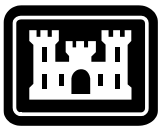
Fort Leonard Wood Military Installation

Directorate of Public Works, Environmental Division

Integrated Natural Resources Management Plan

U.S. Army Maneuver Support Center of Excellence and Fort Leonard Wood

September 2022



US Army Corps of Engineers®

Prepared by Kansas City District
Building Strong

Integrated Natural Resources Management Plan (2022)
U.S. Army Maneuver Support Center of Excellence and Fort Leonard Wood

U.S. Army Garrison
Fort Leonard Wood, Missouri

Reviewed by:

_____

Charlie Neel
Chief, Environmental Division
Directorate of Public Works

Reviewed by:

_____

Leonard L. Hopkins
Director
Directorate of Public Works

Approved by:

_____

Anthony Pollio Jr.
Colonel, U.S. Army
Garrison Commander

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (2022)

U.S. Army Maneuver Support Center of Excellence and Fort Leonard Wood

---

Endorsement

This Integrated Natural Resources Management Plan meets the requirements of the Sikes Act (16 USC 670a *et seq.*) as amended.

Approving Officials:

Anthony Pollio Jr.
Colonel, U.S. Army
Garrison Commander

JOHN WEBER
Digitally signed by JOHN WEBER
Date: 2022.09.26 15:06:57 -05'00'

John Weber
Acting Field Supervisor
U.S. Fish and Wildlife Service
Columbia, MO

Sara Pauley
Director
Missouri Department of Conservation
Jefferson City, Missouri

U.S. Army Garrison
Fort Leonard Wood, Missouri

Integrated Natural Resources Management Plan

U.S. Army Maneuver Support Center of Excellence
and Fort Leonard Wood

September 2022

RESPONSIBLE AGENCY: U.S. Army Garrison, Fort Leonard Wood, Missouri

PREPARED BY: U.S. Army Corps of Engineers, Kansas City District

PREPARED FOR: U.S. Army Garrison, Fort Leonard Wood, Missouri

ABSTRACT: As required by the Sikes Act, this Integrated Natural Resources Management Plan guides implementation of the natural resources program on U.S. Army Maneuver Support Center of Excellence and Fort Leonard Wood (FLW). The program provides management and stewardship guidelines for the conservation and protection of FLW's land and natural resources as well as compliance with applicable environmental laws and regulations. The INRMP helps ensure the maintenance of quality training lands to accomplish FLW's critical military mission on a sustained basis and to ensure that natural resources conservation measures and Army military mission activities are integrated and consistent with federal stewardship requirements.

CONTACT PERSON: Mr. Kenton Lohraff
Wildlife Biologist
DPW Natural Resources Branch
8112 Nebraska Avenue, Bldg. 11400
Forth Leonard Wood, MO 65473
Phone: 573-596-2814
kenton.m.lohraff.civ@army.mil

EXECUTIVE SUMMARY

As we enter the dawn of a new century, the men and women who wear America's uniform stand proud to serve an important role in the continuing efforts to keep our skies clear, our oceans blue, and our precious soils clean. There is no greater gift we can give our children.

Purpose

This Integrated Natural Resources Management Plan (INRMP) guides implementation of the natural resources program on U.S. Army Maneuver Support Center of Excellence (MSCoE) and Fort Leonard Wood (FLW). The program conserves FLW's land and natural resources and helps ensure compliance with environmental laws and regulations. The INRMP helps ensure the maintenance of quality training lands to accomplish FLW's critical military mission on a sustained basis and to ensure that natural resources conservation measures and Army military mission activities are integrated and consistent with federal stewardship requirements.

Environmental Compliance

General

Preparation and implementation of this INRMP are required by the Sikes Act (16 United States Code (USC) 670 *et seq.*), DoD Legacy Resource Management Program (*National Defense Authorization Act, Public Law 104-201, Title 10, Section* 2694 as amended) (DoD 2021), DoD Manual 4715.03 *Integrated Natural Resources Management Plan (INRMP) Implementation Manual)* (DoD 2018), and Army Regulation (AR) 200-1 *Environmental Protection and Enhancement* (DOA 2007).

This INRMP helps FLW comply with other federal and state laws, most notably laws associated with environmental documentation, wetlands, endangered species, and wildlife management in general. Compliance requirements at least partially affecting implementation of the INRMP are listed in Section 2.2, *Compliance Requirements* and Chapter 9.0 *Compliance with Environmental Quality Statutes*. This plan describes how FLW will implement provisions of Army Regulations listed in Section 2.2.5. Specifically, local regulations such as FLW Regulation 210-21, *Hunting and Fishing Regulations* (FLW 2021a) and portions of Fort Leonard Wood Regulation 210-14 (*Ranges, Training Areas, and Training Facilities*) (FLW 2017a).

National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires disclosure of environmental impacts created by proposed major federal actions. 32 CFR Part 651 (*Environmental Analysis of Army Actions, Federal Register Vol. 87, No. 245, December 20, 2019*) 70328 (Proposed Rule) and the Council on Environmental Quality (NEPA Implementing Regulations, 40 Code of Federal Regulations (CFR) Parts 1500-1508 (Phase 1, Final Rule 2022) direct Federal agencies, such as FLW, to conduct the appropriate level of NEPA regarding a Federal action, such as natural resources management plans. In accordance with 32 CFR §651.12 (Army Categorical Exclusions (CXs)), an INRMP

update and its implementation is eligible for CX if activities are similar in type, scope, and intensity to those currently allowed and would result in no new adverse effects on the environment. However, a Record of Environmental Consideration (REC) is required to document that no new adverse effects would occur.

Sikes Act Improvement Act

The Sikes Act, states, *The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation...*

The Sikes Act (16 USC 670 *et seq*.) requires that, consistent with the use of military installations to ensure the preparedness of the Armed Forces, each INRMP shall, where appropriate and applicable, provide for:

- The management of land, forests, fish and wildlife, and fish and wildlife-oriented recreation
- Fish and wildlife protection and enhancement or modification
- Wetland protection and enhancement
- Integration of and consistency among the various activities conducted under the INRMP
- Natural resource management goals, objectives, and time frames
- Sustainable public use of natural resources and public access for such use (subject to requirements necessary to ensure safety and military security and to the extent such use is not inconsistent with the needs of fish and wildlife resources management)
- Enforcement of applicable natural resource laws (including regulations)
- No net loss of the capability of the installation to support the military mission
- Other activities as the Secretary of the Army determines appropriate.

The Sikes Act also requires or provides for:

- 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
- Priority for contracts involving implementation of this INRMP to state and federal agencies having responsibility for conservation of fish or wildlife.

This INRMP includes these items if they are applicable to natural resources management and land use at FLW.

Endangered Species Act

The purpose of the Endangered Species Act (ESA) of 1973 is to protect and recover imperiled species and the ecosystems in which they require. Under the ESA, specific species may be listed as endangered or threatened. All species of plants and animals, except pest insects, are eligible for listing and protection. The ESA is administered by the U.S. Fish and Wildlife Service (USFWS).

This INRMP has the signatory approval of the USFWS. The USFWS signature indicates the INRMP reflects the mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources. This signature approval also includes agreement that the INRMP complies with the ESA. Review of the INRMP is informal consultation with regard to the Section 7 of the ESA. However, any activity with the potential to affect federally listed species, separate informal or informal consultation will be initiated. This would be conducted on a case-by-case basis in accordance with the ESA.

Scope

The INRMP will provide the basis and criteria for protecting and enhancing natural resources using landscape and ecosystem perspectives, consistent with the military mission. The INRMP applies to organizations internal and external to FLW that are involved with or interested in the management or use of FLW natural resources and lands. This application includes active duty units, National Guard and Reserve components, directorates, private groups, and individuals. This INRMP is an integral part of the FLW Installation Master Plan(s).

Relationship to the Military Mission

FLW's principal military missions are basic and advanced individual training in enlisted and officer engineer specialties, basic combat training, Non-Commissioned Officers Academy, Forces Command unit stationing, U.S. Army Military Police School, U.S. Army Chemical School, Enlisted Army Transportation Specialists, Reserve component support, and various other instruction/training activities. The U.S. Army Military Police School provides education and training of military police Soldiers. Military police students are trained in traditional police functions, such as traffic control and crime investigation, fraud investigation, combating terrorism, hostage negotiation, protective services, and counter narcotics investigations. Students are also trained in the areas of battlefield circulation, area security, prisoner of war and civilian prisoner handling, and police intelligence.

The U.S. Army Chemical School provides education and training of selected U.S. military, foreign military, and civilian personnel. These students are trained to detect and identify nuclear, biological, and chemical agents; protect themselves and others from harm caused by nuclear, biological, and chemical agents; and employ smoke and other obscurants to increase soldier combat effectiveness and survivability and construct and detonate flame field expedient deterrents to protect troops in battle.

This INRMP supports the military mission by protecting and enhancing training lands upon which the mission is critically dependent. The INRMP also describes recreational opportunities associated with natural resources to the FLW community, thus supporting the FLW commitment to both Quality of Life and Communities of Excellence programs.

The INRMP describes impacts of the military mission upon natural resources and means to mitigate these impacts. However, this INRMP does not evaluate FLW's military mission, nor does it replace any need or requirement for environmental documentation of the military mission at FLW. Furthermore, the military mission, within the bounds of laws and regulations, takes priority over INRMP implementation.

Partnerships

This document was prepared in partnership and cooperation with the USFWS and the Missouri Department of Conservation, representing the federal and state Sikes Act cooperating agencies, respectively. Other partners in this effort include the U.S. Forest Service, Natural Resources Conservation Service, universities, other federal and state agencies, and other nongovernmental organizations. This INRMP was developed and will be implemented according to principles within the Memorandum of Understanding developed by the DoD, USFWS, and International Association of Fish and Wildlife Agencies.

INRMP Implementation Summary

This INRMP is implemented through a variety funding sources, of which environmental funds make up the majority. Other programs, such as the Integrated Training Area Management (ITAM) program and originations contribute to this effort. The INRMP (Chapters 4, 5, and 7) describes projected management. Each project with its goals and objectives is listed in Appendix A. Section 7.5, *Implementation Funding* lists each project by funding source and provides estimated implementation costs.

Funding and Benefits

- **Funding:** All requirements set forth in this INRMP requiring the expenditure of funds are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31 U.S.C. Section 1341). No obligation undertaken by FLW under the terms of this INRMP will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose.
- **Military Mission Benefits:** Implementation of this INRMP will improve the quality of training land. It will enhance mission realism through the perpetuation of more realistic training lands. It will reduce maintenance costs, improve health and safety, and enhance the capability for long range planning at FLW.
- **Environmental Benefits:** The INRMP provides the basis for the conservation and protection of natural resources. It will help reduce vegetation loss and soil erosion due to military activities, reduce the potential for environmental pollution, protect endangered species, discourage the spread of invasive species, and promote biodiversity conservation. INRMP implementation will increase overall knowledge of the operation of FLW ecosystems through surveys and research.

- **Other Benefits:** Troop environmental awareness will be enhanced while training at FLW. Community relations and FLW's environmental image, internal and external to Defense, will be enhanced. Quality of life for the FLW community and its neighbors will be improved. INRMP implementation will decrease long-term environmental costs and reduce personal and installation liabilities from environmental noncompliance.

Monitoring INRMP Implementation

According to DoD Manual 4715.03, DoD Components review, INRMPs are to be reviewed annually and updated as needed every five years. The INRMP is evaluated through monitoring programs, including the Environmental Performance Assessment System (EPAS) and reviews by Installation Management Command (IMCOM). The list of INRMP goals and objectives in Appendix A can provide a basis for evaluating plan implementation.

NEPA Background and Conclusions

An Environmental Assessment (EA) was incorporated in the initial INRMP (2006) and a finding of no significant impact (FONSI) was determined. An INRMP update was completed in 2017 and subsequently thereafter an EA and FONSI was completed in 2019 to account for the potential environmental effects from the 2017 update. However, under current regulations, 32 CFR §651.12, this 2022 INRMP update and implementation can be classified as a CX and, therefore, only requires a REC to document environmental effects. A REC has been completed and is included in Appendix B.

