of fire at the time a fire call is reported.

Minor amounts of pesticides are also provided for sale or distribution at the Commissary, Post Exchange, Family housing Self-Help, Troop Self-Help, and SSSC.

6.5 Pest Control Vehicles

Current Pest Management vehicles are leased from the General Services Administration. All are pickups with lockable utility bodies. The Golf Course uses Cushman carts with pull trailers or have small tanks mounted directly to the unit. Each applicator is assigned a vehicle. Mixed pesticides are secured in vehicles at all times. Equipment is kept in the truck bodies with no contaminated equipment or pesticides being transported in the cab.

7.0 ENVIRONMENTAL CONSIDERATIONS

7.1 Protection of the Public

Precautions are taken during pesticide application to protect the public, on and off the installation. Pesticides are not applied outdoors when the wind speed exceeds 10 miles per hour or by label direction. Whenever pesticides are applied outdoors, care is taken to make sure that any spray drift is kept away from individuals, including the applicator. Individuals wearing the proper personal protective clothing and equipment indoors accomplish pesticide application for service orders. At no time are personnel permitted in treatment areas during pesticide application where sprayed chemicals are present unless they have met the medical monitoring standards and are wearing the appropriate protective clothing.

7.2 Sensitive Areas

Sensitive areas listed on pesticide labels are considered before pest control operations are conducted. No pesticides are applied directly to wetlands or water areas (lakes, rivers, etc.) unless use in such sites is specifically approved on the label.

Special care is given when pesticides are applied to the child development center, in patient areas of the health clinic, Troop Clinics, Dental Clinics, and the hospital. Pesticide labels instructions and guidance provided in the AFPMB TIM NO. 20, Pest Management Operations in Medical Treatment Facilities are followed.

7.3 Pollution Prevention

The Pest Management Program as outlined in this plan complies with Executive Order 12856 of August 3, 1993, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*. The control of pests with pesticides is considered only after non-chemical control methods have been exhausted. Integrated pest management strategies, which stress non-chemical control, form the basic framework of the Pest Management Program.

7.4 Environmental Documentation

Pest management activities included within this plan have been evaluated programmatically for potential environmental impact within an Environmental Assessment entitled “Fort Campbell Integrated Natural Resources Management Plan 2014-2018 Programmatic Environmental Assessment” supporting the Installation Integrated Natural Resources Management Plan (INRMP). This Pest Management Plan is an Appendix to the INRMP. Copies are available upon request at Directorate of Public Works Conservation Branch.

Pest management activities with potential impacts will be addressed in subsequent NEPA documents following the Fort Campbell NEPA procedure utilizing a Record of Environmental Consideration (REC) for each activity type defined within this analysis in accordance with 32 CFR 651.

7.5 Pesticide Spills and Remediation

A pesticide spill cleanup kit is maintained in the pesticide storage area of each building. Pesticide spill cleanup procedures, notification procedures, and a list of components of the spill kit is provided at Appendix E. In addition, a spill cleanup kit is kept on each vehicle. All pesticide spills are reported to the Environmental Division, Pollution Prevention Branch.

7.6 Pollution Control/Abatement Projection

Currently no pesticide spill abatement projects are active on the installation.

7.7 Prohibited Activities

At no time will a pesticide be used in any manner which is inconsistent with its label.

No pesticides will be used when its registration has been suspended or canceled by the EPA or the States of Kentucky or Tennessee.

7.8 Threatened and Endangered Species

Currently three federally protected species, Indiana and gray bats are listed as endangered and the Northern long-eared bat is listed as threatened, occur on the installation. These bats reside in the training areas and are not usually found in the cantonment area. All applications that could affect water and water quality take into consideration the bats and the effects of that may result.

Herbicide applications that are scheduled to occur within areas containing rare, threatened, or endangered plant species are coordinated and reviewed through the installation NEPA process.

7.9 Application Methods

Use of pesticides on Fort Campbell will follow specific chemical labels and may utilize the most appropriate and acceptable application technique (boom sprayer, aerial application, spot spray, etc.) to limit impacts to non-treatment areas.

8.0 ADMINISTRATION

8.1 Agricultural Outleases

Outleasing involves extensive acreage on the installation. Approximately 6,000 acres of land is leased annually. Pesticide usage complies with this plan and is reported to the Agriculture Outlease Manager and forwarded to the IPMC. For quality assurance and compliance with quality assurance requirements, lessees shall notifiy installation pest management staff prior to the application on agricultural products on Fort Campbell.

8.2 Staffing

Only individuals certified for handling, storage, mixing, application and inspection of pesticides are involved with the application of herbicides on Fort Campbell. Individuals certified in pesticide application may be found in DPW, DFMWR, Preventative Medicine, agricultural lessees, and various contractor supporting construction and maintenance activities. All certifications are maintained by the IPMC.

Installation biologists must complete annual qualification requirements for use of compressed air pellet rifles for depredation activities. Appendix N outlines qualifications and requirements for use of air rifles on Fort Campbell.

8.3 Materials and Equipment

The Government furnishes all materials, buildings and equipment except for leases and contracts for the government. Only pesticides and pesticide application equipment required by the programs are maintained on the installation. Pesticides are ordered as required.

8.4 Mixing Facilities

All pesticides are mixed at building 5112, 5161, and 7606. Building 5161 is an open-air structure that is contained in an enclosed compound. Herbicides are stored in an approved storage building. Agricultural chemicals are mixed in the field from bulk tank water trucks and then applied utilizing approved equipment or are custom mixed at the CO-OP and transported to the installation and applied. A metal structure located within the DPW, Roads and Grounds compound contains small equipment, materials and supplies. All structures are curbed in event of a spill.

8.5 Reports and Records

Adequate records of all pest management operations performed by installation personnel (pest management and the Golf Course), agricultural lessee, and self-help are maintained on the installation.

Each section maintains daily application and surveillance records. Daily forms provide a historical record of pest management operations for each building, structure or outdoor site on the installation. All sections maintain internal application records and report usage of pesticides to IPMC monthly.

The Entomology Section supervisor maintains a current inventory of stored pesticides and provides data to AEC annually.

Depredation documentation is maintained by the Fish and Wildlife Program and maintained within the administrative record for three years following the conclusion of all control actions.

8.6 Training

Government employees, who apply pesticides, are DoD certified. Training and certification is conducted by Academy of Health Services, Fort Sam Houston, TX. Pesticide applicators must also be certified within the states in which they operate. Certified personnel must recertify every three years. Installation pest management personnel are certified in the appropriate EPA categories in order to perform pest

management operations. PMC, Pest Control Supervisor and select personnel are certified as Quality Assurance Evaluators.

8.7 Job Orders

The Public Works pest management technicians perform pest surveillance and control through Service Orders. Fort Campbell customers submit DPW Service Orders and all Pest Management staff address the requested service. Service Orders may be requested for indoors and outdoors in 1) food handling buildings, 2) the Health Clinic and Child Development Center, and 3) all other buildings on Fort Campbell.

Family housing units are serviced through a support contract administered by Campbell Crossing LLC. Fort Campbell monitors the amounts and types of pesticides used in the housing area. Campbell Crossing LLC is responsible for overall administration, work orders generated, and annual pesticide use reporting to the IPMC.

8.8 Contracts

Fort Campbell pesticide contracts include the Agriculture Outleasing, MCA project sub-contractors, RCI sub-contractors and GSA contractors. Pesticide application shall be in accordance with label directions and this plan. The Pest Management Coordinator will review pesticide contracts during the contracting phase. Contracts shall be submitted for AEC approval in accordance with AR 200-1. Contract applications shall contact installation QAE staff prior to application.

Construction projects on Fort Campbell shall be reviewed with pest prevention and control in mind. Engineering and medical personnel review the design of new buildings or other structures and conduct a pest evaluation in the constructed facility prior to completion of the project to ensure that insect and rodent entry points and potential harborages have been eliminated.

9.0 COORDINATION - DoD, Other Federal, State and Local

The Army Pest Management Program is responsible for protecting personnel from illness and material from damage by pests, wherever in the world they may be. The program includes both medical and operational responsibilities. While these responsibilities do overlap, Medical Command (MEDCOM) focuses on preventing and minimizing medical consequences of pests and pest management operations while the Assistant Chief of Staff for Installation Management and the Army Environmental Center concentrate on safe, effective implementation of pest management operations and environmental considerations of pest management operations. A list of organizations involved with, or who have impact on, the Army Pest Management Program is found in Appendix I. Their addresses and a description of their responsibilities are also included.

The AEC Pest Management Consultant approves the Pest Management Plan, and gives special attention to any pesticide application that: uses restricted use pesticides; uses any pesticide that may significantly contaminate surface or ground water; includes 259 or more hectares (640 acres) in one pesticide application; may adversely affect endangered or other protected species or habitats; or involves aerial application of pesticides.

Liaison is maintained between the Pest Management Coordinator and Preventive Medicine personnel at MEDDAC to determine the prevalence of disease vectors and other public health pests in the area surrounding the installation. Installation personnel coordinate with the Corps of Engineers to assure that pesticide application, such as termite pretreatment for new construction, is properly performed and documented.

10.0 SALE AND DISTRIBUTION OF PESTICIDES

10.1 Family Housing Self-Help

The Campbell Crossing LLC initiative has made the Family Self Help Program defunct.

10.2 Troop Self-Help

Pest control items are available to unit self-help representatives through the self-help store, operated by the Directorate of Public Works in building 863. The hours of operation are Monday thru Friday (0900-1600). Records are kept and provided monthly to IPMC. Self-help items include:

a. Red Panther Wasp Spray;

b. Combats for cockroach control;

c. Snap traps for mouse control; and

d. Boric acid roach powder.

10.3 Other Activities

AAFES/Commissary. Pesticides sold by the Post Exchange, Building 2840, are registered by the EPA for general use; restricted use products are not sold. Pesticide products are grouped into several separate categories: Products applied to pets for ectoparasite control, repellents, household, and lawn and garden products. A spill cleanup kit is on hand in the immediate vicinity of the home and garden pesticide storage area. Store personnel are familiar with the use of the cleanup kit and with installation spill contingency procedures. A building layout plan is included in the Fire Plan.

Veterinary Clinic. Products containing pesticides are sold to Veterinary Clinic customers for their own use. These products are registered by EPA and are labeled for application to animals. Hours of operation are from 0700-1600 Monday thru Friday.

11.0 REGULATED PEST

11.1 Quarantine Pests

Fort Campbell works in conjunction with the USFS (U. S. Forest Service) to set survey sticky traps to detect the presence of Gypsy Moth. Fort Campbell has no other requirements for quarantine pests at this time.

11.2 Noxious Weeds

The INRMP lists dozens of plants considered noxious weeds or invasive plants. Many are encountered throughout the training areas in field habitats. Every effort is made to eliminate these species whenever possible. Special care is taken not to harm non-targeted species when treating for noxious weeds. All invasive noxious weeds are addressed whenever found and eliminated as soon as possible.

12.0 PEST MANAGEMENT REFERENCES

12.1 Federal and State Laws

The Federal Insecticide, Fungicide and Rodenticide Act (thru PL 100 460, 100-464 to 100-526, and 100-532).

Title 29, Code of Federal Regulations, 1993 revision, Section 1910, Occupational Safety and Health Standards.

12.2 Regulations

DoDI 4150.07, DoD Pest Management Program, May 2008.

DoDD 4715.1E, Environment, Safety, and Occupational Health (ESOH), March 2005.

DA PAM 40-11, Preventive Medicine, July 2005

AR 11-34, The Army Respiratory Protection Program, February 1990.

AR 40-5 Preventive Medicine, May 2007

AR 200-1, Environmental Protection and Enhancement, December 2007.

12.3 Technical Manuals

TM 5-629, Weed Control and Plant Growth Regulation, 24 May 1989.

TM 5-632, Military Entomology Operational Handbook, December 1971.

TBMED S61, Pest Surveillance in Medical Facilities

12.4 U.S. Army Center for Health Promotion and Preventive Medicine Technical Guides

No. 114, Guide for Medical Surveillance of Pest Controllers, March 1976.

No. 138, Guide to Commensal Rodent Control, December 1991.

12.5 Armed Forces Pest Management Board Technical Information Memorandums

No. 13, Ultra Low Volume Dispersal of Insecticides by Ground Equipment.

No. 14, Protective Equipment of Pest Control Personnel, March 1992.

No. 15, Pesticide Spill Prevention Management, June 1992.

No. 16, Pesticide Fires: Prevention, Control, and Cleanup, June 1981.

No. 20, Pest Management Operations in Medical Treatment Facilities, October 1989.

No. 26, Lyme Disease Vector Surveillance and Control, March 1990.

No. 29, Integrated Pest Management in and Around Buildings, July 1994.

No. 34, Bee Resource Manual, Aug 1995.

No. 35 Termite Inspection Recommendations, Feb 1996.

No. 37 Guidelines for Reducing Feral/Stray Cat Populations on Military Installations in the US. January 1996.

Department of Defense Guidance for the Surveillance, Control, and Testing of *Aedes albopictus*, *Ae. aegypti*, and *Ae. polynesiensis* for Zika Virus, Feb 2016.

12.6 Other References, Manuals, Books and Guides

Crop Protection Chemicals, 7th Edition, Chemical and Pharmaceutical Publishing Corp, 1155 15th Street, NW, Washington, D.C. 20005, 2169 pp.

Mallis Handbook of Pest Control, 7th Edition, PCT Books, 4012 Bridge Ave, Cleveland, Ohio 44113, 1100 pp.

Military Handbook #1028/8a, 1 November 1991.

Soil Survey of Christian, Trigg Counties, KY, Natural Conservation Resource Service, 1994.

Soil Survey of Montgomery and Stewart Counties, TN, Natural Resources Conservation Service, 1993.

Appendix A
Integrated Pest Management Outlines

1. German Cockroaches - Family Housing
2. German Cockroaches - Food Service Facilities
3. German Cockroaches - Barracks, Offices and Other Administrative Buildings
4. American Cockroaches
5. Filth Flies - Food Serving Facilities
6. Filth Flies – Stables
7. Stored Products Insects
8. Mosquitos
9. Ants
10. Carpenter Ants
11. Spiders
12. Crickets
13. Earwigs, Ground Beetles, and Other Crawling Insects
14. Bees and Wasps
15. Subterranean Termites
16. Tick
17. Silverfish
18. Lice
19. Fleas
20. Tent Caterpillars
21. Mice - Food Storage Warehouses
22. Mice - Family Housing, Offices, Barracks, and Other Administrative Buildings
23. Birds (Pigeons, Blackbirds, Starlings, and Sparrows)
24. Other Vertebrate Pests
25. Snakes
26. Broadleaf Weeds - Parade Fields, Lawns, and Other Common Grassy Areas
27. Broadleaf Weeds - Golf Course
28. All Vegetation - Utility Pole and Hydrant Bases, Sidewalks Around Building Foundations, Parking Lots, and Fence Lines
29. Aquatic Weeds, Floating and Submerged
30. Mosquitos - Container Breeding *Aedes* (Zika virus transmission)

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Integrated Pest Management Outline No. 1

PEST: German Cockroaches.

SITE: Family housing.

1. Purpose: To control nymphal and adult cockroaches in family housing.

2. Surveillance.

a. Conducted by: Occupants. Pest management technicians between occupancy and when services are requested following self-help failure. Preventive medicine upon special request.

b. Methods: Visual observation and sticky traps.

c. Frequency: As necessary.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Use sticky traps in kitchens and bathrooms when a minor infestation of cockroaches occurs. Eliminate cockroach harborage by caulking (or filling with other materials) minor cracks, crevices, holes in walls and floors, or other areas where the structure has provided small openings which could be used by cockroaches.

(b) Conducted by: Occupants - sticky traps and caulking materials can be obtained from Self-Help. Preventive Maintenance may also eliminate cockroach harborage when work is done between occupancy or during renovation.

(2) Type: Biological.

(a) Method and Location: None.

(b) Conducted by: Contract personnel

(3) Type: Cultural.

(a) Method and Location: Clean up spilled food and place stored food items in closed containers. Keep papers, bags, boxes and other items off the floors in the kitchen and bathroom to eliminate harborage areas for the cockroaches. Be sure not to overlook items such as recycle materials, pet food, etc.

(b) Conducted by: Occupants.

b. Initial Chemical.

(1) Basis for Treatment: Presence of cockroaches in the quarters.

(2) Conducted by: Contract.

(3) Pesticide – An approved EPA registered chemical

(5) Control Standard: If cockroaches are still found, then call the pest management technician for assistance.

c. Follow-up Chemical.

(1) Basis for Treatment: Cockroaches still present after initial measures have been used and failed to control the infestation.

(2) Method and Location: Apply residual pesticides to harborage areas in kitchens, bathrooms and other areas where cockroaches are found.

(3) Conducted by: Contract.

(4) Pesticide. (IPM)

(5) Control Standard: No call backs indicate successful treatment. Spot treat quarters where follow-up control is indicated.

4. Precautions for Sensitive Areas: Cholinesterase inhibiting pesticides are not applied in areas that infants may occupy.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: None.

Integrated Pest Management Outline No. 2

PEST: German Cockroaches.

SITE: Food service facilities.

1. Purpose: To control nymphal and adult cockroaches in food service facilities.

2. Surveillance.

a. Conducted by: Food service personnel, Preventive Medicine, and Pest Management Technicians.

b. Methods: Visual observations by workers. Sticky traps by other inspectors. Preventive medicine conducts inspections at night for cockroaches.

c. Frequency: Daily by food service personnel. During sanitation inspections or conducted as a special survey for cockroaches by Preventive Medicine. Monthly by pest management technicians.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Eliminate cockroach harborage by caulking (or filling with other materials) minor cracks, crevices, holes in walls and floors, or other areas where the structure has provided small openings which could be used by cockroaches. Caulking materials can be obtained from Self-Help.

(b) Conducted by: Pest management technicians and augmented by food service and maintenance personnel.

(2) Type: Cultural.

(a) Method and Location: Use good sanitation to reduce food and water for cockroaches. Clean up spilled food from work surfaces, walls and floors. Wash dirty dishes and cooking containers following use - do not leave exposed food in the facility overnight. Remove bags, boxes and other potential harborage from kitchens, storerooms, etc. Keep food in sealed containers when not in use. Standing water should be eliminated and leaking pipes should be fixed.

(b) Conducted by: Food service personnel.

b. Initial Chemical.

(1) Basis for Treatment: Cockroaches found during surveillance or a trap index of one or greater.

(2) Method and Location: Crack and crevice residual application.

(3) Conducted by: Pest management technicians.

(4) Pesticide. Use of IPM, and chemical control will be used if all else fail.

(5) Control Standard: No live cockroaches found 30 days following treatment. When sanitation and harborage present problems in a facility, a reduction in the number of cockroaches in sticky traps may indicate the effectiveness or limitation of chemical control efforts.

c. Follow-up Chemical.

(1) Basis for Treatment: Presence of cockroaches.

(2) Method and Location: Place bait stations in locations where cockroaches have been seen (e.g., cabinets, under appliances, under sinks, etc.). Place the bait stations along the junction between walls and floors and in equipment voids for maximum effectiveness.

(3) Conducted by: Pest management technicians.
(4) Pesticide – An approved EPA registered chemical.
(5) Control Standard: Leave bait stations in place until bait is gone. Remove empty bait stations to preclude cockroaches using them for harborage sites.

4. Precautions for Sensitive Areas: Do not apply to areas where aquariums are present.

5. Prohibited Practices: Do not apply pesticides on food items, utencils, or on food preparation surfaces. Do not let unauthorized personnel in the facility during treatment.

6. Environmental Concerns: None.

7. Remarks: Pesticides should be considered the last option in controlling cockroaches. As long as poor sanitation or harborage exist, the effectiveness of chemicals to control cockroaches may be limited.

Integrated Pest Management Outline No. 3

PEST: German Cockroaches.

SITE: Barracks, offices and other administrative buildings.

1. Purpose: To control nymphal and adult cockroaches in building areas where people store and/or eat food on an occasional basis (e.g., break areas, coffee rooms, vending areas, etc.).

2. Surveillance.

a. Conducted by: Occupants. Pest management technicians when services are requested following self-help failure. Preventive medicine upon special request.

b. Methods: Visual observation and sticky traps.

c. Frequency: As necessary.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Use sticky traps in break areas or in other areas where food is eaten or stored when a minor infestation of cockroaches occurs. Eliminate cockroach harborage by caulking minor cracks, crevices, and holes where cockroaches may hide. This may not be required in these types of facilities; however, should cockroaches get out of hand (repeat professional treatment required), then harborage elimination may be required.

(b) Conducted by: Occupants - sticky traps and caulking materials.

(2) Type: Cultural.

(a) Method and Location: Place stored food items in closed containers. Keep break areas clean and clean up spilled food immediately. Rinse out food containers (e.g., soda cans, coffee cups, etc.) to reduce cockroach food. Keep papers, bags, boxes and other items off the floors in areas where food is present to eliminate harborage areas for the cockroaches.

(b) Conducted by: Occupants.

b. Initial Chemical.

(1) Basis for Treatment: Presence of cockroaches.

(2) Method and Location: Use self-help-items where cockroaches have been seen. Apply bait stations in locations where cockroaches have been seen (e.g., cabinets, desks, under sinks, etc.). Place the bait stations along the junction between walls and floors for maximum effectiveness.

(3) Conducted by: Occupants.

(4) Pesticide – An approved EPA registered chemical

(5) Control Standard: Continue bait station use for 30 to 60 days. If cockroaches are still found, then call the pest management technicians for assistance.

c. Follow up Chemical.

(1) Basis for Treatment: Cockroaches still present after self-help measures have been used and failed to control the infestation.

(2) Method and Location: Apply residual pesticides to harborage areas in kitchens, bathrooms and other areas where cockroaches are found.

(3) Conducted by: Pest management technicians.

(4) Pesticide: (IPM), before the usage of approved chemical.

(5) Control Standard: No call backs indicate successful treatment. Do follow up in two weeks.

4. Precautions for Sensitive Areas: Cholinesterase inhibiting pesticides are not applied in areas that infants may occupy.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: Cockroach elimination usually responds to good sanitation and light chemical treatment.

Integrated Pest Management Outline No. 4

PEST: American Cockroaches.

SITE: Mechanical rooms, steam tunnels, and crawl spaces.

1. Purpose: To prevent cockroach infestations in basements, crawl spaces, and other below-ground or on-ground areas in buildings which are connected to the utility and sewer systems.

2. Surveillance.

a. Conducted by: Building occupants.

b. Methods: Visual observation in manholes, crawl spaces, and other places where these cockroaches have been a problem.

c. Frequency: As needed.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Eliminate moisture in basements and other below-ground areas in buildings that could support cockroaches - this is most likely to occur in the main post area. Ventilate wet or damp areas under buildings. In buildings which experience frequent invasion of American cockroaches, drains, particularly those in the basements or on ground level, should have grates or screens over the openings with a mesh size less than 1/8-inch. Utility doors should fit tightly, and pipe chases and other entry points should be sealed.

(b) Conducted by: Pest Control Technician

(2) Type: Biological.

(a) Method and Location: Sanitation.

(b) Conducted by:

(3) Type: Cultural.

(a) Method and Location: None.

(b) Conducted by: Building occupant

b. Initial Chemical.

(1) Basis for Treatment: American cockroaches found in sewers.

(2) Method and Location: IPM

(3) Conducted by: Pest management technicians.

(4) Pesticide. IPM

(5) Control Standard: No live cockroaches in treated areas 30 days following treatment.

c. Follow up Chemical.

(1) Basis for Treatment: American cockroaches found in basements, crawl spaces, utility tunnels, etc.

(2) Method and Location: Use all methods possible (IPM), before applying pesticides. Conducted by: Pest management technicians.

(3) Pesticide. NONE

(4) Control Standard: No call backs indicate successful treatment. Spot treat areas where follow-up control is indicated.

4. Precautions for Sensitive Areas: Same as German cockroach.

5. Prohibited Practices: Same as German cockroach.

6. Environmental Concerns: Same as German cockroach.

7. Remarks: American cockroaches are not a problem as long as they stay in the sewer system. However, at times the cockroaches invade family housing units or other buildings on main post (e.g., break in the sewer line). Treatment should proceed from the place where cockroaches cause problems in buildings back to other harborage sites in the sewers or other underground places. If this is not done, then treatment in underground cockroach harborage sites may drive additional insects into buildings not previously experiencing problems.

Integrated Pest Management Outline No. 5

PEST: Filth Flies.

SITE: Food service facilities.

1. Purpose: To control filth flies in facilities where food is prepared or served.

2. Surveillance.

a. Conducted by: Food service personnel, Preventive Medicine, and Pest management technicians.

b. Methods: Visual observations. Fly grids may be used by Preventive Medicine when fly infestations are heavy and need to be quantified; however, most fly problems at food service facilities are relatively easy to determine visually.

c. Frequency: Daily by food service personnel. During sanitation inspections or conducted as a special survey for flies by Preventive Medicine. Monthly by Pest management technicians.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Sticky fly traps may be used in areas which are not directly over prepared food or food preparation surfaces. This method may be effective when only a few flies are found indoors. Fly grids designed to stun and capture flies on a sticky surface may be used in kitchen and eating areas (as opposed to older fly grids which are designed to electrocute flies causing them to explode and fragment).

(b) Conducted by: Food service personnel.

(2) Type: Mechanical and Physical.

(a) Method and Location: Screens should be used to preclude fly entry when doors and windows are to be left open. Automatic self-closing devices should be placed on outer doors to reduce the time open doors permit fly entry. Air curtains may also be used at entry points, but must be installed and maintained correctly to blow flies away from the entrance and not into the entrance and should cover the entire door width.

(b) Conducted by: Building maintenance personnel. However, keeping doors closed when not in use is the responsibility of food service personnel.

(3) Type: Biological.

(a) Method and Location: None.

(b) Conducted by:

(4) Type: Cultural.

(a) Method and Location: Use good sanitation to reduce food and water which attract flies. Clean up spilled food from work surfaces, walls and floors. Wash dirty dishes and cooking containers following use - do not leave exposed food in the facility overnight. Place garbage in sealable bags. Place the bags in containers with tight fitting lids and keep containers closed when not in use. Do not place dumpsters within 50 feet of the facility.

(b) Conducted by: Food service personnel.

b. Chemical.

(1) Basis for Treatment: Flies found within the facility.

(2) Method and Location: Contact treatment with aerosol insecticide.

(3) Conducted by: Pest management technician.
(4) Pesticide. Use all methods of IPM before applying pesticides.
(5) Control Standard: Use good sanitation. Flies are killed on contact.

4. Precautions for Sensitive Areas: Some fogging may be necessary as a last result.

5. Prohibited Practices: Do not apply pesticides on food items or on food preparation surfaces.

6. Environmental Concerns: None.

7. Remarks: Good sanitation should virtually eliminate fly problems at food service facilities. The pesticide listed above should be the only chemical control used. If flies are coming into the facility from a nearby source (e.g., farm, dump, etc.), then contract personnel would be notified to look into the problem. Refuse containers need to be cleaned weekly in the summer months to preclude fly breeding.

Integrated Pest Management Outline No. 6

PEST: Filth Flies.

SITE: Stables.

1. Purpose: To control filth flies at the stables.

2. Surveillance.

a. Conducted by: Stable and Veterinary personnel.

b. Methods: Visual observations. Fly grids may be used by Veterinary personnel when fly infestations are heavy and need to be quantified.

c. Frequency: Daily by stables personnel. During inspections or conducted as a special survey for flies and other problems by Veterinary personnel.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Sticky fly traps may be used inside administrative buildings. This method may be effective when only a few flies are found indoors. Fly grids designed to stun and capture flies on a sticky surface (as opposed to older fly grids which are designed to electrocute flies causing them to explode and fragment) may be used in barns or other areas where flies interfere with ongoing operations.

(b) Conducted by: Stable personnel.

(2) Type: Mechanical and Physical.

(a) Method and Location: Screens should be used to preclude fly entry into administrative buildings.

(b) Conducted by: Building maintenance personnel. However, keeping doors closed when not in Use is the responsibility of stables personnel.

(3) Type: Biological.

(a) Method and Location: Parasitic wasps are periodically released in the horse stall areas. The wasps are used to parasite eggs and larvae of flies. The wasps are purchased from a private company.

(b) Conducted by: Stable personnel.

(4) Type: Cultural.

(a) Method and Location: Use good sanitation to reduce or eliminate the potential for fly breeding in manure. Horse stalls are cleaned out daily by horse owners; Army horse stalls are cleaned out daily by stables personnel. Manure is either hauled away to a disposal Bite or spread over the ground to dry. Manure is spread so that it dries in less than one week, thus not providing a medium for fly breeding.

(b) Conducted by: Horse owners and stable personnel.

b. Chemical.

(1) Basis for Treatment: Flies found in administrative buildings.

(2) Method and Location: Contact treatment with aerosol insecticide in administration areas.

(3) Conducted by: Stable personnel.

(4) Control Standard: All flies are killed.

c. Chemical.

(1) Basis for Treatment: Flies found in horse stalls.
(2) Method and Location: Place fly bait in the vicinity of the stalls.
(3) Conducted by: Pest Management Personel.
(4) Pesticide – An approved EPA registered chemical
(5) Control Standard: Fly numbers are reduced.

4. Precautions for Sensitive Areas: Do not apply pesticides in horse areas. Keep fly bait away from pets and horses.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: Good sanitation should significantly reduce flies at the stables. Good manure management, used in conjunction with the parasitic wasps, should be effective. At no-time will residual pesticides be applied to manure, buildings or grounds at the stables for fly control. Because resistance to pyrethrins is common in flies, this chemical should be used as little as possible. If flies are not killed with pyrethrin, discontinue use.

Integrated Pest Management Outline No. 7

PEST: Stored Products Insects.

SITE: Food storage warehouses (Commissary and TISA), and food handling buildings (FHB).

1. Purpose: To control insects which damage food and fiber products.

2. Surveillance.

a. Conducted by: Veterinary Food Inspectors, Preventive Medicine Specialists, and Pest Controllers.

b. Methods: Visual observations for insects and/or conditions that could favor insect infestations in stored food products. Particular attention should be given to rodent bait stations when they are in use since most baits are subject to insect infestation. Augment visual observations with pheromone traps.

c. Frequency: Monthly in food service facilities -Preventive Medicine and pest management technicians; daily in the Commissary and its warehouses, and the TISA - Veterinary Inspectors.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Clean up spilled food materials which may attract and provide a food source for insects at least daily. Vacuuming works better than sweeping in particle-filled cracks and crevices.

(b) Conducted by: Facility personnel.

(2) Type: Biological.

(a) Method and Location: None.

(b) Conducted by:

(3) Type: Cultural.

(a) Method and Location: Damaged goods should be kept in tight-fitting containers. Infested products are removed immediately upon discovery.

(b) Conducted by: Facility personnel.

b. Chemical.

(1) Basis for Treatment: Insects found in products or in the food storage areas.

(2) Method and Location: Residual pesticide - apply around pallets, floor/wall junctures, and other areas where insects may be present.

(3) Conducted by: Pest management technicians.

(4) Pesticide – An approved EPA registered chemical

(5) Control Standard: No evidence-of insects for 30 days following treatment.

4. Precautions for Sensitive Areas: Do not apply pesticides to food products or packages/outer wrappings of food.

5. Prohibited Practices: Do not treat when building is occupied.

6. Environmental Concerns: None.

7. Remarks: None

Integrated Pest Management Outline No. 8

PEST: Mosquitoes.

SITE: Cantonment area.

1. Purpose: To control adult mosquitoes on the main post area, including family housing.

2. Surveillance.

a. Conducted by: Preventive Medicine personnel.

b. Methods: Larval surveys in standing water on main post; six light traps distributed on main post in areas where people are most concentrated at night (when mosquitoes bite).

c. Frequency: Larval surveys done weekly; adult light traps operated twice per week.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Screens should be placed on windows on buildings occupied at night to exclude adult mosquitoes. Temporary standing water sites should be graded or filled to eliminate mosquito breeding. Precautions must be taken not to damage wetlands. Eliminate artificial container breeding sites.

(b) Conducted by: Preventive Medicine.

(2) Type: Biological. *Bacillus thuringiensis* (Bti).

(a) Method and Location: Applied to mosquito larvae found in standing water between the front gate on main post and the canal. If effective, no live mosquito larvae should be present 5 days after treatment.

(b) Conducted by: Preventive Medicine Personnel.

(3) Type: Cultural. None

(a) Method and Location: None.

(b) Conducted by: Preventive Medicine.

b. Chemical.

(1) Basis for Treatment: Tree line treated when adult mosquitoes are first found in light traps exceed 25 female mosquitoes/trap/night.

(2) Method and Location: Treat with an approved chemical with a power sprayer (ULV Fogger) to tree line where needed. As long as the counts remain at or above this level, then the tree line will be retreated every 30 days.

(3) Conducted by: Pest management technicians.

(4) Pesticide – An approved EPA registered chemical

(5) Control Standard: Mosquito numbers are reduced in trap below the 25 mosquito female mosquitos/trap/night.

4. Precautions for Sensitive Areas: Do not apply when wind speeds are in excess of 10 miles per hour. Refer to the local list of sensitive individuals before applying pesticides.

5. Prohibited Practices: Do not apply insecticides in areas where honeybees can be harmed.

6. Environmental Concerns: None.

7. Remarks: None

Integrated Pest Management Outline No. 9

PEST: Ants.

SITE: Family Housing.

1. Purpose: To eliminate ants from family housing units.

2. Surveillance.
    a. Conducted by: Contract Pest Controllers.
    b. Methods: Visual observations following occupant complaints.
    c. Frequency: As required.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Ant bait stations, available through can be placed along baseboards or runways used by ants.
            (b) Conducted by: Occupant.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Spilled food items, to include pest food, should be cleanup up immediately. Food products which are not being used should be kept in containers with tight fitting lids.
            (b) Conducted by: Occupants.
    b. Chemical.
        (1) Basis for Treatment: Ants seen in the quarters.
        (2) Method and Location: – Pesticide applied to foundations and door sills outside buildings.
        (3) Conducted by: Pest Control Contractor
        (4) Pesticide.
            (a) Common Name: Any pesticide as long as it is applied according to label (IPM).
        (5) Control Standard: No call backs to treated quarters within 30 days following treatment.

4. Precautions for Sensitive Areas: None.

5. Prohibited Practices: None.

6. Environmental Concerns: Same as German cockroach.

7. Remarks: Ants are a major problem - placement of a barrier around external building openings appears to control ants before they can enter. Ant problems occasionally occur in other buildings than those in family housing; however, the same information contained in this outline apply.

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Integrated Pest Management Outline No. 10

PEST: Carpenter Ants.

SITE: Wooden buildings.

1. Purpose: To control carpenter ant in wooden buildings.

2. Surveillance.
a. Conducted by: Pest Controller
b. Methods: Visual observation.
c. Frequency: Done in conjunction with termite inspections or as necessary following complaints.

3. Pest Management Techniques.
- a. Nonchemical.
  - (1) Type: Mechanical and Physical.
    - (a) Method and Location: Damaged wood should be replaced. Carpenter ants usually live in damp wood which is soft. Moisture control under and around buildings should be considered to reduce the possibility of carpenter ant infestations or to prevent them from returning.
    - (b) Conducted by: Pest Controllers.
  - (2) Type: Biological.
    - (a) Method and Location: None.
    - (b) Conducted by:
  - (3) Type: Cultural.
    - (a) Method and Location: Do not place firewood or other wood against the outside of the building - this can: 1) bring wood infested with carpenter ants into proximity to the building, 2) provide an attractant to carpenter ants, and 3) hold moisture nest to the building. Do not allow lawn sprinklers to constantly hit wooden portions of the building or allow water to puddle next to building foundations.
    - (b) Conducted by: Building occupants.
- b. Chemical.
  - (1) Basis for Treatment: Presence of ants in and around wooden buildings.
  - (2) Method and Location: Aerosol spray applied to surfaces; residual pesticide or baits to nest.
  - (3) Conducted by: Pest Controllers.
  - (4) Pesticide: Usage may vary, however it must be accordance to label.
  - (5) Control Standard: No live ants 30 days following treatment.

4. Precautions for Sensitive Areas: Same as German cockroach.

5. Prohibited Practices: Same as German cockroach.

6. Environmental Concerns: Same as German cockroach.

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Integrated Pest Management Outline No. 11

PEST: Spiders.

SITE: Buildings and other structures.

1. Purpose: Eliminate poisonous spiders (black widow and brown recluse) and nonpoisonous spiders from buildings or other workplaces.

2. Surveillance.

a. Conducted by: Building occupants.

b. Methods: Visual observations - spiders are frequently found in dry, cool, usually undisturbed places inside buildings; in carports, utility sheds and other outdoor storage areas; and under buildings.

c. Frequency: As required.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Spiders and their webs can be eliminated by using a broom or vacuum cleaner in most cases. Maintenance of screens and weather stripping around doors and windows will keep out small insects which the spiders use for food. Sticky traps can also be placed next to door jambs to intercept incoming spiders (if it is suspected they are coming into the building from outside) - the traps can also be used to determine if further control efforts are needed, depending on the number and species of spiders caught. Sticky traps are available through self-help.

(b) Conducted by: Building occupants.

(2) Type: Biological.

(a) Method and Location: None.

(b) Conducted by:

(3) Type: Cultural.

(a) Method and Location: Spiders can be discouraged through good housekeeping, both inside and outside. Keep boxes, old equipment, and other items neatly stored on shelves, particularly in garages and basements; clean up and dispose of trash, debris, old equipment, etc.

(b) Conducted by: Building occupants.

b. Chemical.

(1) Basis for Treatment: Spiders present in or around building or structure.

(2) Method and Location:

(3) Conducted by: Pest Control Technicians.

(4) Pesticide: Any type, used in accordance to label.

(5) Control Standard: Application of pesticide by the Pest Controllers should not be done unless the occupants have first tried self-help and their efforts have failed to control the spiders. No complaints or call backs should be received within 30 days after treatment.

4. Precautions for Sensitive Areas: Do not apply in areas with children less than one year old.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: Spiders need to eat insects and other arthropods to maintain an infestation. When spiders are simply seeking shelter from the outside, they will die if a food source is not readily available. For this reason, good housekeeping is essential in preventing or suppressing spider infestations.

Integrated Pest Management Outline No. 12

PEST: Crickets.

SITE: Family Housing.

1. Purpose: To eliminate crickets from family housing units.

2. Surveillance.
    a. Conducted by: Contract Pest Controllers
    b. Methods: Visual observations following occupant complaints.
    c. Frequency: As required.

2. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Sticky traps can be placed along baseboards in areas where crickets are seen or heard. This method may work if one or two crickets are the problem. However, if numerous crickets are the problem, then the Pest Controllers should be called.
            (b) Conducted by: Occupant.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Crickets often hide in areas which are cluttered with trash, old boxes, and other debris; cleanup of these types of items may help to reduce the cricket infestation.
            (b) Conducted by: Occupants.
    b. Chemical.
        (1) Basis for Treatment: Crickets seen or heard in the quarters.
        (2) Method and Location: Residual chemical applied to foundations outside buildings; baseboards and voids inside buildings where crickets may hide.
        (3) Conducted by: Contract Pest Controllers.
        (4) Pesticide. Approved chemical.
        (5) Control Standard: No call backs to treated quarters within 30 days following treatment.

4. Precautions for Sensitive Areas: Same as German cockroach.

5. Prohibited Practices: Same as German cockroach.

6. Environmental Concerns: Same as German cockroach.

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Integrated Pest Management Outline No. 13

PEST: Earwigs, Ground Beetles and Other Crawling Insects.

SITE: Family Housing.

1. Purpose: To control crawling insects in family housing units.

2. Surveillance.
    a. Conducted by: Pest Controllers.
    b. Methods: Visual observations following occupant complaints.
    c. Frequency: As required.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Eliminate openings to housing units which provide entry to these insects.
            (b) Conducted by: Occupant.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: None.
            (b) Conducted by:
    b. Chemical.
        (1) Basis for Treatment: Crawling insects seen in the quarters.
        (2) Method and Location: Residual chemical applied to foundations and other areas where insects tend to enter the building
        (3) Conducted by: Contract Pest Control.
        (4) Pesticide: Use any type according to label.
        (5) Control Standard: No call backs to treated quarters within 30 days following treatment.

4. Precautions for Sensitive Areas: Same as German cockroach.

5. Prohibited Practices: Same as German cockroach.

6. Environmental Concerns: Same as German cockroach.

7. Remarks: These insects are minor pests and are easily controlled with light residual sprays.

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Integrated Pest Management Outline No. 14

PEST: Bees and Wasps.

SITE: Occupied buildings.

1. Purpose: To control stinging insects in and around occupied buildings.

2. Surveillance.
    a. Conducted by: Pest Controllers.
    b. Methods: Visual observations following occupant complaints.
    c. Frequency: As required.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Screening windows and doors; removal of wasp nests; and removal of bee swarms by a beekeeper.
            (b) Conducted by: Occupant, with the exception of bee swarm removal.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: None.
            (b) Conducted by:
    b. Chemical.
        (1) Basis for Treatment: Bees and wasps found in or around buildings.
        (2) Method and Location: Hand-held aerosol applied directly to insects and nests.
        (3) Conducted by: Occupants.
        (3) Control Standard: Bees and wasps are killed following treatment.
    c. Chemical.
        (1) Basis for Treatment: Bees and wasps found in or around buildings - insects must present a health risk or interfere with mission accomplishment.
        (2) Method and Location: Residual pesticide applied to nest sites or directly to the insects.
        (3) Conducted by: Pest Controllers.
        (4) Control Standard: No call backs to treated buildings within 5 days following treatment.

4. Precautions for Sensitive Areas: Treat area where unwanted bees and wasps are found; this insecticide is extremely toxic to bees and may harm these insects where they are not presenting a problem. Areas where bees are beneficial to man (e.g., bee hives, flower beds, etc.) should be avoided.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: Beekeepers are called when swarms of bees are found in order to preserve the queen and her workers; chemicals are used only as a last resort for control.

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Integrated Pest Management Outline No. 15

PEST: Subterranean Termites.

SITE: Buildings and other structures.

1. Purpose: To prevent termites from damaging wooden structures on the installation.

2. Surveillance.

a. Conducted by: Pest Controllers.

b. Methods: Visual observation for termites and/or conditions that could favor termite infestations

c. Frequency: Annually - may be done in conjunction with service orders for other pests whenever practical.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Eliminate water sources that could support termite colonies – this is most likely to occur in the main post area where grass watering or broken utility lines provide water next to foundations and under buildings. Ventilate wet or damp areas under buildings. Repair and replace infested wood and structural material.

(b) Conducted by: Public Works personnel.

(2) Type: Biological.

(a) Method and Location: None.

(b) Conducted by:

(3) Type: Cultural.

(a) Method and Location: None.

(b) Conducted by:

b. Chemical.

(1) Basis for Treatment: Pretreat soil under new construction. Treat active termite infestations when they are found.

(2) Method and Location: Soil injection.

(3) Conducted by: Pest Controllers.

(4) Control Standard: No subsequent termite infestations or damage from treated structures for five years after application.

4. Precautions for Sensitive Areas: Avoid getting pesticide in areas where water can become contaminated, and in air ducts of buildings. Do not apply when people are in buildings.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

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Integrated Pest Management Outline No. 16

PEST: Ticks.

SITE: Outdoor areas.

1. Purpose: To prevent ticks from biting people and pets.

2. Surveillance.
    a. Conducted by: Preventive Medicine personnel.
    b. Methods: Tick drags.
    c. Frequency: Monthly in high-use areas such as training and bivouac sites, and picnic and other recreational sites. As required for other areas on post.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Proper wearing of clothing outdoors can prevent ticks from readily gaining access to skin. Long pants should be worn and tucked into boot tops or socks.
            (b) Conducted by: Site users, particularly soldiers in the field.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: When a Bite has a high population of ticks present, an alternate site should be selected for activities whenever possible.
            (b) Conducted by: Site users.
    b. Chemical.
        (1) Basis for Treatment: Ticks expected to be in the area.
        (2) Method and Location: Repellent applied to skin.
        (3) Conducted by: Individuals to be protected.
        (4) Control Standard: Ticks do not attached to skin for feeding.
    c. Initial Chemical.
        (1) Basis for Treatment: Repellent applied to clothing.
        (2) Method and Location: Aerosol spray applied to clothing.
        (3) Conducted by: Individuals to be protected.
        (4) Control Standard: Ticks do not attached to skin for feeding.
    d. Follow-up Chemical.
        (1) Basis for Treatment: Ticks infesting an outdoor site interfere with activities or the mission.
        (2) Method and Location: Power sprayer - pesticide applied to surface of the ground and to low-growing vegetation where ticks may be present.
        (3) Conducted by: Pest Controllers
        (4) Control Standard: No live ticks found on tick drags 30 days following treatment.

4. Precautions for Sensitive Areas: None.

5. Prohibited Practices: None.

6. Environmental Concerns: Use of residual chemical for area control of ticks should be the last alternative selected for control since the pesticide kills other arthropods as well as ticks. Although the pesticide is labeled for outdoor sites, alternative locations should be selected and/or repellents used in lieu of chemical application to the ground.

7. Remarks: None.

Integrated Pest Management Outline No. 17

PEST: Silverfish.

SITE: All buildings.

1. Purpose: To control silverfish in buildings where they are a nuisance or damage products (paper goods).

2. Surveillance.
    a. Conducted by: Pest Controllers.
    b. Methods: Visual observations in: 1) warehouses where paper products are stored (done in conjunction with other pest inspections), and 2) other buildings following occupant complaints.
    c. Frequency: As required.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: None.
            (b) Conducted by:
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Good sanitation - elimination of old boxes, paper and other trash from warehouses and other buildings.
            (b) Conducted by: Building occupants.
    b. Chemical.
        (1) Basis for Treatment: Silverfish observed in the building.
        (2) Method and Location: - Pesticide applied to areas where insects are observed.
        (3) Conducted by: Pest Controllers.
        (4) Pesticide.
            (a) IPM technique applied where applicable.
        (5) Control Standard: No call backs to treated buildings within 30 days following treatment.

4. Precautions for Sensitive Areas: Same as German cockroach.

5. Prohibited Practices: Same as German cockroach.

6. Environmental Concerns: Same as German cockroach.

7. Remarks: These insects are minor pests on the installation

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Integrated Pest Management Outline No. 18

PEST: Lice.

SITE: Building areas occupied by personnel with louse infestations.

1. Purpose: To control lice on clothing, bedding or other surfaces.

2. Surveillance.
    a. Conducted by: Infested individuals.
    b. Methods: Visual observation.
    c. Frequency: As necessary.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: None.
            (b) Conducted by:
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Bedding and clothing can be washed in hot water with detergent.
            (b) Conducted by: Infested personnel.
    b. Chemical.
        (1) Basis for Treatment: Presence of lice in bedding, mattresses, furniture or other surfaces.
        (2) Method and Location: Aerosol spray applied to surfaces.
        (3) Conducted by: Pest Controllers.
        (4) Control Standard: No live lice 24 hours after treatment.

4. Precautions for Sensitive Areas: None.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: Personnel with louse infestations should first be directed to the local medical treatment facility - treatment of the individual is a medical problem. Head, pubic, or body lice rarely leave the body or clothing of the infested individual. Laundering clothing and bedding should be done before any pesticide application is considered. On rare occasions, a light application of pyrethrin (contact insecticide) may be needed if live lice are still encountered on clothing.

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Integrated Pest Management Outline No. 19

PEST: Fleas.

SITE: Family housing and other buildings.

1. Purpose: To control fleas in family quarters and in other buildings when fleas are a problem.

2. Surveillance.
    a. Conducted by: Building occupants.
    b. Methods: Visual observation.
    c. Frequency: As required.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Vacuuming carpets and upholstered furniture will help to control fleas - be sure to empty the cleaner bag immediately after vacuuming since the fleas which have been removed are usually not killed. Pet bedding can also be vacuumed and periodically washed in hot water and detergent.
            (b) Conducted by: Building occupants.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Dogs and cats should be treated with an approved insecticide to control fleas - the Veterinary Clinic may have suitable products for sale or may give advice on various products which can be safely used on pets.
            (b) Conducted by: Pet owners.
    b. Initial Chemical.
        (1) Basis for Treatment: Flea infestations in the quarters or in other buildings.
        (2) Method and Location: Residual chemical to treat interior of buildings in accordance with label directions.
        (3) Conducted by: Pest Control Technician, contractor.
        (4) Control Standard: No live fleas 5 days following treatment.
    c. Follow-up Chemical.
        (1) Basis for Treatment: Flea infestations in the quarters or in other buildings.
        (2) Method and Location: Residual chemical to treat interior of buildings in accordance with label directions.
        (3) Conducted by: Pest Control Technician, contractor
        (4) Control Standard: No live fleas 90 days following treatment.
4. Precautions for Sensitive Areas: None.

5. Prohibited Practices: None.
6. Environmental Concerns: None.

7. Remarks: Fleas may become a serious problem if quarters which contain pets are vacated for extended periods of time (e.g., vacation, between occupancy, etc). During this time, flea larvae develop into pupae and wait for the presence of pets or people to pupate. When this happens, many newly emerged, hungry adult fleas are suddenly present. Fleas can also be a problem in buildings which have feral cats living under them. Adult fleas may enter the first floors of the buildings through small cracks or other openings and subsequently bite people working inside. To remedy this problem, capture and remove the cats.

Integrated Pest Management Outline No. 20

PEST: Bagworms, White Grubs, Fall Webworms, and Tent Caterpillars.

SITE: Pecan, Cherry, Elm, and other trees.

1. Purpose: To control tent caterpillars on elm and other trees. These insects can defoliate the trees and, if the infestations are severe, kill the trees.

2. Surveillance.
    a. Conducted by: Pest management technician.
    b. Methods: Visual observation.
    c. Frequency: Weekly from 1 March through 31 May.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Remove tents from trees. This should be done in the evening, since the insects leave the tents during the day to feed. This method works when the tents are easy to reach; however, for tents higher in trees or when the tents are extensive, then alternate control methods may need to be employed.
            (b) Conducted by: Occupants
        (2) Type: Cultural.
            (a) Method and Location: None.
            (b) Conducted by:
    b. Chemical.
        (1) Basis for Treatment: Presence of caterpillars in trees and hand removal have failed to correct the problem.
        (2) Method and Location: Apply pesticide with power sprayer to affected trees.
        (3) Conducted by: Pest management technicians.
        (4) Control Standard: No live caterpillars 5 days following treatment.

4. Precautions for Sensitive Areas: Do not apply where honey bees may be harmed.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: BT should be applied to all leaf surfaces of the trees. Heavy rains following treatment may necessitate retreatment.

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Integrated Pest Management Outline No. 21

PEST: Mice.

SITE: Food storage warehouses.

1. Purpose: To control mice in the commissary, troop issue storage facility, and AAFES Shoppettes.

2. Surveillance.

a. Conducted by: Food service personnel, Veterinary Food Inspectors, and Pest Controllers.

b. Methods: Visual observations for mouse damage or droppings.

c. Frequency: Daily by warehouse, shoppette, and Veterinary personnel. Monthly by Pest Controllers in the commissary and DFAC.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Eliminate openings to the buildings which are greater than 1/4-inch. Particular attention should be given to loading doors since they do not always close tightly. Snap traps and sticky glue boards may be used to capture mice when an infestation is found.

(b) Conducted by: Public works preventive maintenance personnel are usually requested to make building modifications such as weather stripping, door repair, etc. Facility personnel may set traps or place glue boards for minor infestations; the Pest Controllers usually set traps and glue boards when extensive trapping is required.

(2) Type: Biological.

(a) Method and Location: None.

(b) Conducted by:

(3) Type: Cultural.

(a) Method and Location: utilize good sanitation to reduce food and water for mice. Clean up spilled food products immediately or daily at the latest. Remove bags, boxes and other potential harborage from food storage areas. Keep salvage areas and break areas clean at all times; keep food in closed containers. Store pallets of food at least 24 inches from walls to permit routine cleaning, inspection, and rodent control.

(b) Conducted by: Warehouse, commissary, DFAC or shoppette personnel

b. Chemical.

(1) Basis for Treatment: Mice or evidence of mice found during surveillance.

(2) Method and Location: Bait stations maintained as needed

(3) Conducted by: Pest Controllers.

(4) Control Standard: No product damage from mice. If mouse baiting is instituted following evidence of a large mouse infestation, then significant reduction in the number of droppings should be seen in and around bait stations within the first 30 days following bait placement. If there is no evidence of mice following 30 days of baiting, then the bait stations should be removed unless there is a past history of repeated infestations (e.g., 3-4 times per year). Bait stations should be serviced at least monthly.

4. Precautions for Sensitive Areas: See pesticide labels for precautions.

5. Prohibited Practices: Do not place rodenticides where the bait will be accessible to children or pets. Bait should be placed in tamper proof containers.

6. Environmental Concerns: None.

7. Remarks: Pesticides should be considered the last option in controlling mice. As long as entry points into buildings exist, then trapping or baiting may be the only alternatives for control. The presence of spilled food products and/or poor housekeeping (e.g., pallets against walls, old boxes and equipment kept in the warehouse, etc.) will adversely impact any baiting or trapping program.

Integrated Pest Management Outline No. 22

PEST: Mice.

SITE: Family housing, offices, barracks, and other administrative buildings.

1. Purpose: To control mice in the family quarters and in other administrative areas on the installation.

2. Surveillance.
    a. Conducted by: Building occupants.
    b. Methods: Visual observations for mouse damage or droppings.
    c. Frequency: As required.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Snap traps and sticky glue boards may be used to capture mice when an infestation is found these items can be obtained from Self-Help. Eliminate openings to the building which are greater than 1/4-inch; particular attention should be given to doors and areas on the outside of the building where pipes and other utilities lines enter.
            (b) Conducted by: Facility personnel may set traps or place glue boards for minor infestations; the Pest Controllers usually Bet traps and glue boards when extensive trapping is required. Public works preventive maintenance personnel are usually requested to make building modifications such as weather stripping, door repair, etc.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Utilize good sanitation to reduce food and water for mice. Clean up spilled food products immediately or daily at the latest. Remove bags, boxes and other potential harborage from basements, kitchens, closets, etc.
(b) Conducted by: Building occupants.
    b. Chemical.
        (1) Basis for Treatment:
        (2) Method and Location: None.
        (3) Conducted by: Contractor, Pest Control Technician
        (4) Pesticide.
            (a) Common Name:
            (b) EPA Registration Number:
        (5) Control Standard:

4. Precautions for Sensitive Areas:
5. Prohibited Practices:

6. Environmental Concerns: None.

7. Remarks: As long as entry points into buildings exist, then trapping may only be successful as long as other mice do not enter from the outside. The presence of spilled food products and/or poor housekeeping (e.g., boxes and equipment kept in basements, closets, etc.) will provide harborage for mice, allowing them to breed in the structure. If this occurs, and trapping by occupants fails to control the problem, then the Pest Controllers should be contacted to evaluate the situation.

Integrated Pest Management Outline No. 23

PEST: Birds (Pigeons, Blackbirds, Starlings, and Sparrows).

SITE: Warehouses, loading docks, and other buildings.

1. Purpose: To control birds which nest or roost in areas of buildings where they will damage or contaminate food products or other materiel.

2. Surveillance.
    a. Conducted by: Pest Controller.
    b. Methods: Visual observation.
    c. Frequency: As required in response to customer complaints.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Openings to the outside of the buildings should be screened or closed to prevent bird entry. Minor repairs can be done by occupants; major repairs may require work to be performed by Public Works preventive maintenance. Live traps can be used to capture and relocate birds from inside buildings and from roosting areas on or near buildings - this method works for pigeons, but is not especially effective for other
birds.
            (b) Conducted by: Building occupants/Public Works.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Loading doors and unscreened windows or other openings should be kept closed when not in use. People should be discouraged from feeding birds, especially pigeons.
            (b) Conducted by: Building occupants.
    b. Chemical: Not used.

4. Precautions for Sensitive Areas:

5. Prohibited Practices:

6. Environmental Concerns: None.

7. Remarks: As long as entry points into buildings exist, then trapping may only be successful as long as control measures are effective. If this occurs then the Pest Controllers should be contacted to evaluate the situation.

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Integrated Pest Management Outline No. 24

PEST: Other Vertebrate Pests.

SITE: Cantonment area.

1. Purpose: To control vertebrate animals (stray dogs and cats, skunks, raccoons, deer, etc.) in the main post and housing areas.

2. Surveillance.
- a. Conducted by: Pest Controllers/Fish and Wildlife Program
- b. Methods: Visual observation.
- c. Frequency: In response to complaints.

3. Pest Management Techniques.
- a. Nonchemical.
  - (1) Type: Mechanical and Physical.
    - (a) Method and Location: Live trapping with wire or solid cage traps. Lethal removal undertaken by USDA, DES or Fish and Wildlife.
    - (b) Conducted by: Pest Controllers/Military Police animal control.
  - (2) Type: Biological.
    - (a) Method and Location: None.
    - (b) Conducted by:
  - (3) Type: Cultural.
    - (a) Method and Location: None.
    - (b) Conducted by:
- b. Chemical.
  - (1) Basis for Treatment:
  - (2) Method and Location: None.
  - (3) Conducted by:
  - (4) Pesticide. None
  - (5) Control Standard:

4. Precautions for Sensitive Areas: None.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: Stray pets are apprehended by the Military Police and taken to the Veterinary Clinic. Wild vertebrates (opossum, raccoons, etc.) are trapped by the Pest Controller and released off the main post area and family housing. Deer are removed by either the USDA Wildlife Services or the Fish and Wildlife program.

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Integrated Pest Management Outline No. 25

PEST: Snakes.

SITE: Cantonment area/other mission areas.

1. Purpose: To remove snakes, especially poisonous species, from the main post area or other areas where they interfere with the mission or other post activities.

2. Surveillance.
    a. Conducted by: All personnel.
    b. Methods: Visual observation.
    c. Frequency: As necessary when snakes are encountered in an unwanted area.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Capture with snake loop and removal.
            (b) Conducted by: Pest Controllers.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Avoidance - if at all possible, bypass snakes. Snakes generally prefer to avoid people. Most encounters with snakes can be avoided by simply allowing the snake to leave the area. The biggest risk of snake bites comes from people going out of their way to handle or otherwise provoke snakes into a defense attitude. If snakes cannot be avoided, the Military Police should be called. DO NOT HARM OR KILL SNAKES.
            (b) Conducted by: Personnel encountering snakes.
    b. Chemical.
        (1) Basis for Treatment:
        (2) Method and Location: None.
        (3) Conducted by: Contract Pest Control
        (4) Pesticide. None

4. Precautions for Sensitive Areas: None.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: Snakes, both poisonous and nonpoisonous, will be captured alive and removed to a location where they will not cause any harm or disrupt post activities.

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Integrated Pest Management Outline No. 26

PEST: Broadleaf Weeds.

SITE: Parade fields, lawns, and other common grassy areas.

1. Purpose: To control broadleaf weeds in lawns and grassy areas.

2. Surveillance.
    a. Conducted by: Contractor and Pest Control Technicians
    b. Methods: Visual observations.
    c. Frequency: As needed through customer complaints.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Mowing grass to maintain a uniform height may result in control of some broadleaf weeds by preventing flower and seed formation. However, some weeds have the ability to adapt to mowing condition by flowering just above the surface of the ground, but below the height of most commercial mowers.
            (b) Conducted by: Pest Controllers/Roads and Grounds personnel.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grassy areas promotes good grass growth. This practice will prevent many broadleaf weeds from taking hold and growing.
            (b) Conducted by: Roads and Grounds personnel and Contract personel.
    b. Chemical.
        (1) Basis for Treatment: Presence of broadleaf weeds in grass.
        (2) Method and Location: Selective herbicide application is performed Using a boom sprayer on Parade fields. Broadleaf weed control in family housing lawns is performed by a contractor; weed control is incorporated into a fertilizer application. Weeds in small grassy areas are treated with herbicide using a hand sprayer.
        (3) Conducted by: Roads and Grounds personnel in all areas except family housing which is treated under contract.
        (4) Control Standard: Broadleaf weed are killed within -two weeks following treatment.

4. Precautions for Sensitive Areas: See the pesticide label for precautions.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks:

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Integrated Pest Management Outline No. 27

PEST: Broadleaf Weeds.

SITE: Golf course.

1. Purpose: To control broadleaf weeds on the Golf Course fairways.

2. Surveillance.

a. Conducted by: Golf Course Superintendent.

b. Methods: Visual observations.

c. Frequency: Weekly through the early growing season (March through May) and biweekly from June through September.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical.

(a) Method and Location: Mowing grass to maintain a uniform height may result in control of some broadleaf weeds by preventing flower and seed formation. However, some weeds have the ability to adapt to mowing condition by flowering just above the surface of the ground, but below the height of most commercial mowers.

(b) Conducted by: Golf Course maintenance personnel.

(2) Type: Biological.

(a) Method and Location: None.

(b) Conducted by:

(3) Type: Cultural.

(a) Method and Location: Proper fertilization and watering of grassy areas promotes good grass growth. This practice will prevent many broadleaf weeds from taking hold and growing.

(b) Conducted by: Golf Course maintenance personnel.

b. Chemical.

(1) Basis for Treatment: Presence of broadleaf weeds in grass.

(2) Method and Location: Selective herbicide application is performed using a boom sprayer on the fairways. Weed control is incorporated into a fertilizer application early in the season. The fairways are treated with herbicide using a boom sprayer when the combination weed and feed operations are not programmed.

(3) Conducted by: Golf Course Superintendent.

(4) Control Standard: Broadleaf weed are killed within two weeks following treatment.

4. Precautions for Sensitive Areas: See the pesticide label for precautions.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

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Integrated Pest Management Outline No. 28

PEST: All Vegetation.

SITE: Sidewalks, around building foundations, parking lots, fence lines, and airfields.

1. Purpose: To control all vegetation to reduce vegetative damage to paved surfaces, poles and fences, and to reduce the risk of fire or security breaches.

2. Surveillance.
    a. Conducted by: Pest Control Personnel.
    b. Methods: Visual observations.
    c. Frequency: March through August.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Weed eaters can be used, but are very labor-intensive. In addition, once vegetation is cut, new growth will quickly replace those parts of the plants which have been removed. This method is practical when very few sites (less than 10) are maintained.
            (b) Conducted by: Pest Control Technicians and Contractor.
        (2) Type: Biological.
            (a) Method and Location: None.
            (b) Conducted by:
        (3) Type: Cultural.
            (a) Method and Location: None.
            (b) Conducted by:
    b. Chemical.
        (1) Basis for Treatment: Vegetation along fence lines, and vegetation on or along sidewalks, building perimeters, airfields, expansion joints, and runway lights.
        (2) Method and Location: Hand or power sprayer. Chemical is applied IAW label directions to unwanted vegetation.
        (3) Conducted by: Pest Control Technicians and Contractor.
        (4) Control Standard: Vegetation is killed within two weeks following treatment.

4. Precautions for Sensitive Areas: Avoid contact with foliage, green stems or fruit of crops, desirable plants and trees. Avoid direct application to any body of water. Avoid drift which could damage desirable plants; do not spray if wind is over 10 miles per hour.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

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Integrated Pest Management Outline No. 29

PEST: Aquatic Weeds, Floating and Submerged.

SITE: Ponds, lakes, and streams

1. Purpose: Control weeds and grasses in ponds and streams.

2. Surveillance.
    a. Conducted by: Pest Control and Fish and Wildlife Personnel.
    b. Methods: Visual observations.
    c. Frequency: Routine through daily activity.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Mechanical removal of weeds or dewatering the area.
            (b) Conducted by: Pest Control personnel and Roads and Grounds personnel.
        (2) Type: Biological.
            (a) Method and Location: Tripoloid grass carp.
            (b) Conducted by: DPW wildlife personnel.
        (3) Type: Cultural.
            (a) Method and Location: None.
            (b) Conducted by:
    b. Chemical.
        (1) Basis for Treatment: Nuisance vegetation in ponds, lakes, and streams.
        (2) Method and Location: Hand or power sprayer. Chemical is applied IAW label directions to unwanted vegetation.
        (3) Conducted by: Pest Control personnel.

4. Precautions for Sensitive Areas: None.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Special Health and Safety Measures Required: Individual protective equipment and protective measures called for by the type of chemical or contained in the label instructions.

8. Remarks: None.

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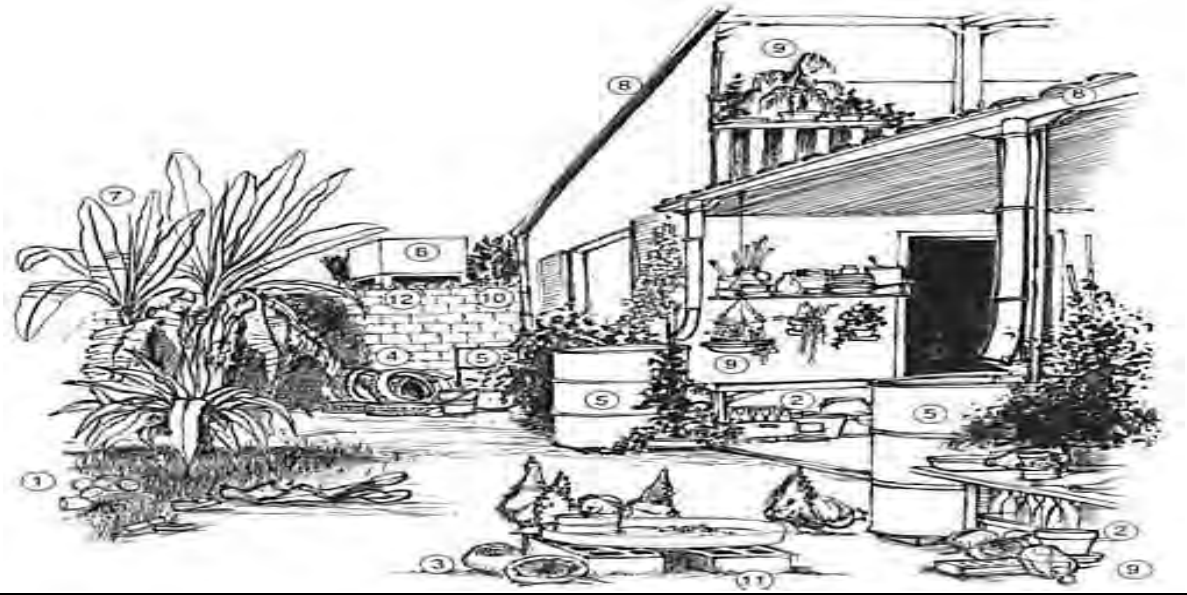
Integrated Pest Management Outline No. 30

PEST: Mosquitos – Container Breeding *Aedes*

SITE: Cantonment Area and Training Areas

1.0 Purpose: To control Container Breeding *Aedes* mosquitoes thereby reducing human annoyance and the risk of disease

Aedes aegypti (left) and *Aedes albopictus* (right) mosquitoes can be distinguished from each other by the presence of a white stripe on the thorax of *Aedes albopictus*.



Examples of outdoor breeding sites of *Aedes* spp. (1) discarded cans/plastic containers, (2) bottles, (3) coconut husks, (4) tires, (5) barrels, (6) water storage tanks, (7) bromeliads and axils of banana trees, (8) obstructed roof gutters, (9) plant pot saucers, (10) broken bottles fixed on walls to deter burglars, (11) holes in unused construction blocks, and (12) the upper edge of block walls. From Rozendaal, 1997.

2.0 Surveillance of Container Breeding *Aedes*

2.1 Conducted By: Installation Preventive Medicine. Special requests for surveillance support for a specific health threat can be obtained from USAPHC-Regions. Pest Management Technicians.

2.2 Methods & Frequency: Installation personnel detect and report biting mosquitoes. Inspect water containing objects (rain buckets, cemetery flower urns, rain gutters, discarded tires or other water containing objects). Seasonal conditions (Typically April/May – Oct/Nov) and breeding habitat are noted on an ongoing basis.

2.3 Specific Surveillance Measures:

2.3.1 The BG-Sentinel Trap (Preventive Medicine)
The BG-Sentinel™ trap is specifically designed to collect daytime-feeding mosquitoes, and has been found to collect *Ae. aegypti* and *Ae. albopictus* more effectively than the standard CDC light trap. Traps should be baited with CO2 from dry ice, when available. Also, commercially available lures that can improve a trap's effectiveness have been designed specifically to attract *Ae. aegypti* and *Ae. albopictus.* The BG-SentinelTM trap requires a lure for effective trapping. Product manuals detail specific setup procedures and instructions for use of each piece of surveillance equipment. Take care when handling the BG-SentinelTM trap, as some components have durability limitations.

Equipment	NSN
BG SentinelTM Trap	3740-01-628-9326
BG-Lure® for BG SentinelTM Trap (Note: trap will not work without lure)	3740-01-628-9325
Catch Bag for BG SentinelTM Trap	3740-01-628-9327
Wall charger for BG SentinelTM Trap	3740-01-628-9324

2.3.2 Black Jar for egg collection and larval identification:

A manufactured ovitrap is available in the DoD stock system (Mosquito Trap-and-Kill, NSN 6840-01-628-4751), and ovitraps can also be constructed with any dark colored container. Simply fill the container partially with water and place a wooden tongue depressor or paper towels along the inside of the cup. Check the tongue depressor and paper towels regularly for the presence of eggs.

3.0 Integrated Control of Container Breeding *Aedes*

3.1 Mechanical and Physical Control

3.2 Method & Location: Ensure placement of screens in windows on buildings occupied at night to exclude adult mosquitoes. Temporary standing water sites (e.g., tire ruts) should be graded or filled to eliminate mosquito breeding. Precautions must be taken not to damage wetlands. Eliminate artificial container (e.g., tires, wrinkled tarps, refuse, neglected equipment, and neglected toys) breeding sites.

Conducted By: Installation Maintenance Personnel

3.3 Method & Location: Proper wearing of clothing including wearing long sleeve shirts rolled down.

Conducted By: Installation Personnel

See AFPMB Tech Guide 36: Personal Protective Measures against Insects and other Arthropods of Military Significance

4.0 Type: Cultural

4.1 Method & Location: Remove and discard any refuse or materials capable of holding water such as tires and broken equipment. Potential for breeding exists particularly at vehicle storage yards where waste tires may accumulate.

4.2 Table indicating appropriate cultural management practices for various water containing objects on the installation.

Larval Habitats	Empty/Clean Regularly	Store Under Roof	Fill with Sand	Throw away/recycle
Buckets	Yes	Yes		Yes
Discarded Containers				Yes
Flower Pot Saucers	Yes		Yes	
Roof Gutters	Yes			
Tires		Yes		Yes
Tree Holes			Yes	

4.3 Examples of outdoor breeding sites of *Aedes* spp. (1) discarded cans/plastic containers, (2) bottles, (3) coconut husks, (4) tires, (5) barrels, (6) water storage tanks, (7) bromeliads and axils of banana trees, (8) obstructed roof gutters, (9) plant pot saucers, (10) broken bottles fixed on walls to deter burglars, (11) holes in unused construction blocks, and (12) the upper edge of block walls. From Rozendaal, 1997.

Conducted By: Installation Personnel

5.0 Personal Protection for Biting Mosquitos

5.1 Basis for Treatment: Mosquitoes (and other biting arthropods) in the area

5.2 Method & Location: Installation personnel (treatment of uniforms with Permethrin and use of DEET on skin only).

Insect Repellent, personal application, Ultrathon EPA Reg # 58007-1; NSN 6840-01-284-3982

Insect Repellent, clothing application, aerosol (Permethrin Arthropod Repellent) EPA Reg # 50404-6-58188; NSN 6840-01-278-1336

Insect Repellent, personal application & sunscreen, 20% DEET/SPF15 (Sunsect) EPA Reg # 66306-1; NSN 6840-01-288-2188

Insect Repellent, personal application & sunscreen, 20% DEET/SPF15 (Sunsect) EPA Reg # 66036-1; NSN 6840-01-452-9582

Insect Repellent, clothing application, permethrin (IDA) (FOR MILITARY USE ONLY) EPA Reg # 63120-3; NSN 6840-01-345-0237

Insect Repellent, personal application, 30% DEET (SP532-Ultra30/LippoDEET) EPA Reg # 82810-1-58188; NSN 6840-01-584-8393

Insect Repellent, personal application, 25% DEET, pump spray bottles (Cutter Backwoods DEET Insect Repellent) EPA Reg # 305-61-121; NSN 6840-01-584-8598

Insect Repellent, personal application, 20% Picaridin, pump spray bottle (NATRAPEL Insect Repellent) EPA Reg # 39967-53-56575; NSN 6840-01-619-4795

6.0 Chemical pest management techniques for Container Breeding *Aedes* (Before applying/using any chemical treatment, consult your Command IPM consultant first. Verify the product is registered for use in the US State or IAW with the Final Governing Standard for the Host Nation)

6.1 Basis for Treatment: Confirmed mosquito presence in area. Confirmed mosquito-borne disease, as determined by the Preventive Medicine Environmental Health office and local health department officials.

6.2 Method & Location: Treatment of breeding sites that cannot be addressed in a non-chemical manner. Conducted By: Pest Management Technicians. Preventive Medicine Environmental Health personnel.

Altosid EPA Reg #: 2724-421 NSN 6840-01-424-2495

Summit Bactimos (BTI) EPA Reg #: 6218-47 NSN 6840-01-377-7049

Ovitrap Mosquito Trap-N-Kill (Dichlorovas) EPA Reg # 8730-50-66433 NSN 6840-01-628-4751

6.3 Control Standard: Mosquitoes not on personnel during potential exposure period. Mosquito trap and larval counts low.

6.4 Precautions and Concerns when doing Chemical Control

6.4.1 Precautions for Sensitive Areas: Do not use repellents on individuals who may show a chemical sensitivity to their ingredients. This is particularly true when dealing with infants and children under 12 years of age.

6.4.2 Prohibited Practices: The use of repellents not in accordance with label instructions.

6.4.3 Environmental Concerns: Do not alter or disrupt designated wetlands. Do not treat uniforms where excess permethrin residue or spray-over would contaminate the environment. Targeted adulticide treatments only considered if disease threat exists.

6.4.4 Remarks: Source elimination and larval control are the best strategies to reduce the threat of mosquitoes.

7.0 Where to go for more information:

Armed Forces Pest Management Board: http://www.afpmb.org/

Army Public Health Center (APHC) Zika Virus website:
http://phc.amedd.army.mil/topics/discond/diseases/Pages/Zika.aspx

Centers for Disease Control and Prevention: http://www.cdc.gov/

Contingency Pest Management Guide. AFPMB Technical Guide 24:
http://www.afpmb.org/sites/default/files/pubs/techguides/tg24.pdf

Guide to Pest Surveillance during Contingency Operations. AFPMB Technical Guide 48:
http://www.afpmb.org/sites/default/files/pubs/techguides/TG48/TG48.pdf

Personal Protective Measures against Insects and other Arthropods. AFPMB Technical Guide 36:
http://www.afpmb.org/sites/default/files/pubs/techguides/tg36.pdf

Ultra Low Volume Dispersal of Insecticides using Ground Equipment. AFPMB Technical Guide 13:
http://www.afpmb.org/sites/default/files/pubs/techguides/tg13.pdf

Walter Reed Biosystematics Unit: http://www.wrbu.org/index.html

Rozendaal, J. A. 1997. Vector Control: Methods for Use by Individuals and Communities. World Health Organization, Geneva. 412 pp. http://www.who.int/mediacentre/factsheets/zika/en/

Appendix B- Golf Course
Golf Course Integrated Pest Management Outlines

1. Broadleaf Weeds (Clovers) - Golf Course
2. Crabgrass – Golf Course
3. Winter Annuals – Golf Course
4. General Weeds and Poison Ivy – Golf Course
5. Weed Grasses – Golf Course
6. Fungus Diseases of Turf – Golf Course
7. Cutworms, Armyworms and Sod Web worms – Golf Course
8. White Grubs –Golf Course
9. Spike Rush, Cattails and other Aquatic Weeds – Golf Course
10. Annual Bluegrass - Golf Course
11. Deer – Golf Course
12. Moles and Groundhogs – Golf Course

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Golf Course Integrated Pest Management Outline No. 1

PEST: Broadleaf Weeds (Clovers).

SITE: Golf course.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified).
    b. Methods: Visual observations.
    c. Frequency: Weekly through the growing season.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Mowing grass properly results in control of some broadleaf weeds by preventing flower and seed formation. However, some weeds have the ability to adapt to mowing.
            (b) Conducted by: Golf Course maintenance personnel.
        (2) Type: Biological. None.
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grass promotes good grass growth. This practice prevents many broadleaf weeds from taking hold and growing.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Chemical.
        (1) Basis for Treatment: Presence of broadleaf weeds on greens, and tees. Weeds covering 25 – 30% of an area in fairways.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Golf Course Superintendent.
        (4) Pesticide.
            (a) IPM practices or approved EPA product or (PUP).
            (b) Follow labeled directions.
        (5) Control Standard: Broadleaf weeds are killed within two weeks following treatment.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks:

Golf Course Integrated Pest Management Outline No. 2

PEST: Crabgrass.

SITE: Golf course greens, tees and sometimes fairways.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified).
    b. Methods: Visual observations.
    c. Frequency: Daily in April.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Hand removal with screw drivers on greens.
            (b) Conducted by: Golf Course maintenance personnel.
        (2) Type: Biological. None.
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grass promotes good grass growth. This practice prevents many weeds from taking hold and growing.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Chemical.
        (1) Basis for Treatment: Crabgrass present the previous year.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified Pesticide Applicator.
    c. Pesticide. PUP
    d. IPM practices or an approved EPA product.
    e. Follow labeled directions.

4. Control Standard: 90% control.

5. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

6. Prohibited Practices: None.

7. Environmental Concerns: Don’t apply directly to water.

8. Remarks: Runoff is minimized due to very sandy soil.

Golf Course Integrated Pest Management Outline No. 3

PEST: Winter Annuals.

SITE: Golf course fairways.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified).
    b. Methods: Visual observations.
    c. Frequency: One time survey each February.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Mowing grass properly results in control of some broadleaf weeds by preventing flower and seed formation. However, some weeds have the ability to adapt to mowing.
            (b) Conducted by: Golf Course maintenance personnel.
        (2) Type: Biological. None.
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grass promotes good grass growth. This practice prevents many broadleaf weeds from taking hold and growing.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Initial Chemical.
        (1) Basis for Treatment: Weeds covering 25 – 30% of an area in fairways.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide. PUP
            (a) IPM or an approved registered EPA product.
        (5) Control Standard: 95 – 100% control.
    c. Follow up Chemical.
        (1) Basis for Treatment: Weeds covering 25 – 30% of an area in fairways.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide (PUP).
            (a) IPM practices or an approved EPA product.
            (b) Follow labeled directions.
        (5) Control Standard: 95 – 100% control.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

Golf Course Integrated Pest Management Outline No. 4

1. PEST: General Weeds and Poison Ivy.

2. SITE: Golf course sand traps, around signs, cart paths, and around ornamental plantings.

3. Purpose: To minimize hand trimming and control poison ivy on the Golf Course.

4. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified) and Golf Course Maintenance Personnel.
    b. Methods: Visual observations.
    c. Frequency: Weekly by the Superintendent, daily by Maintenance personnel.

5. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Hand removal where the number of weeds is small.
            (b) Conducted by: Golf Course maintenance personnel.
        (2) Type: Biological. None.
        (3) Type: Cultural. None.

b. Chemical.
        (1) Basis for Treatment: Weeds covering 25 – 30% of an area in fairways.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide (PUP).
            (a) IPM practices using an approved EPA product.
            (b) Follow labeled directions.
        (5) Control Standard: 95 – 100% control.

6. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

7. Prohibited Practices: None.

8. Environmental Concerns: None.

9. Remarks: No galvanized steel sprayers are used.

Golf Course Integrated Pest Management Outline No. 5

PEST: Weed Grasses.

SITE: Golf Course Greens, Tees and Fairways.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified) and Golf Course Maintenance personnel.
    b. Methods: Visual observations.
    c. Frequency: Weekly by the Superintendent, daily by Maintenance personnel.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical. None.
        (2) Type: Biological. None.
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grass promotes good grass growth. This practice prevents many weeds from taking hold and growing.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Chemical.
        (1) Basis for Treatment: Weeds covering 30% of an area in fairways.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide (PUP).
            (a) IPM practices with an approved EPA product
            (b) Follow labeled directions.
    c. Control Standard: 95 – 100% control after three applications.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

5. Prohibited Practices: None.

6. Environmental Concerns: None

Golf Course Integrated Pest Management Outline No. 6

PEST: Fungus Diseases of Turf.

SITE: Golf Course Greens, Tees and Fairways.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified) and Golf Course Maintenance personnel.
    b. Methods: Visual observations.
    c. Frequency: Weekly by the Superintendent, daily by Maintenance personnel.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical. None.
        (2) Type: Biological. None.
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grass promotes good grass growth.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Chemical.
        (1) Basis for Treatment: Presence of fungi on greens and tees.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide (PUP).
            (a) An approved EPA product.
            (b) Follow labeled directions
        (5) Control Standard: No turf mortality.
    c. Chemical.
        (1) Basis for Treatment: Presence of fungi on greens and tees.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide.
            (a) An approved EPA product.
            (b) Follow labeled directions
        (5) Control Standard: No turf mortality.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: None.

Golf Course Integrated Pest Management Outline No. 7

PEST: Cutworms, armyworms and sod webworms.

SITE: Golf Course Greens, Tees and Fairways.

1. Purpose: To control damage to greens, tees, and fairways of Cole Park Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified) and Golf Course Maintenance personnel.
    b. Methods: Visual observations for castings.
    c. Frequency: Weekly by the Superintendent, daily by Maintenance personnel.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical. None.
        (2) Type: Biological. None.
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grass promotes good grass growth.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Chemical.
        (1) Basis for Treatment: Presence of two or three castings on greens and tees or three castings per square yard on fairways.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.

    c. Control Standard: 70 – 75% control.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH. Avoid areas where drift might reach beneficial insects such as honeybees.

5. Prohibited Practices: No herbicides application near streams, lakes, and ponds.

6. Environmental Concerns: None.

7. Special Health and Safety Measures Required: Individual protective equipment and protective measures called for by the type of chemical or contained in the label instructions.

8. Remarks: May need repeat applications if re-infestation occurs.

Golf Course Integrated Pest Management Outline No. 8

PEST: White Grubs (Scarab Beetle Larvae).

SITE: Golf Course Greens, Tees, Fairways and Roughs.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified) and Golf Course Maintenance personnel.
    b. Methods: Visual observations.
    c. Frequency: Weekly by the Superintendent, daily by Maintenance personnel.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical. None.
        (2) Type: Biological. None.
        (3) Type: Cultural. None.
    b. Chemical.
        (1) Basis for Treatment: Presence of three grubs per square foot or more.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide (PUP.
            (a) An approved EPA product.
            (b) Follow labeled direction.
    c. Control Standard: No turf mortality.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks: None.