Summary

The INRMP outlines steps required to meet DOD, U.S. Army, and FLW legal and moral obligations to provide for the stewardship of the natural resources on FLW, while enabling the accomplishment of the military mission. The INRMP has been developed through cooperation with appropriate regulatory agencies. As a public document, it will support and perpetuate the military mission while fostering stewardship and goodwill for FLW, the U.S. Army, and the DoD. This plan will not resolve all existing and/or future environmental issues. It does, however, provide the guiding strategy, personnel, and means to minimize and work toward resolution of such issues.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

1.0 OVERVIEW

1.1 AUTHORITY

The Sikes Act Improvement Act (Sikes Act), as amended (16 USC §§ 670a-670o), requires the Secretary of each military department to prepare and implement an Integrated Natural Resources Management Plan (INRMP) for each military installation in the United States (US) with significant natural resources. Implementation of the INRMP would create potential impacts on the natural and human environment and, as such, requires National Environmental Policy Act (NEPA) documentation per 32 Code of Federal Regulations (CFR) Part 651 *Environmental Analysis of Army Actions.* Specifically, in accordance with 32 CFR §651.12 (Army Categorical Exclusions (CXs)), the implementation of this 2022 INRMP update can be categorized as a CX because activities are similar in type, scope, and intensity to those currently allowed and would result in no new adverse effects on the environment. A Record of Environmental Consideration (REC) has been prepared to document environmental effects (Appendix B).

1.2 SCOPE

This INRMP has been prepared by U.S. Army Corps of Engineers (USACE) Kansas City District for the U.S. Army Maneuver Support Center of Excellence (MSCoE) and Fort Leonard Wood (FLW) Directorate of Public Works, Environmental Division. The geographical scope of this INRMP would be limited to lands, leased or owned, that are managed by FLW. Additionally, INRMPs are intended to be dynamic documents that are reviewed annually, updated as needed, and reapproved not less than every five years (DoDI 4715.03).

1.3 RESPONSIBILITIES

1.3.1 Fort Leonard Wood

Below discussions of FLW organizations primarily deal with natural resources related responsibilities. Relationships between the Natural Resources Branch (NRB) and other organizations are emphasized.

Garrison Commander/Garrison Chief of Staff. The Garrison Commander 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 operations that occur on FLW.

The Garrison Commander bears ultimate responsibility for management of natural resources on FLW, including its land and wildlife. The Garrison Commander is responsible for approving the INRMP and acting through the personal and special staff, directors, and separate commanders, for implementing Army Regulation (AR) 200-1 Environmental Protection and Enhancement (DOA 2007) :

- 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
- 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 Part 651, *Environmental Analysis of Army Actions*
- 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.

Public Works. The Directorate of Public Works (DPW), acting through the Chief of the Environmental Division, is responsible for:

- Managing all phases of FLW's Natural Resources Program with appropriate natural resources management professionals
- Developing and implementing programs to ensure the inventory, delineation, classification, and management of all applicable natural resources to include wetlands, scenic areas, endangered and threatened 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 FLW's natural resources management program
- Preparing and submitting conservation reporting requirements

Responsibilities of the Chief, Environmental Division include the protection and management of wetlands, identification and protection of cultural resources, and compliance with NEPA. The Pest Management Section is within the Environmental

Division, and its functions as they relate to natural resources are discussed in Section 4.13, *Pest Management*.

The FLW NRB, acting through the Land Management, Forestry, Fish and Wildlife and Cultural Resource programs, carries out all integrated natural resource management functions assigned to the Environmental Division. Responsibilities for the Land Management Program include:

- Ensuring that the terrain of FLW supports military training activities
- Protecting, and where possible, improving the quality of land and water resources
- Protecting land investments from depreciation by adopting land use practices based upon soil capabilities
- Supporting development and implementation of the Integrated Training Area Management (ITAM) program on FLW
- Preventing facilities from contributing to wetlands destruction through erosion by protecting wetlands and floodplains and their functions
- Improving the appearance of the installation and associated facilities through the preservation of natural terrain and vegetation and by appropriate new plantings
- Conserving populations of threatened and endangered plants and their habitats
- Ensuring the preservation and protection of archaeological, historical, and architectural resources from damage during natural resources management

Responsibilities specific to the Forestry Program include:

- Supporting development of wildlife habitats on FLW
- Implementing Wildland Fire Management Plan
- Implementing Forest Management Plan (FLW 2016a)
- Implementing and incorporating the best suited management practices on a site-specific basis for FLW forestry
- Supporting development and implementation of the ITAM program on FLW
- Providing forest products via sound scientific forest management, to include timber sales

Responsibilities specific to the Fish and Wildlife Program include:

- Planning and implementing fish and wildlife management tasks via biologically sound fish and wildlife management techniques
- Providing expertise and support to the Installation Commander to ensure FLW compliance with restrictions set forth in the Endangered Species Act (ESA)and other applicable laws
- Cooperating with the Missouri Department of Conservation (MDC) and the Directorate of Morale, Welfare and Recreation (DFMWR) to set hunting season opening and closing dates, bag limits, and other regulations governing harvest of fish and game on FLW, FLW Reg 210-21 *Hunting and Fishing Regulations*, (FLW 2021a)

- Cooperating with state and federal fish and wildlife management agencies in fulfillment of installation fish and wildlife management duties and responsibilities
- Coordinating with the Military Police Command to ensure federal, state, and installation laws and regulations pertaining to fish and wildlife are enforced
- Coordinating the preparation and implementation of threatened and endangered species management and recovery plans by providing direction of forest, fire, and wetlands management conducted in endangered and/or threatened species habitat
- Administer and update the iSportsman online resource
- Coordinating with Range Operations to ensure that an up-to-date roster of closed areas and areas designated for hunting and fishing is available at all times
- Assist in facilitating game check stations to collect biological and other data (as requested) during state managed deer hunts and/or other hunting seasons
- Manage all species; habitats; budget (21X series funding) outreach (conservation councils); scientific research; manage conflicts; and facilitate interagency involvement

Responsibilities specific to the Cultural Resources Program with regard to natural resources include coordinating projects with natural resources personnel responsible for endangered species, wetlands, timber areas, and land use.

Commander, Director of Plans, Training, Mobilization and Security (DPTMS), Range Division. The DPTMS, Range Division is responsible for implementation and/or support of portions of this INRMP which directly affect or interact with training responsibilities including:

- Operating and maintaining FLW range areas, associated training facilities, field training sites, and range equipment
- Preparing, maintaining, and enforcing Post Range Regulations FLW Reg 210-14, (FLW 2019)
- Developing and implementing FLW's ITAM in DPTMS program for training area monitoring (Range and Training Land Assessment Program), providing geographic information system (GIS) support for ITAM in DPTMS, rehabilitating damaged training land (Land Rehabilitation and Maintenance (LRAM)), providing environmental awareness (Sustainable Range Awareness), and providing the interface between training requirements for land use and the capability of land and natural resources to support that training (Training Requirements Integration)
- Coordinating with and informing DPW of military training requirements and objectives as it relates to the implementation of short- and long-term range development plans
- Coordinating with DPW on training activities that may affect fish and wildlife, forests, wetlands, or cultural resources
- Work with Range Operations to provide a daily update of open/closed management areas for access to outdoor enthusiasts

Director of Morale, Welfare and Recreation. The DFMWR establishes procedures and governs various aspects of installation morale, welfare and recreation activities.

The Chief, Community Recreation Division, develops and executes the Community Recreation Program and manages all attendant facilities. Responsibilities of Community Recreation Division's Sportsmen's Center include:

- Planning and implementing the installation Outdoor Recreation Program
- Supervising and maintaining outdoor recreation activities
- Collecting fees and charges for equipment rental
- Coordinating with the NRB to plan and conduct group fishing activities
- Planning, developing, and managing facilities relating to fish and wildlife resources, such as camping areas, boat ramps, and fishing piers
- Participating in national and state-sponsored hunting and fishing events, such as National Fishing Week and National Hunting and Fishing Day

Maneuver Center Safety Office. The Safety Office manages the safety and occupational health program. The Safety Office is the proponent, world-wide, for the Army's Chemical, Engineering, and Military Police branches, ensuring integration of safety into all phases of the development of new systems for all three branches. This is done in a military training, multi-service, Army schools, and base operations environment.

Public Affairs Office. The Public Affairs Office is responsible for promoting an understanding of FLW among its various publics and providing professional public affairs advice and support to installation leaders and activities. The Public Affairs Office is an important component of FLW's natural resources program, especially in disseminating information critical to the success of the program. Specific responsibilities include:

- Supporting FLW's natural resources program by providing news releases and public information notices of activities important to the installation or community, to include National Hunting and Fishing Day and National Fishing Week
- Assisting DPW in promoting, publishing, and promulgating natural resources information for public release in support of the command, the resource, and the resource user

Directorate of Contracting. The Directorate of Contracting provides centralized contracting support to the MSCoE and FLW, satellite/tenant activities, and activities/units in FLW's area of responsibility. Support to the natural resource program includes:

- Providing contract support to DPW for management of land, forest, and fish and wildlife
- Providing contract support to Director of Morale, Welfare and Recreation for implementation of the outdoor recreation program
- Providing contract support to Law Enforcement Command with implementing natural resource law enforcement responsibilities

Staff Judge Advocate. The Staff Judge Advocate provides legal advice and counsel and services to Command, staff, and subordinate elements of the MSCoE and FLW.

Specific Staff Judge Advocate responsibilities with regard to integrated natural resource management include:

- Conducting legal research and preparing legal opinions pertaining to interpretation and application of laws, regulations, statutes, and other directives affecting the administration of personnel, business, property, or financial operations on the installation
- Coordinating with the Department of Justice, Litigation Division of the Office of the Judge Advocate General, and other governmental agencies on all matters Pertaining to litigation for the Federal Government
- Providing legal advice and guidance on legal aspects of procurement, policies, sanctions, and other documents
- Reviews appropriated fund contracts over $100,000 and non-appropriated fund contracts over $25,000 for legal sufficiency, and providing legal advice and counsel concerning military affairs, legal assistance, and procurement to FLW agencies

Fort Leonard Wood Conservation Council. The FLW Conservation Council is a non-governing advisory body to the Garrison focused on recreational use of natural resources on FLW. The Council helps plan, execute, and monitor actions listed in the INRMP, including fish and wildlife conservation, land management, and outdoor recreation, to ensure compliance with the military mission on FLW. This includes the management, harvesting, and exploitation of available resources to maintain and improve hunting, fishing, and other natural resources. The Council also provides a forum for addressing issues on management, law enforcement, and policy pertaining to hunting and fishing. The Council meets quarterly to address conservation related issues, establish permit quotas, and approve management plans and budgets submitted by the Wildlife Biologist.

Other Installation Organizations. Implementation of this INRMP will require assistance from other directorates and organizations. Such organizations include, but are not limited to, the Directorate of Logistics (supply and transportation), Directorate of Resource Management (budget, personnel, and equipment authorizations), Installation Management Command (IMCOM), and First Engineer Brigade (equipment and operations support for projects).

1.3.2 Other Defense Organizations

Army Environmental Command. The Installation Management Command, Headquarters, located at Fort Sam Houston, Texas, provides oversight, centralized management, and execution of Army environmental programs and projects. Army Environmental Command is a subcommand of IMCOM-HQ that provides technical support in the areas of NEPA, endangered species, cultural resources, environmental compliance, and related areas.

U.S. Army Corps of Engineers. The USACE, Kansas City District, assists FLW by administering contracts for outside or other agency support. These contracts include cultural resources management and surveys, wetlands surveys, and other planning

services. The Kansas City District administers timber sales on FLW as part of real property contracts. It also is responsible for issuing wetland permits in accordance with Section 404 of the Clean Water Act.

Construction Engineering Research Laboratory. The USACE Construction Engineering Research Laboratory assists FLW in implementation of the ITAM in DPTMS program, as funding allows. The Construction Engineering Research Laboratory is available for reimbursable natural resources technical support and research, and has been used for cultural resources work in the past.

Army Public Health Center. The Army Public Health Center is a support agency for the pest management program on FLW. However, it also has other responsibilities and functions that impact on FLW. The agency has investigated for incidence of Lyme disease and Hantavirus in the past. They have also supported the preparation of Installation Compatible Use Zones for FLW.

1.3.3 Other Federal Agencies

U.S. Fish and Wildlife Service. The USFWS, Region 3, has a field office in Columbia, Missouri that provides technical advice for management of natural resources on FLW, particularly endangered and threatened species. 50 CFR 402 provides guidance to be followed by FLW when dealing with the USFWS for endangered species management. USFWS can also enter into interagency agreements with installations, such as FLW, to help implement INRMPs. Agreements could include assessments and surveys, fish stocking, invasive species control, and hunting and fishing program management.

The USFWS is a signatory cooperator in implementation of this INRMP in accordance with the Sikes Act. Appendix C contains specific items of agreement among the USFWS, MDC, and FLW, as required by the Sikes Act. This INRMP supersedes the *Integrated Natural Resources Management Plan 2006-2010 and 2017-2021, U.S. Army Maneuver Support Center and Fort Leonard Wood, Missouri* (INRMP 2006, 2017).

U.S. Forest Service. The Mark Twain National Forest provides forest management project support to FLW under a Wildland Fire Suppression Mutual Agreement and in conjunction with the Interagency Cannon Range Prescribed Burn Project. The Wildland Fire Suppression Mutual Agreement is anticipated to be updated by 2023. Additionally, the U.S. Forest Service and FLW are continuing to resolve an Interservice Agreement regarding Stone Mill Spring Recreation Area and a land exchange proposal.

U.S. Department of Agriculture. (feral pigs, food plots, fire break, invasive species)

U.S. Geologic Survey. The U.S. Geologic Survey (USGS) is available to assist FLW for surveys and studies. Projects performed in the past include water quality testing, dye testing, aquifer mapping, and watershed modeling.

1.3.4 State Agencies

Missouri Department of Conservation. MDC works to control, manage, restore, conserve, and regulate bird, fish, game, forests, and all other wild resources in the state. MDC provides technical advice and assistance for programs relating to natural resources, or more specifically, fish and wildlife. MDC provides support to FLW's natural resources management program primarily in the areas of fisheries, wildlife, endangered species, and law enforcement. The Natural History Section provides information regarding sensitive biological resources.

The MDC, through the Director, is a signatory cooperator in implementation of this INRMP (16 USC 670a). This INRMP (2022) supersedes the 2006 and 2017 INRMPs. Appendix C contains specific items of agreement among MDC, USFWS, and FLW as referenced in Section 1.3.3.

Missouri State Historic Preservation Office. The Missouri State Historic Preservation Office (SHPO) works with individuals and groups throughout the state to identify, evaluate, and protect Missouri's diverse range of historic, architectural, and archaeological resources. The SHPO funds and coordinates surveys, nominates significant properties to the National Register of Historic Places, and maintains the state's cultural resources inventory. The SHPO is responsible for Section 106 review of federally funded or assisted projects to ensure compliance with federal preservation legislation. The SHPO assesses the significance of properties within project areas, reviews the impact of projects on significant resources, and consults with agencies to develop ways to avoid or mitigate damage to the resources.

1.3.5 Native American Tribes.

The United States has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the United States, treaties, statutes, executive orders, and court decisions. Since the formation of the Union, the United States has recognized Indian tribes as domestic dependent nations under its protection. Executive Order 13175 and the *American Indian and Alaska Native Policy* (DoD 2006) establish regular and meaningful consultation and collaboration with Indian tribal governments. FLW provides a process that permits elected officials and other representatives of Indian tribal governments to provide meaningful and timely input on actions or policies that might be of tribal interest, such as those that affect sacred or Indian cultural sites.

Federally recognized tribes that may be consulted with in regard to these issues include:

- Kaw Nation
- Omaha Tribe of Nebraska
- Osage Nation
- Ponca Tribe of Oklahoma
- Ponca Tribe of Nebraska
- Quapaw Nation

1.3.6 Universities

Regional universities have provided specialized expertise to support management of natural resources on FLW. The University of Missouri, Missouri University of Science and Technology, Texas State University, Missouri State University, and Colorado State University have assisted FLW by providing personnel support. University of Missouri, et al., also provides research under the Strategic Environmental Research and Development Program for species such as salamanders and bats at FLW. The University of Illinois and Illinois State Museum have provided support to FLW via USACE, Construction Engineering Research Laboratory.

1.3.7 Municipalities

The Cities of Waynesville and St. Robert are located directly north of FLW. A majority of the workforce is located in these cities or other cities near FLW. Additionally, the City of Waynesville is under contract by FLW to operate the Stray Animal Facility located in Building 2396 on FLW. Contracted city workers at this facility detain, manage, and see to stray animals or pets captured on FLW. The initial contract agreement period through date is May 31, 2030, to be renewed annually for the duration of the agreement period.

1.3.8 Other Interested Parties

Organizations interested in the implementation of this INRMP include, but is not limited to, the Clay Howlett Chapter of the National Wild Turkey Federation, Ozark Chapter of the Sierra Club, Big Piney Chapter of Ducks Unlimited, Missouri Coalition for the Environment, and Heartwood.

FLW uses contractors for many programs associated with natural resources, including INRMP preparation, collection of biological data, NEPA documentation, groundwater testing, and cultural and archaeological surveys. This source of expertise will continue as needed.

1.4 GOALS AND OBJECTIVES

The natural resources mission is to provide professional management and stewardship of natural resources at Fort Leonard Wood to achieve optimum, sustainable use of training lands, promote biodiversity and ecosystem functionality, provide opportunities for multiple compatible uses of natural resources, and comply with environmental laws.

Below are general FLW natural resources goals and objectives used to attain them. Some objectives fit more than one category. When this occurs, the most-fitting category was chosen.

Goal 1. Provide quality natural resources as a critical training asset upon which to accomplish the military mission of FLW.

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

Objective 2. Maintain quality training lands through range and training area monitoring, damage minimization, mitigation, and rehabilitation (*i.e.*, execution of the ITAM in DPTMS program).

Goal 2. Comply with laws and regulations that pertain to management of FLW natural resources.

Objective 1. Manage natural resources within the spirit and letter of environmental laws, particularly the Sikes Act upon which this INRMP is predicated.
Objective 2. Protect, restore, and manage sensitive species (e.g., imperiled species and endemic species) and ecosystems (e.g., wetlands, glades, and riparian zones).
Objective 3. Use procedures within the NEPA to make informed decisions that include natural resources considerations and mitigation.
Objective 4. Ensure FLW's natural resources program is consistent with the protection of cultural and historic resources.
Objective 5. Implement this INRMP within the framework of Army policies and regulations. *Integrated Natural Resources Management Fort Leonard Wood Plan/Environmental Assessment Missouri*
Objective 6. Protect and manage threatened and endangered species and critical habitat in accordance with the ESA, NEPA, AR 200-1, USFWS regulations and agreements, and other applicable laws or guidance from higher headquarters.
Objective 7. Implement the INRMP within the assessment and design of Remedial Action Plans projects including those funded through the Comprehensive Environmental Response, Comprehension, and Liability Act (CERCLA). Assessments and actions should follow USFWS guidance: CERCLA Site Cleanup 63 related to imperiled species and the U.S. Environmental Protection Agency (USEPA) CERCLA Compliance with Other Laws Manual: Interim Final 65.

Goal 3. Manage natural resources on FLW to assure good stewardship of public lands entrusted to the care of the Army.

Objective 1. Use adaptive ecosystem management strategies to protect, conserve, and enhance native fauna, flora and associated habitats.
Objective 2. Monitor and manage soils, water, vegetation, and wildlife on FLW with a consideration for all biological communities and human values associated with these resources.
Objective 3. Give special management consideration to species listed by the state of Missouri in the natural resources management program.
Objective 4. Allow harvest of human-valued (e.g., hunting, fishing, and foraging) when such products can be managed in a sustainable fashion without significant negative impacts.
Objective 5. Ensure the FLW natural resources program is coordinated with installation organizations, other agencies, and conservation organizations with similar interests.
Objective 6. Support professional enforcement of natural resources-related laws.
Objective 7. Ensure environmental quality efforts and opportunities are met to the extent practical.

Goal 4. Improve the quality of life of the FLW and surrounding communities through quality natural resources-based recreation opportunities.

Objective 1. Provide high quality opportunities for hunting, fishing and other consumptive recreational activities within biological and recreational carrying capacities of the resources.
Objective 2. Provide opportunities for non-consumptive outdoor recreation, such as picnicking, camping, nature study, etc.
Objective 3. Provide conservation education opportunities.
Objective 4. Use the iSportsman program to improve communication for recreational access on FLW.

The ability to achieve these goals, including direct support of the military mission, depends directly on the health and condition of natural resources at FLW. Properly functioning ecological conditions at the installation provide the vegetation, soil, and water resources needed for realistic military training. These same conditions provide opportunities for outdoor recreation that are important assets to both military and civilian communities associated with FLW.

1.5 STEWARDSHIP AND COMPLIANCE

Compliance with federal and state regulations and guidelines is an integral part of the stewardship of natural resources on FLW as well as the Lake of the Ozarks Recreational Area (LORA) site. Stewardship can be better defined as the responsible use of natural resources, to include conservation, in a way that takes full and balanced account of the interests of the Army, state and federal laws, stakeholders, the public, and future generations. This includes the specific needs of each interested party. As part of good stewardship, managers must comply with federal laws and applicable state laws regarding natural resources. Much of these laws are intended to promote good stewardship of resources in which they protect. AR 200-1 provides further details regarding environmental stewardship.

1.6 OVERALL MANAGEMENT STRATEGY

This INRMP uses an ecosystem-based management approach to support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Over the long-term, this approach maintains and improves the sustainability and biological diversity of terrestrial and aquatic ecosystems while supporting sustainable economies, human use, and the environments required for realistic military training operation. Installation natural resource managers consider and use a full and evolving array of ecosystem-based management tools as appropriate. This management strategy aligns with DoDM 4715.03 Enclosure 6.

1.7 REVIEW AND REVISION PROCESS

According to the Sikes Act all installations must keep their INRMPs current. INRMPs undergo an annual internal review and are updated or revised as necessary. Installations invite the USFWS and the appropriate state agency to participate in the annual review process. In addition to DoD’s annual review policy, the Sikes Act requires that USFWS and state formally review INRMPs for operation and effect at least every

five years. However, because the 2022 INRMP update qualifies for CX with an associated REC, it does not require a public notice or comment period.

1.8 NEPA INTEGRATION

An Environmental Assessment (EA) was incorporated in the initial INRMP (2006) and a finding of no significant impact (FONSI) was determined. An INRMP update was completed in 2017 and subsequently thereafter an EA and FONSI was completed in 2019 to account for the potential environmental effects from the 2017 update. However, under current regulations, 32 CFR §651.12, this 2022 INRMP update and implementation can be classified as a CX and, therefore, only requires a REC to document environmental effects. A REC has been completed and is included in Appendix B.

1.9 OTHER PLAN INTEGRATION

Installation natural resources managers have prepared this INRMP in coordination with all applicable regulatory permits and requirements, and relevant planning documents including but not limited to: installation master plans, range complex master plans, training plans, Integrated Cultural Resources Management Plan (ICRMP), Integrated Pest Management Plan (IPMP), ITAM program, encroachment management plans, installation restoration plans, fire plans, installation information management systems, and applicable regulatory permits, requirements, and mitigations. The INRMP briefly summarizes the key interrelationships with other plans, references where plans may be obtained, and describes where detailed information can be found. INRMPs are not a comprehensive compilation of information on all these related topics.