Golf Course Integrated Pest Management Outline No. 9

PEST: Spike Rush, Cattails and other Aquatic Weeds.

SITE: Golf Course Water Hazards.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified) and Golf Course Maintenance personnel.
    b. Methods: Visual observations.
    c. Frequency: Weekly by the Superintendent, daily by Maintenance personnel.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical.
            (a) Method and Location: Weed-eater where weeds can be reached. Grapple hooks for weeds that form mats.
            (b) Conducted by: Golf Course Maintenance Personnel.
        (2) Type: Biological.
            (a) Method and Location: Triploid Grass Carp in ponds.
            (b) Conducted by: Golf Course Superintendent.
            (c) Stocking Rate: 40 fish per acre of ½ pound fish
        (3) Type: Cultural.
            (a) Method and Location: Steep banks are used on ponds to minimize area where emergent weeds can grow.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Chemical.
        (1) Basis for Treatment: Presence of fungi on greens and tees.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified pesticide applicator.
        (4) Pesticide (PUP.
            (a) An approved EPA product.
            (b) Follow labeled directions.
        (5) Control Standard: 90 – 95% mortality of treated weeds.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

Golf Course Integrated Pest Management Outline No.10

PEST: Annual Bluegrass.

SITE: Golf course greens, tees and sometimes fairways.

1. Purpose: To maintain play on the Golf Course.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified).
    b. Methods: Visual observations.
    c. Frequency: Weekly in August and through the Fall.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical. None.
        (2) Type: Biological None
        (3) Type: Cultural.
            (a) Method and Location: Proper fertilization and watering of grass promotes good grass growth. This practice prevents many weeds from taking hold and growing.
            (b) Conducted by: Golf Course maintenance personnel.
    b. Chemical.
        (1) Basis for Treatment: Bluegrass present at the time of treatment or the previous year.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified Pesticide Applicator.
        (4) Pesticide (PUP).
            (a) An approved EPA product.
            (b) Follow labeled directions
            (c) Control Standard 90% control.
    c. Chemical.
        (1) Basis for Treatment: Bluegrass seedlings present at the time of treatment or the previous year in areas over-seeded with ryegrass.
        (2) Method and Location: Applications are performed using a boom sprayer.
        (3) Conducted by: Certified Pesticide Applicator.

4. Precautions for Sensitive Areas: Treatment is not done when wind exceeds 10 MPH.

5. Prohibited Practices: None.

6. Environmental Concerns: None.

7. Remarks Runoff is minimized due to very sandy soil.

Golf Course Integrated Pest Management Outline No. 11

PEST: Deer.

SITE: Golf Course Greens, Tees and Fairways.

1. Purpose: To prevent tree and shrub mortality and reduce host for ticks.

2. Surveillance.

a. Conducted by: DPW Biologist and golf course conducts daily turf observations at greens, tees, and fairways of Cole Park Golf Course.

b. Methods: Night survey and visual observations.

c. Frequency: Daily by the Superintendent and Maintenance personnel.

3. Pest Management Techniques.

a. Nonchemical.

(1) Type: Mechanical and Physical. Exclusion, trapping, and shooting.

(2) Type: Biological. None.

(3) Type: Cultural. None.

b. Chemical. None.

4. Control Standard: None.

5. Precautions for Sensitive Areas: Avoid areas close to housing areas.

6. Prohibited Practices: None.

7. Environmental Concerns: None.

8. Remarks: None.

Golf Course Integrated Pest Management Outline No. 12

PEST: Moles and Groundhogs.

SITE: Golf Course Greens, Tees and Fairways.

1. Purpose: To prevent damage to turf.

2. Surveillance.
    a. Conducted by: Golf Course Superintendent (Certified) and Golf Course Maintenance personnel.
    b. Methods: Visual observations.
    c. Frequency: Daily by the Superintendent and Maintenance personnel.

3. Pest Management Techniques.
    a. Nonchemical.
        (1) Type: Mechanical and Physical. Trapping.
        (2) Type: Biological. None.
        (3) Type: Cultural. None.
    b. Chemical.
        (1) Basis for Treatment: Signings of turf damage by burrowing vertebrates.
        (2) Method and Location: Applications utilize pellet form of chemical broadcast in areas of concern.
        (3) Conducted by: Certified Pesticide Applicator.

4. Control Standard: None. 90% control.

5. Precautions for Sensitive Areas: Avoid areas where gas may encounter non target species.

6. Prohibited Practices: None.

7. Environmental Concerns: None.

8. Special Health and Safety Measures Required: Wear eye protection when placing cartridges. Wear appropriate clothing when applying treatment.

9. Remarks: None.

Appendix C
Safety

1. Nearly all pesticides are dangerous in one way or another to the Pest Controller, the environment, and non targeted species of both plant and animal, but if used properly, pesticides can be very beneficial to man. It is the responsibility of the Pest Controller for proper application.

2. INORGANIC PESTICIDES - These pesticides are formulated from heavy metals and are extremely toxic to all warm blooded animals. These pesticides are seldom used and only after other pest control methods have been tried.

3. SYNTHETIC ORGANIC PESTICIDES:

a. Organophosphate Compounds - This group of pesticides has a wide range of toxicity from a very low order, as in Malathion, to a high order, as in Parathion. Pesticides in this group affect the central nervous system.

b. Carbamates - This group of pesticides has a wide range of toxicity, and also affects the central nervous system.

4. BOTANICAL PESTICIDES: Botanical pesticides are highly toxic to mammals, and are absorbed through the skin.

5. RODENTICIDES: Rodenticide may be either organic or inorganic; however, their uses and modes of action are sufficient to justify their consideration as a separate group. Some are formulated from heavy metals and plant products while others are anticoagulants. These chemicals have the advantage of low toxicity.

6. FUMIGANTS: Fumigants are rarely used, and only for specialized problems. Signs will be posted and use of a self-contained Breathing Apparatus (SCBA) is required.

7. HANDLING: Read thoroughly and follow all labeled instructions and precautions.

8. GENERAL SAFETY:

a. Do not eat or smoke in pesticide handling areas.

b. Stay up wind while pouring liquid pesticides.

c. Wash hands before eating, smoking, or using the toilet, and after mixing or repackaging.

9. SHOWER: Shower at the end of each shift and frequently rinse exposed skin during pesticide application.

10. FIRST AID:

a. If an accident occurs, immediately remove the victim from the area to prevent continued exposure.

b. Render artificial respiration if the victim is unconscious and not breathing.

c. Obtain medical aid as soon as possible.

11. SAFETY: Safety equipment and clothing for the personal protection of pest controllers will be available and used at all times (i.e. rubber apron, boots, knee pads, gloves and goggles; protective cotton coveralls and cap; safety industrial -gloves, respirator, half mask, and respirator cartridges).

12. PESTICIDE STORAGE:

a. Shop facilities will be maintained in full compliance with EPA and OSHA guidelines.

b. Pest management personnel will be trained and certified in compliance with DOD and DA policies.

13. TRAINING AND CERTIFICATION:

a. Training may be accomplished in this manner.

(1) On-the-job training.

(2) Correspondence courses.

(3) Conference training.

b. Certification: Individuals will attend the three week courses entitled, “Conduct and Evaluation of Military Pest Management” conducted at Fort Sam Houston, Texas, by the U.S. Army Health Services Command. Upon successful completion of the course, the individual will be certified by the Command Entomologist.

14. RECERTIFICATION: Certificates will be valid for a period not to exceed three years. Recertification will require formal training, reexamination and redetermination of job competence by the Command Entomologist.

15. STORAGE:

a. All equipment utilized in the program will be thoroughly cleaned and lubricated as required after every use regardless of the duration or extent of use of the equipment. Therefore, the lubrication and cleaning procedures will be stringently followed.

b. Rinse with water or prescribed diluent at least three times. The rinse water will be drained from the storage tank into the containers which held the concentrate. Containers will be marked to avoid mixing pesticides.

c. Pesticide and used containers will be stored in a secure, dry, well ventilated, single purpose, fire resistant room or building.

d. Herbicides will be stored in a separate area of the storage facility.

e. All storage areas will be identified with warning signs in accordance with EPA standards.

f. All sprayers and equipment will be marked, “Contaminated with Pesticides”.

g. All pesticide containers will be stored in rows to ensure visibility of the labels. Signs will be posted, indicating the type of chemical within the area. The sign will also contain the common name of the pesticide. Current list of pesticides will be maintained at the Fire Department.

h. Precautions: At high temperatures, chemicals may expand and cause bulging of drumheads and leaks in the containers. High temperatures may reduce the effectiveness of the emulsifiers and hasten the corrosion of containers.

i. Material Safety Data Sheets: Material Safety Data Sheets on all pesticides, herbicides, algaecide, Rodenticide, gases, dusts, dry baits, and fungicides will be maintained on file in the Pest Controller Office. All material data sheets are recorded with the Fort Ritchie Fire Department and Safety Office.

Appendix D
Hazardous Waste Management

1. The Resource Conservation and Recovery Act (RCRA) provides for a national program to protect public health and the environment by requiring proper management of hazardous wastes. The program addresses all stages of hazardous waste handling from generation to ultimate disposal (the "cradle to grave" concept). This management plan requires a manifest system of the waste from the generation point through storage and transportation phases to final treatment and disposal.

2. RCRA defines a hazardous waste as a solid waste that may cause or significantly contribute to serious illness or death or poses a substantial threat to human health or the environment when improperly managed.

3. EPA has listed many chemical wastes as hazardous if they exhibit any one of four hazard waste characteristics: ignitability, corrosiveness, reactivity, and toxicity.

4. Subtitle C, Subpart B (Section 2002) of the RCRA regulations outlines standards applicable to generators of hazardous wastes. The standards establish requirements respecting:

a. Record keeping practices that accurately identify the quantities of such hazardous waste generated. The constituents which are significant in quantity or in potential harm to human health or the environment and the disposition of such wastes.

b. Labeling practices for any containers used for the storage, transport, or disposal of such hazardous waste reported, which will identify such waste.

c. Use of appropriate containers for such hazardous waste.

d. Furnishing of information (material safety data sheets) on the chemical composition and characteristics of such hazardous wastes to persons transporting, treating, storing, or disposing of such wastes.

e. Use of a manifest system to assure that all such hazardous waste generated is designated for treatment, storage or disposal in treatment, storage or disposal facilities (other than facilities on the premises where the waste is generated), for which a permit has been issued as provided in this subtitle.

f. Submission of reports to the federal or state agencies, if appropriate, setting out the quantities of hazardous waste identified or listed that have been generated during a particular time period; thus, the generator is responsible for maintaining accurate/detailed records of produced and stored hazardous waste. Also, generated waste must be stored in non-leaking, marked containers (toxic substance plan and the installation spill prevention plan) to prevent any contamination of the environment.

5. The Integrated Pest Management, contractors, and Environmental Pollution Prevention Branch will abide by these established requirements.

Appendix E
Pesticide Spill Clean Up Management

In case of a major spill the following should be contacted as applicable:

Fire Department - 911, 7121

Pest Management Section Supervisor – 798-3110

Roads and Grounds Supervisor – 798-4525/3088

Military Police – 798-2677

Environmental Section – 798-3487

1.0 Spill Emergency Procedures. When a pesticide spill occurs specific procedures should be followed for providing first aid, notifying proper authorities, and cleaning up and decontaminating the spill area. Personnel working with pesticides or in areas containing pesticide chemicals should be adequately trained for quick evacuation and proper spill prevention and emergency procedures as follows:

1.1 Identification. If possible, determine the pesticide involved in the spill incident. Information such as formulation, percent active ingredient, and manufacturers name and address should be obtained. If possible obtain label for listed procedures for cleanup and containment.

1.2 Safety and First Aid. All persons working with pesticides should be well trained in basic first aid and evacuation procedures. It must be emphasized that when managing any spill the most immediate concern is for the health and well being of persons in and around the immediate spill area.

First aid kits should be maintained at pest control shops and storage areas and carried on pest control vehicles. In addition, the telephone numbers of the local medical unit and poison control center should be posted in visible locations and carried by pest control personnel at all times when on the job.

1.3 Care of Injured. It is recognized that pesticide spill emergencies will differ, but the Immediate Concern should be to minimize contamination of personnel. Although the sequence may vary, the following basic procedures should be accomplished as rapidly as possible.

1. Quickly assess the spill situation to determine if personnel are involved.

2. Eliminate all sources of ignition (e.g., pilot lights, electric motors, gasoline engines) in order to prevent the threat of fire or explosion from flammable vapors (if present).

3. If personnel are involved, the rescuer should quickly don necessary protective

equipment and remove the injured to a safe location upwind from the spill. If the spill occurs in an enclosed area, doors and windows should be opened to enhance ventilation of the area.

4. If necessary, remove contaminated clothing form the victim and/or rescuer, then wash affected areas of body with soap and water. Administer additional first aid, which may include flushing contaminated eyes with clean water for 15 minutes.

5. Obtain medical assistance for injured or contaminated persons. *NOTE*: do not leave injured or incapacitated persons alone. Always instruct someone to stay with them until proper medical assistance is provide or a physician has been apprised of the situation.

1.4 Site Security. Secure the spill site from entry by unauthorized personnel by roping off the area and posting warning signs. If necessary, obtain assistance from the activities police or security unit.

1.5 Containment and Control. Spilled pesticides must be contained at the original site of the spill. The pesticide must be prevented from entering storm drains, wells, water systems, and navigable waterways by the following these procedures:

1. Don appropriate protective equipment form a spill kit or the pest control shop.

2. Prevent further leakage by repositioning the pesticide container.

3. Prevent the spill from spreading by trenching or encircling the area with a dike of sand, absorbent material, or, as a last resort, soil or rags.

4. Cover the spill: If the spill is liquid, us an absorbent material: if dry material, use a polyethylene or plastic tarpaulin and secure. *NOTE*: Use absorbent materials sparingly as they must also be disposed of as hazardous waste.

1.6 Pesticide Spill Reporting. Spills which involve pesticides equal to a or exceeding the designated reportable quantity (RQ) specified in EPA's Clean Water Act list of 297 hazardous substances threatening or entering waterways must be reported. All pesticide spills should be reported in accordance with AR 200-1 and Directorate of Public Works, Environmental Handbook, Chapter 17. The coordinator will report the spill to EPA as required.

The individuals or agencies in listed in the front of this section should be notified as appropriate, when spills occur these contacts can also provide information on how to cope with problems which may be encountered in handling pesticide spills. The telephone numbers of Contacts should be posted as part of the Pest Control Shop or activity's emergency plan.

1.7 Cleanup. Adequate cleanup of spilled pesticides is essential in order to remove any health Or environmental hazards. When cleaning up pesticide spills, it is advisable NOT TO WORK ALONE and to make sure the area is properly ventilated and that Appropriate protective equipment is used by all personnel.

1. Dry spills (dusts, wettable powders, granular formulations) should be picked

up in the following manner:

a. Immediately cover powders, dusts, or granular materials to prevent them from becoming airborne. This can be done by placing a polyethylene or plastic tarpaulin over the spilled material. Weight the ends of the tarp especially the end facing into the wind. Begin cleanup operations by systematically rolling up the tarp while simultaneously sweeping up the spilled pesticide using a broom, shovel, or dust pan. While sweeping, avoid brisk movements in order to keep the dry pesticide from becoming airborne. If indoors, a cover may not be necessary. When practical, light sprinkling with water may used instead of a cover.

b. Collect the pesticide and place it in heavy-duty plastic bags. Properly secure and label the bags, identifying the pesticide and possible hazards. Set the bags aside for later disposal.

2. Liquid spills should be cleaned up by placing an appropriate absorbent material (floor sweeping compound, sawdust, sand, etc.) over the spilled pesticide. Work the Absorbent into the spill using a broom or other tool to force the absorbent into close contact with the spilled pesticide. Collect all spent absorbent material and place into a properly labeled leak proof container.

3. Contaminated soil should be removed to a depth of at least three inches below the wet surface lien and placed in properly labeled leak proof drums for disposal.

1.8 Decontamination. Decontamination and disposal will be carried out after clean-up. These operations will only be carried out after reporting spill to immediate supervisor or his supervisor.

Appendix F
Pest Management Operations

1. PURPOSE. To outline procedures for handling pesticides and operating pest control equipment, and safety precautions associated with these operations.

2. GENERAL.

a. Those pesticides generally used on Fort Campbell include insecticides, herbicides and rodenticides.

b. Handling concentrated pesticides during shipment, storage and preparation of dilute formulations and during application of dilute formulations is hazardous in that personal contamination can result in extreme illness, skin damage or death.

c. Pesticide applications shall be carried out by certified pest controllers or under the direct supervision of a certified pest controller. Note: The term “under the direct supervision of” means in the direct line of sight of the certified pest controller.

d. Pesticides shall be procured under the supervision and approval of the Pest Management Coordinator.

e. All locations used for pesticide storage and mixing shall be marked to designate pesticide operations.

3. PROCEDURES.

a. Training and Certification.

(1) The Pest Management Coordinator and personnel who evaluate the quality of work of pest control contracts (Quality Assurance Evaluator - QAE) must also be certified. To minimize costs, the Pest Management Coordinator can also be the QAE.

(2) When pest control requirements necessitate that uncertified personnel assist the certified pest controller, training of these personnel in the handling, mixing and application of pesticides shall be done by the certified pest controller.

b. Pest Control Equipment.

(1) Only authorized, trained, personnel shall operate pest control equipment.

(2) Cleaning and storage of pest control equipment shall be done only by authorized, trained personnel in accordance with manufacturer's instruction manuals for the specific equipment item.

(3) Maintenance and adjustment of pest control equipment shall be carried out in accordance with the manufacturer's instructions for the specific equipment item.

(4) All equipment used in pest control activities shall be marked “Contaminated with Pesticides.”

c. Protective Clothing and Equipment.

(1) Protective clothing and equipment shall be available to installation pest control personnel and, when not in use, stored in the space provided for this use in Building 5160. The following minimum protective clothing and equipment will be provided:

(a) Chemical resistant gloves, aprons, and boots.

(b) Full face shield.

(c) Splash goggles.

(d) Respirators approved for use with pesticides used at Fort Campbell.

(e) Work uniform or coveralls.

(2) Work uniforms shall be worn when handling or applying pesticides. External personal clothing shall not be worn during pesticide operations.

(3) Work uniforms that have become contaminated with pesticides through spillage or during normal use shall be returned to the pest control shop for replacement and laundering. Laundering shall be done at the installation's expense; operators shall not take pesticide contaminated clothing home to be laundered.

(4) Splash goggles, face shields and pesticide respirators shall be cleaned and sanitized as necessary.

(5) All chemical resistant protective equipment, such as aprons, gloves and boots, shall be washed at the end of each day of use and properly stored in the lockers.

(6) Respirators shall be worn during the following operations:

(a) While handling pesticide concentrates and adding diluents to spray tanks.

(b) While spreading granular pesticides when there is danger of breathing the dust.

(c) While applying any pesticide which states on the label that the vapors or dusts should not be breathed.

(d) When the operator is located downwind during any spraying operation.

(e) While cleaning up a pesticide spill.

(7) Approved respirators will effectively prevent the inhalation of pesticide fumes and dust if the procedures for fitting, cleaning, cartridge replacement and storage are conducted as follows:

(a) Each respirator face piece will be numbered for identification.

(b) Masking tape will be attached to each respirator cartridge when it is placed in the respirator. The user will write the amount of time the cartridge is used on this tape. The user will replace the cartridges when eight hours of use have been recorded, when the odor of pesticides is noticed while wearing the respirator, when breathing resistance becomes excessive, or in accordance with manufacturer's instructions.

(c) Each individual will use the same respirator face piece for the duration of the job. If the facepiece becomes dirty or contaminated, it will be cleaned and sanitized. Face pieces will be cleaned and sanitized before being used by different individuals.

(d) Cartridges will be threaded into receptacles making sure that the gaskets are in proper position and hand-tightened to prevent damage to threads or gaskets.

(e) To don the respirator, the face piece should be fitted onto the bridge of the nose, making sure the individual is able to breathe through the nose. Then the bottom of the face piece should be swung into contact with the chin. Position headbands with the long straps above the ears and the short straps below the ears. The adjustment slides can be moved to achieve a comfortable fit.

(f) To test the respirator for leakage, remove the exhalation valve cover and hold the rubber valve against the seat. Create a slight positive pressure inside the face cushion by exhaling. If any leakage is detected around the face seal, readjust head harness' straps and repeat the test until there is no leakage. If other than face seal leakage is detected, the condition must be investigated and corrected before another test is made. The face piece must pass this test before the user should attempt to enter any toxic atmosphere. The mask will not furnish protection unless all inhaled air is drawn through approved cartridges. Replace the valve cover after completion of the test. This procedure does not negate the need to be fit-tested for the respirator by medical personnel, but is used as a final check on the device before use. Note. The procedures for use of respirators mentioned above applies to devices which rely on replaceable cartridges. When disposable respirators are used, the entire mask, including face piece and cartridges, is discarded and replaced. Replacement of disposable respirators will follow the same procedures as those outlined for cartridges in paragraph 3c (7) (b), above.

d. Pesticide Storage.

(1) All pesticides shall be stored in Building 5161 or under the adjacent covered enclosure. The pesticides shall be stored in their original containers. Building 5161 and the covered enclosure area shall be kept locked when not in use.

(2) All pesticides shall be segregated as to kind of pesticide during storage. Labels on all containers shall be visible at all times. Pesticides that are classed as moderately or highly toxic must be stored in facilities that meet the criteria described in 40 CFR 165.10 (Reference 4e).

(3) The Fire Department shall be furnished with an inventory of the kinds and amounts of pesticides present at each storage or mixing location. This inventory shall be updated at least annually, at the end of each calendar year.

e. Pesticide Transportation.

(1) Only authorized operators shall transport pesticides.

(2) When transporting pesticides, operators shall have with them protective clothing and equipment.

(3) Pesticides will not be transported in the cabs or passenger compartments of vehicles.

(4) Pesticides will not be left unattended or unsecured in the vehicle.

f. Pesticide Mixing.

(1) Only authorized, trained and certified personnel shall handle and mix pesticides.

(2) Dispensing concentrates and mixing of all liquid pesticides shall be done on the curbed paved area adjacent to Building 5161.

(3) Any pesticide contamination on the skin shall immediately be washed off with soap and water. Contamination of the eyes shall be flushed generously with water. After washing, the individual will secure immediate medical attention.

(4) Pesticide containers shall be returned to the storage sites upon completion of mixing.

(5) All pesticides shall be applied in accordance with the label directions. The certified pest controller shall determine what pesticide to use, what rate to use and how it should be mixed and applied.

(6) When mixing liquid pesticides, the spray tank shall be filled 1/3 to 1/2 full with the diluents, the pesticide shall be added, and the spray tank shall then be filled with diluents. All pesticide mixtures shall be agitated.

g. Pesticide Application.

(1) Only authorized, trained and certified personnel shall apply pesticides.

(2) Pesticide application shall be carried out in accordance with the label directions of the pesticide used and the manufacturer's operating instructions for the equipment used.

(3) Pesticide application operations shall be conducted as follows:

(a) Dry, granular pesticide application shall be conducted when the wind speed is less than 10 miles per hour to prevent drift. An approved respirator shall be worn whenever required by the pesticide label. The operator shall wear a respirator when pesticide dust is a hazard.

(b) Outdoor liquid pesticide application shall be conducted when the wind speed is less than 10 miles per hour to prevent drift. Approved respirators shall be worn whenever required by the pesticide label.

h. Pesticide Spill Cleanup Kit.

(1) A pesticide spill cleanup kit is located in each pesticide storage facility.

(2) The pesticide spill cleanup kit shall be used in accordance with TB MED 502, Appendix L (latest revision). All items in the kit that have been used shall be replaced as soon as possible.

i. Pesticide Container Disposal.

(1) Liquid pesticide containers shall be triple rinsed, with the rinse water placed in the spray tank and used as a diluent. The empty container shall then be crushed and placed in a sanitary landfill. Pesticide containers shall not be used for any purpose except that of holding the pesticide shown on the label.

(2) Dry, granular pesticide containers (bags and/or sacks) shall be emptied thoroughly and placed in a sanitary landfill. Pesticide bags or sacks shall not be burned or stored near heat or open flame.

j. Reporting.

(1) Adequate records of all pest management operations performed by engineer personnel and contractors will be maintained by the Pest Management Coordinator.

(2) The pest controller will maintain complete daily pesticide application and surveillance records using alternate forms instead of DD Form 1532-1 (Appendix R, Pest Management Maintenance Records). These records will account for all operations and will provide a permanent historical record of pest control operations for each building, structure, or outdoor site.

(3) Alternate forms instead of DD Form 1532 (Pest Management Report) will be used to report all pest control operations. The Pest Management Coordinator shall complete and submit the annual Pest Management Reports in accordance with AR 420-76.

4. REFERENCES.

a. AR 200-5, Pest Management, 29 NOVEMBER 1999.

b. TM 5-632, Military Entomology Operational Handbook, December 1973.

c. Equipment Manufacturer's Handbooks and Manuals.

d. Pesticide Labels and Manufacturer's Literature.

e. Title 40, Code of Federal Regulations, 1993 rev, Section 165.10, Recommended Procedures and Criteria for Storage of Pesticides and Pesticide Containers.

Appendix G
Integrated Pest Management in DODEA Schools
and
DFMWR Child Development Centers

Executive Summary

Ft. Campbell, Kentucky is diverse military community with post housing. Education of post housing children is accomplished by 5 elementary schools, 2 middle schools and 1 high school. There are 7 full time day care facilities, 5 after school care facilities and approximately 40 home day care facilities on the installation. All total approximately 6,000 children are served throughout the installation.

All these facilities have maintenance requirements to provide the best facilities. One aspect of maintenance is the performance of Pest Control activities in schools and child care facilities on the installation. The Army Environmental Center has asked Ft. Campbell to be a pilot program for implementation of Integrated Pest Management (IPM) in schools. IPM is defined as, "A sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks." Basically it means using a comprehensive approach to minimize the amount of pesticides used in schools/day care centers to adequately control pests.

Another aspect of the implementation of IPM in schools coincides with the passage of Commonwealth of Kentucky Pesticide Regulations, 302 KAR 29:050, Section 12, which directs that all schools in the state of Kentucky shall implement an IPM program in the schools. The basic premise of the KY statute and Ft. Campbell's plan is to notify all parents of any applications of pesticides in the school area. Notification shall be done by memo at the first of the school year and also 24 hours prior to selected applications. Parents complete a request to be notified during the enrollment process. Ft. Campbell pest control personnel shall coordinate with school personnel prior to any applications to ensure notification and adherence to this plan. Ft. Campbell, as a federal installation, does not have to follow these guidelines but felt that it is the best interests of Ft. Campbell to incorporate the guidelines of Kentucky in to the plan.

Ft. Campbell personnel shall implement the plan outlined below to minimize use of pesticides in school areas.

A. Background

1. Purpose.

a. Implement Integrated Pest Management Program in schools and child care facilities, following 302 KAR 29:050, Section 12, where practical.

b. Provide information to parents on pesticide use, the risks associated with it and what they need to do about it.

c. Prevent the outbreak of a serious deer disease, which may spread from the cantonment area to the rear area of post.

2. Authority.

AR 200-5, Pest Management, Oct 1999.

B. Responsibilities

1. Director of Public Works

a. Perform Pest Management Service to the schools and child care facilities according to this plan..

b. Coordinate Management Plan with other Directorates and External Organizations.

2. DFMWR, Child Care Facilities

a. Provide information to staff pertaining to this plan.

b. Notify parents initially of pest control activities. When Pest control activities are to be conducted in the facilities, provide information 24 hours prior to any pest control work.

c. Administer program to provide information about pest control activities to parents.

3. Fort Campbell Schools

a. Provide information to staff pertaining to this plan.

b. Notify parents initially of pest control activities. When Pest control activities are to be conducted in the facilities post information 24 hours prior to any pest control work and provide notification to parents who have registered for notification.

c. Administer program to provide information about pest control activities to parents, including notification sign up procedures.

4. Directorate of Public Works, Pest Control Shop

a. Conduct pest control activities according to this plan.

b. Coordinate with facility directors prior to doing any pest control which requires notification.

5. Directorate of Public Works, Environmental Division

a. Prepare, monitor and update the Integrated Pest Management Plan for IPM in Schools/Child Care Facilities.

b. Prepare reports as needed of pest control activities.

c. Work with USDA, APHIS when required to perform activities in child care/school facilities.

d. Provide technical information about pesticides and their use to schools and child care facilities.

C. General

Kentucky recently passed 302 KAR 29:050 Commercial/Structural Pest Control and Fumigation Act. Chapter 29, Section 12 outlines pest control notification procedures in schools. Ft. Campbell intends to adopt the fundamentals of this law in addition to guidance from Army Environmental Center (AEC) by implementing Integrated Pest Management in Schools/Child Care Facilities. Integrated Pest Management in Schools is an initiative that AEC sees as being an issue in the future. Ft. Campbell was selected as a pilot to implement this program. Integrated Pest Management in Schools program shall be implemented nationwide within the next few years.

The installation plan provides for some basic concepts for implementation. The use of a IPM dictates that a comprehensive approach be used to control pests within schools. Cultural, mechanical, physical and chemical controls will be implemented to effect control of pests. Whenever possible, chemical controls will be used to the least extent possible and notification of parents will be conducted prior to actual application of pesticides. Usually 24 hours prior to application. Parents requesting notification shall receive written notification through various mechanisms outlined below.

This plan provides for exemptions from notification for the following classes of chemicals.

1. Germicides, disinfectants, bactericides, sanitizing agents, water purifiers and swimming pool chemicals used in normal cleaning activities

2. Personal insect repellants

3. Human or animal ectoparasite control products administered by a qualified health professional or veterinarian.

4. Manufactured paste or gel bait insecticides placed in areas where human or pets do not have reasonable access to the bait.

5. Aerosols used as a contact to remove site specific pests such as wasp or spiders etc.

D. Notification Procedures, Schools

1. Initial notification.

Initial notification shall be conducted at the beginning of the school year by memorandum to all parents. This memorandum requests that parents read the provided information concerning

pesticide use in the schools. If parents want to be notified prior to any pesticide applications, they must return the memo with signature to be kept in the students files.

2. Notification prior to application

After a pest control problem has been identified which requires use of non-exempt chemical applications, the following notification procedures shall be followed.

a. All parents requesting notification shall receive a memorandum sent via their child advising them of the planned pesticide application.

b. Parents requesting notifications may also receive a phone call via the automated phone system advising them of the planned pesticide application.

c. A general announcement shall be placed on the school bulletin boards, entry ways and/or via internet to ensure all interested parties receive the information.

3. Signage During Application.

Twenty-four hours prior to the planned application signage will be posted by installation pest control personnel advising of the planned application. The signage will contain the following information.

a. Site/area to be treated.
b. Chemical to be applied
c. Time/date of treatment.
d. Re-entry times

E. Notification Procedures, Child Care Facilities

1. Initial notification.

Initial notification shall be conducted when a participant is enrolled in the program. This memorandum requests that parents read the provided information concerning pesticide use in the schools. If parents want to be notified prior to any pesticide applications, they must return the memo with signature to be kept in the students files.

2. Notification prior to application

After a pest control problem has been identified which requires use of non-exempt chemical applications, the following notification procedures shall be followed.

a. All parents requesting notification shall receive a memorandum sent via their child advising them of the planned pesticide application.

b. A general announcement shall be placed on the school bulletin board and via internet to ensure all interested parties receive the information.

3. Signage During Application.

Twenty-four hours prior to the planned application signage will be posted by installation pest control personnel advising of the planned application. The signage will contain the following information.

a. Site/area to be treated.
b. Chemical to be applied
c. Time/date of treatment.
d. Re-entry times

F. Exemptions From Notification

The following chemicals are exempt from the notification procedures listed above. Due to there nature they are considered harmless and are used in everyday activities like cleaning and other activities.

1. Germicides, disinfectants, bactericides, sanitizing agents, water purifiers and swimming pool chemicals used in normal cleaning activities

2. Personal insect repellants

3. Human or animal ectoparasite control products administered by a qualified health professional or veterinarian.

4. Manufactured paste or gel bait insecticides placed in areas where human or pets do not have reasonable access to the bait.

5. Aerosols used as a contact to remove site specific pests such as wasp or spiders etc.

G. Pest Control Priorities

1. Medical.
   a. Poisonous sting/biting: wasps, bees, snakes, black widow spiders.
   b. Disease Vector: ticks, mosquitoes (when so classified by medical authorities), rabid animals.
   c. Nuisance Biter: mosquitoes (normal conditions), fleas, chiggers, spiders, biting flies.
   d. Mechanical Disease Transmitter: cockroaches (indoor breeders), filth flies, rodent and bird ectoparasites.
   e. Stored Products Pests: Rodents, all other pests infesting stored products.
   f. Poisonous Plants: poison ivy.
   g. Nuisance Household Pests Causing Psychological Stress in Admin/Officer worksites.

2. Structural: termites, wood borers, wood fungi, birds, rodents.

3. Large Animal Control: feral cats, skunks, raccoons, opossums, muskrats, ground hogs, squirrel, birds, bats.

4. Weed and Undesirable Plant Control.
    a. Safety and Fire Protection: areas when flammable materials and electrical equipment are stored/maintained, airfield.
    b. Security: usually along fence rows.
    c. Protect Real Property: railway and roadway 'Right-of-ways'.
    d. Beautification (high visibility areas): selective weed control.
    e. Plant Growth Regulator: labor saving by reducing grass cutting.

5. Ornamental Plant, Tree and Turf/Soil Pest Control.
    a. Safety: mole control in athletic areas where uneven surfaces could cause injuries, caterpillars that have urticating hairs such as tussock and ixo moths.
    b. Plant Destroying: gypsy moth, mites, borers, leaf beetles, bark beetles, etc. attacking plants in landscaped areas, plant diseases.
    c. Beautification (high visibility area): any infestation light to heavy.

6. Household and Nuisance Pest Control.
    a. Indoor Breeding: cockroaches in nonfood service facilities, ants, fleas in buildings where occupants have pets.
    b. Outdoor Invaders (admin and offices): most large roaches (American - chestnut colored, and smoky brown - black colored), crickets, spiders, ants, spiders, millipedes.
    c. Outdoor Invaders (family housing): same as 6b above.

7. Other.
    a. Yard Spray (family housing): grubs, ants, ticks, fleas (quarters having pets), flies breeding in animal feces.
    b. Ornamental Plant, Tree and Turf/Soil Pest Control: non-high visibility areas.
    c. Weed Control: non-high visibility areas.
    d. Mole Control.

I. References

    a. AR200-1, Pest Management, 13 December 2009

Appendix H
Equipment Lists for Entomology

Make	Model/Type	Capacity	Use
Clarke	Cougar	15 gal	ULV
Clarke	Cougar	15 gal	ULV
Patchen	Weedseeker	50 gal	Herbicide Sprayer
Clarke	Wolverine	10 gal	ULV
Spray Tank	Diaphram	50 gal	Termiticides X4
Spray Tank	Diaphram	25 gal	Lawn
B&G	Hand Sprayer	1 gal	General Pest Use X6
Solo	BackPack	4 gal	General Pest Use X3
Tractor Tank	Sprayer	500 gal	Herbicides
Tractor Tank (2)	Sprayer	200 gal	Herbicides
Trucks (2)	¾ Ton	50 gal	Herbicides/Insecticides

Appendix I
Minimum Thresholds for Chemical Control

Chemical pesticides should be applied as part of an integrated pest management (IPM) program and only after a pest survey is conducted. Basing pesticide application on quantifiable conditions helps ensure pesticides are used appropriately and responsibly. The following are thresholds for some common pests that may be addressed in the PMP.

Two basic management actions, preventative and corrective, are addressed within this Appendix. Preventive actions are undertaken to prohibit or limit the occurrence of a pest. Corrective actions are taken when the pest population meets the threshold criteria. Thresholds and methods for control or prevention are dynamic and can be modified upon analysis of unique pest situations, to include geographical location, pests present, human population density and demographics, environmental concerns, age and condition of facilities.

I. Fungi

A. Wood-Destroying Fungi

1. Preventive Threshold. Exposed lumber, construction, or remodeling projects. Treat exposed lumber with long-term residual product in potentially wet or high moisture areas during construction or re-modeling projects.

2. Corrective Threshold. Any site with an active wood-destroying fungi infestation where the wooden structure is still sound.

II. Plants

A. All Vegetation (Bare Ground)

1. Preventive Threshold. Treat areas where presence of vegetation would not be conducive with human activity, such as industrial sites, railroad tracks, electrical transformers, utility boxes, petroleum storage yards, equipment storage yards, motor pools, parking lots, and along fence-rows.

Note. Addition of a persistent, pre-emergent herbicide, such as a soil sterilant will maximize the persistent nature of the selected herbicide(s).

2. Corrective Threshold. Presence of unwanted vegetation.

Note. Application of a non-persistent, broad-spectrum herbicide, such as Roundup, to newly seeded areas will kill the existing vegetation and allow the seeds to germinate.

B. Brush

1. Corrective Threshold. Any area where brush impacts the training mission or facilities.

Note. Apply herbicide only if mechanical brush removal is impractical.
Note. Dead vegetation can cause a fire hazard.

C. Weeds in Ornamental Plant Beds

Preventive Threshold. Sites with no visible weed growth

Note. Apply a pre-emergent herbicide.

Corrective Threshold. Sites having visible weed growth (germinated plants).

Note. Apply a post-emergent herbicide combined with pre-emergent products.

D. Weeds in Turf

1. Preventive Threshold. In managed turf areas with a history of undesirable weed growth.

Note. Apply a pre-emergent to prevent weed germination.

2. Corrective Threshold. In managed turf areas with visible weed growth.

Note. Apply both pre-emergent and post-emergent herbicide. If treated area is not included in a turf management program, killing the weeds may result in a dirt field.

E. Woody Vines (Kudzu)

1. Corrective Threshold. Actively growing kudzu in unwanted areas.

Note. Herbicide can also be applied as a dormant plant spray

F. Woody Vines (Poison Ivy)

1. Corrective Threshold. Sites with poison ivy growth interfering with human activity.

G. Algae and Aquatic Weeds

1. Corrective Threshold. Excessive algae growth and aquatic weeds are observed or adversely affect drainage systems.

H. Plant Growth Regulators

1. Preventive or Corrective Threshold. Sites that require reduced plant growth.

I. Plant Diseases

1. Preventive Threshold. When environmental conditions provide opportune growth factors for the spread of plant disease(s) in managed turf and landscaped areas.

2. Corrective Threshold. Presence of active fungus or treatable disease.

III. Animals

A. Invertebrates

1. Bees and Wasps

a. Corrective Threshold. Any observed nest, hive or swarming activity that interferes with human activity

2. Ticks

a. Corrective Threshold.

1. Field Sites – average of 10 ticks per several (4 to 8) 100-yard tick drags

2. Family Housing Areas – 1 tick per single 100-yard tick drag or 4 ticks on a CO_2 trap operated over a 1 hour period.

3. Chiggers

a. Corrective Threshold. Complaints of chigger bites in areas where chigger infestations adversely affect human activities.

4. Mosquitoes (Adults)

a. Corrective Threshold.

New Jersey Light Trap:	25 females/trap/night for nuisance biting mosquitoes 5 females/trap/night for disease vector control
CDC Trap without CO2:	5 females/trap/night for nuisance biting mosquitoes 2 females/trap/night for disease vector control (note: this is not a very effective surveillance method)
CDC Trap with CO2:	25 females/trap/night for nuisance biting mosquitoes 5 females/trap/night for disease vector control

Human Complaints: validated by local light trap surveillance

5. Mosquitoes (Larvae)

a. Preventive Threshold. Treat known mosquito breeding sites (both permanent and semi-permanent) at the beginning and periodically throughout of the mosquito breeding season.

Note: larvae continue to be active in breeding sites treated with an insect growth regulator (IGR). IGRs do not kill the larvae.

b. Corrective Threshold. Sites with 5 or more larvae per larval dip and not previously treated as above.

6. Filth Flies

a. Corrective Threshold: Sustained moderate to heavy filth fly infestations after maximizing use of non-chemical control methods.

Note: No chemical control for fly maggots.

7. Lice (Body, Head & Pubic)

a. Corrective Threshold: None.

Note: Louse control consists of medication prescribed by patient's physician or over the counter medication.

8. Biting Flies (Deerflies, No-see-ums, Black Flies, etc.)

a. Corrective Threshold: Validation of complaints where moderate to heavy infestations of biting flies disrupt outdoor activities or conditions where personal protection products are inadequate.

8. Fleas

a. Corrective Threshold. Presence of any active infestation and collection of at least one flea. Do not treat for fleas based only upon complaints of "flea bites".

Note: For any unspecified "bug" bite, validate complaints by capturing pest prior to authorizing any treatment.

9. Cockroaches

a. Preventive Threshold. Government quarters during change of occupancy. For example, treatment of vacant quarters with boric acid or other long-term residual product in a high infestation area.

b. Corrective Threshold.

Baiting. Any observed level of active roach infestation.

An average of more than 5 roaches/trap/night using sticky traps. (Treatment of entire area or enclosure is indicated)

One trap with more than 5 roaches/trap/night using sticky traps. (Spot or room treatment is indicated)

10. Termites

a. Preventive Threshold. Exposed lumber, construction, or remodeling projects. Treatment of exposed lumber with long-term residual product during construction or re-modeling projects.

b. Corrective Threshold. Presence of any termite activity. Spot treat building only if building has a history or record of being pre-treated with a termiticide.