Natural resources personnel on FLW will coordinate this INRMP with Mark Twain National Forest management plans and park managers to foster collaborative efforts and ensure that priorities align with military mission and resource management requirements as applicable. Similar coordination will occur with the Lake of the Ozarks State Park regarding the LORA site. Coordination plans and related documents will be maintained and recorded by FLW NRB.

2.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

2.1 INTRODUCTION

This INRMP will support the mission and vision of FLW. The natural resources staff at FLW is committed to supporting the military mission, providing stewardship of resources entrusted to the Army, enhancing the quality of life of the FLW and surrounding communities, and being a valued member of the overall FLW team. The information contained in this INRMP update will be reviewed and considered by the acting Army Garrison Commander prior its final approval.

2.1.1 Fort Leonard Wood Mission

MSCoE and FLW's principal military mission is to develop competent leaders and warriors of character and delivers total Army Engineer, Chemical, Biological, Radiological and Nuclear (CBRN), Military Police, and Maneuver Support capabilities to enable mission success across the range of military operations. This includes basic and advanced individual training in enlisted and officer engineer specialties, basic combat training, unit mobilization training, the Non-Commissioned Officers Academy, Forces Command unit stationing, the U.S. Army Military Police School, the U.S. Army Chemical School, Reserve component support, and Joint Intergovernmental and military, interagency, and multinational (JIIM) training. The training of Enlisted Army Transportation Specialists also occurs here, as well as interservice specific courses for engineers, CBRN, and military police occupations. Other military and civilian works are stationed at FLW in support of these JIIM and U.S. military forces. Accomplishment of the military mission is the primary objective on FLW.

Mission operations and activities on FLW that may affect natural resources include the physical activities of training associated to those described in the previous paragraph, operations and maintenance support activities, military construction activities, recreation activities, and various integrated natural resource program support activities such as prescribed fire. All of which have a physical impact, to a varying degree, to the natural resources on FLW. Physical impacts include but are not limited to vehicular and foot maneuvers that disturb soils, vegetation, and wildlife; maintenance activities that can disturb nearly every type of natural resource on FLW through repair and construction activities; recreational activities that can disturb vegetation and result in the harvesting of fish and wild game; and prescribed fires, conducted by the NRB, that can remove vegetation and disturb wildlife ecosystems.

2.1.2 Fort Leonard Wood Vision

At the heart of mission success, across the range of military operations, are capable warriors/leaders with unique skills and tools developed at the MSCoE at FLW.

2.2 COMPLIANCE REQUIREMENTS

2.2.1 Sikes Act

The Sikes Act (16 USC 670 *et seq*.), states, *The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation...*

The Sikes Act (16 USC 670 *et seq*.) Section 101 (a)(3) describes the purpose of the INRMP and its requirements, where appropriate and applicable, and consistent with the use of military installations to ensure the preparedness of the Armed Forces. The Sikes Act can be found online at https://www.govinfo.gov/content/pkg/COMPS-1136/pdf/COMPS-1136.pdf

2.2.2 National Environmental Policy Act

As previously stated, this document is an update to the existing 2017 INRMP; therefore, does not require an additional NEPA analysis. As a CX, public comments are not required for this INRMP update. The USFWS and MDC will be allowed to review and comment as required by the Sikes Act and DoD Instruction (I) and Manual (M) 4715.03.

2.2.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act is an international agreement among the United States, Canada, and Mexico that protects designated species of birds. Many birds are protected under the Migratory Bird Treaty Act. Birds classified as migratory also include species that occupy FLW throughout the year. A complete list of all species of all migratory birds protected by the Migratory Bird Treaty Act is in 50 CFR 10.13 (USFWS 2000).

The Migratory Bird Treaty Act controls the taking of these birds, their nests, eggs, parts, or products. The Act states that it is unlawful "at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, attempt to capture, or attempt to kill, purchase, offer to purchase, deliver for shipment, ship, export, import, cause to be shipped, deliver for transport, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, possess, offer for sale, sell, offer to sell, barter, offer to barter, any migratory bird, any part, nest, or egg of any such bird, or any part, nest, or egg thereof;" unless and except as permitted by regulations in the Migratory Bird Treaty Act.

All persons, organizations, and agencies are liable for prosecution for violations and must follow permitting requirements for taking migratory birds. Special purpose permits may be requested and issued that allow for the relocation or transport of migratory birds for management purposes.

Executive Order 13186. Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* requires that DoD and the USFWS establish a memorandum of understanding that will promote the conservation of migratory bird populations. A memorandum of understanding signed in 2014 and states that the purpose of the MOU is to promote the conservation of migratory bird populations while sustaining the use of military managed lands and airspace for testing, training, and operations (DoD 2014). This MOU can be found on the USFWS website at https://www.denix.osd.mil/nr/focus-areas/biodiversity/birds/birds/memorandum-of-understanding-between-the-dod-and-the-u-s-fish-and-wildlife-service-to-promote-the-conservation-of-migratory-birds/18_MOU-Between-DoD-USFWS-to-Promote-Conservation-of-Migratory-Birds-2.pdf.

50 CFR 21.45 – Military Readiness Activities Authorization. The USFWS take authorization and monitoring states "…*the Armed Forces may take migratory birds incidental to military readiness activities provided that, for those ongoing or proposed activities that the Armed Forces determine may result in a significant adverse effect on a population of a migratory bird species, the Armed Forces must confer and cooperate with the Service* (USFWS) *to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects.*" except to the extent

authorization is withdrawn or suspended pursuant to "*If the Secretary* (Secretary of the Interior) *determines, after seeking the views of the Secretary of Defense and consulting with the Secretary of State, that incidental take of migratory birds during a specific military readiness activity likely would not be compatible with one or more of the migratory bird treaties, the Secretary* (Secretary of the Interior) *will suspend authorization of the take associated with that activity*."

The Secretary of the Interior may propose to withdraw, and may withdraw in accordance with the procedures provided in 50 CFR Part § 21.15(b)(2) the authorization for any take incidental to a specific military readiness activity if the Secretary of the Interior determines that a proposed military readiness activity is likely to result in a significant adverse effect on the population of a migratory bird species and one or more of the following circumstances exists:

The Armed Forces have not implemented conservation measures that:

- Are directly related to protecting the migratory bird species affected by the proposed military readiness activity
- Would significantly reduce take of the migratory bird species affected by the military readiness activity
- Are economically feasible
- Do not limit the effectiveness of the military readiness activity

The Armed Forces fail to conduct mutually agreed upon monitoring to determine the effects of a military readiness activity on migratory bird species and/or the efficacy of the conservation measures implemented by the Armed Forces; or

The Armed Forces have not provided reasonably available information that the Secretary has determined is necessary to evaluate whether withdrawal of take authorization for the specific military readiness activity is appropriate.

2.2.4 Endangered Species Act

This INRMP has the signatory approval of the USFWS. This signature approval includes agreement that the INRMP complies with the ESA. Review of the INRMP is informal consultation with regard to the ESA.

Per provisions of the 2021 National Defense Authorization Act, this INRMP is to conduct management to "improve the habitat of threatened, endangered, or sensitive species." The USFWS policy states that, where applicable, federal critical habitat designation is not warranted if the INRMP includes certain criteria, which are summarized in Section 4.10, Special Status Species Management.

2.2.5 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act, as amended, protects eagles, their nests, eggs, and body parts. Protection also includes direct or indirect human activities that may disturb bald or golden eagles. The Act provides criminal 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 or any golden eagle, alive or dead, or any part, nest, or egg thereof. FLW continues eagle related activities to monitor and provide information to MDC; who in turn coordinates with USFWS.

In 2016 the USFWS finalized its ruling on regulations for permits for incidental take of eagles and take of their nests (50 CFR 22.80 Permits for eagle take that is associated with, but not purposed of, an activity and 22.85 Removal of eagle nests). Changes include the name change of “non-purposeful take permits” to “incidental take permits” and eliminated the distinction between standard and programmatic permits. Other changes include permitted removal of inactive nests with associated fees and guidelines. Additionally, the USFWS will evaluate each long-term permit at no more than five-year intervals. Refer to 50 CFR 22 for further Bald and Golden Eagle Protection Act details.

2.2.6 Applicable Army Regulations

AR 200-1 (*Environmental Protection and Enhancement*) (DOA 2007) provides policies, procedures, and responsibilities for implementing environmental programs, exclusive of those involving natural resources, pest management, and cultural resources. Some of these areas affect and/or are affected by natural resources programs (*e.g.*, water quality, pollution prevention, restoration). It also provides the framework for the Army Environmental Management System (EMS).

32 CFR Part 651 (*Environmental Analysis of Army Actions*) (DOA 2002) see Subpart B for National Environmental Policy Act. A proposed update to the rule was presented December 2019 with closing comments in February 2020.

AR 350-19 (*The Army Sustainable Range Program*) (DOA 2005) defines responsibilities and prescribes policies for implementing the Sustainable Range Program (SRP) on Army controlled training ranges and training lands located in and outside of the Continental United States. SRP core programs include ITAM in DPTMS and the Range and Training Land Program.

2.2.7 List of Laws and Regulatory Instruments

Chapter 9 lists the most applicable federal and state laws and regulations, and other regulatory instruments that govern implementation of this INRMP.

2.3 STUDY AREA

The installation is located in south central Missouri approximately 120 miles southwest of St. Louis, Missouri, and 85 miles northeast of Springfield, Missouri. The installation is in Pulaski County. The towns of Waynesville and St. Robert are located to the northwest and north of FLW respectively and are the closest municipalities. The installation encompasses 61,641 acres of land in the Ozark Plateau region. The Big Piney River flows along the eastern boundary of the installation and Roubidoux Creek is located near the western boundary. Much of the land surrounding FLW is part of the Mark Twain National Forest. See Figure 1 for a map of the study area.

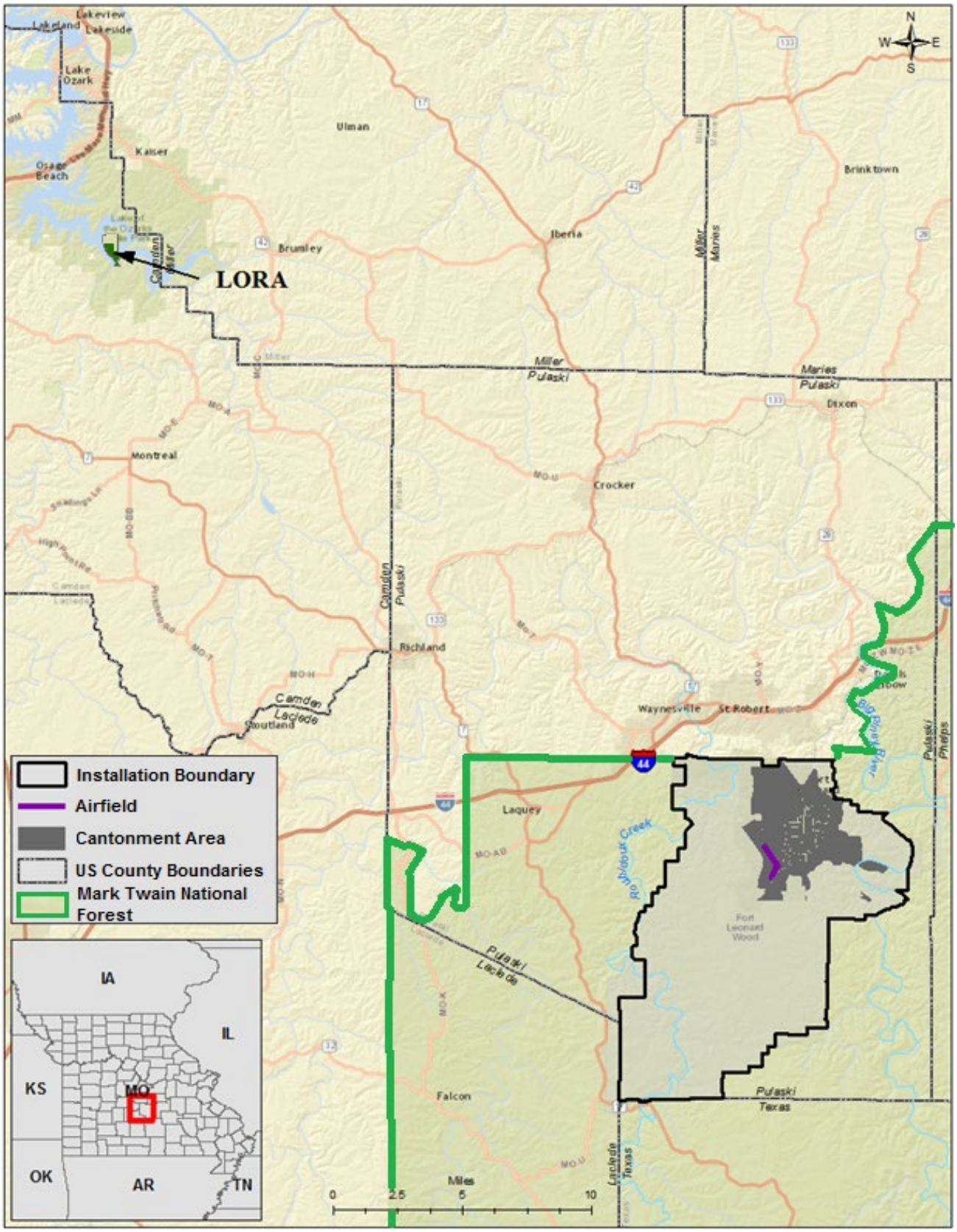


Figure 1. Location of Fort Leonard Wood, Missouri

The study area includes LORA, a 360-acre area leased by FLW from the State of Missouri. The LORA site is surrounded by the Lake of the Ozarks and associated State Forest. Recreation is the primary activity that occurs on the site; however, water related training does periodically occur in the southern portion. Roughly 76,000 recreational users visit the LORA site each year.

The Installation annually trains more than 80,000 military, and provides support for 7,000 military permanent party, 17,000 active duty family members, 9,000 civilians, and 55,000 retirees and family members. It also provides mobilization and demobilization capabilities and other support to its military units, the Army Reserve, and the Army National Guard. The Installation is the home of the MSCoE, which includes the US Army Chemical, Biological, Radiological, and Nuclear (CBRN) School, US Army Engineer School, and US Army Military Police School. The Installation is also home to three gender-integrated Training Brigades, one of the five Reception Stations in the Army for newly accessed soldiers, and houses the largest Non-Commissioned Officers Academy in the Army. The Installation also supports the military's largest inter-service detachments from the Marine Corps, Navy, and Air Force as well as joint intergovernmental and military, interagency, and multinational training.

Regional Land Uses. Extensive Mark Twain National Forest lands (Rolla-Houston Unit) are located east, west, and south of FLW boundaries as seen on Figure 1. In addition, there are a number of private land holdings within the Mark Twain National Forest adjacent to the FLW boundary. Timber management and recreational activities are the primary uses occurring within the boundaries of the National Forest. Private holdings adjacent to the installation are devoted primarily to agricultural uses, principally grazing.

Urban development is located north of the installation along Missouri Avenue (I-44) and in the cities of St. Robert and Waynesville, Missouri. This development is characterized primarily by strip commercial development. However, the majority of the area between the installation and the developed portion of St. Robert consists primarily of undeveloped property that is zoned for commercial development.

The National Forest land is not zoned, since Federal government-owned land is exempt from zoning. In addition, the surrounding unincorporated areas are not zoned, since Pulaski County does not have a zoning ordinance. Incorporated developed areas east and west of Missouri Avenue (I-44) are respectively zoned for residential use.

2.4 PURPOSE AND NEED OF THE PROPOSED ACTION

The purpose of updating and implementing the INRMP is to meet the requirements of the Sikes Act as amended, which provides the primary legal basis for the Secretary of Defense to carry out a program for the conservation and rehabilitation of natural resources on military installations. To facilitate such a program, the Act requires the Secretary of each military department to prepare and implement an INRMP at appropriate military installations throughout the United States under their respective jurisdictions. Specifically, such plans shall be prepared in cooperation with, and reflect

the mutual agreement of, the USFWS and state agencies where the installation is located.

FLW has ensured that this INRMP has met the Sikes Act requirements as listed in Section 2.5 as well as been prepared in accordance with DoDM 4715.03 and AR 200-1. The focus of the INRMP is to be ecosystem based, rather than management for single species. To ensure that FLW can meet its mission needs now and into the future, the natural resources that provide the training environment must be managed such that they are ecologically sustainable. Updating and implementing the INRMP would ensure that desired future conditions, which envision all aspects of a future ecosystem and include conservation and military mission related needs, are integrated and consistent with applicable federal and state stewardship requirements. Fundamentally, an INRMP would represent a proactive approach in assuring training over the long-term continues through the sustainability of the natural resources.

2.5 PUBLIC AND AGENCY COORDINATION

2.5.1 Cooperating Agencies and Agency Coordination

The cooperating and coordinating agencies for this INRMP include the USFWS and MDC. As outlined in DoDM 4715.03, and in accordance with the Sikes Act, these agencies will be contacted to provide comment as well as approval of this updated INRMP. Other agencies, stakeholders, and the public commented during the 2006 and 2019 INRMP NEPA review process.

2.5.2 Section 106, National Historic Preservation Act Coordination

Preparation of this INRMP does not constitute an undertaking with the potential to cause effects to historic properties. Actions and activities within the scope of this INRMP will be reviewed separately by an appropriate agency official to determine if these actions are an undertaking pursuant to Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations 36 C.F.R. § 800, as amended. For activities at FLW that are determined to be categorically excluded from review under NEPA, the agency must, as noted in C.F.R. § 800.8(b), still determine if that action qualifies as an undertaking requiring review under Section 106 pursuant to C.F.R. § 800.3(a). The cultural resource review process is outlined in FLW's ICRMP (2017). Adherence to the process outlined in the ICRMP is critical to this determination.

2.5.3 Public Review

This document is an update to the 2017 INRMP and no significant changes have occurred in the resources, their management, or the selected alternative from the 2019 INRMP NEPA review. Therefore, public comments are not required.

2.6 ENVIRONMENTAL CONSTRAINTS AND CONSIDERATIONS

Environmental constraints and considerations include training and mission objectives, individual priorities of stakeholders, laws and regulations, availability of funding, and climate change. The military training mission takes priority over natural resource

management, with the exception of applicable federal laws and regulations. This may also include limited access areas on FLW due to safety concerns and training uses on range complexes. Examples of individual priorities of stakeholders include pressure to manage for a particular game species for hunting rather or focusing solely on timber management instead of ecological diversity and a functioning ecosystem. . Federal and state laws may impact how natural resource components of an ecosystem are managed; an example could include those species listed for protection and their associated habitats under the ESA. Though the protection of these species and their habitats take priority, other species and ecosystem management opportunities may be limited to fulfill this obligation. The availability of funding constrains the number and type of natural resource activities that can occur, as well as the supporting staff. Considerations regarding climate change are discussed in Section 4.15.

The training mission and associated activities on FLW and the LORA site may also have constraints or limitations due to protected environmental resources. These areas are primarily protected by applicable laws and regulations. These locations include wetlands, streams, protected special status species and habitat areas such as riparian corridors, cultural resource areas, unique or high-quality natural areas such as the sandstone glades, invasive species areas, and areas with highly erodible soils. These locations may or may not be restricted but typically have limited training related activities that can occur. A consolidated constraints map of these locations is not provided due to the size and complexity of the installation. DPW maintains Geographic Information System (GIS) records of these locations. Figures throughout Chapter 3 show a majority of these locations.

3.0 NATURAL RESOURCES

3.1 INTRODUCTION

This chapter describes the natural environment and biological resources of FLW, the LORA site, and a general description of the surrounding areas.

3.1.1 History

3.1.1.1 LORA Site

The LORA site is remotely located in a heavily forested area of the Lake of the Ozarks and that is under lease from the State of Missouri since 1961. This lease was recently renewed in June of 2010 for a period of 50 years. The approximately 360-acre site has been primarily utilized for recreation; however, periodic water related military training does occur in the southern portion of the property. Camp sites, cabins, and other housing facilities were constructed over the past 50 years. RV access and hookups, grills, pavilions, marinas, roads, tails, and parking areas were also developed. A small convenience store has also been added to the site since its original lease was signed.

3.1.1.2 Land Use

Prior to establishment of FLW, a portion of the installation owned by the Department of Agriculture had been under management of the U.S. Forest Service. The remaining area was in private ownership divided into small tracts of 20 - 200 acres with 10 - 20 percent of the area cleared for farming. Once FLW was established in 1940, a letter permit was obtained from the Secretary of Agriculture to use 16,000 acres of U.S. Forest Service land within the military installation boundaries. The remaining land within the installation boundaries was acquired from private owners bringing the total installation acreage to about 71,000 acres. Ownership modifications continued into 1980 with several exchange agreements and boundary line redrawing's, including 9,672 acres of U.S. Forest Service land. A land exchange completed in 2001 with the U.S. Forest Service included eight parcels of land. This exchange brought FLW's acreage to 61,641 acres.

The loss of native ecosystems due to construction and land clearing associated with the cantonment area and equipment training at the Normandy Training Area are the primary effects the military mission has had on natural resources at FLW. In addition, localized impacts have occurred at other designated training areas and ranges from weapons and munition uses, bivouac, and vehicular movements.

Damaging effects of ground-oriented military missions come primarily from two sources, projectile impact and maneuver. Munitions can damage vegetation, wildlife, and disturb soil upon impact. Projectile impacts can also cause wildfires, which may have positive or negative effects on vegetation. Vehicle maneuvers also damage soil and vegetation via equipment moving across the landscape. The extent of this damage is determined by many factors, including vehicle weight and the distribution of this weight, soil type, extent of soil saturation, vegetation, terrain, and the type of training mission involved. FLW has relative few problems associated with large formations of tracked vehicles. These issues exist, but at a much smaller scale than found at larger, maneuver-oriented installations.

Forestry. A forester was first assigned to FLW in 1958. Prior to this, several basic forest management plans were written, but the first comprehensive *Woodland Management Plan* was completed in 1964.

Timber harvesting was minimal from 1940 - 1958 but intensified thereafter. Approximately 2,700 acres were planted to shortleaf pine and black walnut from 1958 - 1977. Small timber harvests for troop projects and installation use have occurred from the time construction started on FLW. No data are available on volumes harvested prior to 1958, but they are believed to have been negligible. A sawmill was run as a military training operation prior to 1960 near what is now Training Area 211.

From 1958 to 1962, 2,448,900 board feet of timber were sold by the U.S. Forest Service from land now owned by the Army. A regulated timber harvest program has continued since the first Army harvests in 1960. A firewood permit system was initiated in 1978. In 1990 a small volume standing timber sale operation began, primarily to allow for the

sale of shortleaf pine thinned from plantations. Timber sales are ongoing as part of the Forest Management Plan.

Military use of the installation in the form of small arms, artillery, grenade, and rocket launcher firing commenced immediately after acquisition. Extensive areas of timber were soon riddled with projectiles and shrapnel. Cantonment, family housing, training, range, and other construction areas have now displaced large areas of forest and tended to be located on more level, upland areas which are low-quality timber sites. FLW thus remains heavily forested.

Agricultural Out-leases. FLW had 289 acres available for agricultural lease; however agricultural leases have been discontinued. Leased land was restricted to hay and/or grass seed production and harvesting.

3.1.1.3 Historic Military Background on Fort Leonard Wood

Seventh Corps Area Training Center was established on December 3, 1940. The post was officially activated one month later and named in honor of Major General Leonard Wood. During World War II the installation was used for infantry, engineer, artillery, and armor training. A prisoner of war camp for German and Italian soldiers was in operation on post from 1943 until 1946. From 1946 through 1950 the installation was virtually inactive. A small work force was retained to provide minimum protection and maintenance to facilities. Army and National Guard units still trained at FLW in summer, but the land was not called a fort. The entire post was leased by an Oklahoma rancher who grazed thousands of cattle and named it the Bar-O-Ranch.