11. Other Wood-Destroying Insects

a. Preventive Threshold. Exposed lumber, construction, or remodeling projects. Treat exposed lumber with long-term residual product during construction or re-modeling projects.

b. Corrective Threshold. Any site having an active wood-destroying insect infestation.

12. Foliage-Feeders (Cutworms, Webworms, Tent Caterpillars, Leaf Beetles, Sawflies, Bagworms, Grasshoppers, etc)

a. Corrective Threshold. When moderate to heavy infestation(s) detract from plant's aesthetic value or can possibly cause permanent injury to the plant.

13. Sap-Feeders (Aphids, Scales, Whiteflies, Lacebugs, Leafhoppers, etc.)

a. Corrective Threshold. When moderate to heavy infestation(s) detract from the plant's aesthetic value or can possibly cause permanent injury. Also, when deposits of honey-dew (excretion from many types of sap-feeding pests) cause excessive soiling of vehicles or other equipment parked or stored under affected plants or trees.

14. Plant Mites (Spider Mites)

a. Corrective Threshold. First sign of mite activity in and around plants in landscaped, high- visibility areas.

Note. Treat adjacent sites where moderate to heavy mite infestations could cause permanent plant damage.

15. Turf Insect Pests

a. Corrective Threshold. Moderate to heavy infestations of turf foliage or root-feeding pests in managed turf areas.

Note. Treating for soil pests can provide indirect control of moles by eliminating food sources.

16. Household Nuisance Pests (such as Ants, Spiders, Silverfish, Drain Flies, Fruit Flies, Brown Dog Ticks, etc.) Indoor Treatments

a. Corrective Threshold. Any level of observed infestation.

Note. Identify pest before treatment

17. Outdoor Invading Household Pests (such as Smoky-brown or American Cockroaches, Water bugs, Crickets, Earwigs, Spiders, Ants, Ground Beetles, Elm Leafbeetles, Sowbugs, Pillbugs, etc.) Building Exterior Treatment

a. Corrective Threshold. Any level of observed infestation.

18. Spiders (Brown Recluse, Black Widows, Yellow Sac, Aggressive House, etc.)

a. Corrective Threshold. Upon capture and identification of spider known to produce painful bites or determination of spider infestation. Do not treat for spiders based only upon complaints of “spider bites”.

B. Vertebrates

1. Snakes

a. Corrective Threshold. Snake presence when building occupant(s) has excessive fear of snakes.

Note: Treatment with a repellent is more to address the psychological duress of a building occupant than actual repellency provided by the product.

2. Rodents (Rats & Mice)

a. Preventive Threshold. Conditions exist for the infestation of rodents. (For example, baiting in and around food storage facilities.)

b. Corrective Threshold. Continued signs of rodent activity after maximizing use of nonchemical control methods, such as traps and rodent-proofing.

2. Moles

a. Corrective Threshold. Presence of mounds, tunnels, or runways causing ornamental plant or turf damage in areas not conducive with human activity.

Note. Collapse mounds and runways to determine if mole activity is current; mounds/runways reappear within a couple of days.

3. Bats

a. Corrective Threshold. Presence of roosting activity in buildings or areas not conducive with human activity.

4. Birds (Starlings, Pigeons or Sparrows)

a. Corrective Threshold. Active bird infestation(s) in site(s) not conducive with human activity where non-chemical controls are delayed or impractical.

b. Preventative Threshold. Conditions exists for the roosting of birds within buildings. Exclusion devices are applicable.

5. Large Animals (Feral Cats, Skunks, Raccoons, Squirrels, Muskrats, opossums, Ground Hogs, Armadillos, etc.)

a. Corrective Threshold. Presence of any large animal in and around buildings or other sites that interferes with human activity or presents a health threat.

Appendix J
Coordinating Organizations

CHEMTREC 1-800-424-9300
(for assistance in a chemical emergency involving a spill, leak or exposure)

NATIONAL PESTICIDE TELECOMMUNICATIONS NETWORK 1-800-858-7378
(up-to-date technical reference material on toxicity, human and environmental health effects, disposal, and proper use of each pesticide)

DEPARTMENT OF DEFENSE (DOD)

Armed Forces Pest Management Board (AFPMB)

The mission of the AFPMB is to recommend policy, provide scientific advice, and enhance coordination among the DOD components on all matters related to pest management. The AFPMB approves introduction, stockage, and deletion of pest management material in the DOD supply system; coordinates and develops requirements for pest management related research and testing within DOD; and operates the Defense Pest Management Information Analysis Center (DPMIAC) (DSN: 295-7479). DPMIAC maintains a military entomology and pest management information data base. Scientific information pertinent to the military pest management program is indexed, abstracted, stored, analyzed, disseminated, and retrieved on request.

Armed Forces Pest Management Board
Forest Glen Section
Walter Reed Army Medical Center
Washington, DC 20307-5001
Phone DSN: 295-7476

Defense Pest Management Information Analysis Center DSN 295-7479
(24 hour telephone recorder for information about Armed Forces Pest Management Board information and publications such as Technical Information Memorandum and the Technical Information Bulletins)

DEPARTMENT OF THE ARMY (DA)

The conservation division of the Director of Environmental Programs is responsible for developing Army policies, standards, and procedures relative to pest management programs, operations, pesticides, and related issues. Performs reviews to assure adherence to policies and provide technical advice as appropriate. Represents Army installations on the AFPMB, and with other government agencies. Establishes Army program requirements relative to Research and Development; interacts with other DA programs and disciplines.

Headquarters, Department of the Army
Assistant Chief of Staff for Installation Management
Directorate of Environmental Programs, Conservation Division
ATTN: DAIM-ED-N (Pest Mgmt)
600 Army Pentagon
Washington, DC 20310-0600
Phone DSN: 226-8816

U. S. Army Center For Health Promotion and Preventive Medicine (USACHPPM) [Provisional (Prov)]

The pest management program is responsible for providing technical assistance and support in all aspects of vector borne disease, pesticides, and integrated pest management. USACHPPM (Prov) maintains laboratories and a staff of military and civilian entomologist and technicians for providing assistance to the Army pest management community. USACHPPM (Prov) operates the DOD Pesticide Hotline, produces technical guides, identifies arthropods, provides resistance test kits, and performs resistance testing. Examples of on-site services provided are: Pest Management Program Reviews, MEDCOM Pest Management Assistance Visits, Pest Resistance Evaluations, Lyme Disease Risk Assessments, Environmental Compliance Audits, and Pesticide Risk Management Studies. Other services are available by request and are tailored to the needs of the requesting organization.

USACHPPM (Prov)
ATTN: MCHB-DC-OEN (C, PMaB)
Aberdeen Proving Ground, Maryland 21010-5422

DOD Pesticide Hotline
DSN 584-3773
Commercial (410) 671-3773
(for information concerning federal pesticide information, EPA or state registered pesticides and pesticide labels)

Army Medical Department Center and School (AMEDD)

The Medical Zoology Branch of AMEDD is the Army's designated center for DoD pest management certification training. Provides training to enlisted, officer, and civilian personnel. Involved in development of educational materials, including videos and graphic aids. Provides technical input to correspondence course.

Army Medical Department Center and School
Preventive Medicine Division, Medical Zoology Branch
ATTN: MCS-HPM
Fort Sam Houston, TX 78234-6142
Phone: DSN 471-7649/6801/6733

Walter Reed Army Institute of Research (WRAIR)

The Department of Entomology, WRAIR, implements an extensive program of basic and applied research on vectors of arthropod-borne diseases of military significance. Major areas of emphasis include: 1) design and evaluation of improved methods of biosystematics to include vector genetics, molecular taxonomy, and development and production of computerized interactive taxonomic keys for use by far-forward deployed preventive medicine personnel; 2) selection and development of rapid assays for detection and identification of parasites in vectors; 3) identification of arthropods responsible for transmission of infectious diseases and maintenance of reference insect collections of important vectors; 4) investigation of parasite vector host interactions and risk factors for prediction and disruption of natural transmission cycles; 5) culturing of malaria and *Leishmania* parasites and development of animal models to support vaccine development and diagnostics studies; 6) investigation of repellent mechanisms and optimization, composition, formulation and delivery of candidate repellents; 7) preparation of field sites for vaccine, drug, and repellent testing, and 8) design and evaluation of integrated vector control measures for preventing diseases.

Walter Reed Army Institute of Research
Department of Entomology
Building 503
Robert Grant Ave, WRAMC
Washington, DC 20307-5100

Phone DSN 285-9655

DEPARTMENT OF THE INTERIOR, U.S. Fish and Wildlife Service

900 Clay Street, room 236
Vicksburg, Mississippi 39180
Phone COMM (601) 638-1891

DEPARTMENT OF AGRICULTURE, U.S. Forest Service

100 West Capital Street, Suite 1141
Jackson, Mississippi 39265
Phone COMM (601) 965-4391

Animal Plant Health Inspection Service, Animal Damage Control

State Director
P.O. Drawer FW
Room 316, Dorman Hall
Mississippi State University
Mississippi State, MS 39762

Appendix K

USACE SPECIFICATIONS FOR NEW CONSTRUCTION
USACE / NAVFAC / AFTCESA UFGS-02361N (September 1999)
UNIFIED FACILITIES GUIDE SPECIFICATIONS

SECTION TABLE OF CONTENTS
DIVISION 02 - SITE WORK
SECTION 02361N SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

NOTE: This guide specification covers soil treatment for subterranean termite control before construction (new construction) of buildings which is commonly referred to as preconstruction treatment. Comments and suggestion on this specification are
welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet. Use of electronic communication is encouraged.
Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

1.1 REFERENCES

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
7 USC Section 136 Federal Insecticide, Fungicide, and Rodenticide Act
1.2 SUBMITTALS

NOTE: Where a "G" in submittal tags follows a submittal item, it indicates Government approval for that item. Add "G" in submittal tags following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically significantly to merit approval by the Government. Submittal items not designated with a "G" will be approved by the QC organization.

Submit the following in accordance with Section 01330, "Submittal Procedures."
SD-04 Samples Pesticides; G

Submit on request, or the Contracting Officer may draw at any time and without prior notice, from stocks at the job site, samples of the pesticides used in this work. Should analysis, performed by the Government, indicate such samples to contain less than the amount of active ingredient specified on the label, work performed with such products shall be repeated, with pesticides conforming to this specification, at no additional cost to the Government.

SD-07 Certificates
Qualifications of pesticide applicators; G
Submit data as required in paragraph entitled "Qualifications of Pesticide Applicators," prior to commencement of work.

SD-08 Manufacturer's Instructions
Pesticides; G
Submit a copy of manufacturer's label and Material Safety Data Sheet (MSDS).

SD-11 Closeout Submittals
Warranty
Application report
Submit documents signed by an officer of the Contractor.

1.3 QUALIFICATIONS OF PESTICIDE APPLICATORS

The pesticide applicator's principal business shall be pest control and the pesticide applicator shall be State certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control, and certified in the state and county of operation.

NOTE: For projects located in North Carolina, add the following at the end of the preceding paragraph.

The Contractor shall:
a. Have personnel with a state of North Carolina certification as required by North Carolina Pesticide Law of 1971 as amended.
b. Check in with insect vectors personnel prior to application of pesticide and herbicides for projects located at Camp Lejeune.
c. Provide a submittal with the following information to Contracting Officer:
(1) Quantity of pesticide used.
(2) Rate of dispersion.
(3) Percent of use.

(4) Total amount used.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver pesticides to the project site in sealed and labeled containers in good condition as supplied by the manufacturer or formulator. Store, handle, and use pesticides in accordance with manufacturer's labels. Labels shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or appropriate regulations of the host county.

1.5 SAFETY REQUIREMENTS

Formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Contracting Officer, and fit the filling hose with a backflow preventer meeting local plumbing codes or standards. The filling operation shall be under the direct and continuous observation of a contractor's representative to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application. Dispose of used pesticide containers off Government property.

1.6 WARRANTY

NOTE: Use 5 years in temperate regions and 3 years in tropical and subtropical regions. Warranty period and the Contractor's responsibilities during the warranty period may be modified to be consistent with prevailing state or local practices if approved by the cognizant EFD applied biologist. NAVFACENGCOM Headquarters point of contact is the Assistant for Applied Biology Policy, Code 13411, telephone (703) 325-8183.

Furnish an 5 year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Perform annual inspections of the building[s] or building addition[s]. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim, the Contractor shall:
a. Retreat the soil and perform other treatment as may be necessary for elimination of subterranean termite infestation;
b. Repair damage caused by termite infestation; and
c. Reinspect the building approximately 180 days after the retreatment.

1.7 QUALITY ASSURANCE

1.7.1 Application Report

Upon completion of this work, submit Pest Management Report Form identifying target pest, type of operation, brand name and manufacturer of pesticide, formulation, concentration or rate of application used. Maintain daily records using Pest Management Maintenance Record, DD Form 1532-1 and submit copies of records when requested by the Contracting Officer.

PART 2 PRODUCTS

2.1 PESTICIDES

Termiticides bearing current registration by the EPA or approved for such use by the appropriate agency of the host country. Comply with 7 USC Section 136 for requirements on contractor's licensing, certification, and record keeping. Contact the command Pest Control Coordinator prior to starting work.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

At the time of application, the soil shall have a sufficiently low moisture content to allow uniform distribution of the treatment solution throughout the soil. Do not make applications during or immediately following heavy rains or when conditions may cause runoff and create an environmental hazard.

3.2 APPLICATION

3.2.1 Treatment Area

Apply termiticide to soil material which will be covered by or lie immediately adjacent to the buildings and structures so as to provide a protective barrier against subterranean termites.

3.2.2 Treatment Application

Apply termiticide as a coarse spray and in such manner as to provide uniform distribution onto the soil surface. Apply treatment prior to placement of a vapor barrier or waterproof membrane and at least 12 hours prior to concrete pouring. Where treated soil or fill material is not to be covered with a vapor barrier or waterproof membrane, exercise adequate precautions to prevent its disturbance. If soil or fill material has been disturbed after treatment, retreat as specified above before placement of slabs or other covering structures. Coordinate treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures with final grading and planting operations so as to avoid disturbance of the treated barriers by such operations. Observe manufacturer's warnings and precautions in the handling and use of such materials. Exercise precaution that these chemicals do not enter water supply systems or potable water supplies or aquifers, and that they do not endanger plants and animals as well. Notify the Contracting Officer at least 48 hours prior to beginning of treatment and perform formulating, mixing, and application in the presence of the Contracting Officer's representative.

3.2.3 Rates and Methods of Application

Apply in accordance with the pesticide label. Provide maximum application or dosage rates. Resolve conflict between this specification and label direction in favor of the label.

SECTION TABLE OF CONTENTS
DIVISION 02 - SITE WORK
SECTION 02363N TERMITE CONTROL BARRIER SYSTEM

NOTE: This specification consists of furnishing and installing a complete stainless steel mesh system at all penetrations, joints and perimeter foundations as a physical barrier below the concrete slabs and foundations of a structure to prevent the entry of Formosan and other ground termites into wood components of the structure, similar to laying down a chemical barrier of soil termiticide treatments. The use of this material does not preclude the use of other preventive measures such as chemical treatment, basaltic termite barrier system and pressure treated lumber for construction to provide maximum protection to the structure. In fact, it is recommended that this material be used in conjunction with chemical treatment at all vulnerable areas such as penetration areas around electrical conduits and plumbing pipes that penetrate the slab as well as the foundation perimeter and shoulder portions of the barrier. This termite physical protection system must comply with all codes. It is also recommended that pressure treated lumber be used to provide maximum protection to the structure.

NOTE: This new NFGS-02286N conforms to the requirements of the Unified Facilities Criteria (UFTC 1-300-02) Unified Facilities Guide Specifications (UFGS) Format Standard dated March 23, 2001.

Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet. Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

NOTE: Termite infestation exists throughout the United States and overseas areas with the exception of Alaska. Mesh termite barriers can be prescribed for installation at all sites where termites are likely to establish colonies and make concealed entries to wood construction, when it is deemed appropriate and cost effective.

1.1 REFERENCES

SBCCI Public Safety Testing and Evaluation Services, Inc., report 9713 for Termite Control System used to provide protection against subterranean termites.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 478 (1997) Chromium-Nickel Stainless Steel Weaving and Knitting Wire

ASTM A 580/A 580M (1998) Stainless Steel Wire

1.2 SYSTEM DESCRIPTION

NOTE: A complete termite control barrier system encompasses a fine steel mesh placed across all termite entry points to the building. Principal entry points include all cracks, joints, penetrations and other termite entry points within the concrete slabs and cavities in walls. The steel mesh and fastening system physically prevents the termites from entering the building. The mesh is too fine for the termites to squeeze through, too hard to chew through, and highly corrosion resistant for future break down.

The stainless steel termite mesh barrier shall be placed across all openings, joints, penetrations and other termite entry points to the building (including all shrinkage cracks in concrete slabs and built penetrations in slabs and walls that termites may use for access point)and as per manufacturer's recommendations. The termite mesh shall be clamped, parged adhered, bonded and/or embedded to the material surrounding the opening as per the manufacturer's recommendations. The termite barrier mesh system shall be installed with no gaps, penetrations or damage to the mesh system.

1.3 SUBMITTALS

NOTE: Where a "G" in submittal tags follows a submittal item, it indicates Government approval for that item. Add "G" in submittal tags following any added or existing submittal items deemed

sufficiently critical, complex, or aesthetically significantly to merit approval by the Government. Submittal items not designated with a "G" will be approved by the QC organization.

Submit the following in accordance with Section 01330, "Submittal Procedures."

D-02 Shop Drawings
Barrier Mesh
Shop drawings of the termite barrier mesh system installation at all perimeter foundations, joint and penetration conditions.

SD-03 Product Data
Barrier Mesh Accessories System Description
Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment.
Manufacturer's Guidance; G
Visual Inspection Guide; G

SD-04 Samples
Barrier Mesh; G
Samples of stainless steel mesh to be used in this work, 102 x 102mm 4 x 4 inches.

SD-07 Certificates
System Installers; G
Certification that installers meet the requirements specified under paragraph entitled "Qualifications of System Installers."
Statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

SD-08 Manufacturer's Instructions
Manufacturer's Installation Instruction Manual.
Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports
Site Conditions
Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
Written verification that site conditions are as required and other site work will not disturb the installation.

SD-11 Closeout Submittals
Warranty
Written warranty required in paragraph entitled "Warranty" and signed jointly by an officer of the Contractor and the supplier.

1.4 QUALITY ASSURANCE

1.4.1 QUALIFICATIONS OF SYSTEM INSTALLERS

a. The installer shall be trained and accredited by the system supplier.
b. The installer shall employ only workers trained and accredited at the appropriate level by the system supplier.

1.4.2 PREINSTALLATION MEETING

Convene a pre-installation meeting at least one week prior to beginning installation, to review conditions of preparation, storage and handling, installation procedures, sequencing, protection and coordination with other related work. Attendance by the project superintendent, installer, installer's crew leader, and representatives of the trades affected by this work is required. Notify the Contracting Officer at least 10 calendar days
before meeting.

1.5 DELIVERY, STORAGE AND HANDLING

Deliver materials to the site in original unbroken packaging and containers, with original labels in place. Store materials in conformance with system supplier's recommendations.

1.6 WARRANTY

NOTE: Use 5 years for family housing and 3 years for other types of facilities.

Furnish a 5 year written warranty against infestations or reinfestation by subterranean termites of the buildings or building additions constructed under this contract. Perform annual inspections of the building[s] or building addition[s]. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and building conditions have not been altered in the
interim, the Contractor shall:
a. Correct defective stainless steel mesh installation and perform other treatment as may be necessary for elimination of subterranean termite infestation;
b. Repair damage caused by termite infestation; and
c. Reinspect the building approximately 180 calendar days after the repair.

PART 2 PRODUCTS

NOTE: Check with local agencies to determine the local building code requirements and specifications to ensure conformance where required.

2.1 MATERIALS

2.1.1 Asbestos Prohibition

No asbestos containing materials or equipment are permitted at the job site. The contractor shall ensure that materials proposed for the project are asbestos free.

2.1.2 Barrier Mesh
Stainless steel mesh shall conform to ASTM A 478 and ASTM A 580/A 580M, Type A1AA marine grade 316 stainless steel mesh of 0.18 mm 0.007 in. diameter wire with mesh openings of 0.66 x 0.45 mm. 0.026 x 0.018 inches.

2.1.3 Accessories
Parging adhesives, bonding cement, high grade stainless steel clamps, ties, and other accessories as recommended by system supplier.

PART 3 EXECUTION

NOTE: The stainless steel mesh must be installed in a manner to provide maximum protection to the dwelling. The material provides a physical barrier to the termites, thus, preventing entry. A range of techniques and material widths may be required to meet site conditions. The designer is required to determine the extent of openings to be covered to provide quantity estimates for the material installed.

3.1 SURFACE EXAMINATION

3.1.1 Examination
Examine the substrates and conditions under which work of this section will be performed. Do not proceed until unsatisfactory conditions detrimental to timely and proper completion of the work have been corrected.

3.1.2 Verification
Provide a written verification that the site conditions under the proposed slab(s) are proper for the installation of termite barrier system as per manufacturer's recommendations. Work related to final grades, landscape plantings, foundations, or any other operations that might alter the condition of the site, shall be performed in accordance with this specification. Before installation, the contractor shall ensure that:
a. The ground has been cleared of wood scraps such as ground stakes, forms and other termite food sources.
b. The work area has been filled with finely graded soil consisting of particle sizes no larger than 25 mm 1 in. and compacted to eliminate soil movement. The condition of the site shall meet the manufacturer's recommendations for installing the mesh barrier.
c. Footings and foundations, and outer forms are in place.
d. Communications, electrical and plumbing penetrating pipes are in place.

3.2 INSTALLATION

3.2.1 Instructions
Strictly follow the manufacturer's instructions published in Manufacturer's Installation Instruction Manual.

3.2.2 Installation Sequence
a. Install mesh as required, fit and clamp mesh around all pipe penetrations, and terminate at perimeters as appropriate for the building construction as described in installation manual.

b. Install special fittings appropriate to construction as described in installation manual.
c. Following installation of mesh, vapor barrier, install reinforcing steel and concrete specified under other sections.
d. Where required, integrate mesh into subsequent construction as described in installation manual.

3.3 PROTECTION

The installed termite mesh system, attachments and accessories shall be protected before, during and after the work of all trades as required by the system supplier or directed by the Contracting Officer. Dissimilar metals shall not be used in contact with the stainless steel mesh to avoid an electrolytic reaction.

3.4 VISUAL INSPECTION GUIDE

To maintain resistance to termites, the system shall be complete and not disturbed, penetrated or damaged during the remaining contract time period. The installer shall provide Manufacturer's Guidance for performing a visual assessment of the installed mesh barrier to ensure the mesh barrier provides the designed termite physical barrier.

3.5 FIELD QUALITY CONTROL

In the event following trades on the site move or damage the mesh, clamps or parging mix, immediately contact the mesh installer, for recommendation of necessary repairs.

SECTION TABLE OF CONTENTS
DIVISION 02 - SITE WORK
SECTION 02364A TERMITICIDE TREATMENT MEASURES FOR SUBTERRANEAN TERMITE CONTROL

3.7.4 Termites Found Within the Warranty Period

3.8 RE-TREATMENT

NOTE: This guide specification covers the requirements for termiticide treatment measures for subterranean termite control. Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet. Use of electronic communication is encouraged.

PART 1 GENERAL

NOTE: Termite infestation exists throughout the United States and overseas areas with the exception of Alaska. Soil treatment will be specified for all types of construction where termites are likely to establish colonies and make concealed access to wood construction, including wood doors, windows, finish, and trim, or to wood-product, cloth, or cellulose storage in buildings. Soil treatment will also be required for structures constructed of or containing wood-preservative-treated items. However, soil treatment is not required for power plants, central-heating plants, water- or sewer-treatment plants, incinerators, pump houses, and structures of similar nature which have neither wood in their construction nor wood or cellulose items stored within, and which have little chance of conversion to alternative uses.

Modification of this section, including materials, concentrations, or rates of application, considered necessary because of climatic conditions, porosity of soil to be treated, type of termite, or heavy infestation of termites, will be as recommended by the certified installation pest management coordinator. The modification will be in accordance with the guidance contained in the installation pest management program. Army Regulation 210-50, Housing Management, paragraph SPECIAL CONDITIONS, prohibits termiticide treatment through or under concrete slabs where HVAC ducts or vents are within or beneath the slab. Information is also available from state and local agriculture agencies and from the EPA National Pesticide Telephone Network at 1-800-858-7378.

When termites are known to be present on the project site, any crawl space on the ground level designed in a building needs to be designed for a concrete cover to be placed over the soil after treatment by a termiticide. Since the crawl space remains accessible to people and animals, it requires the concrete cover and signage.

For maximum termite protection, new structures should be designed and constructed using CCA- or borate-treated lumber, especially for foundation members. Untreated lumber in existing structures may be treated using rods of CCA or borate salts which can be inserted into non-treated wood and dissolved with water for absorption by the wood.

1.1 SUBMITTALS

****

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required. Indicate submittal classification in the blank space following the name of the item requiring the submittal by using "G" when the submittal requires Government approval. Submittals not classified as "G" will show on the submittal register as "Information Only". For

submittals requiring Government approval, a code of up to three characters should be used following the "G" designation to indicate the approving authority; codes of "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval are recommended.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data
Termiticide Application Plan; [_____], [_____]
Termiticide application plan with proposed sequence of treatment work with dates and times. The termiticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area/volume treated, amount applied; and the name and state license number of the state certified applicator shall be included.
Termiticides; [_____], [_____]
Manufacturer's label and Material Safety Data Sheet (MSDS) for termiticides proposed for use.
Foundation Exterior; [_____], [_____]
Written verification that other site work will not disturb the treatment.
Utilities and Vents; [_____], [_____]
Written verification that utilities, vents have been located.
Crawl and Plenum Air Spaces; [_____], [_____]
Written verification that crawl spaces and plenum air spaces have been located.
Verification of Measurement; [_____], [_____]
Written verification that the volume of termiticide used meets the application rate.
Application Equipment; [_____], [_____]
A listing of equipment to be used.

SD-04 Samples
Termiticides; [_____], [_____]
Termiticide samples obtained during application, upon request.

SD-06 Test Reports
Equipment Calibration and Tank Measurement; [_____], [_____]
Certification of calibration tests conducted on the equipment used in the termiticide application.
Soil Moisture; [_____], [_____]
Soil moisture test result.

SD-07 Certificates
Qualifications; [_____], [_____]
Qualifications and state license number of the termiticide applicator.

1.2 QUALIFICATIONS

The Contractor's principal business shall be pest control. The Contractor shall be licensed and the termiticide applicators certified in the state where the work is to be performed. Termiticide applicators shall also be certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control.

1.3 SAFETY REQUIREMENTS

The Contractor shall formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Use the clothing and personal protective equipment specified on the labeling for use during all phases of the application.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Termiticide material shall be delivered to the site in the original unopened containers bearing legible labels indicating the EPA registration number and manufacturer's registered uses. All other materials to be used on site for the purpose of termite control shall be delivered in new or otherwise good condition as supplied by the manufacturer or formulator.

1.4.2 Storage

Materials shall be stored in designated areas and in accordance with manufacturer's labels. Termiticides and related materials shall be kept under lock and key when unattended.

1.4.3 Handling

Termiticides shall be handled in accordance with manufacturer's labels. Manufacturer's warnings and precautions shall be observed. Materials shall be handled preventing contamination by dirt, water, and organic material. Protect termiticides from sunlight as recommended by the manufacturer.

1.5 INSPECTION

Termiticides shall be inspected upon arrival at the job site for conformity to type and quality in accordance with paragraph TERMITICIDE. Each label shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Other materials shall be inspected for conformance with specified requirements. Unacceptable materials shall be removed from the job site.

1.6 WARRANTY

NOTE: Use 5 years in temperate regions and 3 years in tropical and subtropical regions. Warranty period and the Contractor's responsibilities during the warranty period may be modified to be consistent with prevailing state or local practices.

The Contractor shall provide a 5-year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Warranty shall include annual inspections of the buildings or building additions.

PART 2 PRODUCTS

2.1 TERMITICIDES

Termiticides shall be currently registered by the EPA. Termiticide shall be selected for maximum effectiveness and duration after application. The selected termiticide shall be suitable for the soil and climatic conditions at the project site.

PART 3 EXECUTION

3.1 TECHNICAL REPRESENTATIVE

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for subterranean termites. They may be present during treatment application.

3.2 SITE PREPARATION

Site preparation shall be in accordance with Sections 02230 CLEARING AND GRUBBING, 02300 EARTHWORK, 02315 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS, 02921 SEEDING, 02922 SODDING, 02923 SPRIGGING, and 02930 EXTERIOR PLANTING. Work related to final grades, landscape plantings, foundations, or any other alterations to finished construction which might alter the condition of treated soils, shall be coordinated with this specification.

3.2.1 Ground Preparation

Food sources shall be eliminated by removing debris from clearing and grubbing and post construction wood scraps such as ground stakes, form boards, and scrap lumber from the site, before termiticide application begins.

3.2.2 Verification

Before work starts, the Contractor shall verify that final grades are as indicated and smooth grading has been completed in accordance with Section 02300 EARTHWORK. Soil particles shall be finely graded with particles no larger than 25 mm 1 inch and compacted to eliminate soil movement to the greatest degree.

3.2.3 Foundation Exterior

The Contractor shall provide written verification that final grading and landscape planting operations will not disturb treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures.

3.2.4 Utilities and Vents

The Contractor shall provide written verification that the location and identity of HVAC ducts and vents, water and sewer lines, and plumbing have been accomplished prior to the termiticide application.

3.2.5 Crawl and Plenum Air Spaces

The Contractor shall provide written verification that the location and identity of crawl and plenum air spaces have been accomplished prior to the termiticide application.

3.3 SITE CONDITIONS

The following conditions shall determine the time of application.

3.3.1 Soil Moisture

Soils to be treated shall be tested immediately before application. Soil moisture content shall be tested to a minimum depth of 75 mm 3 inches. The soil moisture shall be as recommended by the termiticide manufacturer. The termiticide will not be applied when soil moisture exceeds manufacturer's recommendations because termiticides do not adhere to the soil particles in saturated soils.

3.3.2 Runoff and Wind Drift

Termiticide shall not be applied during or immediately following heavy rains. Applications shall not be performed when conditions may cause runoff or create an environmental hazard. Applications shall not be performed when average wind speed exceeds 16 km 10 miles per hour. The termiticide shall not be allowed to enter water systems, aquifers, or endanger humans or animals.

3.3.2.1 Vapor Barriers and Waterproof Membranes
Termiticide shall be applied prior to placement of a vapor barrier or waterproof membrane.

3.3.2.2 Utilities and Vents
Prior to application, HVAC ducts and vents located in treatment area shall be turned off and blocked to protect people and animals from termiticide.

3.3.3 Placement of Concrete

Concrete covering treated soils shall be placed as soon as the termiticide has reached maximum penetration into the soil. Time for maximum penetration shall be as recommended by the manufacturer.

3.4 TERMITICIDE TREATMENT

3.4.1 Equipment Calibration and Tank Measurement

Immediately prior to commencement of termiticide application, calibration tests shall be conducted on the application equipment to be used and the application tank shall be measured to determine the volume and contents. These tests shall confirm that the application equipment is operating within the manufacturer's specifications and will meet the specified requirements. The Contractor shall provide written certification of the equipment calibration test results within 1 week of testing.

3.4.2 Mixing and Application

Formulating, mixing, and application shall be performed in the presence of the Contracting Officer or the technical representative. A closed system is recommended as it prevents the termiticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying termiticides shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.4.3 Treatment Method

NOTE: Application shall be as a surface spray and/or by rodding and trenching.

For areas to be treated, the Contractor shall establish complete and unbroken vertical and/or horizontal soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Application shall not be made to areas which serve as crawl spaces or for use as a plenum air space.

3.4.3.1 Surface Application
Surface application shall be used for establishing horizontal barriers. Surface applicants shall be applied as a coarse spray and provide uniform distribution over the soil surface. Termiticide shall penetrate a minimum of 25 mm 1 inch into the soil, or as recommended by the manufacturer.

3.4.3.2 Rodding and Trenching
Rodding and trenching shall be used for establishing vertical soil barriers. Trenching shall be to the depth of the foundation footing. Width of trench shall be as recommended by the manufacturer, or as indicated. Rodding or other approved method may be implemented for saturating the base of the trench with termiticide. Immediately after termiticide has reached maximum penetration as recommended by the manufacturer, backfilling of the trench shall commence. Backfilling shall be in 150 mm 6 inch rises or layers. Each rise shall be treated with termiticide.

3.4.4 Sampling

The Contracting Officer may draw from stocks at the job site, at any time and without prior notice, samples of the termiticides used to determine if the amount of active ingredient specified on the label is being applied.

3.5 VERIFICATION OF MEASUREMENT

Once termiticide application has been completed, tank contents shall be measured to determine the remaining volume. The total volume measurement of used contents for the application shall equal the established application rate for the project site conditions. The Contractor shall provide written verification of the measurements.

3.6 CLEAN UP, DISPOSAL, AND PROTECTION

Once application has been completed, the Contractor shall proceed with clean up and protection of the site without delay.

3.6.1 Clean Up

The site shall be cleaned of all material associated with the treatment measures, according to label instructions, and as indicated. Excess and waste material shall be removed and disposed off site.

3.6.2 Disposal of Termiticide

The Contractor shall dispose of residual termiticides and containers off Government property, and in accordance with label instructions and EPA criteria.

3.6.3 Protection of Treated Area

Immediately after the application, the area shall be protected from other use by erecting barricades and providing signage as required or directed. Signage shall be in accordance with Section 10430 EXTERIOR SIGNAGE. Signage shall be placed inside the entrances to crawl spaces and shall identify the space as treated with termiticide and not safe for children and animals.

3.7 CONDITIONS FOR SATISFACTORY TREATMENT

3.7.1 Equipment Calibrations and Measurements

Where results from the equipment calibration and tank measurements tests are unsatisfactory, re-treatment will be required.

3.7.2 Testing

Should an analysis, performed by a third party, indicate that the samples of the applied termiticide contain less than the amount of active ingredient specified on the label, and/or if soils are treated to a depth less than specified or approved, re-treatment will be required.

3.7.3 Disturbance of Treated Soils

Soil and fill material disturbed after treatment shall be re-treated before placement of slabs or other covering structures.

3.7.4 Termites Found Within the Warranty Period

If live subterranean termite infestation or termite damage is discovered during the warranty period, the Contractor shall re-treat the site.

3.8 RE-TREATMENT

Where re-treatment is required, the Contractor shall:
a. Re-treat the soil and/or perform other treatment as necessary for prevention or elimination of subterranean termite infestation.
b. Repair damage caused by termite infestation.

Appendix L
Deer Management Plan

1.0 BACKGROUND

The Fort Campbell cantonment area supports fragmented forested habitat throughout the built up city area. These fragmented habitats provide ample resources to support sizeable populations of deer, groundhog, squirrel, raccoon, fox, turkey, and coyotes. Populations of these animals tend to be concentrated in forest fragments greater than 5 acres. The white-tailed deer is of great concern due to its size and ability to cause property damage in the form of vehicle strikes and landscape browsing. This plan is specific to the cantonment area with maintaining a sustainable herd being the desired management outcome.

1.1 Purpose

a. Reduce car-deer collisions within and around the cantonment area.

b. Reduce damage to ornamental plants, shrubs, and real property.

c. Develop a deer education program for housing communities.

d. Prevent the outbreak of deer diseases, which may spread from the cantonment area to the rear area of post.

1.2 Authority

a. AR 200-5, Pest Management, Oct 1999.

b. AR 200-1, Environmental Protection and Enhancement, 13 December 2007.

2. RESPONSIBILITIES

2.1 Director of Public Works

a. Develop and implement a comprehensive deer management plan for the installation.

b. Coordinate Management Plan with other Directorates and External Organizations.

2.2 Provost Marshall/ Law Enforcement Command

a. Provide any vehicular or pedestrian control necessary during deer control measures.

b. Provide records of deer/car collisions to identify high concentrations of deer.

2.3 Directorate of Families, Morale, Welfare, and Recreation

a. Release areas under DFMWR control to DPW, Fish and Wildlife personnel when necessary to implement deer control measures.

2.4 Command Safety Office

a. Review the annual plan for removal of deer.

2.5 Directorate of Public Works, Housing

a. Inform occupants of housing areas concerning hazards of deer and provide information concern control efforts. Discourage the feeding of deer in and around housing areas.

2.6 Directorate of Public Works, Fish and Wildlife Program

a. Responsible for deer management within the cantonment area to include preparing, monitoring and updating the Deer Management Plan.

b. Control deer population numbers through lethal means (if required) within the cantonment area. Assist USDA, APHIS personnel in remove deer from high value targets on the installation.

c. Provide technical information about deer management and conduct deer surveys.

d. Coordinate with all Directorates during actual control measures.

3. GENERAL

The white-tailed deer is a very adaptable species that can create special urban management problems. Many of the problems stem from their nocturnal movements from bedding to foraging areas. Within the cantonment area deer numbers are concentrated near forested areas scattered throughout the area. Damage to landscaping and the golf course from browsing is of great concern due to the costs required to repair the damage. Deer are hosts to ticks, fleas and other parasites that can transfer diseases to humans that occupy the same area. Allowing high deer densities in close proximity to humans is unacceptable.

Deer on the installation west of Market Garden Road receive hunting pressure. This area provides many thousands of recreational hours for soldiers and is a sustainable population is maintained through this pressure. However, the cantonment area lacks the hunting pressure of the rear training areas. This has caused some areas within the cantonment area to carry larger than desired deer numbers. To compound this problem, recent developments have expanded into new forested areas. These expansions have displaced some animals but, concentrations of deer are higher than desired due to the availability of ample forage.

4. CURRENT STATUS

The cantonment area has a localized deer problem and no single control method will work. An integrated approach that utilizes a combination of techniques should work to control deer in any given area. Areas

needing attention should be identified annually through scientifically valid surveys. The Fish and Wildlife Program is responsible for determining cantonment area carrying capacity, annual population estimates, control quotas, timing, and control techniques.

5. CONTROL LEVELS

Deer populations have the potential to increase drastically without control measures. Urban environments provide perfect habitat for deer numbers to exceed the carrying capacity of area. Numerous car-deer collisions (deer searching for food), destruction of ornamentals and shrubbery, and poor condition of animals indicate high deer numbers. Setting guidelines for urban environments is difficult; however, the following deer population levels are used to determine when control actions are needed within the cantonment area.

Level 1 Deer numbers have been recorded greater than 15 deer per square mile or occupy habitat adjacent to or on high value targets (airfields): This level is considered a high risk environment and requires immediate control to reduce the threat to military operations or the community. Employment of sport hunting with total emphasis on removal of does, construction of fences to eliminate nuisance deer problems, or baiting deer and conducting lethal removal with Fish and Wildlife personnel are viable remedies for this level.

Level 2 Population levels between 10 and 15 deer/square mile: Sport Hunting should be used with an increased emphasis on the harvest of does. This level is considered a moderate threat although the deer concentration's proximity to high value targets can increase the risk to high.

Level 3 Population levels between 5 and 10 deer/square mile: Sport Hunting should be initiated with emphasis on does. Exclusion measures like fencing should be installed to prevent deer from becoming nuisances.Habitat manipulation should occur to promote deer remaining in certain areas and preclude them from using others.

Level 4 Populations under 5 deer per square mile require no action other than monitoring.

6. CONTROL PLAN

Cantonment area deer management is completed in three phases: surveillance, data analysis and plan development, and implementation.

Surveillance. Fort Campbell biologists are required to conduct surveillance surveys throughout the cantonment area from July through August, and as needed in highly sensitive areas to determine population levels. High concentration monitoring shall occur on an as needed basis to determine control efficacy. The Fish and Wildlife Manager shall brief the Installation Pest Management Coordinator(IPMC) on deer numbers, areas requiring control, and harvest goals.

Data Analysis/Plan Development: Data analysis will be conducted following completion of each surveillance action and maintained in a database for quota calculations. Control plan development is contingent upon the determined population level. The Fish and Wildlife Manager shall brief the IPMC and Garrison Commander on the proposed control action. Cantonment area control shall not occur unless approved by the Garrison Commander.

Implementation: Conducting control actions in accordance with action plan. The Fish and Wildlife Manager is responsible for the administration of all cantonment area control actions. Deer removed from the cantonment area must be affixed with a harvest tagged provided by the Fish and Wildlife Program to ensure accurate harvest records. Coordination with DES, MWR, and Safety is required for all deer removal actions.

7. CONTROL METHODS

No Action: Areas determined to be Level 4 do not require control actions and should be monitoring annually to determine population trends of the areas.

Fencing: This method can be very effective, but is expensive and preferred in areas where deer are not posing health and safety issues. Long-term fencing may be the most cost-effective control of deer around high value targets. Most importantly, fence maintenance is key ensuring their presence are effective.

Sport Hunting: This method is the preferred means of controlling deer since it incurs little or no cost to the government and provides additional outdoor recreational activities to soldiers. Management schemes and incentives should promote the harvest of does prior to buck harvest to increase the take of female deer. Archery is the preferred method and a hunter certification program should be implemented to limit the possibility of a wounded deer lying in a community area.

Trapping: Trapping can reduce deer to manageable numbers in certain areas but, is limited in application due to its resource requirements. A favorable feature of trapping is the public relations benefit of relocating deer to the rear area.

Professional Removal: This method can be expensive but, lends itself to extremely sensitive areas. It usually is unobtrusive and highly effective in rapidly reducing deer numbers to acceptable levels. This method typically employs Interagency Agreements prior to any removal action.

8. SPECIAL CONTROL AREAS

Airfields. Deer and aircraft are a potentially deadly combination. A comprehensive approach of fencing, hunting and removal has reduced the number of deer inside the airfield. Daily surveillance is necessary to ensure minimal impacts to the training mission.

Golf Course/Recreational Areas. Deer have created problems on the Cole Park Golf Course and continue to cause traffic accidents along Lee Road. Parks and greenways within the cantonment area draw deer in large numbers during the fall and winter. Management options for controlling deer in these areas are 1) construct a high fence along creek to inhibit deer from crossing creek and 2) bait, trap, or lethally remove deer on both sides of Little West Fork Creek.

Housing Areas: Deer within housing areas create special management problems. Public visibility along with the presence of large numbers of people precludes the use of large scale hunting within these areas. Exclusion of deer from these area is cost prohibitive as well. Management options for these areas are 1) construct fencing where feasible and 2) bait, trap, or lethally remove deer through the employment of special localized hunting.

Range Areas/Small Arms Impact Area: The Small Arms Impact Area can support a large deer population and is a primary source of cantonment area deer. Without comprehensive control, deer migrate from range areas back into areas with reduced populations. Management options for these areas are 1) introduce some form of hunting on improved ranges, 2) professional removal if hunting cannot remove deer, and 3) baiting and lethal removal from improved ranges within the Small Arms Impact Area.

9. DISPOSITION OF ANIMALS

All legally harvested animals (animals with a valid harvest tag) may be retained by the authorized individual. Individuals that do not wish to retain the animal may donate the harvest to the Fort Campbell soldier donation list or a local recognized non-profit group.

10. FUNDING

QDPW and 21X5095 funding are utilized for deer control within the cantonment area. QDPW funds support USDA Wildlife Services Interagency Agreements for deer removal from the airfields. 21X5095 Fish and Wildlife Reimbursable account is utilized to purchase supplies (bait, stands, etc.) supporting depredation activities within the cantonment area.

11. CONCLUSIONS

Implementing a scientifically sound management plan can manage deer and their associated problems within the cantonment area. The Fish and Wildlife Program has the staff, expertise and equipment to implement control actions designed to meet annual management objectives.

Appendix M
Feral Hog Action Plan

1.0 Introduction

Feral mammals cause greater ecological damage than any other introduced, terrestrial taxonomic group due to their size and energy consumption (Ebenhard 1988), and feral hogs are perhaps one of the most harmful mammalian species worldwide (Long 2003). Feral hogs have been a recognized threat to Fort Campbell since 2000. Feral hogs were classified as very high-risk species by the Unites States Department of Agriculture, Wildlife Services (Penrod 2010, pers com). Wildlife Services has determined control of the feral hog population should be a top priority on Fort Campbell. Feral hogs have the greatest threat of destruction to natural habitat, agriculture, and soldier health and safety without action. Currently, feral hog populations on Fort Campbell are in isolated areas within the rear training areas that make intensive hog control efforts feasible. This feral hog action plan was developed to prevent severe ecological and human health impacts on Fort Campbell. The plan should be considered a living document and should be modified annually as the feral hog population is reduced.

2.0 History of Feral Hogs on Fort Campbell

Feral hogs were first recorded on Fort Campbell 2004. Hogs were initially found in Training Area 21 (Suckchon Drop Zone) just west of Palmyra Road. Several pods of hogs were located in adjacent training areas, 8A, 9A, 19, 22, 23, and 49, during 2004 through 2007. In late 2007, a large population of hogs was found in Training Area 40 just east of the Impact Area. These hogs occupied approximately 6,000 acres of land in and outside of the Impact Area. No other sightings of hogs were reported from areas other than the Training Area 40 site.

3.0 Impacts of Feral Hogs

3.1 Ecological Impacts

Feral hog impacts are well documented in areas with large swine populations. Lack of noticeable ecological damage on Fort Campbell is likely due to the relatively small population size and isolated location along the large impact area boundary. Hogs have the greatest reproductive capacity of all free-ranging large mammals in the United States (Wood and Barrett 1979) and population expansion can occur rapidly. A feral sow reaches reproductive age at eight months and can produce up to two litters per year that contain 10-12 swine each (Tisdell 1982).

Feral hog degrade ecosystems through predation and competitive impacts on native fauna, grazing on native plants, and physically altering habitats by rooting. Rooting creates large, disturbed areas that can lead to extensive erosion, displace native species, and facilitate invasion by non-native, weedy species (Sweitzer and Van Vuren 2002, Waithman *et al*. 1999, Choquenot *et al*. 1996, Mayer and Brisbin 1991, Sweeney and Sweeney 1982, Wood and Barret 1979, Hanson and Karstad 1959).

Impacts of hog have been noted in within localize training areas on Fort Campbell, although most reports are anecdotal and detailed documentation of impacts is lacking. Soil erosion and facilitation of noxious

weed invasions due to rooting have been reported in grassland habitats in Training Areas 8A, 9A and 40 and in woodland habitats in Training Areas 8A, 9A, 23, 40, and 49 (Whitfill 2009, pers com).

3.2 Agricultural Impacts

Agricultural areas are very susceptible to hog rooting due to the high density of easily accessible food and moist soil. Losses of row crops in areas with large hog populations are regularly reported (Schley and Roper 2003, Caley 1997, Wood and Lynn 1977). Losses due to feral swine rooting and consumption to agriculture in the United States are estimated to be greater than $800 million per year (Pimental *et al*. 2000). Damage to agriculture in Texas, the state with the highest density of feral hogs, exceeds $50 million (Hutton *et al*. 2006).

Losses to Fort Campbell Agricultural Leases caused by feral hog are minimal, but the potential is great. Fort Campbell Agriculture Lease Program supports 7,190-acres of wheat, corn, beans, and hay which are favorites of feral hog worldwide. If feral hog populations expand to areas on Fort Campbell with high value crops, losses could be in the thousands of dollars.

3.3 Disease Transmission

Feral hogs are susceptible to, and can be carriers of, a wide range of infectious diseases that are detrimental to wildlife populations, livestock, and humans (Choquenot *et al*. 1996) (Table 1). Pseudorabies and swine brucellosis are considered the two most potent disease threats to the commercial pork industry and bovine tuberculosis is a serous threat for the cattle industry in the USA. The USDA has established a national eradication program for eliminating these three diseases (Witmer *et al*. 2003). Currently, when feral hog are harvested by USDA/APHIS/Wildlife Services personnel they are sampled for pseudorabies, swine brucellosis, and classical swine fever, which is a foreign-animal disease of concern. Disease surveillance is the only way to determine the threat of transfer of bovine tuberculosis, pseudorabies or swine brucellosis from feral hogs to off post livestock.

Feral swine can also transmit disease to humans. Recently, the death of three people and illness in 200 people in the USA and Canada was attributed to feral hog spreading *Escherichia coli* via excrement onto spinach fields in California (Nordqvist 2006). Diseases that can infect humans from feral hog include brucellosis, balantidiasis, leptospirosis, salmnellosis, toxoplasmosis, trichinosis, trichostrongylosis, tuberculosis, tularemia, anthrax, rabies and plague. Most human cases cause mild flu-like symptoms and often go unreported (Hutton *et al*. 2006).

4.0 Action Plan

Feral hog populations on Fort Campbell are currently at relatively low levels similar to those 4-5 years ago. Left unchecked, feral hog populations are likely to grow and cause ecological, economic, and human health impacts on Fort Campbell and potentially adjacent off post communities. Our current understanding of feral hog population size and distribution on Fort Campbell are limited, however, known populations adjacent to the western Impact Area can be eradicated. Dense vegetation and a human exclusion zone (Impact Area), complicate eradication efforts there. The strategies outlined in this action plan are aimed at reducing the threat of ecological, economic, and human health impacts by feral hog. To be successful, the strategy will require a long-term commitment and application of a suite of control techniques used in an adaptive manner.

Table 1. A partial list of viral and bacterial diseases to which feral swine are susceptible (Compiled by Witmer *et al.* (2003) from Williams and Barker (2001) in Hutton *et al.* (2006)).

Viral Diseases	Bacterial Diseases
Bovine Herpesvirus	Anthrax
Classes Swine Fever (hog cholera)	Brucellosis
Coronaviral infections	Erysipelothrix infections
Encephalomyocarditis	Helicobacter
Foot-and-mouth disease	Letpospirosis
Influenza A	Bovine tuberculosis
Louping-ill virus	Pasteurellosis
Malignant catarrhal fever	Plague
Menangle virus	Salmonellosis
Papillomavirus infections	Yersiniosis
Parainfluenza virus	
Pestvirus infections	
Pseudorabies	
Rabbit hemorrhagic disease	
Rinderpest	
San Miguel sea lion virus	
Swinepox	
Swine vesicular disease	
Vesicular swine virus	
Vesicular stomatitis	

4.1 Task 1: Source Control

Successful eradication requires the elimination of hog introductions. Escapes or intentional releases from private property are probably the main sources of feral hog on Fort Campbell. A method to limit civilian access to the rear training areas during non-duty hours has been implemented to reduce individual access. The rear training areas are patrolled by United States Fish and Wildlife Service enforcement officers daily.

4.2 Task 2: Population Determination

4.2.1Feral swine database and mapping

A current and accurate GIS database of feral hog populations and management actions should be created and maintained by the Wildlife Program. Population data should be updated monthly and provided to the Installation Pest Management Coordinator (IPMC) for use in eradication efforts. The IPMC must provide the Wildlife Program feral hog removal data following each eradication effort.

4.2.2 Survey

To determine the current status of feral hogs, and to populate the database, a detailed survey of Fort Campbell for feral hogs is required. The survey should obtain information on signs of hog disturbance, cost associated with hog disturbance, hog sightings, number of hog sighted, and numbers of

hogs removed. Survey methods should follow appropriate minimally invasive scientifically defensible methods. Detailed surveys of known areas are considered first priority.

4.3 Task 3: Lethal Control Actions

Based upon current feral hog population information, the Training Area 40 site is the primary target location. The initial control effort is to prevent the spread of the population into adjacent training areas. Control methods will follow standard USFWS' protocols to ensure humane treatment of the feral hogs.

Control of feral hogs on Fort Campbell will require long-term commitment and a well conceived strategy. Reports of feral hog sightings in areas outside the existing, known core population should receive high control priority and a rapid response system should be organized and put in place. Contracts with the USFWS should be in place to permit rapid response throughout the year.

All potential control techniques should be applied where appropriate including ground hunting, aerial hunting, and trapping. All successful feral hog control actions have included a combination of methods, e.g., hunting and trapping and aerial shooting (Cruz *etal*. 2005, Schuyler *et al*. 2002). The assistance from US military aircraft is a possibility.

The time required to eradicate feral hog from an area will be a function of population size and accessibility. Large populations require several breeding seasons for eradication. Contracts with the USFWS should be developed to target the known feral hog population. Rapid response eradications will be crucial to feral hog eradication.

4.4 Task 4: Monitoring and Assessment

Swine have been known to reinvade, or be reintroduced, six months to a year following eradication (Schuyler *et al*. 2002) and monitoring is required to document and reinforce the eradication effort. Monitoring includes visitation of the site to check for disturbances and communication with range facility managers about possible swine sightings. All areas are to be checked for subsequent disturbance by installation biologist for two years following the removal effort. A minimum of two years is suggested for monitoring areas in which feral hog have been eradicated.

5.0 Budget

A five-year 250K eradication and maintenance budget is proposed. Feral hog eradication project management should be included within the Installation Pest Manager's responsibilities. The position would be primarily responsible for eradication/control contracting and overall program coordination. Population censusing will be completed by installation wildlife biologists. Funds for rapid response to new sightings and eradication will be an ongoing requirement. Eradication funds would focus on the core population in Training Area 40. All monitoring efforts will be completed by installation wildlife biologist. It is anticipated that a minimum of 50K per year is required until total eradication is completed.

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Appendix N
Removal of Vertebrates Using Lethal Means

1. Nuisance Wildlife Management

Nuisance wildlife management is a process of managing wildlife that are determined to be a nuisance due to overpopulation, causing property damage or are a risk to transfer of diseases (zoonosis) to humans or pets. Most pest wildlife species typically have the following characteristics:

- are adaptable to fragmented habitat;
- are not tied to eating a specific type of food; and
- pose an obvious significant risk to human health and safety.

Many wildlife species have the potential of becoming a "nuisance" species, and whether or not a species is regarded as a pest can be directly correlated with the degree to which that animal can be tolerated by humans.

2. Installation Requirements

Fort Campbell supports numerous wildlife species that can become pest species when left unchecked or which occupy habitat that are near high value targets (airfields, housing areas, community areas, etc.). Many of these locations are considered fragmented habitat within the cantonment area. For example, deer densities are concentrated at small wooded areas scattered throughout the cantonment area. Small vertebrate pests are normally associated with installation facilities and can potentially pose health risks to the community. Maneuver space pests, feral hogs and beavers, routinely affect range and transportation infrastructure. The installation pest control policy requires personnel to implement non-lethal control methods first; however, their location and threat to the community and installation infrastructure may eliminate the option for non-lethal control. For this reason, Fort Campbell has developed this procedure for lethal control of wildlife.

3. Lethal Removal Decision Process

The decision to remove an animal using lethal means is based upon the following criteria:

a. Does the animal pose an immediate threat to humans?
b. Is the animal posing a significant threat to personal or installation property?
c. Is the animal injured beyond recovery?
d. Is the population above carrying capacity within areas of human development?
e. Has non-lethal methods failed to mitigate the encounter?

Every effort will be made to relocate animals when possible. Lethal means will be evaluated using the above measures to determine the merit and need to use lethal techniques. When an animal poses a risk to either personnel or the community, it shall be removed to avoid any impacts to the Fort Campbell community.

4. Use of Weapons

The control of nuisance wildlife is the responsibility of the Directorate of Public Works. Lethal control of nuisance wildlife is completed through two DPW Programs, Pest Management and Fish and Wildlife. Each program is tasked to complete nuisance wildlife control for specific nuisance groups. The Pest Management section is responsible for the removal of small animals (squirrels, groundhogs, skunks, feral cats, etc.); whereas the Fish and Wildlife Program is responsible for large animal control (deer, feral hogs, and beaver). Table 1 lists the caliber and quantity required to meet each program's control tasks.

Table 1. Authorized caliber, quantity, and target species for each DPW Program.

Program	POC	Caliber	Quantity	Target Species
Pest Management	Legere, Ed	.177	1	Squirrel, groundhogs, birds
Pest Management	Legere, Ed	.20	2	Raccoon, fox, coyote
Fish and Wildlife	Zirkle, Gene	.25	2	Deer, beaver, coyote
Fish and Wildlife	Zirkle, Gene	.357	2	Feral hog, deer, coyote

Each program is tasked with lethal removal of vertebrate pests when all non-lethal means fail. Installation staff shall respond to emergency or non-reoccurring instances for animal control. Recurring or large scale general operations requiring centerfire ammunition shall be performed using the USDA, APHIS. An Interagency Support Agreement will be used to the greatest extent possible for the control of nuisance wildlife on or near airfields, high risk targets, or areas where their expertise is essential on the installation. The use of firearms by APHIS shall be at the discretion of the Pest Management Coordinator. All firearm use by APHIS shall be accompanied by an installation representative to direct the safe use of firearms. Installation staff may transport pellet guns in Government Owned Vehicles during the performance of job duties. Transport of firearms shall comply with all transporting requirements for firearms on the installation. Control work that uses vehicles as an integral part (ATV's or trucks at the actual site) may have firearms uncased but unloaded until actual use. Close coordination with U.S. Fish and Wildlife Law Enforcement and 716th MP desk is required to ensure the safety of all personnel during nuisance control operations.

5. Type of Weapons

The Pest Management and Fish and wildlife Programs shall utilize compressed air rifles to effectively euthanize animals determined to require lethal removal. Each program is authorized to possess air rifles in several calibers to allow effective removal of wildlife (Table 1). Weapons required to perform installation pest functions are:

a. .177 caliber, compressed air rifle (pellet gun)
b. .22 caliber, compressed air rifle (pellet gun)
b. .25 caliber, compressed air rifle (pellet gun)
c. .357 caliber, compressed air rifle (pellet gun)

Use of centerfire weapons to remove wildlife is prohibited for both DPW programs. However, USDA personnel operating under an Interagency Agreement may utilize centerfire weapons to complete wildlife control activities.

6. Storage of Weapons

All weapons shall be stored in an approved safe located at Building 2159 and 5111. DPW personnel shall use the firearms on an as needed basis. Although these weapons are not included in the AR 190-11 requirements for centerfire weapons, each program is required to comply with AR 190-11 for the storage and access to the weapons. SF Forms 700 and 702 shall be used to document compliance with the required daily inspections. This log shall be maintained within the safe for 90 days. A list of names, contacts and other information for individuals authorized to use the weapons shall be maintained within the safe. Combinations shall be changed annually or when personnel transition per AR 190-51, Appendix D-7f. Weapons are the responsibility of DPW, Fish and Wildlife Manager and Supervisory Pest Manager, who shall maintain air rifles in operating condition and be responsible to DES and CIPBO for control of firearms.

7. Ammo Acquisition and Storage.

Ammo requirements for pest control and nuisance wildlife control are small. Total requirements should for control and training shall not exceed 500 rounds of .22, .25, and .357 caliber pellets. The Director of Public Works shall authorize pellet ammunition as the operational load for nuisance animal control activities. Ammunition purchases should utilize the MICC Government Purchase Card process. Ammo shall be stored in conjunction with DPW weapons. Ammunition shall be stored in the firearms safe separate from the firearms. Access shall be by the SF 700 form located in the safe.

8. Firearms Proficiency

Pest Management and Fish and Wildlife personnel are required to use weapons to accomplish depredation tasks and should demonstrate proficiency by attending semi-annual firearms refresher/familiarization training. Training shall provide overall technical aspects of the weapons, their operation, and a minimum of 20 rounds fired for each weapon at 8 meters (25 yards) from a supported position (kneeling, standing, or prone) striking the aiming black of 5 bullseyes on a standard NRA TQ 5/5 air rifle target. Shooters must record 5 of 5 hits to the bullseye on each of the scoring targets. Shooters are authorized unlimited shots to the siting shot bullseye on a TQ 1/1 NRA target.

Firearm proficiency scores shall be retained by the Pest Management Supervisor and Fish and Wildlife Manager and reported annually to the Installation Pest Management Coordinator. Lists of proficient personnel should be reported to each Program's first line supervisor. Individuals that do not qualify with the weapons are excluded from use until the next training cycle.

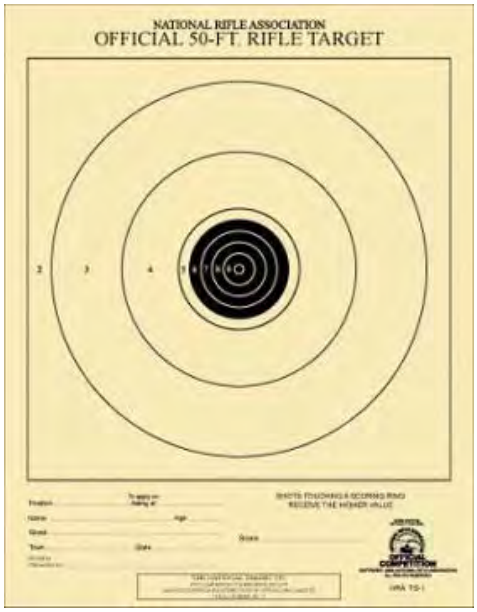
9. Animal Disposition

All small animal carcasses shall be disposed of throughout the installation training areas. By placing the carcasses in various locations, the animals can be recycled by natural systems. Animals that can be utilized for food (deer) shall be provided for disposition to needy soldiers of the installation. Priority shall be given to soldiers E-4 and below. All animals shall have the appropriate installation harvest tag with an assigned harvest number. Soldiers receiving deer must sign an agreement that the animal shall be for personal use. Only one deer per soldier or family is authorized. Chaplains or church groups may receive multiple animals as long as an authorized person signs a waiver that the animals will not be sold.

Due to diseases associated with feral hogs, animals harvested by installation personnel shall be delivered to Breathitt Veterinary Medical Center located in Hopkinsville, Kentucky for disease testing, whenever possible, or left in place for consumption by other wildlife, per guidelines of the USDA Veterinary Services.

10. NRA TQ 1/1 and TQ-5/5 Air Rifle Target Examples

TQ 1/1 Practice Target:



TQ 5/5 Qualification Target:

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND, ATLANTIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, FT CAMPBELL
39 NORMANDY BOULEVARD
FORT CAMPBELL, KENTUCKY 42223-5617

REPLY TO
ATTENTION OF

IMCB-PWE

22AUG16

MEMORANDUM FOR RECORD

SUBJECT: Authorization, Use, and Acquisition of Compressed Air Rifles for Lethal Removal of Nuisance Wildlife

1. Nuisance wildlife management is conducted by Directorate of Public Works (DPW) Pest Management and Fish and Wildlife Management Programs per the Installation Integrated Pest Management Plan (IPMP) Appendix N. The installation pest control policy requires personnel to implement non-lethal control methods first; however, the pest's location, threat to the community, and impact on installation infrastructure may eliminate the option for non-lethal control. For this reason, Fort Campbell has developed a procedure for lethal control of wildlife.

2. Fort Campbell supports numerous wildlife species that can become pest species when left unchecked or which occupy habitat that are near high value targets (airfields, housing areas, community areas, etc.). Every effort will be made to implement non-lethal control when possible. Lethal means will be evaluated using measures included within IPMP Appendix N to determine the merit and need for lethal techniques. Interagency agreements with the US Department of Agriculture, Wildlife Services shall be pursued for removal of wildlife, using centerfire weapons, from high value targets.

3. The Pest Management and Fish and Wildlife Programs are authorized to acquire and utilize compressed air rifles to humanely and effectively euthanize animals determined to require lethal removal. Compressed air rifles are available commercially in calibers ranging from .177 through .357. Selection of the appropriate caliber for the nuisance species will be determined by the Pest Management Supervisor and the Fish and Wildlife Manager. Use of centerfire weapons to remove wildlife is prohibited for both DPW programs.

4. The authorized caliber, quantity, and target species for each DPW Program is listed below.

Program	POC	Caliber	Quantity	Target Species
Pest Management	Legere, Ed	.177	1	Squirrel, groundhogs, birds
Pest Management	Legere, Ed	.20	2	Raccoon, fox, coyote
Fish and Wildlife	Zirkle, Gene	.25	2	Deer, beaver, coyote
Fish and Wildlife	Zirkle, Gene	.357	2	Deer, feral hogs

5. DPW is authorized to purchase ammunition and compressed air rifles through the MICC Government Purchase Card or Purchase Request process. QDPW and 21X5095 Wildlife Account funds shall be utilized for the purchase of ammunition and weapons.

6. Compliance with the requirements contained within IPMP Appendix N is mandatory and subject to annual audits to ensure compliance. Each program lead is required to maintain an administrative record for all completed training, semi-annual qualifications, and lethal removal actions for three (3) years.

7. Points of contact for the acquisition, use, and compliance with the requirements of this memorandum and IPMP Appendix N are, Ed Legere, Pest Management Supervisor, 270-798-3110 and Gene Zirkle, Fish and Wildlife Manager, 270-798-9854.

JAMES R. SALOME
COL, IN
Commanding

Appendix O
Department of Defense Guidance for the Surveillance, Control and Testing of *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis* for Zika Virus February 2016

1. INTRODUCTION/OBJECTIVE

The objective of this document is to provide the Department of Defense (DoD) guidance for the Surveillance, Control and Testing of *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis* for the Zika virus.
Background

Zika virus is primarily spread from an infected person to an uninfected person through the bite of an infected *Aedes* species mosquito. Although most infections do not cause symptoms, Zika virus infection may result in fever, rash, joint/muscle pain, and conjunctivitis (Pink Eye). Outbreaks of Zika have occurred in parts of Africa, Southeast Asia, and the Pacific Islands. Zika spread to the Western Hemisphere in 2015 and has affected more than a million people in South and Central America, Mexico, and the Caribbean. With the recent outbreaks, the number of Zika cases among travelers visiting or returning to the United States will likely increase. These imported cases may result in local spread of the virus in some areas of the United States. Zika virus infection can be prevented by protecting against mosquito bites and eliminating mosquito breeding areas.

Some evidence suggests that Zika virus can also be spread from mother to child during pregnancy. The U.S. Centers for Disease Control and Prevention (CDC) is aware of increased numbers of babies with microcephaly (smaller than expected head size) in Brazil and is currently supporting the investigation into a possible link with Zika virus infection. There are currently no reports of infants getting Zika virus through breastfeeding. The CDC is also investigating a possible link between Zika virus and Guillain- Barre syndrome, a rare disorder in which the body's immune system attacks part of the nervous system.

Aedes aegypti and *Ae. albopictus* are known to transmit Zika and are well established in the United States, to include Puerto Rico, US Virgin Islands, Hawaii, Guam, and American Samoa. *Ae. polynesiesis* transmits dengue and potentially could transmit Zika and is found in the Pacific Region. There are other species of *Aedes* located throughout the US, but at this time we have no reason to suspect they can transmit Zika. Installations may choose to have additional *Aedes* spp. tested for Zika in coordination with their supporting testing laboratory. Overall, there are over 190 DoD installations located in areas where these three *Aedes* mosquitoes are known to occur thus making them at risk for Zika transmission.

MOSQUITO SURVEILLANCE

Military installations located (Map l and Table I) in areas where *Ae. aegypti*, *Ae. albopictus* or *Ae. polyneisensis* are known to occur will expand their existing vector surveillance programs to specifically include *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis* if not already included.

The Biogent (BG) Sentinel trap with BG lure (Table 2) is specifically designed to target day biting mosquitoes and is the recommended trap for conducting surveillance for *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis*. Installations should have enough BG sentinel traps on hand to conduct surveillance in high population areas such as housing, Child Development Centers, youth centers, barracks, and other areas as deemed appropriate by public health authorities. For privatized housing installations should coordinate

with the local housing developer.

Larval surveillance will be conducted on a routine basis to identify the presence of breeding populations on the installation and identify areas for source reduction or larviciding. Areas identified with multiple breeding sites (i.e. containers) will have source reduction measures implemented in those areas.

MOSQUITO TESTING

We have the capability to test *Aedes* collected during surveillance for the presence of Zika virus. Installations will coordinate with one of the below entomological testing laboratories for testing of collected *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis* for Zika.

U.S. Army Public Health Center (Provisional) has five regional commands, all of which have Entomological Sciences Divisions that perform mosquito-borne disease surveillance. Four of the five regional commands have laboratories capable of testing for Zika in mosquito pools (the fifth lab can quickly set up capability). For environmental laboratory support:
LTC Robert Richards
robert.s.richards.mil @mail.mil 410-436-5060 (DSN 584-5060)

The U.S. Air Force School of Aerospace Medicine (USAFSAM) identifies and tests mosquitoes worldwide for many arboviruses, including Zika and dengue. In addition, USAFSAM provides expertise for operational disease vector surveillance, control, and training.
Dr. Will Reeves
Entomologist, USA FSAM
will.reeves@us.af.mil
Epidemiology Consult Services
937-938-3071 (DSN 798-3071)

These entomology laboratories and any other DoD laboratory that is testing mosquitoes for Zika will coordinate with each other to use the same screening and confirming assays.

The US Army Medical Research and Material Command, US Army Medical Research Institute of Infectious Disease (USAMRIIO) will provide limit of detection (LOO) panels and positive controls in accordance with all applicable safety guidelines to the DoD testing laboratories to validate assays.

For LOO panels and positive controls:
LTC Robert Lowen
robert.g.lowen.mil@mail.mil 301-619-4881 (OSN 343-4881)

Collected *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis* will be submitted at least weekly for testing. Confirmed Zika positive mosquito pools will be reported back to the installation and to the Armed Forces Health Surveillance Branch (dha.ncr.health-surv.list.afus-ib-alert-response@mail.mil) within 24 hours of confirmation. Reports will include at a minimum: Installation/Base, trap location, date collected, species, and test results.

Entomology testing laboratories will submit a monthly report to the Armed Forces Pest Management Board (osd.pentagon.ousd-atl.mbx.afumb@mail.mil) of all the samples tested . Reports will include at a

minimum: Installation/Base, trap location, date collected, species, and test results.

MOSQUITO CONTROL

Installation Pest Management Plans will include integrated measures such as source reduction, physical control (window/door screens), adult & larval control, and other appropriate control measures to reduce breeding habitat and feeding opportunities for *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis*.

This must be a sustained effort in order to reduce and control the population of *Ae. aegypti*, *Ae. Albopictus*, or *Ae. polynesiensis*. Failure to implement a coordinated sustained control effort will allow for an *Ae. aegypti*, *Ae. albopictus* or *Ae. polynesiensis* population that could transmit Zika.

Installations will also have a response plan, to include coordination with the installation medical authority and strategic communication, ready to implement if a positive mosquito sample is detected on the installation.

Map 1: *Aedes aegypti* and *Ae. albopictus* distribution range in the Continental United States

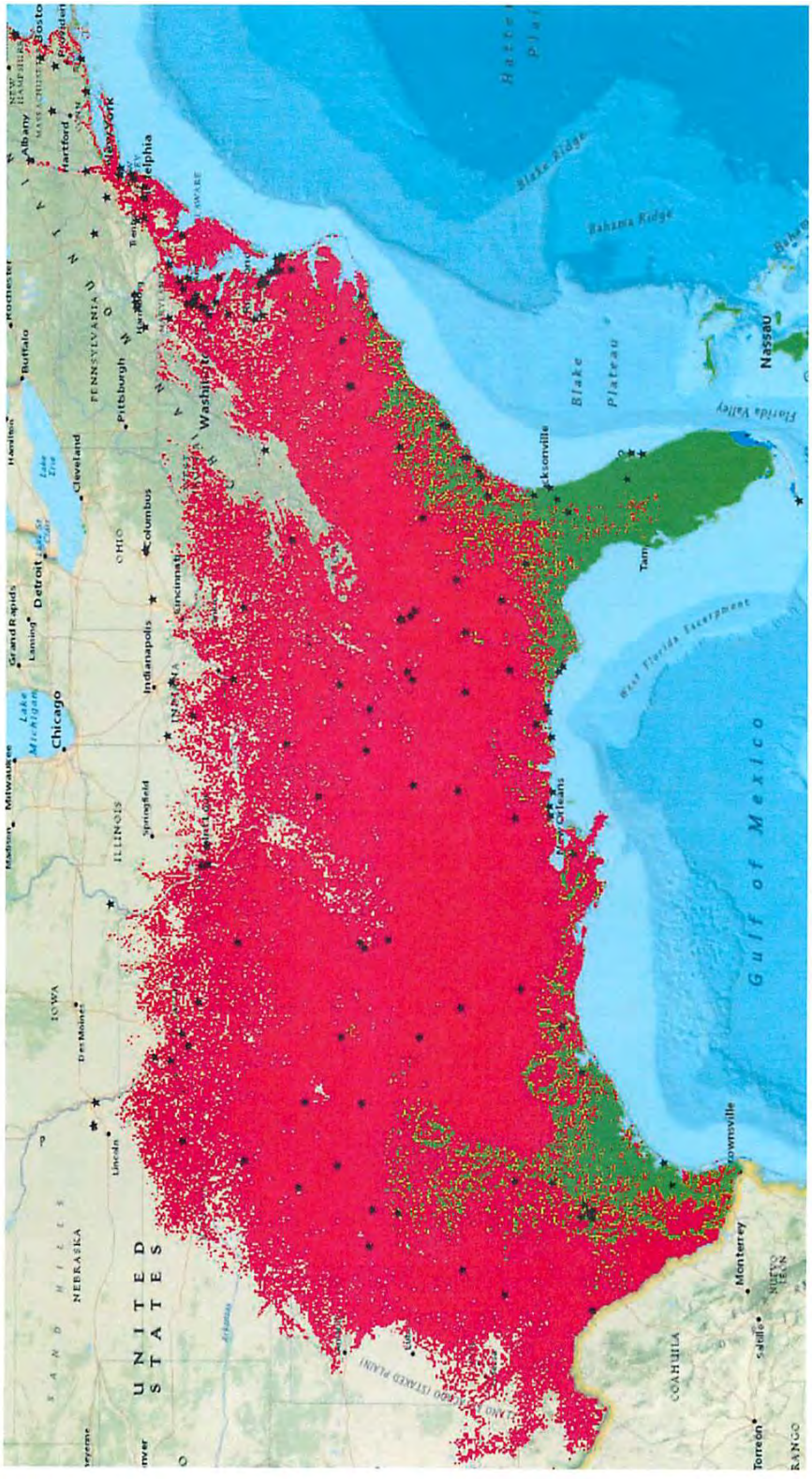


Table 1:

States/territories with U.S. Military Installations that fall within the predicted distribution of *Ae. albopictus*, *Ae. Aegypti*, and *Ae. polynesiensis*.	
Alabama	Maryland
Arkansas	Missouri
Connecticut	Mississippi
The District of Columbia	North Carolina
Delaware	Nebraska
Florida	New Jersey
Georgia	New York
Guam	Ohio
Hawaii	Oklahoma
Illinois	Pennsylvania
Indiana	Puerto Rico
Kansas	South Carolina
Kentucky	Tennessee
Louisiana	Texas
Massachusetts	Virginia

Table 2: Ordering Information for BG Sentinel Trap

NSN	Nomenclature	Cage Code	**Ace•**	Price	U/ I	Users
3740-01-628-9325	BG Lure, Human Skin, Non-Toxic, Chemical Lure, P/N 2881 for use BG Sentinel 2880 Mosquito Trap	59590	Z	$37.43	EA	A, N,F
3740-01-628-9327	BG Sentinel2880 Mosquito Trap Catch Bag, P/N 2880C	59590	Z	$9.26	EA	A,N,F
3740-01-628-9324	BG Sentinel2880 Mosquito Trap 12 V Wall Charger for 2861 Battery, P/N 2861C	59590	Z	$52.80	EA	A, N,F
3740-01-628-9326	BG Sentinel2880 Mosquito Trap, P/N 2880	59590	Z	$286.07	EA	A, N, F
6130-01-467-4177	BG Sentinel2880 Mosquito Trap,12 V DC Battery Pack, with Charger, P/N 2861	59590	L	$268.23	EA	A, F,N
3740-01-464-9998	BG Sentinel2880 Mosquito Trap,12 V DC Replacement Battery, P/N 2861A	59590	Z	$112.S8	EA	A,F,N

Appendix Q
Cultural Resources Programmatic Agreements

PROGRAMMATIC AGREEMENT AMONG THE UNITED STATES ARMY, THE STATE HISTORIC PRESERVATION OFFICER OF KENTUCKY AND THE STATE HISTORIC PRESERVATION OFFICER OF TENNESSEE REGARDING THE OPERATION, MAINTENANCE, AND DEVELOPMENT OF THE FORT CAMPBELL ARMY INSTALLATION AT FORT CAMPBELL, KENTUCKY

WHEREAS, the Army proposes to continue to coordinate and administer an ongoing program of operation, maintenance, and development at Fort Campbell, Kentucky and Tennessee; and,

WHEREAS, the Army has determined that the aforementioned program may have an effect on properties eligible for listing on the National Register of Historic Places (National Register) and has consulted with the Advisory Council on Historic Preservation (Council) and the Kentucky and Tennessee State Historic Preservation Officers (SHPO) pursuant to Section 800.14(b) of the regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f). The Council declined to participate in the consultation as stated in a letter to the Fort Campbell Garrison Commander dated 29 September 2008; and,

WHEREAS, Fort Campbell is understood to be the property indicated on the map at Attachment A; and,

WHEREAS, this Programmatic Agreement (PA) applies to all undertakings within the boundaries of Fort Campbell that are under the direct or indirect jurisdiction of the Army including undertakings performed by Fort Campbell lessees and permitees and tenant units; and,

WHEREAS, pursuant to Army Regulation 200-1 (AR 200-1), the Army has designated the Garrison Commander (Commander) to serve as the agency official responsible for compliance with the requirements of Section 106 of the National Historic Preservation Act; and,

WHEREAS, Fort Campbell has consulted with the federally recognized Indian tribes listed in Attachment D with potential concerns for properties of traditional religious or cultural importance in the Fort Campbell Military Reservation;

WHEREAS, Fort Campbell has notified the following individuals and organizations to invite comment and participation in the consultations to develop this PA. This contact followed the procedures in Fort Campbell's Public Participation Plan for the Cultural Resources Management Program.

County Historian of Montgomery County, Tennessee,
The Montgomery County Historical Society,
The Customs House Museum in Clarksville, Tennessee,
The Pennyroyal Area Museum in Hopkinsville, Kentucky,
Mr. John O'Brien, Installation Historian for Fort Campbell

None of the potentially interested parties were interested in consulting with respect to the Programmatic Agreement.

NOW, THEREFORE, the Army, the Kentucky and Tennessee SHPO agree that the program of operation, maintenance, and development at Fort Campbell shall be administered in accordance with the following stipulations to satisfy the Army's Section 106 responsibilities for all individual undertakings of the program.

STIPULATIONS

The Garrison Commander, on behalf of the Army, shall ensure that the following measures are carried out:

A. Staffing

1. Fort Campbell shall appoint a government employee as the installation cultural resources manager and ensure that efforts to identify, evaluate and treat historic properties consider the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation, and are conducted under the supervision of personnel who meet applicable professional qualifications for undertaking such work. The Garrison Commander shall ensure that the qualified professionals are in place or available upon the execution of this PA and throughout its duration. The Garrison Commander shall provide to each SHPO information regarding the names and qualifications of those persons providing the qualified professional services in support of the cultural resources management programs at Fort Campbell through the duration of this agreement.

2. The Garrison Commander shall ensure that the CRM participates in installation-level planning of projects and activities that may affect historic properties. The Garrison Commander shall ensure that the CRM reviews all undertakings that are carried out in accordance with the terms of this PA.

3. The Garrison Commander shall ensure that all historic preservation work carried out pursuant to this PA is carried out by or under the supervision of or in coordination with the CRM, unless otherwise indicated in this PA. If the appropriately qualified professional for particular preservation activities is not available to the installation, the Garrison Commander shall ensure that the services of a qualified preservation professional will be obtained as needed to appropriately inform decisions for these activities.

B. Planning

1. The Garrison Commander shall ensure that installation planning documents are analyzed by the CRM to identify specific undertakings that may be subject to review pursuant to Section 106 and the terms of this PA over a five year planning cycle. The documents to be analyzed shall include but are not limited to the Master Plan, military construction plans, troop training and range operation plans, Integrated Natural Resource Management Plans, tenant activities, and historic property renovation and demolition plans that are scheduled for implementation within five years of the execution date of this PA.

2. The Garrison Commander shall ensure that schedules and priorities are established and documented for identification, evaluation, and treatment of historic properties that might be affected by the undertakings identified pursuant to Stipulation B1. The Garrison Commander shall ensure that all relevant offices at Fort Campbell are informed of the schedules and priorities,

the potential of these undertakings to affect historic properties, the requirement to ensure that an analysis of alternatives is fully considered as early as possible in project planning, and of the requirement for review of the undertaking pursuant to this PA.

3. The Garrison Commander shall ensure that the undertakings and all related activities identified pursuant to Stipulation B1 are planned, reviewed, and carried out in accordance with the terms of this PA. The Garrison Commander shall include a list of undertakings in the annual report required pursuant to Stipulation J.

4. As funds are available, the Garrison Commander will ensure that the Army continues to conduct archaeological inventories of the unsurveyed and undisturbed areas of the installation. Inventory methods will take into account the recommended standards of the Kentucky and Tennessee SHPO. Priorities for archaeological survey will be based upon the projected threat to an area by routine military maneuver usage based on prior and expected patterns of use. Areas that have been previously disturbed by construction, troop activities, or other intensive uses within the Cantonment Area, Campbell Army Airfield, or the Sabre Heliport shall be exempted from further archaeological survey or other efforts to identify archaeological sites. Areas in which archaeological survey would be unsafe due to the presence of unexploded ordnance (designated Impact Areas and any immediately adjacent area considered of elevated danger by the Range Safety official) shall also be exempted from further archaeological survey or identification efforts. The maps in Attachment B illustrate the areas of these exemptions.

Reports documenting these surveys will be sent to the appropriate SHPO for comment and review. Inventory and reporting will meet the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation and relevant guidelines established by each State Historic Preservation Office.

5. The Garrison Commander will ensure that the Army, in consultation with the Kentucky and Tennessee SHPO, develop and maintain appropriate historic contexts to evaluate the eligibility of historic properties for inclusion on the National Register. The Garrison Commander shall provide for the timely application of these criteria to historic properties in the Fort Campbell inventory. Determinations of eligibility based on these criteria will be sent to the appropriate SHPO for concurrence. Disputes or disagreements regarding eligibility of any particular site or sites will be resolved by request for a determination of eligibility from the Keeper of the National Register in accord with 36 CFR 63.

6. The Garrison Commander will, to the extent that funds are available, initiate an installation-wide historic properties inventory to identify potentially eligible historic buildings, structures, objects, sites, and districts. This will include application of the criteria for the evaluation of the properties' eligibility for inclusion on the National Register. Determinations of eligibility will be made by the Army and forwarded to the appropriate SHPO for concurrence. Disputes or disagreements regarding eligibility of any particular historic building, object, structure or district will be resolved by request for a determination of eligibility from the Keeper of the National Register in accord with 36 CFR 63.