In 1950 the installation was activated for the type of training that was carried out during World War II. Grazing leases were terminated with exception of the ammunition storage area on which grazing leases were granted until about 1964. The installation's role as a U.S. Army reception station began in 1953. The training center role grew again in 1955 with the passage of the Reserve Forces Act. The installation title was changed in 1956 to the U.S. Army Training Center, Engineer. Only five days later, the installation was declared a permanent post to be known as Fort Leonard Wood. While engineers had been trained at FLW for years, it was not until 1985 that the U.S. Army Engineer School was moved to FLW from Fort Belvoir, Virginia. In 1999 the U.S. Army Military Police School and U.S. Army Chemical School relocated to FLW from Fort McClellen, Alabama. For a more detailed historic background of FLW see *Fort Leonard Wood Master Plan* (FLW 1990) and the *Fort Leonard Wood Post Guide* (FLW 1996).

3.2 PHYSICAL ENVIRONMENT AND CLIMATE

3.2.1 Physiography and Topography

FLW is in the center of an approximately 3,600-square mile watershed known as the Gasconade River Basin, characterized by heavily forested hills formed by erosion from major streams. These streams were formed in the gradual uplifting of the peneplain that is now the Ozark Plateau. Narrow, flat alluvial floodplains formed by these streams are bordered by sheer and steep bluffs that commonly rise 200 feet. Remnants of the

peneplain are characterized by relatively flat upland areas between major streams. Elevations range from 760 feet above sea level along parts of the Big Piney River to over 1,300 feet above sea level on hilltops in the southern portion of the installation. Some localized topography features have been altered, mostly in high traffic and use areas such as the cantonment area, from construction and development projects. These alterations include features such as berms, drainages, and grading to level the ground.

The LORA site is located on the Grand Glaize arm of Lake of the Ozarks. The topography ranges from the elevation of the lake at approximately 650 feet above sea level to roughly 800 feet above sea level at its hill tops. The sight is mostly hilly a few, mostly, level spots around the buildings and parking lots.

3.2.2 Geology

Bedrock in the FLW area consists of cherty dolomites and sandstone from the Ordovician period. Depth to bedrock is typically 5-20 feet. Rock outcrops and cliffs, such as those commonly found along Big Piney River and Roubidoux Creek, are composed of dolomite capped with sandstone. Along Roubidoux Creek on the southern end of the installation, the sandstone cap is thicker and comes nearly down to the creek bottomland. This dolomite is generally of poor quality for quarrying. Additionally, it is expected that the LORA site has similar major geologic features to that of FLW. See Figure 2 for the major geologic formations on FLW.

River hills are composed of weathered dolomite and sandstone with a very thin layer of silt on ridge tops. Small wet weather springs commonly occur along the hill side streams but are often dry by early summer. The upland hills are formed from weathered and eroded sandstones overlain with wind loess. Since the surface is well weathered, very little rock outcropping occurs. However, sinkholes are common in upland hills with rimrock appearing around some sinkholes. Most streams in these areas are ephemeral, usually carrying water only during and following heavy rainfall events. There are some very small, nearly perennial, springs.

Flat open woodland plains are the remnant of the flat ocean plain, which was uplifted and subsequently weathered. The bedrock underlying the plain is a well consolidated dolomite with little fracturing or solutional cavities. An ice age loess commonly overlies the weathered dolomite to a depth up to three feet. On slopes and hills the loess has eroded to a thin mantle or is completely eroded away to expose underlying dolomite. Where streams have cut into the dolomite, seeps and small springs have formed just above the contact point with the underlying sandstone.

In the low-land areas, sand and gravel deposits typically underlie the floodplain. Floodplains are comprised of rich alluvial material from the parent rock of the uplands within its watershed. This alluvial material from the parent rock is also partly mixed in with the eroded ice age loess that has overlaid parts of the flat open woodland plains and upland areas.

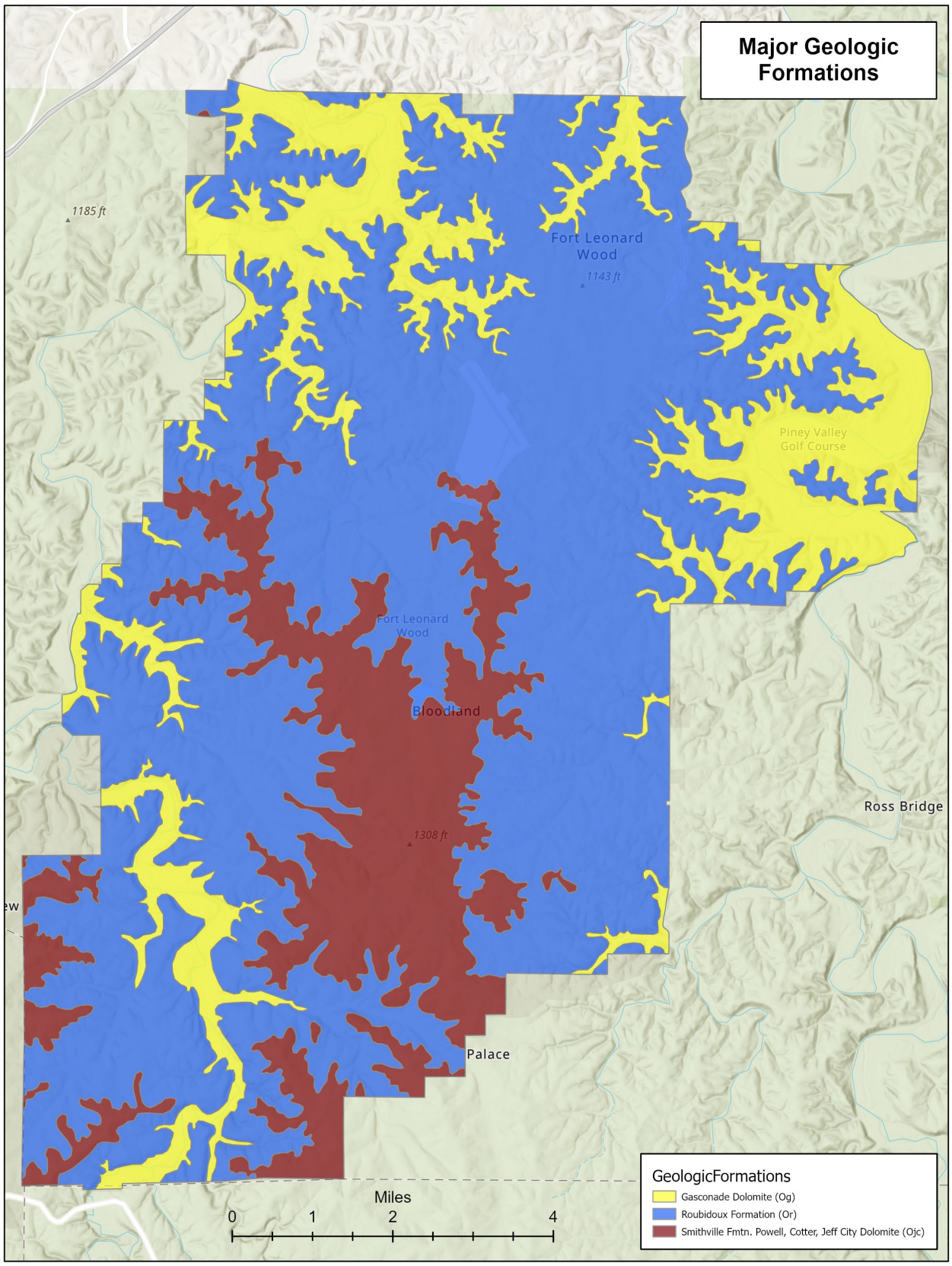


Figure 2. Geology

Dolomites, such as those found throughout the area, are highly susceptible to solution from ground water and can form Karst features. Karst features, such as sinkholes, caves, and springs, are evident across most of the installation but seem to be more concentrated in the cantonment area and northern portion of the installation. Most caves on the installation are found in dolomite. Caves are solutional cavities in the rock that were left as rivers cut into the bedrock. A number of springs are located within or near FLW, including Shanghai, Miller, Stone Mill, Tunnel Hollow, Ballard Hollow, Roubidoux, Ousley, Falling, Creasey, Bartlett Mill, and Prewett springs.

Roubidoux Creek is known as a losing stream. This stream loses its flow to groundwater in the southwestern portion of FLW and appears to be dry, except in periods of extremely high flow. The point at which the Roubidoux Creek loses its flow under low flow conditions coincides with the Hurd Hollow Fault. The location of flow loss under higher flow conditions coincides with the projection of the northeast-southwest alignment of sinkholes.

3.2.3 Mineral Resources

Minerals and mining on FLW are minimal with little potential. Several abandoned dolomite and sandstone sites occur, but there is only one active quarry, the Quarry Machine Operators Course (TA 256) located on the Big Piney River. The demand for commercial quarrying is not great as quarry sites are common in the local area.

Mining or borrowing waterway gravel deposits is common in the region. Military units and installation maintenance personnel have used this resource heavily in the past, but this practice is now only used to maintain culverts at low water crossings. Topsoil borrowing was also common, especially from the Big Piney River and Roubidoux Creek bottomlands, but has also been eliminated to protect riparian areas. Depending on the amount required, borrow material may be acquired on-site or from designated locations where clean fill has been stockpiled from other projects. Small borrow pits are constructed to act as water retention/sedimentation basins for the projects. The NRB is involved in siting new borrow pits on FLW. No mining occurs or is expected to occur on the LORA site and minerals are expected to be similar to those found within the Ozark region.

3.2.4 Soils

Soils are generally non-glacial in origin, formed from native bedrock on FLW. They have a thin loess (wind-blown silt deposited after the last ice age) deposit on the surface and stones (mostly chert) in the hills. A majority of the soils lack the fine textured soils such as clays and are considered highly erodible. They have low inherent fertility (especially low in phosphorus). Although organic matter content of upland soils is generally very low, sufficient vegetative cover grows to hold the soil in place except on sites where the subsoil has been exposed due to disturbance. Land disturbances from construction and training activities have altered much of the soils from the original profile in the cantonment area; however, a majority of the installation has remained undeveloped and relatively undisturbed. Detailed information on FLW soils and associated geology is in

the *U.S. Soil Conservation Service Soil Survey of Pulaski County, Missouri* (Wolf 1989). Additionally, it is expected that the soils at the LORA site would be similar to those found in the upland areas of FLW. Refer to Figure 3 for locations of highly erodible soils on FLW.

Bottomland soils are distinct from most soils on FLW, being essentially stone free. These soils are a loam mixture of silt, clay, and sand, varying from a clay loam to a sandy loam. These are highly productive for vegetative growth. When cleared and properly drained, many bottomland soils are prime farmland. Since most bottomland soils are on flat or very gently sloping sites, erosion is not a great hazard except from flood waters on the annual floodplain. Wetland soils are common, especially where ancient river bends existed.

Soils of the river hills are very stony, gravelly, and well drained. Clay is common in the soil profile along with the stone. A discontinuous fragipan, referred to locally as hardpan, occurs on broader ridge tops and shoulders. During wet weather, river hills soils hold up relatively well under vehicular traffic, but they do get muddy. If stripped of the forest cover, these soils are highly erodible due to the degree of slope.

Forested hills areas show well-weathered sandstone that produced a sandy and gravelly clay loam soil on slopes. Wider stream bottomlands are a sandy loam, and very narrow bottomlands are gravelly. Flat ridge topsoils are a slightly sandy silty-clay loam, 4 - 24 inches deep to the underlying stony soil. These soils of higher elevation are highly erodible. Fragipan is common on ridge tops. These upland soils are relatively tolerant to vehicle traffic with just moderate drying but become very muddy when wet.

3.2.5 Water Resources

3.2.5.1 Surface Water

Water resources at the LORA site include the lake waters and the surface drainage ditches on the property. The entire area drains into the Lake of the Ozarks. The lake itself is approximately 92 square miles. Primary tributaries include the Osage River, Niangua River, and Glaize River. Unless otherwise specified, the remainder of this section focuses on water resources within the installation boundary.

Two major drainages transect FLW. A perennial river, Big Piney River, flows through post on the eastern side, and a perennial and/or losing stream, Roubidoux Creek, flows through post on the western side. There are numerous small springs, seeps, and sinkhole ponds and many intermittent seeps and springs on FLW. All of which drain into the Big Piney River or Roubidoux Creek.

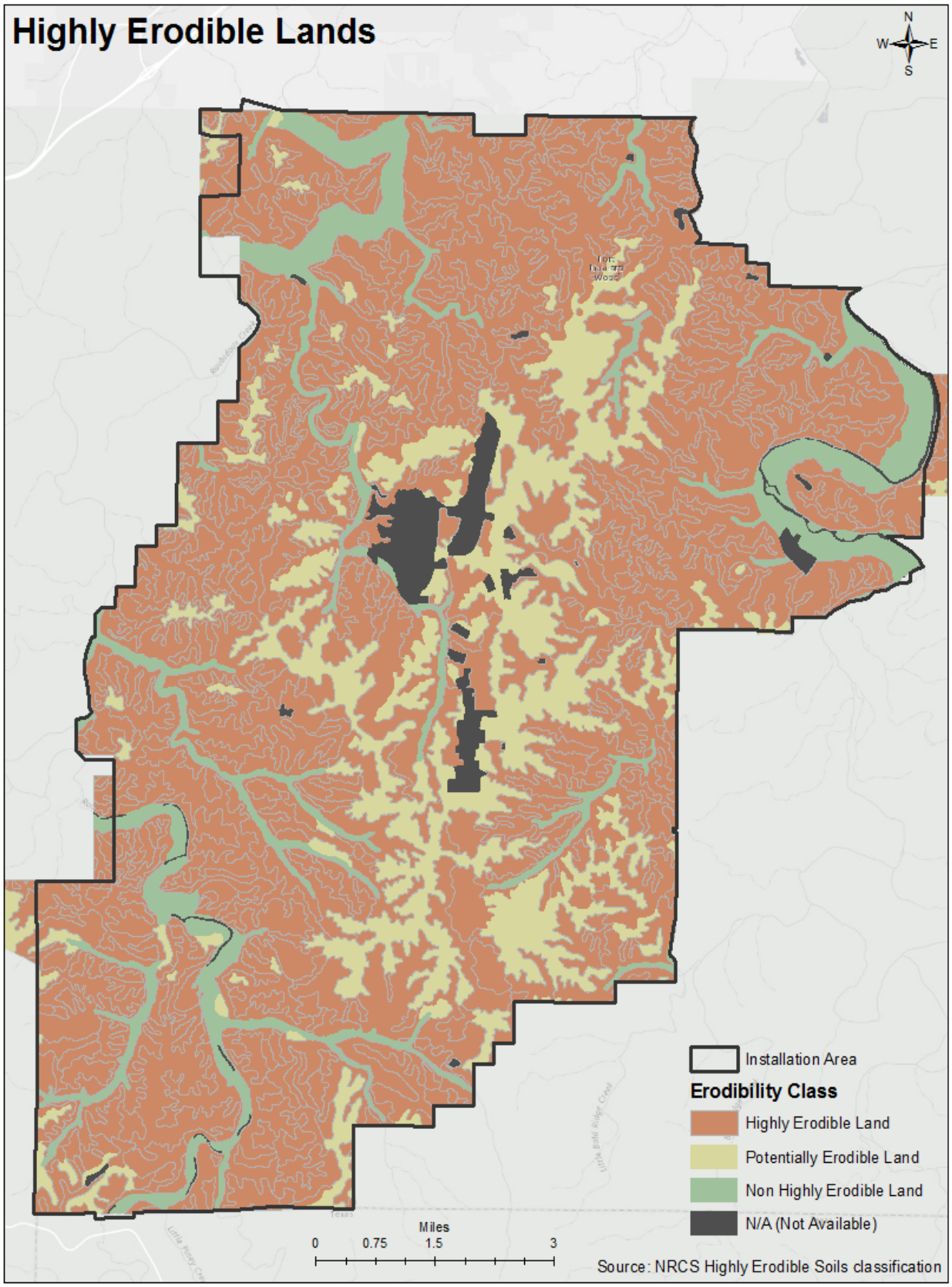


Figure 3. Highly Erodible Soils

Big Piney River and Primary Tributaries. The Big Piney River is classified as a perennial stream. A perennial stream is defined by the USACE as a stream that has flowing water year-round during a typical year and groundwater is the primary source for stream flow. It also has a water table that is located above the stream bed for most of the year. Approximately 9.5 miles of the Big Piney River flows along the eastern boundary and through FLW. The Big Piney River, a principal tributary of the Gasconade River, has a drainage basin of 768 square miles, of which 580 square miles are upstream from FLW. Approximately 94 miles of the main stem Big Piney River maintains a permanent flow; whereas, an additional approximately 31 miles maintains permanent pools. The river flows to the north with an average gradient of 5.2 feet per mile. The annual mean discharge according to a USGS gage near Big Piney, Missouri is approximately 543.1 cubic feet per second (USGS 2016).

The Big Piney River has a relatively uniform base flow that is sustained during dry periods by springs. Six of the springs have minimum flows of 3.2 MGD (million gallons per day). These springs are Boiling, Miller, Prewett, Shanghai, Slabtown and Stone Mill. The main tributaries of the Big Piney River that drain FLW, are Dry Creek, McCourtney Hollow and Falls Hollow. Dry Creek drains the northeast portion of the installation and collects discharges from the cantonment area. McCourtney Hollow and Falls Hollow drain the southeast portion of the installation and collect run-off from undeveloped maneuver and impact areas. Several well established, unnamed tributaries to the Big Piney River also drain portions of FLW. Many tributaries of the Big Piney River are known or suspected losing streams. At normal flows, the riverbed ranges from 100 to 300 feet wide at an average depth of 2.5 to 3.0 feet. The stream banks consist of silt loam and sandy clay loam eight to eleven feet high. The river bottom is comprised of gravel and cobbles in the riffles with small gravel, sand, silt and detritus in pools and backwater areas.

The Big Piney River is considered to have good water quality because normal flows are clear, and detectable pollutants are below impairment levels. Thus, the river is the principal source of potable water for the installation. However, the USEPA approved 303(d) list does note an aquatic life impairment related to a dissolved oxygen deficiency (MDNR 2020). The source is unknown and is upstream of the installation in Texas, County. Six storm water outfalls located in the Big Piney River watershed are monitored in accordance with Missouri State Operating Permits. Monitoring data results since July 1995 have not shown that permit limits have been exceeded.

In 2022, a cooperative agreement project with Missouri State University pertaining to water quality was completed. Results indicated no impairments for temperature or dissolved oxygen during ambient flows within areas of the Big Piney River on FLW (Owen et al. 2021). Additionally, cooperative agreement projects pertaining to geomorphology indicated that the mean annual discharge on the Big Piney River increased by 6% per year during the period from 2000 to 2020. Thus, geomorphology instability is likely contributing to widespread reworking of previously stable mussel habitats and is a risk to mussel beds in higher energy reaches (Pavlowsky et al. 2022). Mussels are further discussed in Chapters 3 and 4. Furthermore, lead, zinc, and copper concentrations detected in the geomorphology studies were below threshold effect

concentrations and probable effect concentrations for toxicity to sediment dwelling organisms.

Roubidoux Creek and Primary Tributaries. Roubidoux Creek flows north, meandering through 16 miles of FLW, eventually discharging into the Gasconade River. Ballard Hollow, Caby Hollow, Hurd Hollow, Musgrave Hollow, Smith Branch, McCann Hollow, Bailey Hollow, Pond Hollow, Wolf Hollow, and Turnbull Hollow all drain into Roubidoux Creek. Primary Watersheds on FLW can be seen on Figure 4. Roubidoux Creek is classified as a losing stream and many of its tributaries are also known or suspected losing streams.

The stream banks consist of silt loam and clay loam and are generally eight to eleven feet high. The stream bottom consists of gravel with sand in pools and slack water areas. Upstream of the installation, the creek has clear, permanent flow. As the creek traverses through the installation, the streambed is relatively dry until just north of the installation near Waynesville, where the creek is recharged by Roubidoux Spring. A 4-mile segment of the Roubidoux Creek north of the installation (Roubidoux Spring to the Gasconade River) has been designated a cold-water sport fishery. This designation as defined by the MDNR includes waters in which naturally occurring water quality and habitat conditions allow the maintenance of a naturally reproducing or stocked trout fishery and other naturally reproducing populations of important recreational fish species (10 CSR 20-7). Red and White Ribbon trout fishing zones are located in this 4-mile segment and are stocked with rainbow and brown trout by MDC.

Similar to the Big Piney River, Roubidoux Creek has good water quality except on the northern portion of FLW where the stream becomes isolated pools with warm water and low dissolved oxygen levels are known to occur. However, unlike the Big Piney Roubidoux Creek does not have any impairments noted on the MDNR 303(d) list (MDNR 2020). In accordance with Missouri State Operating Permit No. MO-0117251, there are six storm water outfalls in the Roubidoux Creek watershed in addition to two river monitoring stations.

Dry Creek. Dry Creek is classified as a losing stream and is considered to be losing year-round. Dry Creek drains the northeastern portion of the installation that contains the majority of the cantonment area and discharges into the Big Piney River. What stream flow there is occurs mainly as a result of the discharge from the wastewater treatment plant at FLW. This discharge is in accordance with a National Pollutant Discharge Elimination System (NPDES) permit. Intermittent stormwater flows are frequent in the spring and during intense or extended periods of rainfall. The streambed width is generally 10-30 feet. The stream banks consist of silt loam and sandy clay four to five feet high, with the streambed consisting primarily of gravel with some sand.