7. The Garrison Commander will ensure that in its planning efforts, the Army will make reasonable and good faith efforts to avoid adversely affecting archaeological sites and other historic properties eligible for the National Register. When there are practical alternatives available for accomplishing Fort Campbell's mission related needs that allow archaeological sites or historic buildings and structures to be left undamaged or undisturbed, Fort Campbell will give preference to that alternative. Historic buildings and structures will be treated in accordance with

the Secretary of the Interior's Standards for Preservation, Rehabilitation, or Restoration as appropriate. If it is determined that an undertaking will adversely affect historic properties, the Garrison Commander will comply with Stipulation C.2.h.

C. Project Review

1. Projects Exempt from Review

The following activities are considered to have no effect on historic properties and shall be exempt from further consideration under the terms of this agreement provided that the project is limited to activities herein:

a) Roadway, parking lot, and firebreak repair, resurfacing, or reconstruction that takes place within the previously maintained roadway or parking lot surfaces;

b) Maintenance, repair, or replacement in-kind of existing sidewalks and curbs, not including historic pavements such as bricks or cobblestones;

c) Routine foot trail maintenance that does not involve new ground disturbance;

d) Routine maintenance of installation cemeteries including mowing, clearing, reseeding, fencing, and straightening of headstones;

e) Repair or maintenance of utility lines that takes place within the existing disturbed utility right of way;

f) Approved active landfill operations, not including expansion into undisturbed areas, and formerly active landfills that are now closed;

g) Approved active borrow pits, not including expansion into undisturbed areas, and formerly active borrow pits that are now closed;

h) Removal, repair or replacement within existing locations of underground fuel and storage tanks; and

i) The repair or installation with in-kind material of the same size, texture and color of railroad warning devices, signs, lighting, guide rail, fencing, and traffic signals, provided that activities occur within the existing railroad corridors.

j) Routine installation maintenance including grass cutting and tree trimming throughout the post;

k) Routine cross-country passage of military field vehicles, including tracked vehicles; except through specifically protected areas such as cemeteries or significant historic properties as may be established in consultation between the Army, CRM staff and the SHPO;

l) Routine firing of ordnance during the course of Army training and maneuvers; and

m) Training activities that do not involve mechanically assisted excavation.

n) Alteration, maintenance, repair or demolition of buildings less than fifty (50) years of age, unless it has been determined by CRM staff, in consultation with the appropriate SHPO, that such buildings possess characteristic of exceptional significance or significance associated with the Cold War era; and

o) the alteration, maintenance, repair or demolition of World War II temporary buildings that have been documented as part of the Programmatic Agreement among the Department of Defense (DoD), the Council, and the National council of State Historic Preservation Officers (NCSHPO) (Attachment C); and

p) Projects at properties considered eligible for the National Register of Historic Places may proceed with certification by the CRM that the planned work stays entirely within the following limitations:

i) Replacement in-kind, matching the configuration, material, size, detail, and color of the historic fabric or landscaping;

ii) Refinishing in-kind, such as painting or covering surfaces with the same materials and in the same color;

iii) Undertakings at properties for which effects have been taken into account through Department of the Army or Department of Defense program alternatives. These include program comments for Capehart/Wherry era family housing (67 FR 39332-5), Unaccompanied Personnel housing (72 FR 28464), Ammunition Storage facilities (72 FR 28464), Ammunition Production facilities (72 FR 28464), and any other similar nation wide program alternatives that may come into effect during the term of this agreement.

iv) Energy conservation measures that are not visible or do not alter or detract from the qualities that make a resource eligible for the National Register, that include but are not limited to the following:

1) Modifications to HVAC control systems, or conversions to alternative fuels;

2) Insulation in roofs, crawl spaces, ceilings, attics, walls, floors, and around pipes and ducts;

3) The installation of storm doors or windows, or insulated double or triple glazing, which match the size, color, profile and other distinguishing characteristics of the historic door or window;

4) Interior modifications when the significance of the building does not include the interior space;

5) Caulking and weather-stripping, provided the color of the caulking is consistent with the appearance of the building;

6) Replacement or modification of lighting systems when the modifications do not alter or detract from the significance of the property;

7) Removal of asbestos-containing materials, provided that the removal does not alter or detract from the qualities that make the resource eligible to the National Register, or

provided that replacement is made in-kind both in color and appearance of non-asbestos containing materials;

2. Review of Undertakings

Undertakings not excluded from further review by the stipulation C.1 will be reviewed as described below:

a) The proponent of the undertaking, in consultation with the CRM, will determine the areas of potential effects as defined in 36 CFR 800.16d and assess whether prior efforts for identification of historic properties within the areas of potential effects are adequate, in accord with guidelines established by each State Historic Preservation Office. If the identification efforts within the areas of potential effects are adequate and there are no historic properties or properties with eligibility for the National Register of Historic Places not established, the proposed undertaking may proceed as planned.

The CRM staff may inspect small areas not surveyed for archaeological materials to determine whether they are so disturbed that there is very little likelihood of any significant archaeological sites remaining. The areas found to be disturbed shall be recorded within Fort Campbell's GIS as adequately surveyed for archaeological sites and included in the annual report described in stipulation J.

b) If identification efforts are not adequate in part or all of the areas of potential effects for an undertaking, the Army will ensure that adequate identification is completed by professionals meeting the qualifications described by the Secretary of the Interior (48 FR 44738-9) as appropriate to the kinds of historic properties likely to be within the areas of potential effects.

If there are properties needing evaluation present in the areas of potential effects, the Army will evaluate the property for eligibility to the National Register pursuant to 36 CFR Section 800.4(c) and will forward documentation supporting the evaluations to the appropriate SHPO for review and concurrence. The SHPO shall be afforded 30 calendar days to respond to the Army's determinations of eligibility. If the Army and the SHPO agree that the properties in the areas of potential effect are not eligible for inclusion on the NRHP, the undertaking may proceed as planned. If Fort Campbell and the SHPO do not agree on determinations of eligibility, Fort Campbell will either resolve the disagreement through further consultation with the SHPO or will consult the Keeper of the National Register pursuant to 36 CFR Section 800.4(c).

c) If there are historic properties or properties considered eligible for listing in the National Register of Historic Places within the areas of potential effects for an undertaking, Fort Campbell will assess whether the undertaking is likely to cause adverse effects on the historic properties or properties considered eligible.

d) The following kinds of undertakings will be considered as having no adverse effects upon historic properties with certification by the CRM staff that the undertakings include appropriate measures or procedures to avoid historic properties or to avoid adverse effects to historic properties. Undertakings approved as having no adverse effect and the measures implemented to avoid adverse effect under this stipulation shall be listed in the annual report described in stipulation J.

1. Mechanically assisted excavations conducted for training and other purposes by military units that takes place in adequately surveyed areas and avoids known historic properties;

2. Approval of tracts for forest management activities in adequately surveyed areas when known historic properties are excluded from the areas of ground disturbance;

3. Agricultural activities restricted in tillage depth to a level no deeper than previously practiced on a particular tract.

e) If the Army determines that the effects of an undertaking other than those described in section d are not adverse, Fort Campbell will document that determination in accord with 36 CFR 800.11 and send the determination and documentation to the appropriate SHPO.

The SHPO will have 30 days to respond to the determination of no adverse effect. If there is no response 30 days after the appropriate SHPO has received the determination and documentation, the Army may assume concurrence with the determination.

f) If Fort Campbell and the appropriate SHPO concur after consultation that the project will have no adverse impact on historic properties, the project may proceed as planned.

g) If the appropriate SHPO objects to the determination of no adverse effect, the Army will attempt to resolve the objection through consultation with the objecting party. If the Army cannot resolve the objection to a determination of No Adverse Effect through further consultation, Fort Campbell will consult to resolve adverse effect as in stipulation C.2.h or as set forth in 36 CFR 800.6.

h) If Fort Campbell determines that the effects of an undertaking are adverse, the Army will provide documentation as specified in 36 CFR 800.11 to the SHPO and to any consulting tribe or other party maintaining an interest in the historic property adversely affected. The documentation will specify Fort Campbell's efforts to avoid or minimize adverse effects or Fort Campbell's proposed mitigation measures.

Fort Campbell will consult with the SHPO and any consulting tribes or other parties to reach a proposed agreement to resolve the adverse effects. Fort Campbell will document the terms of the resolution agreement in writing to the consulting parties, and will report the terms of these agreements in the annual report described in stipulation J.1.a.

i) If the SHPO disagrees with the Army's proposed mitigation of adverse effects and the disagreement cannot be resolved with further consultation, the Army will forward all relevant documentation to the Council and request Council comment pursuant to 36 CFR Section 800.7(a)(1) and allow the Council 45 days to respond. Any Council comment provided in response to such a request will be taken into account by the Army in accordance with 36 CFR Section 800.7(c) with reference to the subject of the dispute.

D. Native American Consultation

1. The Garrison Commander shall consult with Tribal Historic Preservation Officers and/or other designated representatives of the Native American tribes listed in Attachment D that may have an

affiliation with or interest in cultural items found at Fort Campbell to determine whether and which historic properties at Fort Campbell have religious or cultural significance to each tribe.

2. When survey in previously unsurveyed areas results in the discovery of historic properties dating earlier than non-indigenous settlement of the Fort Campbell area, Fort Campbell will consult with the tribes to determine whether the discovered historic property is of religious or cultural significance to any tribe.

3. When any of the undertakings described in Stipulation C2 may affect a known historic property with religious or cultural significance to a Native American tribe, the Garrison Commander will ensure that information regarding the proposed undertaking and the possible effects to the known site are provided to the tribes and that the views expressed are considered in determinations of effect.

4. When a proposed undertaking will have an adverse effect on a historic property of religious or cultural significance, the tribe or tribes for which the historic property has such significance will be consulted according to the same procedures as afforded the SHPO in stipulation C2.

E. Emergency Discovery

The Garrison Commander shall ensure that written instructions are provided to individuals and groups conducting ground-disturbing construction activities on the installation that specify procedures to be followed if archaeological material is found during construction. If archaeological remains, including human skeletons are found, the CRM must be notified immediately.

Activities in the area immediately surrounding the find will immediately stop, and will remain stopped until the Garrison Commander determines it can resume consistent with reasonable efforts to avoid, minimize or mitigate adverse effects (36 CFR 800.13(b)), and consistent with other applicable legal authorities. The CRM will visit the location as soon as possible, but within four business days of notice, to examine the deposits. Deposits will be documented photographically and in writing by CRM staff. If damage to the site is minor and the project can be relocated, site forms will be filed with the appropriate SHPO and the project will be relocated. If the project cannot be relocated or if damage is extensive, emergency consultation with the SHPO will be initiated. The Army will evaluate the eligibility of the site to the NRHP, and if the Army determines that the site is eligible for inclusion on the NRHP, and the site cannot be avoided, will also develop a data recovery plan. The Army will forward documentation regarding its decisions to the appropriate SHPO. The SHPO will respond to the Army within seven (7) working days. If the SHPO does not respond within seven (7) days, the Army will implement the proposed actions. If Native American human skeletal remains or associated cultural items are found, consultation with appropriate Native American groups will be initiated, as specified in the Native American Graves Protection and Repatriation Act (25 USC 3001-3013 and 43 CFR Part 10). All cases of emergency discovery will be documented in the annual report to the SHPO required pursuant to Stipulation J.

F. Involvement of Interested Parties

The installation, in consultation with the SHPO, shall identify parties that may be interested in the effects of Army undertakings on historic properties and develop a plan for involving such parties, as appropriate, in consultations to resolve adverse effects.

G. Public Access to Information

1. The Garrison Commander shall, to the extent compatible with other responsibilities (for example, 16 U.S.C. 470 hh) ensure that information about historic properties at Fort Campbell and the history associated with them are freely and openly available to the public. Fort Campbell will not publicly distribute information that may be considered confidential in accord with Section 304 of the National Historic Preservation Act and 36 CFR 800 Section 800.11(c).

H. Dispute Resolution

1. Should any signatory to this PA object to any action carried out or proposed by the Army with respect to the implementation of this PA, the Garrison Commander shall consult with the objecting party to resolve the objection. If after initiating consultation, the Garrison Commander determines that the objection cannot be resolved through consultation, the Garrison Commander shall forward all documentation relevant to the dispute to the Council. Within thirty calendar days after receipt of all pertinent documentation, the Council shall exercise one of the following options:

a) Advise the Army that the Council concurs in the Army's proposed final decision, whereupon the Army will respond to the objection accordingly;

b) Provide the Army with recommendations, which the Army shall take into account in reaching a final decision regarding its response to the objection;

c) Notify the Army that the Council will comment pursuant to 36 CFR Section 800.7(c), and proceed to comment. The resulting comment will be taken into account by the Army in accordance with 36 CFR Section 800.7(c)(4) and Section 110(l) of NHPA.

2. Should the Council not exercise one of the above options within 30 days after receipt of all pertinent documentation, the Army may assume the Council's concurrence in its proposed response to the objection.

3. The Army shall take into account any Council recommendation or comment provided in accordance with this stipulation with reference only to the subject of the objection; the Army responsibility to carry out all actions under this PA that are not the subject of the objection shall remain unchanged.

4. At any time during implementation of the measures stipulated in this PA, should an objection pertaining to this PA be raised by a member of the public, the Army shall notify the parties to this PA and take the objection into account, consulting with the objector and should the objector so request, with any of the parties to this PA to resolve the objection.

I. Anti-Deficiency Act Compliance

The stipulations of this PA are subject to the provisions of the Anti-Deficiency Act. If compliance with the Anti-Deficiency Act alters or impairs the Army's ability to implement the stipulations of this PA, the Army will consult in accordance with the amendment and termination procedures found at Stipulations K and L of this PA.

J. Reporting and Annual Review

1. The Garrison Commander shall provide the SHPO, the Council, and IMCOM-SE, with an annual report on or before January 1 of each year summarizing activities carried out under the terms of this PA.

a) Annual reports shall include a list of projects and program activities reviewed for possible effects to historic properties, determinations of effect concluded under this programmatic agreement, a summary of mitigation or treatment measures implemented or still pending to address the effects of undertakings, and a summary of consultation activities and the views of the SHPO and interested parties where appropriate.

b) The signatories to this PA shall review this information to determine what, if any, revisions or amendments to the PA may be necessary.

2. The Garrison Commander shall ensure that the annual report is available for public inspection that interested members of the public are made aware of its availability, and that interested members of the public are invited to provide comments to the Army, SHPO, and the Council.

K. Amendments

Any party to this PA may propose to the Army that the PA be amended, whereupon the Army shall consult with the other parties to this PA to consider such amendment. If the signing parties agree to an amendment, copies of the amended agreement shall be provided to all of the consulting parties and to the Advisory Council on Historic Preservation.

L. Termination of the Programmatic Agreement

1. If the Garrison Commander determines that the Army cannot implement the terms of this PA, or if either SHPO or Council determines that the PA is not being properly implemented, the Army, or either SHPO, may propose to the other parties to this PA that it be terminated.

2. The party proposing to terminate this PA shall notify all parties to the PA explaining the reasons for termination and affording them at least thirty days to consult and seek alternatives to termination. Should such consultation fail and the PA be terminated, the Army shall:

a) Consult in accordance with 36 CFR Section 800.14 to develop a new PA; or,

b) Comply with 36 CFR Part 800 subpart B with regard to each undertaking.

M. Monitoring

The SHPO and the Council may monitor any activities carried out pursuant to this Agreement, and the Council will review any activities if so requested. The Garrison Commander will cooperate with the SHPO and the Council should they request to monitor or to review project files for activities carried out pursuant to this Agreement.

When the Army becomes aware that any historic property at Fort Campbell has been inadvertently damaged by an action or undertaking not in conformity with the review process set out in this programmatic agreement or other applicable agreement, the Garrison Commander will

ensure that a report describing how the damage occurred and the extent of damage to the historic property involved is provided to the SHPO.

N. Failure to Comply with the Programmatic Agreement

In the event that the Army does not carry out the terms of this Programmatic Agreement, the Army shall comply with 36 CFR Part 800 subpart B with regard to each individual undertaking at Fort Campbell.

O. Expiration and Renewal of the Programmatic Agreement

This Programmatic Agreement shall take effect on the date it is signed by the last signatory and will remain in effect unless terminated pursuant to Stipulation I. If not renewed or extended, this Programmatic Agreement will expire on December 31, 2013. No extension or modification will be effective unless all signatories have agreed in writing.

Execution and implementation of this Programmatic Agreement evidences that the Army has afforded the Council a reasonable opportunity to comment on the program and that the Army has taken into account the effects of the program on historic properties.

FORT CAMPBELL, KENTUCKY

By: _____ Date: 12 JAN 09

FREDERICK W. SWOPE
COL, IN
Commander, USAG

KENTUCKY STATE HISTORIC PRESERVATION OFFICER

By: _____ Date: 1/22/09

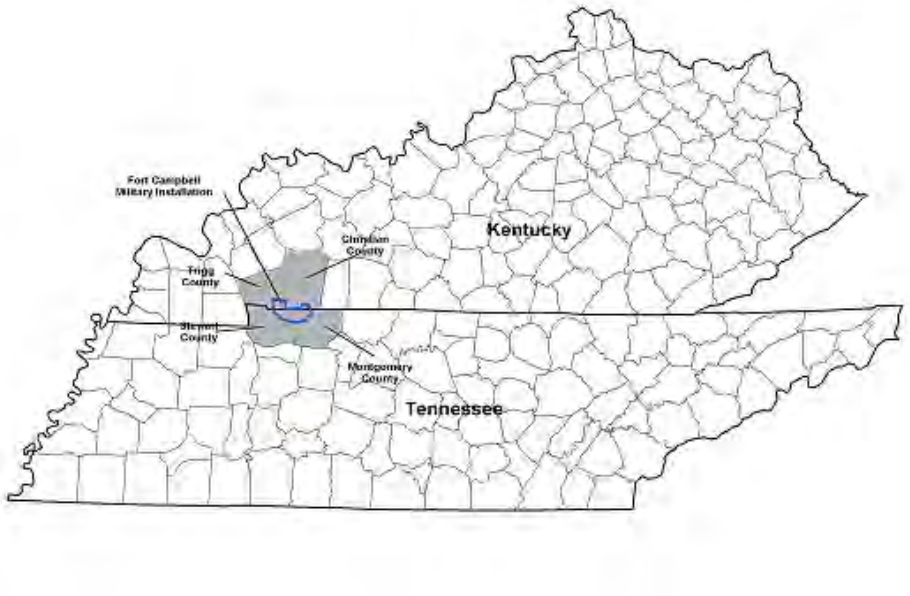
MARK DENNEN
State Historic Preservation Officer

TENNESSEE STATE HISTORIC PRESERVATION OFFICER

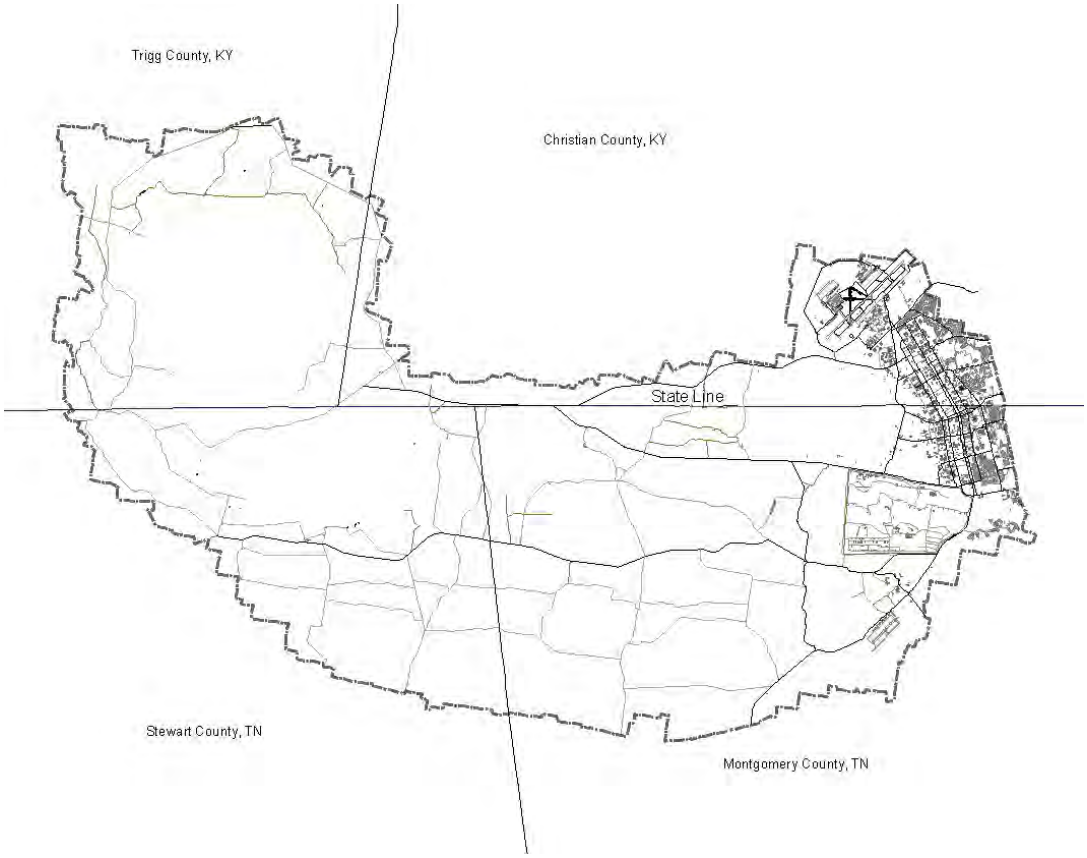
By: _____ Date: 15 Jan 09

E. PATRICK MCINTYRE, JR.
State Historic Preservation Officer

Attachment A



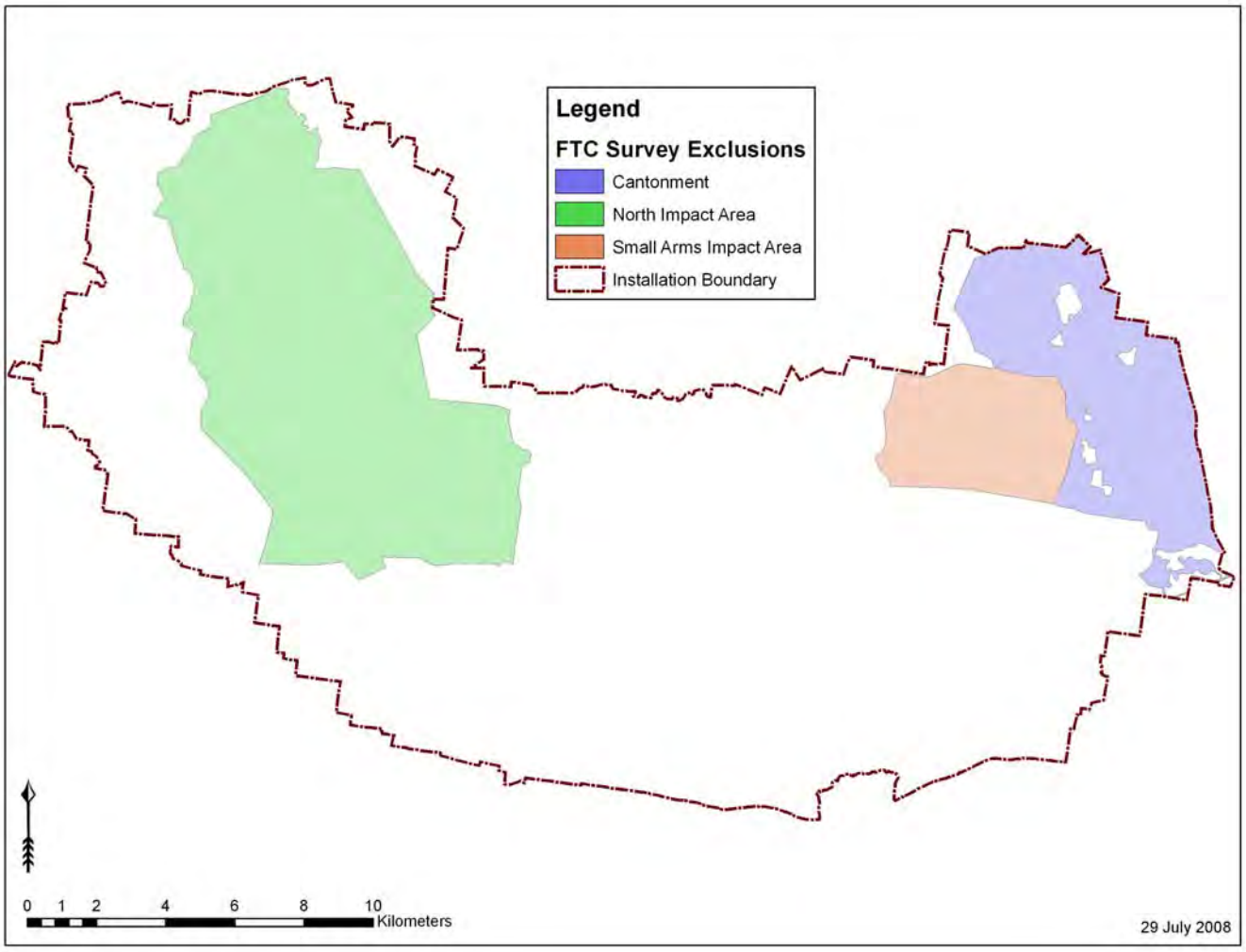
Location of Fort Campbell in Tennessee and Kentucky



Location of Fort Campbell within Four Counties in Kentucky and Tennessee

ATTACHMENT B

Areas Excluded from further Archaeological Survey due to
Prior Disturbance and Development (Cantonment) or
Danger from Unexploded Ordnance (Impact Areas)



Attachment C

Programmatic Agreement Regarding World War II Temporary Buildings

PROGRAMMATIC MEMORANDUM OF AGREEMENT

AMONG

THE UNITED STATES DEPARTMENT OF DEFENSE

THE ADVISORY COUNCIL ON HISTORIC PRESERVATION

AND THE

NATIONAL CONFERENCE OF STATE HISTORIC PRESERVATION OFFICERS

WHEREAS, the Department of Defense (DoD) has been directed by United States Senate Armed Services Committee Report 97-440 to the Military Construction Authorization Bill for 1983 to demolish World War II (1939-1946) temporary buildings (buildings); and

WHEREAS, these buildings were not constructed to be permanent facilities and were intended to be demolished; and

WHEREAS, DoD has determined that these buildings may meet the criteria of the National Register of Historic Places; and

WHEREAS, DoD has determined that its program of demolition of these buildings (program) may have an effect on their qualities of significance and has requested the comments of the Advisory Council on Historic Preservation (Council) pursuant to Section 106 of the National Historic Preservation Act, as amended, (16 U.S.C. 470f) and its implementing regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800).

NOW, THEREFORE, DoD, the National Conference of State Historic Preservation Officers (NCSHPO), and the Council agree that the Program will be carried out in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

I. DoD will ensure that the following actions are carried out:

A. In consultation with the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) (National Park Service, Washington, DC), DoD will develop documentation that includes:

1. A narrative overview of WW II military construction establishing the overall historical context and construction characteristics of each major type of building and including:

a. Explanation of the origins and derivations of the construction techniques and designs.

b. Chronology that summarizes the political and military decisions that affected scheduling, locations, quantity, design, and construction techniques. Photocopies shall be made of all military manuals used to guide significant aspects of design or construction.

c. Summary statements of major installations' WW II development including site plans, lists of buildings, photocopies of appropriate photographs, and evaluations of the significance of the various building types and groups.

2. Documentation of one example of all major building types that includes: drawings (title sheet, floor plans, sections, elevations, and isometrics of framing systems and other pertinent construction details), photographs (perspective corrected, large format negative and contact print), and appropriate explanatory data. All documentation shall meet HABS/HAER Standards for format and archival stability.

3. Submission of the above documentation to HABS/HAER, for deposit in the Library of Congress, not later than three years from the date of this agreement.

4. Development of the above documentation will be undertaken with periodic reviews by HABS/HAER to ensure that completed documentation will meet HABS/HAER Standards.

B. In consultation with the Council and the NCSHPO, DoD will select some examples of building types or groups to treat in accordance with historic preservation plans (HPP), until such time as demolished or removed from DoD control. The HPPs will be submitted to the Council and the NCSHPO within three years from the date of this agreement. Work done in accordance with the HPPs will require no further review by a SHPO or the Council.

C. All buildings that are identified within sixty days of the Federal Register publication of this Agreement by organizations and individuals will be considered by DoD in its selection of examples to be documented and/or treated in accordance with Stipulations A and B above.

D. Until the documentation program is completed and HPPs have been developed for the representative sample of building types and groups, DoD will continue its current program of building demolition with caution, avoiding disposal of obviously unique and well-preserved, original buildings that are not documented.

II. NCSHPO agrees to:

A. Assist the appropriate SHPO in informing DoD within sixty days of the Federal Register publication of this agreement of buildings that they wish to have considered in the selection of examples to be documented and/or treated in accordance with Stipulations I.A and I.B.

B. Represent all SHPOs in the consultation on a selection of examples of buildings to be treated in accordance with Stipulation I.B.

III. If any of the signatories to this Agreement determines that the terms of the Agreement cannot be met or believes that a change is necessary, the signatory will immediately request an amendment or addendum to the Agreement. Such an amendment or addendum will be executed in the same manner as the original Agreement.

EXECUTION of this Agreement evidences that DoD has afforded the Council a reasonable opportunity to comment on its program of disposal of temporary WW II buildings and that DoD has taken into account the effects of this program on historic resources.

7/2/86
Executive Director, Advisory Council on Historic Preservation

7/7/86
Chairman
Advisory Council on Historic Preservation

6/6/86
President CHARLES E. LEE
National Conference of State Historic Preservation Officers

Historic American Buildings Survey/
Historic American Engineering Record

Department of Defense

Department of Army

Department of Navy

U. S. Marine Corps

Department of Air Force

Attachment D

Federally Recognized Tribes Consulted

TRIBAL CONTACTS LIST

Absentee-Shawnee Tribe of Indians of Oklahoma

Alabama-Quassarte Tribal Town

Cherokee Nation of Oklahoma

Chickasaw Nation of Oklahoma

Coushatta Tribe

Eastern Shawnee Tribe of Oklahoma

Eastern Band of Cherokee Indians

United Keetoowah Band of Cherokee

Kialegee Tribal Town

Muscogee Creek Nation of Oklahoma

Poarch Creek Indians

Seminole Tribe of Florida

Shawnee Tribe

Thlopthlocco Tribal Town

Programmatic Agreement

Between Fort Campbell and the Tennessee State Historic Preservation Office Regarding Development, Construction, and Operations At Clarksville Base Historic District

Whereas, Fort Campbell proposes use of areas located within the Clarksville Base Historic District (CBHD) for the development of new buildings, structures and facilities in support of the Army Campaign Plan, Transformation, Grow The Force and other initiatives that require expanded facilities at Fort Campbell; and

Whereas, Fort Campbell has determined that no practical and feasible alternative locations within the existing cantonment can support the increased facilities needed, nor can lands be withdrawn from the training and maneuver lands inventory for this need; and

Whereas, Fort Campbell and the Tennessee Historical Commission have agreed that the former Clarksville Base is eligible for inclusion in the National Register of Historic Places as a district with significant associations to the storage and maintenance of nuclear weapons in the early years of the Cold War; and

Whereas, the Tennessee Historical Commission and Fort Campbell agree that taking into account the effects of multiple undertakings within the Clarksville Base Historic District required in multiple years in support of increased mission requirements is best addressed through the program alternative of a programmatic agreement in accord with 36 CFR 800.14(b), and

Whereas, The Area of Potential Effects for the proposed developments within the CBHD is the entire area of the CBHD including both the development area and the preservation area within the district as illustrated in attachments A and B; and

Whereas, Program Comments regarding ammunition storage facilities have been adopted by the Army (72 FR 28464), and there are some structures at CBHD to which these program comments apply as individual structures, however the program comments explicitly do not extend to the effects that undertakings at these structures may have on the district within which they are located, and

Whereas, within the bounds of the CBHD, there are other historic properties with significance unrelated to the historical associations of Clarksville Base, including both prehistoric and historic era archaeological sites; and

Whereas, Fort Campbell has determined that use of the areas within the Clarksville Base Historic District (CBHD) for these developments may adversely affect the CBHD and may affect other historic properties located within the boundaries of the CBHD; and

Whereas, Fort Campbell has made reasonable and good faith efforts to identify all historic properties within the boundaries of CBHD, whether they relate to the Cold War associations of CBHD or have significance through other criteria; and

Whereas, Fort Campbell has consulted with the Tennessee State Historic Preservation Officer; and

Whereas, Fort Campbell has consulted with the federally recognized Indian tribes listed in Attachment C. The Garrison Commander sent letters including information as specified at 36 CFR 800.11 with respect to the proposed undertaking. The letter acknowledged the potential for indirect effects to the archaeological site 40MT28. This site, though not in the proposed development area of CBHD, is known to contain prehistoric burial features. The Garrison Commander's letter was followed up by telephone inquiries and email copies of the same information in staff to staff contacts; and

Whereas, Fort Campbell has notified the Advisory Council on Historic Preservation and the Council decided not to participate in consultations and advised Fort Campbell by letter dated July 25, 2008; and

Whereas, Fort Campbell has notified the following individuals and organizations to invite comment and participation in the consultations. Each organization or individual received a letter explaining the proposed developments and agreement. Enclosed with the letter was the same document with the compiled information as was provided to the Advisory Council on Historic Preservation:

County Historian of Montgomery County, Tennessee,
The Montgomery County Historical Society,
The Customs House Museum in Clarksville, Tennessee,
The Pennyroyal Area Museum in Hopkinsville, Kentucky,
Mr. Jim Hurst, President of the Clarksville Base Employees Association,
Mr. John O'Brien, Installation Historian for Fort Campbell; and

Whereas, the following individuals and organizations have declined to participate or have not responded:

County Historian of Montgomery County, Tennessee,
The Montgomery County Historical Society,
The Customs House Museum in Clarksville, Tennessee,
The Pennyroyal Area Museum in Hopkinsville, Kentucky, and

Whereas, the following individuals and organizations have contributed verbal comments and suggestions which Fort Campbell has taken into account and communicated to the SHPO:

Mr. Jim Hurst, President of the Clarksville Base Employees Association,
Mr. John O'Brien, Installation Historian for Fort Campbell;

NOW THEREFORE, Fort Campbell and the Tennessee State Historic Preservation Office agree that Undertakings within Clarksville Base Historic District (CBHD) shall be implemented in accordance with the following stipulations in order to take into account the effect of the Undertakings on historic properties.

STIPULATIONS

Fort Campbell shall ensure that the following measures are carried out.

A. Mitigation Measures Addressing District-wide or General Effects

1. Since general development within the areas illustrated in Attachment B may entail substantial adverse effects to the Clarksville Base Historic District as a whole and to a substantial number of contributing structures and features, Fort Campbell will ensure that the public has access to a detailed description of the history and to illustrations of the buildings and structures that contribute to the District.

Fort Campbell will sponsor the development and hosting of a site on the World Wide Web comparable to the structure and depth of detail at http://www.mnhs.org/places/sites/hfs/tour/tour.html presenting the history and structures of Clarksville Base to the general public.

2. Fort Campbell will develop a museum quality exhibit on the history of Clarksville Base, including a scale model of the base after the majority of its facilities were constructed and in operation. The exhibit and model will be offered for exhibition in museums and other suitable institutions throughout Kentucky and Tennessee.

3. Fort Campbell will erect and maintain signs at the entrances to Clarksville Base Historic District and at contributing structures within the district that explain the history of the district and the functions carried out by the contributing structures. Fort Campbell will use these signs to provide a self-guiding tour for both residents of Fort Campbell and those who may work or visit within the area.

4. Fort Campbell will reproduce the construction and engineering drawings for buildings at Clarksville Base and will maintain a set of these drawings at the Directorate of Public Works (DPW) at Fort Campbell, the Cultural Resources Management program office, the Donald F. Pratt Museum, and the Tennessee Historical Commission. Fort

Campbell will ensure that to the extent possible, the archival sets of construction drawings include each unique building design and two of each kind of structure that followed a repetitive or duplicated design.

5. Fort Campbell will ensure that there is a systematic and coordinated effort to collect information and oral history accounts from those who formerly worked at or had connections to the efforts at Clarksville Base and to make this information accessible to the public.

6. Fort Campbell will assess the maintenance and conservation needs of structures and features in the areas of Clarksville Base indicated in attachment B that are not included in the proposed development areas. Fort Campbell will request funding for maintenance and conservation in accord with the results of the assessments.

B. Undertaking excluded from review throughout Clarksville Base Historic District

Undertakings Exempt from Review

The following activities are considered to have no effect on the Clarksville Base Historic District and shall be exempt from further consideration under the terms of this agreement provided that the project is limited to activities herein:

a) Roadway, parking lot, and firebreak repair, resurfacing, or reconstruction that takes place within the previously maintained roadway or parking lot surfaces;

b) Maintenance, repair, or replacement in-kind of existing sidewalks and curbs, not including historic pavements such as bricks or cobblestones;

c) Routine foot trail maintenance that does not involve new ground disturbance;

d) Routine maintenance of cemeteries within the CBHD including mowing, clearing, reseeding, fencing, and straightening of headstones;

e) Repair or maintenance of utility lines that takes place within the existing disturbed utility right of way;

f) Removal, repair or replacement within existing locations of underground fuel and storage tanks;

g) The repair or installation with in-kind material of the same size, texture and color of railroad warning devices, signs, lighting, guide rail, fencing, and traffic signals, provided that activities occur within the existing area of disturbance.

h) Routine maintenance within the CBHD including grass cutting and tree trimming;

i) Routine firing of ordnance during the course of Army training and maneuvers;

j) Training activities that do not involve mechanically assisted excavation.

k) Alteration, maintenance, repair or demolition of buildings that are less than fifty (50) years of age and which are not associated with the operations of Clarksville Base, unless it has been determined by CRM staff, in consultation with the SHPO, that such buildings possess characteristics of exceptional significance;

l) Minor ground disturbance or mechanical digging in areas where archaeological survey has established the absence of archaeological sites, so long as the previous appearance or condition can be re-established upon completion of the disturbance.

m) Projects involving properties considered eligible for the National Register of Historic Places may proceed with certification by the Cultural Resources Manager that the planned work stays entirely within the following limitations:

i) Replacement in-kind, matching the configuration, material, size, detail, and color of the historic fabric or landscaping;

ii) Refinishing in-kind, such as painting or covering surfaces with the same materials and in the same color;

iii) Energy conservation measures that are not visible or do not alter or detract from the qualities that make a resource eligible for the National Register, that include but are not limited to the following:

1) Modifications to HVAC control systems, or conversions to alternative fuels;

2) Insulation in roofs, crawl spaces, ceilings, attics, walls, floors, and around pipes and ducts;

3) The installation of storm doors or windows, or insulated double or triple glazing, which match the size, color, profile and other distinguishing characteristics of the historic door or window;

4) Interior modifications when the significance of the building does not include the interior space;

5) Caulking and weather-stripping, provided the color of the caulking is consistent with the appearance of the building;

6) Replacement or modification of lighting systems when the modifications do not alter or detract from the significance of the property;

7) Removal of asbestos-containing materials, provided that the removal does not alter or detract from the qualities that make the resource eligible to the National Register, or provided that replacement is made in-kind both in color and appearance of non-asbestos containing materials;

C. Treatments for properties related to Operations of the Former Clarksville Base

1. The Master Planning Branch shall confer with the Cultural Resources Program staff no less than twice each calendar year to review the status of all construction or

improvement projects planned or potentially considered for placement in the CBHD.

2. For undertakings that pose potential effects to the CBHD as a whole and to contributing elements of the district and located in the area illustrated in attachment B, the following standard treatments will be applied:

The Cultural Resources Management program and the Master Planning Branch shall jointly document the following for each project affecting Clarksville Base Historic District or its contributing elements. The documentation will be retained in project planning files:

a. alternatives considered and/or implemented for avoiding or minimizing adverse effects.

b. a list of the contributing elements to be affected by the undertaking.

c. documentation of consideration of adaptive re-use of buildings or structures that are contributing elements in accord with section 111 of the National Historic Preservation Act and E.O. 13287.

d. verify that the archival drawings as described in stipulation A.4. have already been completed for the buildings and structures that are contributing elements at issue. The project shall not proceed until this documentation is completed and distributed to the parties as specified in stipulation A.4.

e. take a detailed set of digital photographs of each contributing element adversely affected by the undertaking.

f. completion of the documentation in sections a-e will constitute evidence that Fort Campbell has complied with section 106 of the NHPA in regard to effects of its undertaking with respect to the Clarksville Base Historic District and this documentation may be cited as such for purposes of any other coordinated planning processes.

D. Effects on historic properties within CBHD but not associated with operations of the former Clarksville Base

1. For undertakings within CBHD that pose potential effects to historic properties other than CBHD itself and its contributing elements, Fort Campbell will use the following procedures to take into account the effects of undertakings on those historic properties. Throughout the following subparts of stipulation D, “historic property” means “historic property other than Clarksville Base Historic District and its contributing elements.”

2. So long as the Army continues to maintain a Cultural Resources Manager in accord with Army Regulation 200-1, Chapter 6-4, including access to personnel qualified under

the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation to perform technical work, undertakings in Clarksville Base Historic District not excluded from further review by the stipulation B.1. will be reviewed as described below.

a) The proponent of the undertaking, in consultation with the CRM program manager, will determine the areas of potential effects as defined in 36 CFR 800.16d and assess whether prior efforts for identification of historic properties within the areas of potential effects are adequate, in accord with guidelines established by the Tennessee Historical Commission. If the identification efforts within the areas of potential effects are adequate and there are no historic properties or properties considered potentially eligible for the National Register of Historic Places, the proposed undertaking may proceed as planned.

b) If identification efforts are not adequate in part or all of the areas of potential effects for an undertaking, the Army will ensure that adequate identification is completed by professionals meeting the qualifications described by the Secretary of the Interior (48 FR 44738-9) as appropriate to the kinds of historic properties likely to be within the areas of potential effects.

If potentially eligible or unevaluated properties are present in the areas of potential effects, the Army will evaluate the property for eligibility to the National Register pursuant to 36 CFR Section 800.4(c) and will forward documentation supporting the evaluations to the appropriate SHPO for review and concurrence. The SHPO shall be afforded 30 calendar days to respond to the Army's determinations of eligibility. If the Army and the SHPO agree that the properties in the areas of potential effect are not eligible for inclusion on the NRHP, the undertaking may proceed as planned. If Fort Campbell and the SHPO do not agree on determinations of eligibility, Fort Campbell will either resolve the disagreement through further consultation with the SHPO or will consult the Keeper of the National Register pursuant to 36 CFR Section 800.4(c).

c) If there are historic properties or properties considered eligible or potentially eligible for listing in the National Register of Historic Places within the areas of potential effects for an undertaking, Fort Campbell will assess whether the undertaking will cause adverse effects.

d) The following kinds of undertakings will be considered as having no adverse effects upon historic properties with certification by the CRM staff that the undertakings include appropriate measures or procedures to avoid historic properties or to avoid adverse effects to historic properties. Undertakings approved as having no adverse effect and the measures implemented to avoid adverse effect under this stipulation shall be listed in the annual report described in stipulation H.

1. Mechanically assisted excavations conducted for training and other purposes by military units that takes place in adequately surveyed areas and avoids known historic properties;

2. Approval of tracts for forest management activities in adequately surveyed areas when known historic properties are excluded from the areas of ground disturbance;

e) If the Army determines that the effects of an undertaking (other than those described in section D2d) on historic properties are not adverse, Fort Campbell will document that determination in accord with 36 CFR 800.11 and provide it to the SHPO. If the historic property has religious or cultural significance for a federally recognized Indian tribe or tribes, Fort Campbell will also send its determination of no adverse effect to the tribe or tribes.

The SHPO will have 30 days to respond to the determination of no adverse effect. If there is no response 30 days after the SHPO has received the determination and documentation, the Army may assume concurrence with the determination.

f) If Fort Campbell and the SHPO concur after consultation that the project will have no adverse impact on historic properties, the project may proceed as planned.

g) If the SHPO objects to the determination of no adverse effect, the Army will attempt to resolve the objection through consultation. If the Army cannot resolve the objection to a determination of No Adverse Effect through further consultation, Fort Campbell will consult to resolve adverse effect as in stipulation D.2.h or as set forth in 36 CFR 800.6.

h) If Fort Campbell determines that the effects of an undertaking are adverse, the Army will provide documentation as specified in 36 CFR 800.11 to the SHPO and to any consulting tribe or other party maintaining an interest in the historic property adversely affected. The documentation will specify Fort Campbell's efforts to avoid or minimize adverse effects or Fort Campbell's proposed mitigation measures.

The Army will consult with the SHPO and any consulting tribes or other parties to reach a proposed agreement to resolve the adverse effects for a period of 45 days to reach a proposed agreement to resolve the adverse effects. The 45 day consultation period may be extended through mutual agreement by all parties. The Army will internally review any proposed agreement document in accordance with Army Regulation 200-1 or other applicable regulations before the Garrison Commander may sign it.

i) If the SHPO disagrees with the Army's proposed mitigation of adverse effects and the disagreement cannot be resolved with further consultation, the Army will forward all relevant documentation to the Council and request Council comment pursuant to 36 CFR Section 800.7(a)(1) and allow the Council 45 days to respond. Any Council comment provided in response to such a request will be taken into account by the Army in accordance with 36 CFR Section 800.7(c) with reference to the subject of the dispute.

E. Effects on Contributing Elements and Setting within the Preservation Area of Clarksville Base

1. For undertakings not excluded from review by stipulation B and having Areas of Potential Effect that extend into the preservation area as illustrated on attachment B, Fort Campbell will assess the effects of the undertaking and consult with the SHPO.

2. If the Army determines that the effects of an undertaking on historic properties within the preservation area are not adverse, Fort Campbell will document that determination in accord with 36 CFR 800.11 and send the determination and documentation to the SHPO.

The SHPO will have 30 days to respond to the determination of no adverse effect. If there is no response 30 days after the SHPO has received the determination and documentation, the Army may assume concurrence with the determination.

3. If Fort Campbell and the SHPO concur after consultation that the project will have no adverse impact on historic properties, the project may proceed as planned.

4. If the SHPO objects to the determination of no adverse effect within the 30 day review period, the Army will attempt to resolve the objection through consultation. If the Army cannot resolve the objection to a determination of No Adverse Effect through further consultation, Fort Campbell will consult to resolve adverse effect as in stipulation E.5 or as set forth in 36 CFR 800.6.

5. If Fort Campbell determines that the effects of an undertaking are adverse, the Army will provide documentation as specified in 36 CFR 800.11 to the SHPO and to any other party maintaining an interest in the historic property adversely affected. The documentation will specify Fort Campbell's efforts to avoid or minimize adverse effects or Fort Campbell's proposed mitigation measures.

The Army will consult with the SHPO and any other consulting parties for a period of 45 days to reach a proposed agreement to resolve the adverse effects. The 45 day consultation period may be extended through mutual agreement by all parties. The Army will internally review any proposed agreement document in accord with Army Regulation 200-1 or other applicable regulations before the Garrison Commander may sign it.

6. If the SHPO disagrees with the Army's proposed mitigation of adverse effects and the disagreement cannot be resolved with further consultation, the Army will forward all relevant documentation to the Council and request Council comment pursuant to 36 CFR Section 800.7(a)(1) and allow the Council 45 days to respond. Any Council comment provided in response to such a request will be taken into account by the Army in accordance with 36 CFR Section 800.7(c) with reference to the subject of the dispute.

F. Native American Consultation

1. The Garrison Commander shall consult with Tribal Historic Preservation Officers and/or other designated representatives of the Native American tribes listed in Attachment C that may have an affiliation with or interest in cultural items found at Fort

Campbell to determine whether and which historic properties within Clarksville Base Historic District at Fort Campbell have religious or cultural significance to each tribe.

2. When any of the undertakings described in Stipulation D2 may affect a known historic property with religious or cultural significance to a Native American tribe, the Garrison Commander will ensure that information regarding the proposed undertaking and the possible effects to the known site are provided to the tribes and that the views expressed are considered in determinations of effect.

3. When a proposed undertaking within Clarksville Base will have an adverse effect on a historic property of religious or cultural significance, Fort Campbell will consult with the tribe or tribes for which the historic property has such significance and Fort Campbell will take into consideration comments and views of such tribes.

G. Discoveries.

Fort Campbell has undertaken reasonable and good faith attempts to identify all historic properties within Clarksville Base Historic District. If, during the implementation of undertakings under this agreement a potentially historic property not previously identified is discovered, Fort Campbell shall:

a. take reasonable steps to avoid, minimize or mitigate adverse effect to such properties until it is assessed by the Fort Campbell Cultural Resources Management program staff.

b. Based on the assessment of the discovery, Fort Campbell shall either

1. find that the discovered property is not a historic property, report the assessment to the Tennessee SHPO and resume normal construction activities.

2. find that the discovered property is similar in nature to those features of Clarksville Base for which treatments have been defined at stipulations A.4 and C.2, document the property to a similar standard as applied to others, report the assessment to the Tennessee SHPO and resume normal construction activities when the documentation is completed.

3. find that the discovered property is different in nature than those for which treatments have been established in this agreement. In this case Fort Campbell will consult with the Tennessee SHPO, the Indian Tribes that may attach religious and cultural significance to the affected property, propose a course of action to resolve adverse effects, and on agreement among the consulting parties, implement the course of action. Fort Campbell may also elect to follow the procedure at 36 CFR 800.13(b)(3) instead. Should the discovery involve human remains or grave sites, Fort

Campbell will comply with the requirements of the Native American Graves Protection and Repatriation Act and other legal responsibilities with respect to cemeteries and graves as applicable to the discovery.

H. Reporting.

Each calendar year by the anniversary of the effective date of this agreement, Fort Campbell will provide to the Tennessee Historic Preservation Officer a report including a list and description of the undertakings initiated within the CBHD. The report shall include maps of the areas affected by these undertakings and the documentation listed in C.2.a-d. The annual report shall also summarize the efforts to complete the general mitigation measures in Stipulations A.1-6, if any of these measures are incomplete at the time Fort Campbell compiles the report.

I. Unanticipated Adverse Effects

Should Fort Campbell become aware of unanticipated adverse effects to historic properties, including CBHD and its contributing features and which were not previously considered under the procedures of this agreement, Fort Campbell shall notify all consulting parties of the unanticipated adverse effect and consult regarding appropriate responses.

Fort Campbell will take reasonable efforts to avoid, minimize, or mitigate the extent of further adverse effects until agreement regarding appropriate responses has been reached.

J. General Dispute Resolution

1. Should any signatory to this PA object to any action carried out or proposed by the Army with respect to implementation of this PA, the installation shall consult with the objecting party to resolve the objection. If the objection cannot be resolved through consultation, the installation shall forward all documentation relevant to the dispute to the Council.

Within thirty calendar days after receipt of all pertinent documentation, the Council shall exercise one of the following options:

a. Advise the Army that the Council concurs in the Army's proposed final decision, whereupon the Army will respond to the objection accordingly;

b. Provide the Army with recommendations, which the Army shall take into account in reaching a final decision regarding its response to the objection; or,

c. Notify the Army that the Council will comment pursuant to 36 CFR Section 800.7, and proceed to comment. The resulting comment shall be taken into account by the Army

according to 36 CFR Section 800.7(c)(4) and Section 110(l) of the National Historic Preservation Act.

2. Should the Council not exercise one of the above options within 30 days after receipt of all pertinent documentation, the Army may assume the Council's concurrence with its proposed response to the objection.

3. The Army shall take into account any Council recommendation or comment provided according to this stipulation with reference only to the subject of the objection; the Army responsibility to carry out all actions under this PA that are not the subject of the objection shall remain unchanged.

4. Should an objection pertaining to this PA be raised at any time by a member of the public, the Army shall notify the parties to this PA and take the objection into account, consulting with the objector and, should the objector so request, with any of the parties to this PA to resolve the objection.

K. Administrative Provisions

1. **Effective Date and Duration**. This PA shall take effect on the date it is signed by the last signatory and will remain in effect for a period of five years unless sooner terminated pursuant to Stipulation J4.

2. **Anti-Deficiency Act Compliance.** The stipulations of this PA are subject to the provisions of the Anti-Deficiency Act (31 U.S.C. Section 1341). If compliance with the Anti-Deficiency Act alters or impairs Fort Campbell's ability to implement the stipulations of this PA, Fort Campbell will consult according to the amendment and termination procedures found at stipulations J3 and J4.

3. **Amendment.** If Fort Campbell, or the Tennessee State Historic Preservation Officer determines that the terms of this PA cannot be met, or that an amendment is necessary, that party shall request that the other party consider an amendment to the PA. Such an amendment shall be executed in the same manner as the original.

4. **Termination.**

a. If the Garrison Commander determines that the Army cannot implement the terms of this PA, or if the Tennessee SHPO or the Council determines that the MOA is not being properly implemented, Fort Campbell, the SHPO or Council may propose to the other parties to this PA that it be terminated.

b. The party proposing to terminate this PA shall so notify all parties to this PA, explaining the reasons for termination and affording them at least 30 days to consult and seek alternatives to termination.

c. Should such consultation fail, Fort Campbell or the SHPO may terminate the agreement by so notifying all parties.

d. Should this agreement be terminated, Fort Campbell shall:

i) Consult in accordance with 36 CFR 800.14(b) to develop a new PA; or

ii) Comply with 36 CFR 800 Subpart B for each individual undertaking of the program covered by this agreement; or.

iii) Comply with the procedures of the Operations PA for each individual undertaking of the program covered by this agreement.

5. Execution and implementation of this Programmatic Agreement and providing a copy of the signed agreement to the Advisory Council on Historic Preservation evidences that the Army has afforded the Council a reasonable opportunity to comment on the program and that the Army has taken into account the effects of the program on historic properties.

FORT CAMPBELL, KENTUCKY

By: _____ Date: 22 DEC 08

FREDERICK W. SWOPE
COL, IN
Commander, USAG

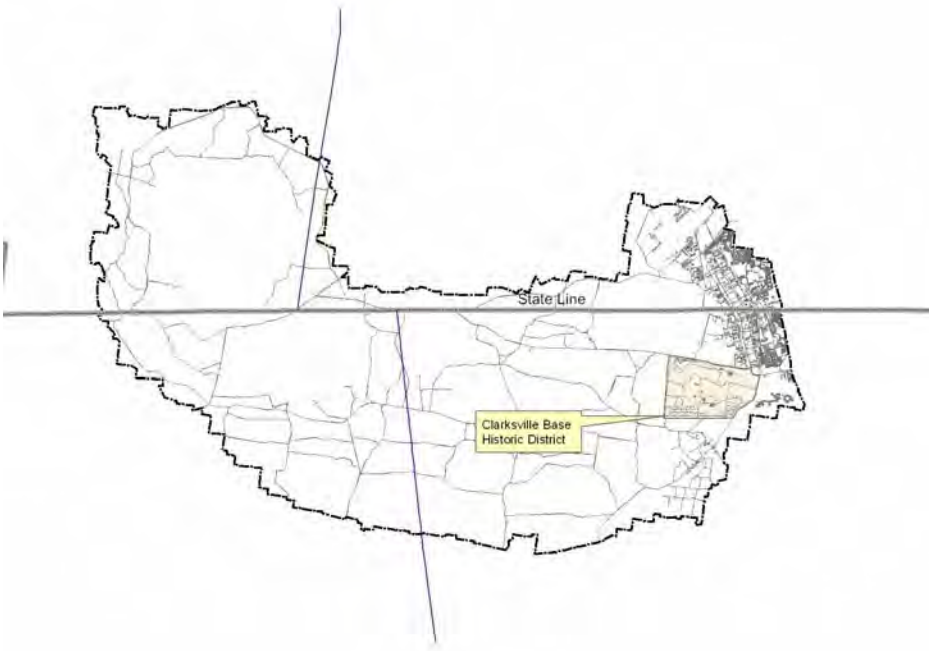
TENNESSEE STATE HISTORIC PRESERVATION OFFICER

By: E. Patrick McIntyre, Jr. Date: 15 Jan 09

Mr. E. Patrick McIntyre, Jr.
State Historic Preservation Officer

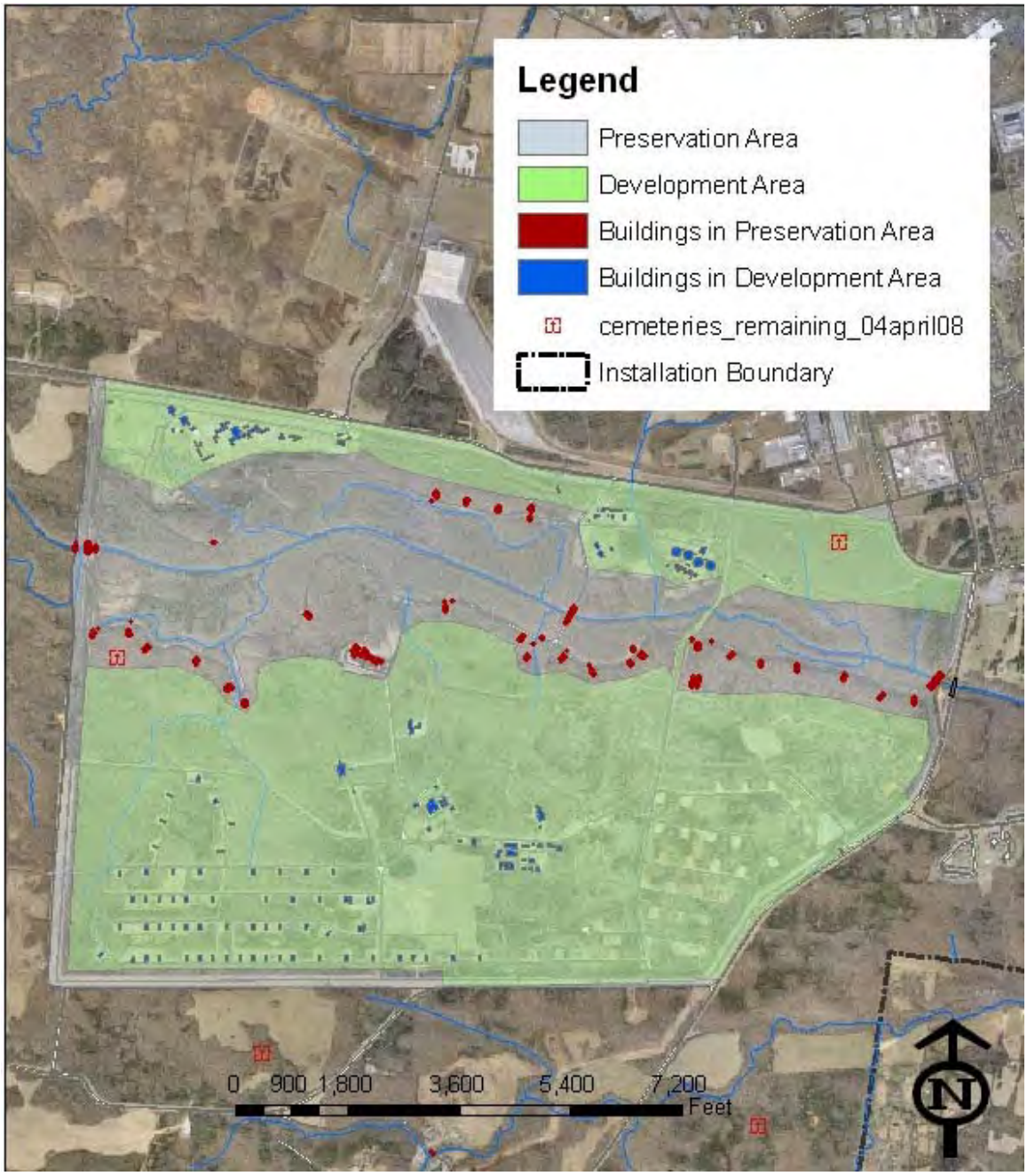
Attachment A

Location of Fort Campbell in Tennessee and Kentucky



Location of Clarksville Base Historic District within Fort Campbell
And in Montgomery County, Tennessee

Attachment B
Development and Preservation Areas
Of Clarksville Base Historic District



Attachment C

Federally Recognized Tribes Consulted

TRIBAL CONTACTS LIST

Absentee-Shawnee Tribe of Indians of Oklahoma

Alabama-Coushatta Tribes of Texas

Alabama-Quassarte Tribal Town

Cherokee Nation of Oklahoma

Chickasaw Nation of Oklahoma

Coushatta Tribe

Eastern Shawnee Tribe of Oklahoma

Eastern Band of Cherokee Indians

United Keetoowah Band of Cherokee

Kialegee Tribal Town

Muscogee Creek Nation of Oklahoma

Poarch Creek Indians

Seminole Tribe of Florida

Shawnee Tribe

Thlopthlocco Tribal Town

Note: This list of consulting tribes differs from the one contained in the Operations PA. The Seminole Tribe of Oklahoma has notified Fort Campbell that it has no interests in the lands now used for Fort Campbell Military Reservation. The email notification reads:

From: Pare Bowlegs [hpo@seminolenation.com]
Sent: Friday, June 16, 2006 1:34 PM
To: richard.davis9@us.army.mil
Subject: Brigade Combat Team: Ft. Campbell.

Mr. Davis,

Sorry for the delayed response from my office. Mr. Emman Spain, the former Historic Preservation Officer, is no longer with the Seminole Nation. He abruptly left after the new election in September 2005. I was hired in January '06 to replace him. Being unfamiliar with Seminole history, Mr. Spain had included States that were outside of our homelands of Oklahoma and Florida, but included Kentucky, Tennessee, Mississippi and the Carolinas. There is no documentation that supports the fact that we ever lived in those States. Please remove the Seminole Nation of Oklahoma from any lists you might have concerning your State.

Thank you.

Sincerely,

Pare Bowlegs

Historic Preservation Officer
Seminole Nation of Oklahoma
Wewoka, Ok. 74884
1-405-257-7292
www.seminolenation.com

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON
FORT CAMPBELL, KENTUCKY 42223-5000

MAY 27, 2003

REPLY TO
ATTENTION OF

Public Works Business Center

Herbert Harper, Director
Tennessee Historical Commission
Clover Bottom Mansion
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. Harper:

Enclosed is the draft Programmatic Agreement by which Fort Campbell proposes to resolve the potential adverse effects of the privatization of family housing through the Residential Communities Initiative program.

This draft Programmatic Agreement should serve as a starting point for consultations. Fort Campbell has used a model agreement for a similar undertaking in which the Advisory Council on Historic Preservation participated in the consultations and helped craft many of the provisions included.

The determination of adverse effect for this project has already been submitted for your consideration. Upon receiving a concurrence with the determination of adverse effect, Fort Campbell intends to move forward with consultations immediately and will invite the participation of the Advisory Council on Historic Preservation as required.

If you have any further questions or concerns regarding this matter, please contact Mr. Neil D. Smith, RCI Program Manager, 931-906-2814, FAX 931-906-2495.

Sincerely,

Michael Davis
Chief, Environmental Division
Public Works Business Center

Enclosures

PROGRAMMATIC AGREEMENT

AMONG

FORT CAMPBELL, KENTUCKY
KENTUCKY STATE HISTORIC PRESERVATION OFFICER
TENNESSEE STATE HISTORIC PRESERVATION OFFICER
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION

FOR THE

PRIVATIZATION OF FAMILY HOUSING AT
FORT CAMPBELL, KENTUCKY

WHEREAS, Fort Campbell pursuant to the Military Housing Privatization Initiative (P.L. 104-106, 110 Stat. 544, Title XXVIII, Subtitle A, Section 2801), which amends 10 U.S.C. 169 by addition of a new subchapter, IV—Alternative Authority for Acquisition and Improvement of Military Housing has determined to privatize family housing at Fort Campbell, Kentucky, through the Residential Communities Initiative (RCI) (Undertaking); and

WHEREAS, under the RCI the Army has selected Actus Lend Lease LLC, to implement the privatization of current and future family housing assets at Fort Campbell, as a member with the Army in a limited liability company that will be known as Fort Campbell Family Housing LLC (FCFH). The privatization of the housing at Fort Campbell will result in the transfer of a long-term interest in the construction, demolition, renovation, rehabilitation, operation, and maintenance of housing and other ancillary facilities at Fort Campbell largely independent of direct government control but intended for the primary use of soldiers and their families; and

WHEREAS, Fort Campbell has determined that implementation of the Undertaking has the potential to adversely effect Historic Properties (as defined in Section I.B below) eligible for the National Register of Historic Places (NRHP), as identified in Attachment A, and has consulted with the Kentucky State Historic Preservation Officer (KY SHPO), the Tennessee State Historic Preservation Officer (TN SHPO), and the Advisory Council on Historic Preservation (ACHP) in accordance with sections 106 and 111 of the National Historic Preservation Act (the Act), as amended, (16 U.S.C. 470 et. seq.) and its implementing regulations found at 36 CFR Part 800 (2000); and

WHEREAS, the Area of Potential Effect (APE) for the RCI program at Fort Campbell includes existing Fort Campbell housing areas and areas proposed for development of new housing and supporting amenities (Attachment A); and

WHEREAS, Fort Campbell has conducted an inventory of Historic Properties and completed an Integrated Cultural Resources Management Plan (ICRMP) identifying properties considered eligible for the National Register of Historic Places within this APE; and

WHEREAS, the effects of demolition of World War II temporary buildings within the APE of this Undertaking are already taken into account under an existing Programmatic Agreement among the Department of Defense, the National Conference of State Historic Preservation Officers (NCSHPO), and the ACHP and no further action shall be required with respect to such buildings; and

WHEREAS, potential effects to all Capehart and Wherry Era housing on Fort Campbell has been taken into account through an Army-wide Program Comment by the Advisory Council on Historic Preservation and there is no further preservation or consultation requirements for these housing areas pursuant to the Act. The Draft Design Guidelines for Capehart and Wherry Era Housing were

considered during preparation of the RCI Community Development and Management Plan and no further action shall be required with respect to such housing units; and

WHEREAS, Clarksville Base Historic District (Historic District), as depicted on Attachment A, is considered eligible for inclusion in the National Register of Historic Places for associations with the storage and maintenance of nuclear weapons early in the Cold War era. Fort Campbell proposes to allow FCFH a permit to use a part of the perimeter trail at Clarksville Base Historic District as a portion of a pedestrian trail and related facilities between two of the family housing areas; and

WHEREAS, Fort Campbell has provided the public an opportunity to comment on the stipulations of this agreement and has considered the public's views; and

WHEREAS, Fort Campbell has provided a copy of this Agreement to federally recognized Indian tribes listed in Attachment B with potential concerns for properties of traditional religious or cultural importance in the Fort Campbell area and has notified the tribes of the potential for future consultation pursuant to Stipulation VIII of this Agreement;

NOW THEREFORE, Fort Campbell, the Kentucky and Tennessee State Historic Preservation Officers, and the ACHP agree that the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the Undertaking on Historic Properties.

STIPULATIONS

Fort Campbell will ensure that the following measures are carried out:

I. NATIONAL REGISTER OF HISTORIC PLACES

A. Fort Campbell has determined the NRHP eligibility for properties within the Area of Potential Effect of the Undertaking in accordance with Section 110(a)(2) of the NHPA and the respective State Historic Preservation Officers have concurred with these determinations. Fort Campbell will make available an information package concerning the NRHP eligibility of these properties to FCFH. This information package will describe NRHP eligible structures and buildings, historic landscapes, and archeological sites that may be present within and adjacent to existing housing developments and areas proposed for development of housing and supporting amenities as identified in Attachment A.

B. Based on analysis of the residential infrastructure, Fort Campbell has determined in consultation with the KY SHPO and the TN SHPO that, except for the properties identified on Attachment A, no other existing buildings, structures, objects, districts or landscapes affected by the Undertaking are now eligible for listing in the National Register of Historic Places under NRHP criteria A, B, C or D (36 C.F.R. 60.4) (hereinafter "Historic Properties"). Fort Campbell will conduct a periodic historic architectural survey for all buildings, structures, and landscapes on Fort Campbell property that have reached fifty years of age since the previous survey. These periodic surveys will occur at five-year intervals. Any new Historic Properties recognized as such under NRHP criteria A, B, C or D (36 C.F.R. 60.4) through this process and administered by FCFH will be subject to the provisions of this agreement and added to Attachment A. This stipulation does not limit any other evaluation and possible nomination that may occur at the discretion of the FCFH or consistent with the requirements of 36 CFR 60, as long as FCFH coordinates with the Fort Campbell Cultural Resources Management Program staff in the preparation of the nomination package and in appropriate nomination procedure.

II. CONVEYANCE ACTIVITIES

A. Fort Campbell may convey long-term interests in family housing units and ancillary improvements to FCFH by real estate instrument, at this time proposed to be a Ground Lease. Fort Campbell will ensure that the Ground Lease shall contain such terms and conditions as necessary and

appropriate to meet the requirements of Sections 106 and 111 of the Act to provide for adequate consideration and treatment of Historic Properties that may be affected by the RCI program. The terms and obligations of this Programmatic Agreement will be incorporated by reference into the Ground Lease.

B. Ground Lease:

1. Before execution of any conveyance or finalization of the Ground Lease for the Undertaking, Fort Campbell shall provide FCFH all previously compiled information on any Historic Properties within the APE to guide FCFH in the management and use of the properties. The Ground Lease shall indicate that the Historic Properties are subject to alternate and more stringent management requirements set forth in Section II. B(3) below.

2. There is no current anticipation that the Undertaking will result in a substantial alteration or demolition of the Historic Properties identified on Attachment A. Fort Campbell will ensure that the Ground Lease prohibits alteration or demolition of Historic Properties without completion of agreed upon actions or further coordination with some exemptions (See Stipulation II.B.3.b).

3. In regard to preservation and upkeep of the Historic Properties, the Ground Lease shall require FCFH, to either:

a. Conform to the management standards and guidelines for treatment of Historic Properties established by the Secretary of Interior ("The Secretary of the Interior's Standards for the Treatment of Historic Properties", 36 CFR Part 68). FCFH is encouraged to conform to the Secretary of the Interior's Standards for Treatment of Historic Properties through development and implementation of management plans for each of the Historic Properties in consultation with the respective SHPO. These plans should be revised periodically and in the event of changed circumstances.

Or;

b. Perform an economic analysis to justify why it would not be economically feasible for FCFH to preserve or maintain specific Historic Properties in accordance with the "The Secretary of the Interior's Standards for the Treatment of Historic Properties". FCFH will submit the economic analysis and its recommended course of action for the Historic Properties in question to the Fort Campbell Cultural Resources Management Program (CRMP) for review and consultation with the respective SHPO. The SHPO will be given a 30-day opportunity to review and comment on the economic analysis and recommended course of action. If the SHPO agrees in writing with the economic analysis findings and the treatment recommendation, FCFH will proceed with the action. If the SHPO disagrees with the economic analysis or the proposed course of action and an acceptable compromise cannot be reached, the Installation, supported by FCFH, and the SHPO will then participate in consultations in accordance with the procedures outlined in 36 CFR 800.

4. The Ground Lease shall require FCFH to have access to and utilize "Qualified Staff" on an as needed basis, for the development of rehabilitation plans, development of historic property management plans, to review and screen proposed projects and work requirements that affect the Historic Properties, and to assist FCFH with Fort Campbell CRMP and SHPO consultations. For the purposes of this agreement "Qualified Staff" is defined as an individual that meets the Secretary of the Interior's Historic Preservation Professional Qualification Standards (as proposed at 62 FR 3307-33723) for Historical Architect, Historical Landscape Architect, or other appropriate profession.

5. The Army will monitor the activities of FCFH and the activities of its property management agent, as they execute the maintenance and upkeep of the Historic Properties to insure compliance with the historic preservation provisions of the Ground Lease.

6. In the case of an emergency FCFH will perform those actions necessary for the protection of the Historic Properties with on site monitoring by Qualified Staff. FCFH is not required to consult with Fort Campbell or with the respective SHPO in advance of emergency actions affecting Historic Properties. Where possible, such emergency measures will be undertaken in a manner that is consistent with the Secretary of Interior's Standards for Rehabilitation. FCFH will notify Fort Campbell CRMP, who will notify SHPO, following execution of all emergency measures affecting Historic Properties. This stipulation applies only to undertakings initiated within 30 days of the emergency and as a response to the emergency. If the response to emergency conditions requires no Design/Build Agreement or Ground Lease modification, FCFH must act in conformance with contract terms previously reviewed by the SHPO and there is no new federal undertaking as defined in this Agreement.

7. The Ground Lease shall include an inadvertent discovery clause as follows. "In the event of discovery of archeological materials during any activity associated with the CDMP, FCFH shall immediately stop work in the area of the discovery and notify the Fort Campbell, Cultural Resources Management Program point of contact. FCFH shall protect the discovery until Fort Campbell has complied with the National Historic Preservation Act, 36 CFR 800.13(b) and any other legal requirements."

8. The Ground Lease shall include provisions that provide for Army review and approval of any successors to ensure that they meet or exceed original RFQ source selection criteria for the developer/partner.

9. Renewal or any material modification to the Ground Lease shall be subject to consultation among the signatories to determine whether such renewal or material modification constitutes a new federal undertaking subject to the provisions of the National Historic Preservation Act.

C. The Army will report to the SHPO on the status of the Historic Properties in an annual asset management report to be prepared by FCFH. This report will include information on the current condition of the Historic Properties, actions taken by the FCFH to maintain the properties in accordance with agreed upon standards, and descriptions of problems encountered that could affect the integrity or upkeep of the Historic Properties.

D. Fort Campbell shall document existing interior and exterior conditions at contributing quarters and at contributing landscapes in the Historic Properties areas within three years of execution of the Agreement. Still photographs shall constitute this record and three copies of the documentation shall go one each to FCFH, Fort Campbell and the respective SHPO. This record will serve as a reference throughout the term of the Agreement and Fort Campbell will provide it to the parties in a hard copy format. Fort Campbell may supplement the record to maintain accuracy and to document modifications to historic properties.

E. The Installation Commander of Fort Campbell shall ensure that any permits for use of the perimeter areas of Clarksville Base Historic District by FCFH for the construction and maintenance of a trail network and ancillary facilities or any other purposes will require timely consultations between FCFH and the Cultural Resources Management Program (CRMP)at Fort Campbell. The CRMP will review proposed actions to determine the effect of the action on the Historic District. If the CRMP makes a determination of no adverse effect, FCFH will be notified and allowed to proceed with the action; the determination and action will be reported in the annual report. If the CRMP makes a determination of adverse effect that cannot be resolved during discussions with FCFH, the Installation, supported by FCFH, will consult with the Tennessee State Historic Preservation Office, using the procedures at 36 CFR 800 or any alternative procedures currently in effect at the time of consultations.

F. Tax Credits

1. Fort Campbell will also inform the FCFH, that Historic Properties may also offer potential advantages in tax benefits under current law. The Tax Reform Act of 1986 (P.L. 99-514;

Internal Revenue Code, Section 47) currently offers a 20-percent tax credit for the certified rehabilitation of certified historic structures. Fort Campbell shall encourage FCFH to explore this benefit via the established application process with the SHPO and National Park Service (NPS) before the start of rehabilitation projects.

2. Any application for historic tax credits shall require review by the SHPO and NPS. These reviews are part of existing procedures available and applicable to any entity or individual that owns historic properties. When FCFH takes advantage of the processes to apply for and receive historic tax credits, the parties to this Agreement concur that these systems should operate in addition to Design/Build Agreement provisions.

III. PROJECT REVIEW and CONSULTATION REGARDING HISTORIC PROPERTIES

A. FCFH will submit to the Fort Campbell CRMP point of contact project plans for all proposed projects that may effect the Historic Properties recognized as such under this Programmatic Agreement that are not exempt in accordance with Section IV hereof. Coordination of this project review may be facilitated through the Fort Campbell Public Works Business Center. The CRMP point of contact will review the project and plans and respond within 15 working days with a determination that the project is either consistent with agreed historic property management plans, exempt from further review, or, if the project plans effecting the Historic Properties do not conform to the Secretary of the Interior's Standards for the Treatment of Historic Properties, that further review and consultation with the respective SHPO is needed If further review and consultation with a SHPO is needed, FCFH will provide all necessary documentation needed to complete the further consultation using procedures consistent with 36 CFR 800 or with any alternate procedures currently in effect for Fort Campbell. Such review and consultation with a SHPO shall be promptly commenced and shall be completed no later than 30 days after the Installation provides all necessary documentation needed to complete the further consultation.

B. Mitigation measures agreed upon during review and consultation will be incorporated into project plans and implementation of projects.

C. Certain actions of FCFH specified in Stipulation IV of this Programmatic Agreement will be exempt from project review in order to expedite the implementation of routine matters which by their nature pose very minimal or no potential to affect Historic Properties. Further project or plan review is not required if the project is covered by one of the listed exemptions. Specific projects that have been implemented using these exemptions should be described in the annual report required in stipulation II.C.1., along with description of how the exemptions were determined to apply.

IV. EXEMPT ACTIVITIES

A. The following activities are exempt from CRMP and SHPO consultations:

1. General operation and maintenance, rehabilitation and/or renovation of existing improvements (other than the Historic Properties identified in Attachment A) and new construction, provided such new construction is not "visible" from the specific historic housing units identified in Attachment A. The parties acknowledge that meaning of the term "visible", as used in the prior sentence, will be quantified separately with respect to each of the historic housing units identified in Attachment A in the applicable historic property development plan which shall be developed for such historic housing unit in consultation with the applicable SHPO in accordance with Stipulation II.B.3(a).

2. Temporary installation of facilities to provide access to Historic Properties by disabled persons, provided these changes make no permanent modification to contributing architectural or landscape elements.

3. Activities that conform to conditions for a Federal historic preservation tax credit.

4. Implementation of the terms of an approved historic properties management plan.

5 Any change to the mechanical systems, kitchen, bathroom or basement spaces of Historic Properties, as long as such change does not affect any significant exterior or interior historic-character defining element.

6. Roadway and parking lot repair, resurfacing, or reconstruction that takes place within the previously maintained roadway or parking lot surfaces.

7. Maintenance, repair, or replacement in-kind of existing sidewalks and curbs, not including historic pavements such as bricks or cobblestones.

8. Routine foot-trail maintenance that does not involve new ground disturbance.

9. Replacement in-kind, matching the configuration, material, size, detail, color and condition of the historic fabric or landscaping.

10. Refinishing in-kind, such as painting or covering surfaces with the same materials and in the same color.

11. Energy conservation measures that are not visible or do not alter or detract from the qualities that make a resource eligible for the National Register, that include but are not limited to the following:

a. Modifications to HVAC control systems, or conversions to alternative fuels.
b. Insulation in roofs, crawl spaces, ceilings, attics, wall, floors, and around pipes and ducts.
c. The installation of storm doors or windows, or insulated double or triple glazing, which match the size, color, profile and other distinguishing characteristics of the historic door or window.

d. Caulking and weatherstripping, provided the color of the caulking is consistent with the appearance of the building.
e. Replacement or modification of lighting systems when the modifications do not alter or detract from the significance of the property.
f. Removal of asbestos-containing materials, provided that the removal does not alter or detract from the qualities that make the resource eligible to the National Register, or provided that replacement is made in-kind both in color and appearance of non-asbestos containing materials.

12. Routine maintenance including landscaping, grass cutting and tree trimming.

B. Activities not listed above shall be completed as directed in Stipulation II.B.3.

V. FISCAL REQUIREMENTS AND SOURCES

The stipulations of this Agreement are subject to the provisions of the Anti-Deficiency Act. If compliance with the Anti-Deficiency Act alters or impairs Fort Campbell's ability to implement the stipulations of this Agreement, Fort Campbell will consult in accordance with the dispute resolution, amendment or termination stipulations as specified in stipulations VI, and VII.C.

VI. DISPUTE RESOLUTION

A. Should the respective SHPO or the ACHP object within 30 days to any plans or other documents provided by the Installation for review pursuant to this Agreement, the Installation, supported by FCFH, will consult with the objecting party to resolve the objection. If the Installation

determines it cannot resolve the objection, the Installation shall promptly forward to the ACHP all dispute-relevant documentation. Within 30 days after receipt of documentation, the ACHP will either:

1. Provide the Installation with recommendations, which the Installation will take into account in reaching a final decision regarding the dispute; or

2. Notify the Installation that it will or will not comment pursuant to 36 C.F.R. 800.7(c). The Installation will take into account any comment the ACHP provides in response to such request and do so in accordance with 36 C.F.R. 800.7(c)(4) with reference to the subject of the dispute.

B. Any recommendation or comment the ACHP provides pertains only to the subject of the dispute. The Installation's responsibility to carry out all other actions under this Agreement, other than those disputed, will not change.

VII. EFFECTIVE DATE, DURATION, AMENDMENT AND TERMINATION

A. This Programmatic Agreement is effective on the last date that all signatories sign. The Army will comply with all terms and stipulations from that date forward.

B. This Programmatic Agreement will be incorporated into the Ground Lease as an exhibit and will become an integral part of the Ground Lease. The Programmatic Agreement will become applicable to FCFH after FCFH has executed and delivered the Ground Lease. The Ground Lease is expected to be a 50 year lease, with an option to renew that lease for 25 more years upon mutual agreement of the Army and FCFH.

C. If a change occurs in the Undertaking that creates new circumstances that Fort Campbell must address, or, if Fort Campbell is unable to carry out the terms of this Agreement, any party to this Agreement may request an amendment in accordance with 36 CFR Part 800.6(c)(7).

D. Should the parties to this Agreement not agree on an amendment or in the event of Fort Campbell's failure to comply with the stipulations of this Agreement prior to execution of a Ground Lease, this Agreement shall be terminated. In such an event, Fort Campbell shall not execute a Ground Lease that has the potential to adversely affect Historic Properties until applicable stipulations of the Agreement are met or it obtains alternative documentation from the ACHP that it has met the requirements of the Act.

E. This Agreement will be in effect so long as the Ground Lease is in effect, unless previously terminated under the provisions of D. above. If the term of the Ground Lease is extended beyond the 75 year period specified in B. above, the parties to this Agreement will consult on the need to renew or amend this Agreement at the time that the Ground Lease is being considered for such extension.

VIII. CONSULTATION WITH FEDERALLY RECOGNIZED INDIAN TRIBES

Federally recognized Indian tribes with potential concerns for properties of traditional religious or cultural importance in the Fort Campbell area which are interested in developing consultation procedures for projects relating to Historic Properties recognized as such under this Programmatic Agreement may consult with the Installation to develop such procedures pursuant to 36 C.F.R. 800.2(c)(2)(ii)(E).

Execution of this Programmatic Agreement and implementation of its terms evidence that Fort Campbell has afforded the ACHP an opportunity to comment on the undertaking to privatize family housing at Fort Campbell, and its effects on historic properties, and that Fort Campbell has taken into account the effects of the undertaking on historic properties.

FORT CAMPBELL, KENTUCKY

By: _____ Date: 29 May 03

Kim L. Summers
Colonel, U.S. Army
Commanding USAG

KENTUCKY STATE HISTORIC PRESERVATION OFFICER

By: _____ Date: 7-11-03

David L. Morgan
State Historic Preservation Officer

TENNESSEE STATE HISTORIC PRESERVATION OFFICER

By: _____ Date: _____

~~Mr. Milton Hamilton~~ Herbert L. Harper
Deputy State Historic Preservation Officer

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By: _____ Date: _____

John Fowler
Executive Director

Fort Campbell Family Housing LLC has reviewed the above terms and stipulations of the Programmatic Agreement. We acknowledge that the above terms and stipulations will become a part of the Ground Lease and that, subject to the terms and provisions of the Ground Lease, they will become binding on Fort Campbell Family Housing LLC, as lessee under the Ground Lease, upon the execution and delivery of the Ground Lease by the Army and Fort Campbell Family Housing LLC following the approval by Congress of the RCI project at Fort Campbell.

FORT CAMPBELL FAMILY HOUSING LLC

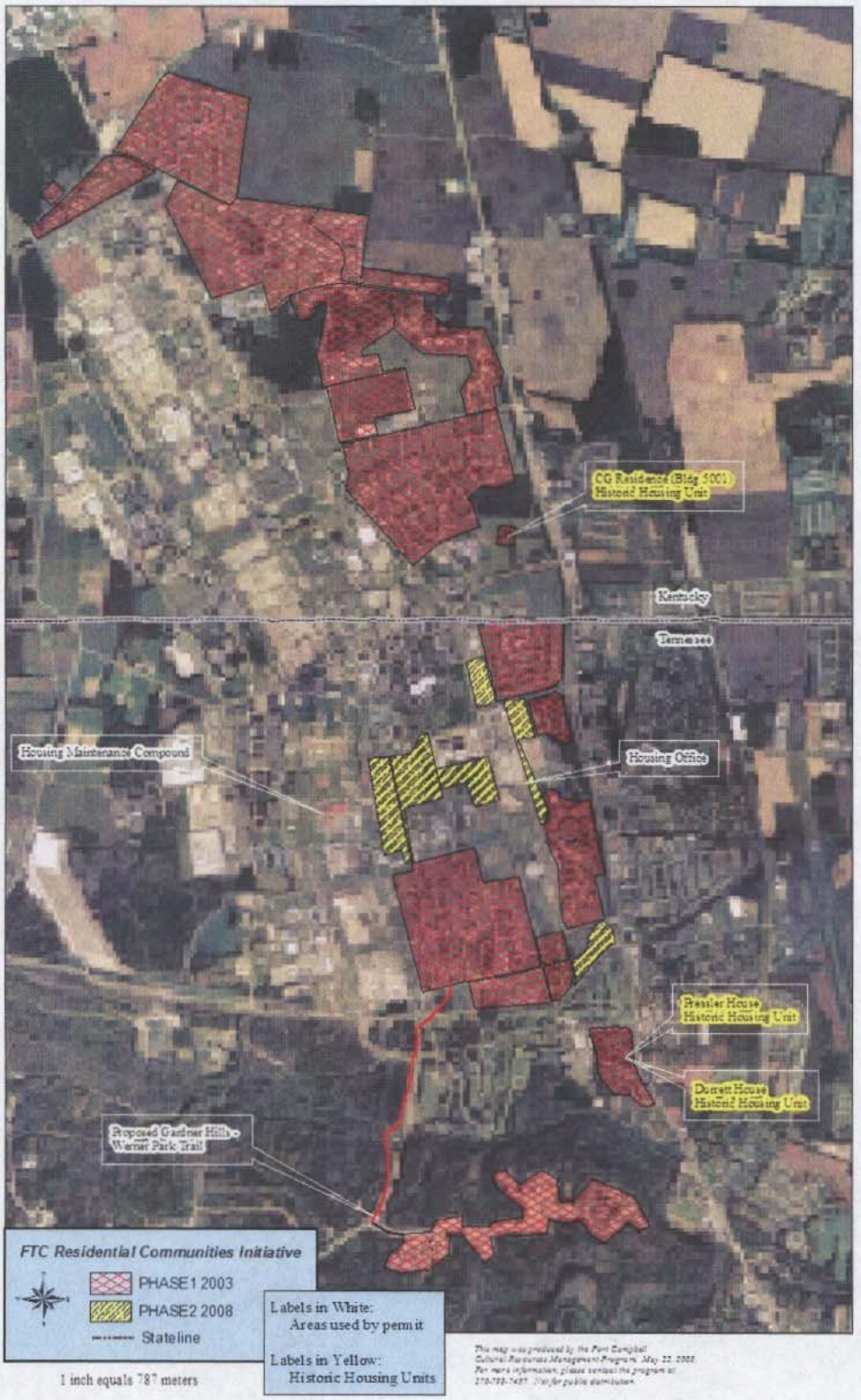
By: FCFH MANAGING MEMBER LLC,
its managing member

By: ACTUS LEND LEASE HOLDINGS LLC,
its sole member

By: _____
Name: Bruce L Anderson
Title: U.P Design & Construction

ATTACHMENT A

PRIVATIZATION OF FAMILY HOUSING AT FORT CAMPBELL, KENTUCKY



ATTACHMENT B

TRIBAL CONTACTS FOR POTENTIAL CONSULTATION
Residential Communities Initiative at Fort Campbell

Absentee Shawnee Tribe of Oklahoma

Alabama-Coushatta Tribal Council

Alabama-Quassarte Tribal Town

Cherokee Nation of Oklahoma

Chickasaw Nation of Oklahoma

Coushatta Tribe

Eastern Shawnee Tribe of Oklahoma

Eastern Band of Cherokee Indians

United Keetoowah Band of Cherokee

Kialegee Tribal Town

Loyal Shawnee

Muscogee Creek Nation of Oklahoma

Poarch Band of Creek Indians

Seminole Tribe of Florida

Seminole Nation of Oklahoma

Shawnee Tribe

Thlopthlocco Tribal Town

Bald Eagle Management Plan

Directorate of Public Works
Environmental Division, Conservation Branch
Fish and Wildlife Program

May 2018

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1.0 Introduction

The purpose of this plan is to provide a consistent management approach to protect and manage Bald Eagles (*Haliaeetus leucocephalus*) and their habitat on Fort Campbell Military Installation. This management plan incorporates federal and state laws, Fort Campbell resource management plans, and applicable management guidelines to implement a comprehensive strategy for Bald Eagle management on Fort Campbell. Bald Eagles are protected under the *Bald and Golden Eagle Protection Act of 1940* (Eagle Act) and *Migratory Bird Treaty Act of 1918* (MBTA). Many human activities can interfere with the Bald Eagles ability to forage, nest, roost, breed, or raise young. Any actions considered as disturbance to eagles is prohibited by the Eagle Act. This management plan is intended to minimize such impacts to Bald Eagles on Fort Campbell and ensure compliance with the Eagle Act and MBTA.

Although the U.S. Fish and Wildlife Service removed the Bald Eagle from its list of endangered and threatened wildlife in 2007, the species remains a federal species of conservation concern. This management plan incorporates inventorying and monitoring for known and potential Bald Eagle nesting, roosting, foraging, and perching sites. Through regular monitoring, the Fort Campbell Fish and Wildlife Program can determine if protections, such as buffer zones and seasonal access restrictions, need to be established.

2.0 Legal Protections for the Bald Eagle

2.1 The Bald and Golden Eagle Protection Act

The Eagle Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" Bald Eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any Bald Eagle ... [or any Golden Eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb'' means:

> "Disturb means to agitate or bother a Bald or Golden Eagle to a degree that causes, or is likely to cause, based on the best scientific information available, injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment. A violation of the Act can result in a criminal fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.

2.2 The Migratory Bird Treaty Act

The MBTA (16 U.S.C. 703-712), prohibits the taking of any migratory bird or any part, nest, or egg, except as permitted by regulation. The MBTA was enacted in 1918; a 1972 agreement supplementing one of the bilateral treaties underlying the MBTA had the effect of expanding the scope of the Act to cover Bald Eagles and other raptors. Implementing regulations define "take" under the MBTA as "pursue, hunt, shoot, wound, kill, trap, capture, possess, or collect."

3.0 Natural History of the Bald Eagle

3.1 Description

Bald Eagles are the second largest birds of prey in North America, only smaller than the California Condor (*Gymnogyps californianus*). Body size varies widely throughout range with largest birds found in Alaska and Canada, and smallest in southeast and southwest. Total length ranges from 71 to 96 cm, wingspans vary from 168 to 244 cm, and body masses range from 3.0 to 6.3 kg (Palmer et al. 1988). Adults usually attain the characteristic plumage of a white head and tail, with a dark body, by 5 years of age. Juveniles are completely dark with some white on the underwing and may be confused with Golden Eagle (*Aquila chrysaetos*). The plumage of male and female Bald Eagles is similar; females are generally about 25% larger than males (Buehler 2000). Both sexes share responsibilities equally at the nest; there are no obvious differences in behavior between the sexes (Stokes and Stokes 1989).

3.2 Range

Bald Eagles are the only species of eagle with a distribution restricted to the North American continent (Grossman and Hamlet 1964). The largest breeding populations in North America occur in Canada and Alaska (USFWS 2006). Bald Eagles are found throughout much of the contiguous 48 states along waterways and impoundments (Figure 1). Although the historic and current distributions of Bald Eagles in the United States are essentially the same (Snow 1973), they have undergone dramatic fluctuations over the past two centuries.

Bald Eagles are recorded from Stewart and Montgomery counties, Tennessee, and Trigg County, Kentucky. During winter, Bald Eagles are found throughout the state of Tennessee near reservoirs or large rivers. In Kentucky, the winter range is concentrated in the southwest portion of the state near the Ohio, Cumberland, and Tennessee rivers; Bald Eagles also winter in the south central portion of Kentucky near the Wolf River (USFWS 1989). One of the largest concentrations of Bald Eagles in Tennessee and Kentucky occurs at Land Between the Lakes National Recreation Area (LBL), where a Bald Eagle reintroduction program was started in 1980. The LBL is located about 10 miles west of Fort Campbell. Between 100 and 150 wintering individuals are found at LBL from December through March (LBL 2006).

Bald Eagles also nest in Kentucky and Tennessee. The Southeastern States Recovery Plan (USFWS 1989) indicates essential nesting habitat in Tennessee occurs along rivers and reservoirs in Stewart County and six other counties west (Lake, Obion), southwest (Benton), south (Humphreys), and southeast (Jackson, Coffee) of Fort Campbell. Essential nesting habitat at LBL is between 10 and 30 miles from the installation, and other essential nesting areas in Tennessee are between 40 and 110 miles away. In the

Figure 1. Distribution of bald eagles in North America.

past decade, the number of Bald Eagle nests has increased dramatically along the Tennessee River and the Cumberland River (T. Henry, pers. comm.). Before 1989, three nests were recorded along Kentucky and Barkley lakes in Stewart County (USFWS 1989). In 1999, 14 nesting pairs of Bald Eagles were observed at LBL. Currently, in addition to numerous nests at LBL, Bald Eagles nest near Dover, Tennessee, about 10 miles southwest of the installation; and near Cadiz, Kentucky, about 12 miles northwest of the installation (T. Henry, pers. comm.).

3.3 Habitat and Limiting Factors

Generally, Bald Eagles are found near bodies of open water (lakes, reservoirs, large rivers) that provide fish and waterfowl prey. While some Bald Eagles reside in a local area throughout the year, some migrate and seasonally occupy different areas. Bald Eagles that nest in southern latitudes may migrate north in late spring and early summer, sometimes as far north as Canada. Eagles that breed at northern latitudes often migrate south to winter near unfrozen lakes and reservoirs. Certain areas may be used year-round

by southern eagles in summer and by northern eagles in winter. Food availability is a primary factor determining habitat use by Bald Eagles. Greater numbers of Bald Eagles may migrate greater distances in years when northern water bodies freeze, compared to years with less extensive freezing.

In southeastern states, Bald Eagles may occupy nesting habitat between September, when nest building is initiated, and June, when young fledge (USFWS 2007). Nesting habitat for the Bald Eagle includes areas with mature trees near or at the edge of a lake or large river where eagles feed (USFWS 1983). Almost all Bald Eagle nests are within 2 miles of a waterbody, with the majority within 0.5 mile of a waterbody. Most Bald Eagles build a nest in a crotch of a large tree near the tree top. The nest is constructed of sticks and may be lined with moss, grass, plant stalks, or sod. Nests are usually 4 to 6 feet in diameter, 3 feet deep, and can weigh as much as 1000 pounds (USFWS 2006). Nest trees are usually greater than 12 inches diameter-at-breast height (dbh) with strong forking branches. Bald Eagles usually choose the largest living tree in the area; dead trees rarely are used for nesting. Bald Eagles seem to prefer foliage above nests for shade and protection from inclement weather. Suitable nest trees have at least one side with a clear view of open water hunting grounds. Eagles tend to nest near foraging areas with easily available prey, and require a clear flight path from nest to foraging area (Green 1985). Eagles will nest farther from water where more extensive flight paths exist. In the southeast, nests are found within the ecotone of forest with marsh or open water (USFWS 1983). The area must have a good supply of prey consisting mainly of fish and waterfowl, although small mammals, reptiles, and carrion are often preyed upon as well. Many Bald Eagles avoid suitable nesting habitat if humans disturb the area.

Breeding Bald Eagles establish territories that may include an active nest and one or more alternate nests. Resident eagles will defend the territory against other eagles. Bald Eagles often return to their nesting territory year after year, and may use different nests within the territory (USFWS 2006).

Bald Eagles wintering in the southeast are typically found near larger rivers, reservoirs, and lakes with readily available food resources; especially when these resources are near one or more suitable night roosts (USFWS 1983). Eagles congregate at good feeding areas and stay until food sources are depleted, or otherwise become unavailable due to winter conditions before moving on (Stokes and Stokes 1989). Wintering eagles sustain themselves on a diet including fish and waterfowl, often taking those that are dead, crippled, or otherwise vulnerable (USFWS 1983). Mammalian carrion also is an important alternate food source at some locations (Green 1985, Lish and Lewis 1975). The winter diet varies with the type of food most readily available.

Wintering eagles roost at night, singly or in groups, in areas sheltered from extreme weather and human disturbance. Typical night roosts are in mature trees with heavy limbs and widely spaced branches (Lish and Lewis 1975). Roost trees are of various species, but typically are large and sheltered from prevailing winds, providing a more favorable thermal environment. Bald Eagles have been reported to travel 12.5 miles or more from feeding areas to a roost site (Edwards 1969, USFWS 1983). Grubb et al. (2002) observed Bald Eagles changing roost sites every 3 to 4 nights. Some trees are apparently so desirable they become traditional communal roosts and are used by more than one eagle over many years. Several authors describe characteristics of preferred roost sites where multiple Bald Eagles gather at a tree(s) to spend the night (Grubb et al. 2002, Lish and Lewis 1975, Steenhof et al. 1980). Diurnal foraging perches typically are large trees near streams, lakes, or other water bodies where the eagles can feed.
Habitat altered by human development typically is not preferred by the Bald Eagle. Habitat alteration from human development is one of the most significant limiting factors in the southeastern states (USFWS 1989).

Human disturbance also may decrease the suitability of Bald Eagle nesting habitat. Disturbance at the nest between the nest building and nestling periods is often a cause of nest failure. Areas with little human activity are preferred nesting habitat. Wintering eagles also may be disturbed by human activity, which may limit Bald Eagle use of otherwise suitable foraging areas (Stalmaster and Kaiser 1997). However, recent studies indicate Bald Eagles are tolerant of certain human activity that is routine and/or was initiated prior to construction of the nest (e.g., routine use of roads or homes) (USFWS 2007). Additionally, Bald Eagles may tolerate human activity that occurs near a Bald Eagle nest, but is shielded from view by vegetation. Human activity that is intermittent, irregular, and/or in full view of the nest may be the most disturbing to Bald Eagles (USFWS 2007). Bald Eagles nesting on lakes in Minnesota apparently have habituated to watercraft; nesting eagles tolerated presence of watercraft except those traveling within about 300 feet of the nest (Grubb et al. 2002). Studies of military activities (e.g., artillery firing, ordnance explosions, automatic weapons fire, helicopter overflights) indicate wintering and nesting Bald Eagles habituate to those activities, but tolerance may vary depending upon the sound intensity, frequency, and proximity of the activity, and individual eagles may respond differently depending upon their experience (Russell et al. 1996, Stalmaster and Kaiser 1997).

3.4 Life History

Bald Eagles usually begin breeding at 4 or 5 years of age, after they have molted into adult plumage (Nicholson 1997). Nest construction begins 1-3 months prior to egg-laying (Buehler 2000). In Tennessee and Kentucky, Bald Eagles typically begin incubating eggs between early February and late April (Nicholson 1997, Palmer-Ball 1996), with the peak occurring around 20 February. Clutch size generally ranges from 1-3 eggs, but 2 is most common (Buehler 2000). Young hatch in approximately 35 days, and fledge 8-14 weeks after hatching (Buehler 2000). The young hatch asynchronously, with a spacing of 1-4 days between hatching. The difference in hatch dates gives first hatchling substantial advantage in food competition. Bald Eagles are highly territorial when raising young and interference from other eagles can result in problems at the nest site. The young usually stay near the nest for several weeks due to their total dependence on the parents for food. At approximately four months, young eagles become independent from their parents and leave the vicinity of the nesting area.

Breeding Bald Eagles occupy territories, areas they will typically defend against intrusion by other eagles. In addition to the active nest, a territory may include one or more alternate nests (nests built or maintained by the eagles but not used for nesting in a given year). The Eagle Act prohibits removal or destruction of both active and alternate Bald Eagle nests. Bald Eagles exhibit high nest site fidelity and nesting territories are often used year after year. Some territories are known to have been used continually for over half a century. They often nest in mature or old-growth trees; snags (dead trees); cliffs; rock promontories; rarely on the ground; and with increasing frequency on human-made structures such as power poles and communication towers. In forested areas, Bald Eagles often select the tallest trees with limbs strong enough to support a nest that can weigh more than 1,000 pounds. Nest sites typically include at least one perch with a clear view of the water where the eagles usually forage. Shoreline trees or snags located in reservoirs provide the visibility and accessibility needed to locate aquatic prey. Eagle nests are constructed with large sticks, and may be lined with moss, grass, plant stalks, lichens, seaweed, or sod. Nests are usually about 4-6 feet in diameter and 3 feet deep, although larger nests exist.

4.0 Recent Species Status Change

The Bald Eagle was listed in 1978 by USFWS as endangered throughout most of its range. It was classified as threatened in Minnesota, Michigan, Wisconsin, Washington, and Oregon. In 1980, only 1250 nesting pairs were known in the lower 48 states. Factors contributing to the species decline include poisoning from pesticides, primarily DDT, and heavy metals in the environment, shooting, habitat loss, and human disturbance at nest sites.

After severely declining in the lower 48 states during the 1970's and 80's, the Bald Eagle population has recently taken a sharp increase in numbers. The USFWS changed the status of the Bald Eagle from endangered to threatened in the lower 48 states 1 August 1995 (CFR 60 [50]). In 2007, the U.S. Fish and Wildlife Service removed the Bald Eagle entirely from its list of threatened and endangered wildlife. The Bald Eagle is listed as "deemed in need of management" by the State of Tennessee and "threatened" in the Commonwealth of Kentucky.

The Bald Eagle is also protected under the Bald Eagle Protection Act (16 U.S.C. 668), which protects the species from take, and disallows the possession, sale, transport, or trade of Bald Eagles, or their parts (e.g., feathers, eggs, body parts) without a permit. The Bald Eagle is also protected under the Migratory Bird Treaty Act (16 U.S.C. 703-721) which prohibits the taking of any migratory bird or any part, nest, or egg except as permitted by regulation.

5.0 Occurrence on Fort Campbell

Historically, Bald Eagles have only occurred on Fort Campbell as occasional visitors, with most sightings near Lake Kyle or Lake Taal. While no systematic surveys for Bald Eagles are conducted on Fort Campbell, the Fish and Wildlife Program has recorded 62 separate observations of Bald Eagles on the installation since 2001 (Table 1). Between one and three Bald Eagles were observed on each occasion. The greatest number of observations have occurred around Lake Kyle and the former Lake Taal (Figure 2). The majority of observations occurred between December and February, but in 2006, Bald Eagles were observed near Lake Kyle between February and May, and again in 2016.

Potential habitat for nesting bald eagles on Fort Campbell is forest within about 0.25 mile of Lake Kyle and the former Lake Taal. However, potential nesting habitat on Fort Campbell is marginal quality compared to the abundant, high quality nesting habitat available less than 5 miles away along the Cumberland River, and approximately 10 miles away at LBL. Bald eagles wintering on Fort Campbell most likely will be found foraging or perching near those water bodies, but could potentially establish roosts in any suitable large tree on the installation. Foraging bald eagles potentially could be observed anywhere on Fort Campbell.

Up until 2018 there were no records of Bald Eagles nesting on Fort Campbell. But on 25 March 2018, an active nest site was recorded just north of Lake Kyle in Stewart County, Tennessee. Fort Campbell biologists confirmed an active nest with one eaglet. Immediate conservation measures were developed and implemented to ensure compliance with the Eagle Act. An active monitoring program was also developed to gather information on the potential impacts of training activities on the bird's behaviors.

Table 1. Observations of Bald Eagles on Fort Campbell between 2001 and 2018.

Date	Location	Birds Observed
14 February 2001	TA 42A	2 adults
15 February 2002	Lake Kyle	1 adult
30 April 2002	TA 30	1 adult
24 October 2002	TA 45	1 adult
29 November 2005	TA 00 (skeet range)	1 adult
1 December 2005	Lake Taal	1 adult
2 February 2006	Lake Kyle	2 adults
22 March 2006	Lake Kyle	2 adults
18 April 2006	Lake Kyle	2 adults, 1 juvenile
9 May 2006	Lake Kyle	2 adults
7 November 2006	Lake Kyle	1 adult
20 March 2007	Lake Kyle	1 adult
21 March 2008	Lake Kyle	1 adult
3 April 2008	Lake Kyle	1 immature
27 April 2008	TA 20	1 adult
10 September 2008	Lake Kyle	2 adults
9 November 2008	Lake Kyle	1 adult
2 December 2008	Lake Kyle	1 adult
3 December 2008	Old Clarksville Base	1 adult
7 December 2008	Lake Kyle	1 adult
10 December 2008	Lake Kyle	1 adult
8 January 2009	Lake Kyle	1 adult
12 February 2009	Lake Kyle	1 adult
7 January 2010	Suckchon DZ	1 immature
26 January 2010	TA 9A	1 adult
23 February 2010	Suckchon DZ	1 adult
13 May 2010	TA 28	1 adult
22 December 2010	TA 48	1 adult
12 January 2011	Lake Kyle	1 adult
4 February 2011	TA 4	1 adult
9 February 2011	Suckchon DZ	1 adult
31 October 2011	TA 19	1 adult
29 December 2011	TA 49	1 adult
11 April 2012	TA 19	1 immature
2 April 2013	TA 13	1 immature
3 April 2013	TA 13	1 adult
24 February 2013	Lake Taal	1 adult
12 December 2013	Lake Kyle	1 adult
4 January 2014	Lake Taal	1 immature
6 January 2014	Lake Kyle	2 adults
6 February 2014	Lake Kyle	1 adult
19 February 2014	Suckchon DZ	1 immature

4 September 2014	TA 9A	1 adult
26 November 2014	Lake Taal	1 adult
16 December 2014	Suckchon DZ	1 immature
5 February 2015	Suckchon DZ	1 immature
30 December 2015	Lake Kyle	1 immature
8 March 2016	Lake Kyle	1 adult, 1 immature
15 March 2016	TA 19	1 immature
18 March 2016	Lake Kyle	1 adult
5 April 2016	Lake Kyle	1 adult
24 May 2016	Lake Kyle	1 adult
24 October 2016	TA 17	1 adult
17 December 2016	Lake Taal	1 adult
29 December 2016	Lake Kyle	1 adult
12 January 2017	Lake Kyle	1 adult
25 January 2017	TA 23	1 adult
3 May 2017	Lake Kyle	1 adult
23 May 2017	Lake Kyle	1 adult
26 October 2017	TA 19	1 immature
19 December 2017	TA 19	1 adult
25 March 2018	TA 31	2 adults, nest

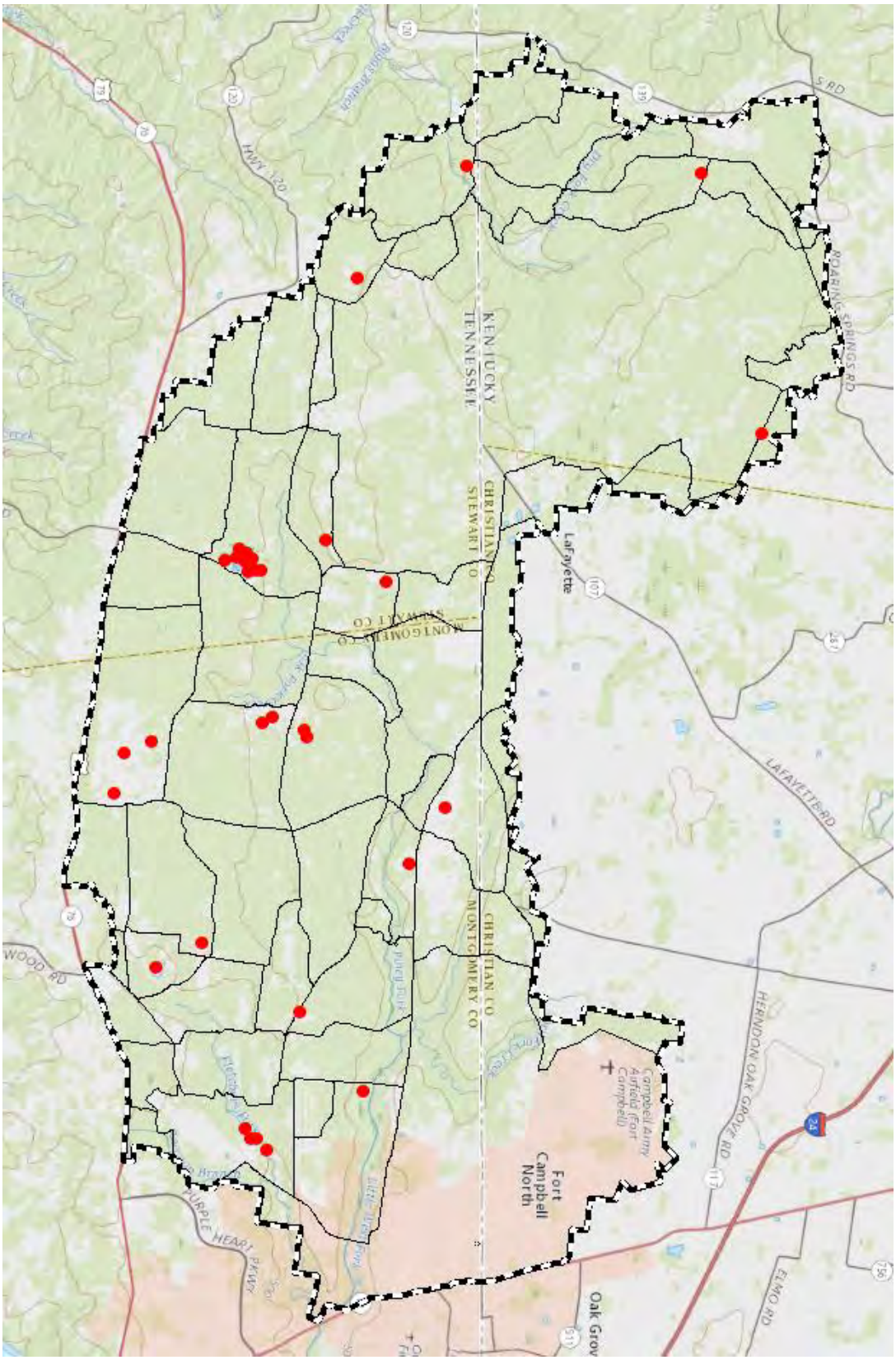

Figure 2. Bald Eagle observations records since 2001 on Fort Campbell.

6.0 Range-wide Conservation Measures

Bald Eagle recovery plans were implemented in five regions in the lower 48 states: Pacific, Southwest, Northern States, Southeast, and Chesapeake Bay area. The Recovery Plan for the Southeastern States (USFWS 1989) addresses Bald Eagles in the region that includes Fort Campbell. Recovery plans are intended to increase numbers of nesting pairs and protect habitat for this species. Additionally, the USFWS has drafted National Bald Eagle Management Guidelines designed to assist land owners in avoiding disturbance to Bald Eagles, as required by the Bald Eagle Protection Act and Migratory Bird Treaty Act (USFWS 2007).

Federal and state agencies in Tennessee and Kentucky are actively monitoring and implementing conservation measures for the Bald Eagle. The USDA Forest Service annually surveys the population of wintering and nesting Bald Eagles within LBL. The Tennessee Valley Authority (TVA) annually surveys winter populations and monitors nesting Bald Eagles along the Tennessee River and certain tributaries, including the Cumberland River. Protection and conservation of Bald Eagles are addressed in land management plans and environmental assessments prepared by those agencies. The TDEC Natural Heritage Program and the Kentucky State Nature Preserves Commission Natural Heritage Program also monitor populations of Bald Eagles in those states.

7.0 Conservation Measures on Fort Campbell

Since discovery of an active Bald Eagle nest in 2018, the Fish and Wildlife Program has implemented the conservation measures to meet the intent of the Bald and Golden Eagle Protection Act. These measures are in accordance with USFWS Bald Eagle management guidance and are intended to exclude activities that have the potential to interfere with the bird's reproductive behavior. Seasonal exclusion zones for military and non-military activities are shown in Figure 3.

Specific measures implemented to reduce impacts to the nest site are:

1) Helicopters and fixed-wing aircraft: Avoid operating aircraft within 1,000 feet of the nest during the breeding season (March-September).

2) Blasting and other loud intermittent noises: Avoid blasting and other activities that produce extremely loud noises within 1/2 mile of active nests (March-September).

3) Non-motorized recreation and human entry: Avoid activities that will be visible or highly audible from the nest and maintain a 330-foot buffer during the breeding season (March-July).

4) Off-road vehicle use: Do not operate off-road vehicles within 660 feet of the nest (March-July).

8.0 Activities with Potential to Affect Bald Eagles

Activities conducted on Fort Campbell that are not consistent with the conservation standards described in Section 7.0 above have potential to adversely affect the species. Deviation from these standards require prior coordination with the Endangered Species Program Manager.

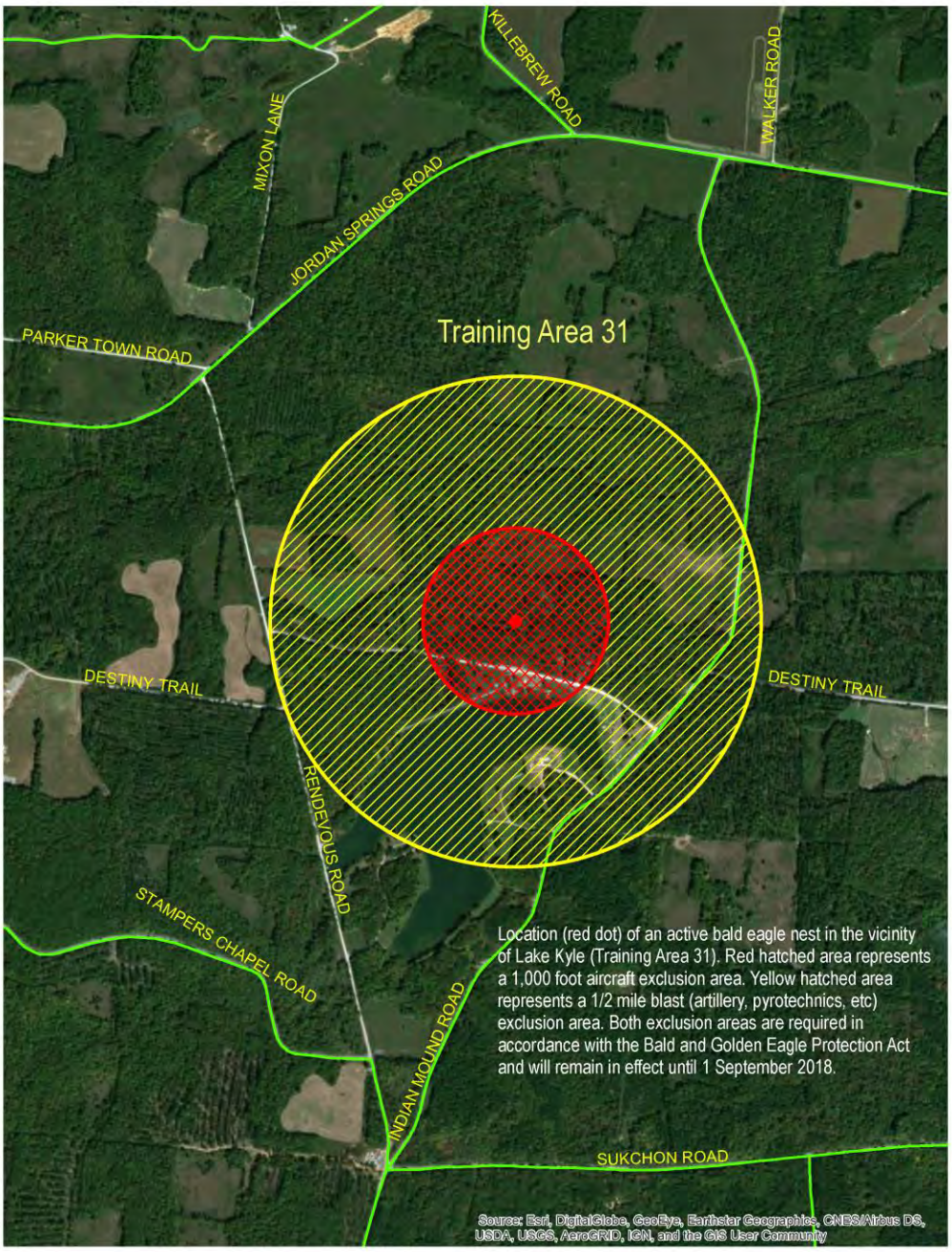

Figure 3. Military and non-military readiness activities exclusion zones.

Historically the Bald Eagle was an occasional visitor; however, since nesting behavior has been recorded by this species several activities that occur on the installation have the potential to affect this species. Activities anticipated to affect the species are:

- Removal of forest within 1 kilometer of the nest location;
- Military activities with frequent loud noises (artillery, mortar, pyrotechnics, generators, etc.) within 1 kilometer of the nest location;

- Military foot and vehicle traffic from the adjacent bivouac site;
- Water quality degradation in Lake Kyle; and
- Impacts to forage resources at Lake Kyle.

To avoid adverse effects to the Bald eagle, the Fort Campbell Fish and Wildlife Program evaluates all installation activities that have the potential to affect protected listed species. The Fish and Wildlife Program may evaluate habitat suitability or conduct a survey to assess the potential for when a proposed activity may affect the species. Consultation with the USFWS is conducted under the Eagle Act and affects are documented in a Biological Assessment. The Fort Campbell Endangered Species Program Manager must be notified and consulted prior to implementation of training or non-training activity that may affect the species.

9.0 Conservation Goals and Management

Management of federally protected species on Fort Campbell is conducted in accordance with the ESA, Eagle Act, MBTA, and U.S. Army regulations and guidance. Conservation, as defined by the USFWS, means the use of all methods and procedures necessary to bring any protected species to the point where conservation measures or protections are no longer necessary. All Army land uses, including military and non-military readiness activities are subject to the Eagle Act requirements for the protection of Bald Eagles and their habitat.

Conservation goals adopted by Fort Campbell to meet requirements set forth in the USFWS management guidance are discussed in this section. Specific objectives designed to achieve each goal are described. Associated monitoring actions are designed to measure ecosystem conditions and progress toward goals. Objectives are described in as much detail as practicable, to allow Fort Campbell to monitor progress toward implementation of objectives. Goals and associated objectives and monitoring actions are designed to avoid adverse impacts to Bald Eagles, and to provide suitable habitat for the long-term stability of current resident populations.

Management of natural resources at Fort Campbell, including endangered species and their habitat, must remain flexible to achieve long-term success. Fort Campbell employs adaptive management to ensure conservation goals and objectives are realistic and effective. Monitoring activities provide data to evaluate the success of management goals and objectives. During the annual review of the INRMP, or more often as appropriate, the INRMP team evaluate the status of management objectives and progress toward goals. Based upon results of monitoring and other new information (e.g., new scientific literature, updated management guidance), resource managers may adjust management objectives to improve achievement of goals and continue support of the military mission. Resource managers may also be required to adapt to unforeseen changes in military mission and legal requirements.

Fort Campbell takes a landscape-scale, watershed-based approach to land management, in which emphasis is placed on maintaining an ecosystem suitable for native flora and fauna. Suitable nesting, roost, and foraging habitat is necessary to support Bald Eagles on Fort Campbell. Several of the goals below address maintaining habitat, monitoring, and education outreach which benefits the bird directly by providing necessary protection, as well as indirectly by providing a sustainable ecosystem that offers abundant prey and foraging habitat in the long term.

9.1 Conservation Goals and Objectives

Conservation goals for the Bald Eagle are described below. Goals are numbered sequentially, with associated objectives and monitoring actions in subheadings beneath each goal.

Goal 1: Ensure all proposed projects on Fort Campbell are in compliance with the Eagle Act.

Objective 1 The Fish and Wildlife Program will support project planning and timely environmental reviews under NEPA to identify potential effects to Bald Eagles and prepare Biological Assessments to support the effect determination.

Objective 2 The Fish and Wildlife Program will coordinate with the USFWS if a proposed action may affect, directly or indirectly, Bald Eagles and their habitat.

Goal 2: Educate the Fort Campbell community about Bald Eagles on the installation.

Objective 1 The Fish and Wildlife Program will support the portion of the Environmental Quality Officers (EQO) course pertaining to Bald Eagles on Fort Campbell. The program educates soldiers and other personnel on individual responsibilities and liabilities under Federal law; the importance of protecting species; and the need for balancing the mission with the conservation of the protected species and their habitats. The Endangered Species Program Manager will annually review EQO course materials, and brochures/flyers pertaining to the species, and update those materials if necessary.
Objective 2 The Fish and Wildlife Program will prepare a single-page flyer about the Bald Eagle and the installation point of contact for reporting Bald Eagle sightings. The flyer will be distributed to EQO courses.

Objective 3 The Fish and Wildlife Program will present educational displays and/or talks about Bald Eagles during Fort Campbell's Earth Day event.

Objective 4 Establish a protocol for hunters, anglers, and other recreational users to report Bald Eagle sightings to the Fish and Wildlife Program. The flyer developed in Objective 2 will be posted on the iSportsman portal/social media and copies made available to sportsmen and women visiting the Fish and Wildlife facility.

Objective 5 Establish a camera system for nest activity observations and link camera output to the internet for public viewing.

Goal 3: Annually review and update this plan as required by AR 200-1.

Objective 1 The Endangered Species Program Manager will annually evaluate the status of this plan's objectives, will identify where revised information potentially creates opportunities or conflicts with other INRMP goals/objectives, and will coordinate with appropriate natural resource managers to resolve the issue.

Goal 4: Improve understanding about the habitat use by Bald Eagles on Fort Campbell, and the regional significance of Fort Campbell to those species.

Objective 1 Annually conduct surveys for the bald eagle at a minimum on twice per month between November and February. The Endangered Species Program Manager will contact the USFWS regarding a regional winter survey protocol. Surveys will be conducted around Lake Kyle and biologists will record observations of eagles and/or eagle nests. When eagles are observed, their age (adult, juvenile) and behavior (perching, foraging, nesting, other) will be recorded. The Endangered Species Program will maintain a database containing observations recorded during surveys, as well as observations reported by others. Results of the report will be communicated to the USFWS by the end of May each year.

Goal 5: Continue to participate in regional conservation planning efforts for the Bald Eagle.

Objective 1 Annually, or more frequently, the Fish and Wildlife Program will coordinate with the USFWS Tennessee and Kentucky Ecological Services Offices to discuss long-term conservation plans and regional trends associated with bald eagles.

Goal 6: Continue to provide suitable habitat on Fort Campbell for Bald Eagles.

Objective 1 To provide suitable roosting, nesting, and foraging habitat for Bald Eagles on the installation, conduct a habitat survey on the current nest location to determine forest metrics. Detailed forest descriptions will provide the baseline used to determine long-term management actions.

Monitoring Action 1 Evaluate results of the habitat survey and determine potential alternative roost/nesting habitat in the vicinity of Lake Kyle.

Monitoring Action 2 Develop GIS database for suitable roost/nest habitat.

Monitoring Action 3 Cooperatively develop a forest management plan to protect Bald Eagle roost/nesting habitat within 1 kilometers of Lake Kyle.

10.0 Internal and External Coordination

All management activities conducted pursuant to this management plan will be coordinated with the appropriate units at Fort Campbell (e.g., G3/ Directorate of Plans, Training, and Mobilization, Cultural Resources Staff). The Endangered Species Program Manager reviews plans for proposed actions to determine if the activity potentially affects protected species. The Endangered Species Program may evaluate habitat suitability or conduct site-specific surveys in the proposed project area to determine the potential for effects to Bald Eagles. Management activities and future projects that may affect Bald Eagles will be coordinated with the USFWS through informal or formal consultations.

Fort Campbell's natural resource activities, including those contained in this plan, are addressed in Fort Campbell's Integrated Natural Resources Management Plan (INRMP), which is coordinated with the USFWS. Additionally, on-going training and non-training activities are coordinated with the USFWS via consultation on project specific biological assessments.

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