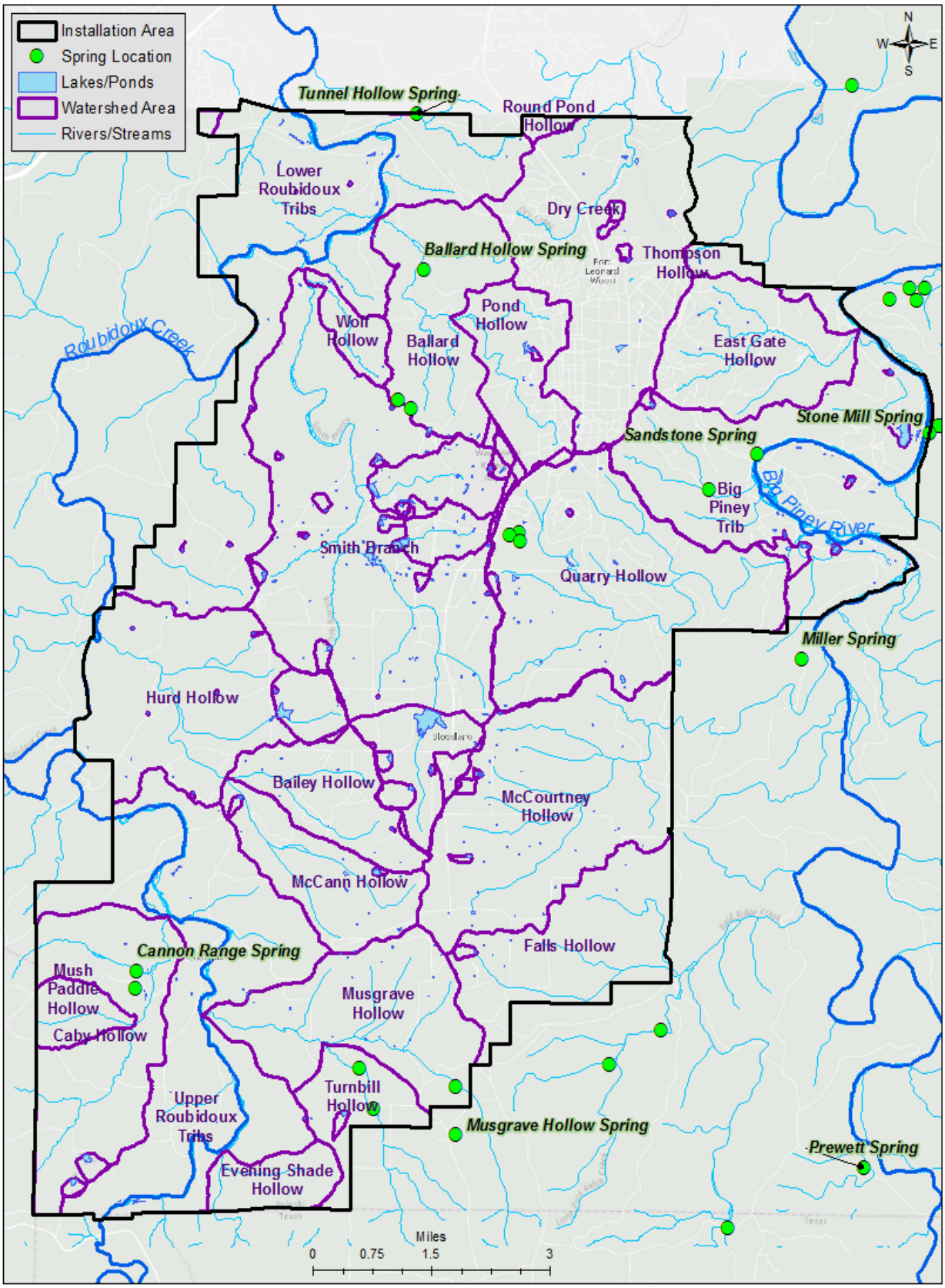


Figure 4. Surface Waters and Watersheds

Stone Mill Spring. Stone Mill Spring is the largest spring in the FLW region. Previously located within the installation boundary, the spring has been transferred to the U.S. Forest Service for management in 2001. The spring is located along the east bank of the Big Piney River, east of the cantonment area. Primary access to the site is maintained through FLW. Flow records date from 1925 to 1966 and indicate an average flow of 18.7 MGD, a maximum of 34.2 MGD, and a minimum of 11 MGD. A levee was constructed between the Big Piney River and the spring in 1970 to preclude the river from flowing through the spring except during periods of high flow. Stone Mill has been designated as a cold-water sport fishery by the MDNR (10 CSR 20-7). The area is designated as Stone Mill Spring Trout Management Area and is managed by the Forest Service in conjunction with FLW and MDC.

Other Streams. Musgrave Hollow and the lower portion of Ballard Hollow are both suspected gaining streams. The remaining streams located on FLW are intermittent or ephemeral, flowing into either the Big Piney River or Roubidoux Creek. The primary stream courses and drainage areas are identified in Figure 4. These include McCourtney Hollow, Falls Hollow, Musgrave Hollow, Quarry Hollow, Hurd Hollow, Ballard Hollow, Dry Creek, and Smith Branch. Flow associated with these streams occurs during or following intense or extended periods of precipitation. Flow occurs in streambeds ranging from 10 to 50 feet and at a depth of six to eight feet for the 10-year recurrence interval flood event. Stream banks are normally three to four feet high and consist of silt and sandy clay loam. Flow is carried over a bed of gravel with some sand.

Lakes/Impoundments. A total of 19 well-defined lakes, ponds and impoundments ranging in size from 0.5 to 50 acres are located at FLW. Together, these bodies of water cover approximately 100 acres. All ponds except for sinkhole ponds, are manmade reservoirs. Where practical, impoundments are stocked and managed as recreational fisheries. A total of 110 impoundments are scattered throughout the installation. Figure 4 shows surface water resources of FLW.

The largest lake, Bloodland Lake, is located in the Wildlife Management and Recreation Area just south of the cantonment area and west of Range Operations office. The lake has a surface area of approximately 40 acres, and accounts for one-half of the total impounded surface acreage for the installation. The second largest lake, TA250 Lake, is roughly 18 acres and has controlled recreational access due to training activities. The third largest lake, Penn's Pond, has a surface area of approximately eleven acres. Bloodland Lake and Penn's Pond primarily used for recreation, boating and canoeing, and fishing; however, they also provide migratory birds and terrestrial wildlife with a source of water.

Approximately 40 other impoundments, ranging in size from 0.1 to 0.5 acres, are scattered throughout the installation. These impoundments have "multi-purpose" functions. Watershed management, sediment control and wildlife habitat enhancement are the primary functions, however, some are managed for recreational fisheries.

Several of the sediment control ponds are located in Training Areas (TAs), with several concentrated at the heavy equipment TA 244. The sediment ponds are functioning as

designed, that is, to collect and trap sediment from disturbed areas and to protect the downstream drainages.

April and May are generally high discharge periods on waterways of FLW. However, flash floods can occur throughout the year as a result of intense weather activity. Nonpoint source pollution, especially sedimentation, has a moderate to high potential of occurrence on FLW. Measures to mitigate erosion/sedimentation are discussed throughout this INRMP.

3.2.5.2 Groundwater Resources.

The hydrology of the groundwater system is influenced by the karst terrain of the installation. Sinkholes, springs, losing streams and caves provide a connection between surface waters and the groundwater system (MDNR 1982). Horizontal groundwater movement has been documented at FLW (FLW 2006). Groundwater is available from several permeable zones within the Ozark aquifer that underlies FLW. The most productive formation within the Ozark aquifer at FLW is the Potosi Dolomite. Located at a depth between 800 to 1,000 feet below the surface, this formation produces large quantities (80 to 750 gallons per minute) of water.

Groundwater generally flows northward, although the karst terrain may cause local variations in groundwater flow. Recharge to the aquifers occurs through losing streams, sinkholes, and infiltration to the soils. There are no geologic units above the base of the Potosi Dolomite that would act as a confining layer to prevent groundwater movement across the unit. Vertical flow of water between the Potosi Dolomite and the Gasconade Dolomite, however, is probably very slight. The USGS reports that vertical head differences between the two units are variable, but are typically limited to less than ten feet (FLW 2006). This small head difference results in a small gradient that would result in limited flow, particularly given the high horizontal permeability compared to the vertical permeability.

Over 120 groundwater wells have been installed at FLW, of which only 112 remain active. Nearly 100 of these wells were constructed for monitoring purposes. Some of which are used for monitoring areas enrolled in the Installation Restoration Plan. With the exception of two of the total wells located at the LORA site, wells on FLW are shown on Figure 5.

3.2.6 Water Quality.

Water quality at FLW is considered to be good, having little to no impairments or pollutants, such as turbidity, nutrient loading, etc. Much of river, creek, and spring flows are associated to groundwater. The clarity of the Big Piney River, Roubidoux Creek, and associated tributaries is very high during ambient flows. During periods of high precipitation events, much of these streams lose clarity and become fairly turbid from suspended sediment. FLW continues to monitor surface and groundwater water quality associated to the installation.

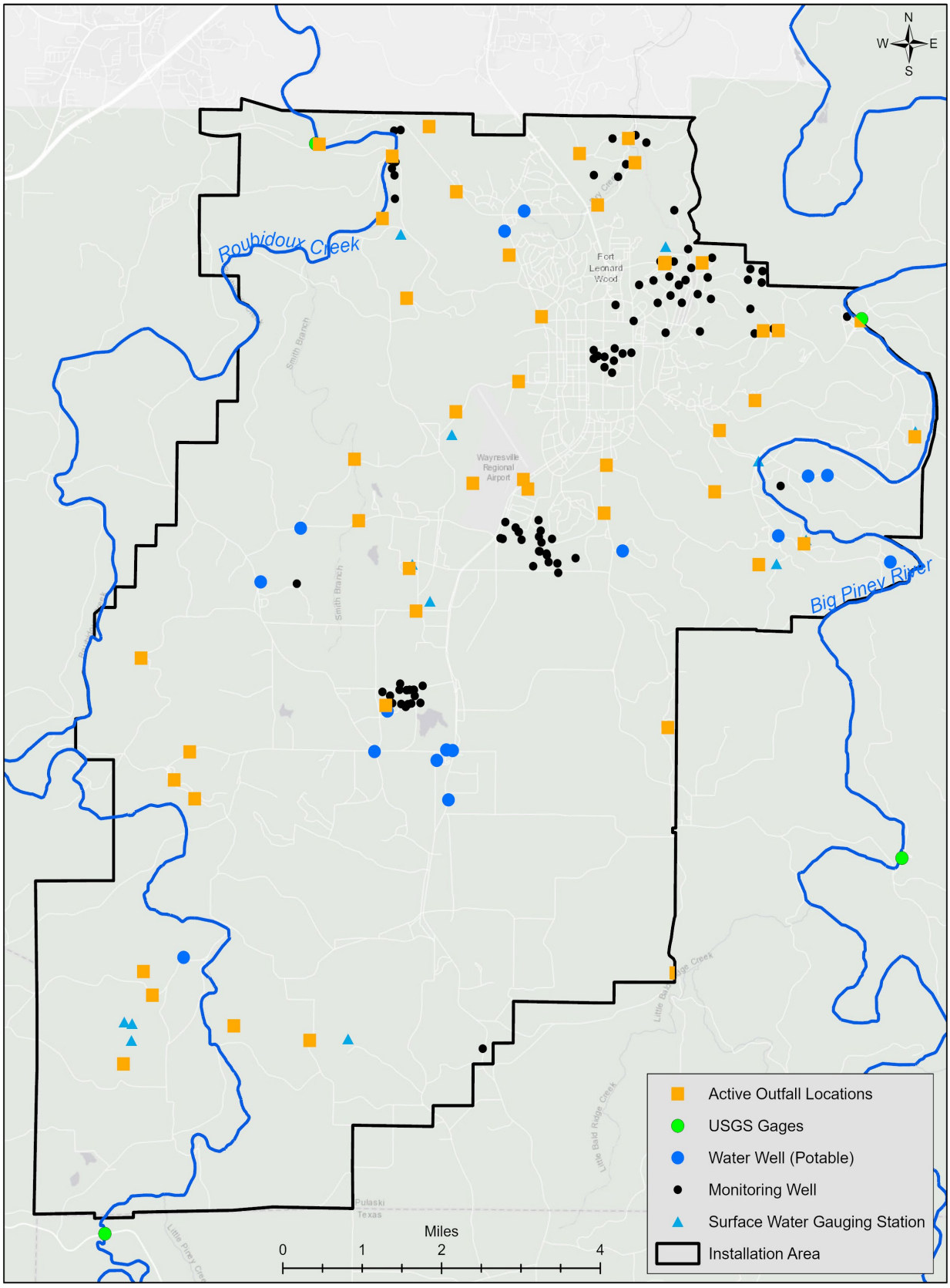


Figure 5. Groundwater and Monitoring Wells, and Outfalls

3.2.7 Air Quality

Clean Air Act Attainment. The USEPA has the authority under the Clean Air Act to protect air quality. Under this Act, the USEPA has developed National Ambient Air Quality Standards (NAAQS) that set specific acceptable concentrations for six criteria pollutants (i.e., sulfur dioxide, carbon monoxide, ozone, nitrogen oxides, lead, and particulate matter). FLW is located in an attainment area for all NAAQS. Based on USEPA's general conformity rule, 40 CFR Parts 6, 51, and 93, the installation and the LORA site are not required to complete a conformity determination. Additionally, the Clean Air Act requires state and local governments to monitor ambient levels of pollutants that have federal standards. The State of Missouri has developed ambient air quality standards that are more stringent than federal standards. Air emissions resulting from prescribed burns are reported annually in its Emission Inventory Questionnaire to the MDNR.

Title V Operating Permit. The Installation Operates under a Title V Permit (Permit No. OP2017-033; 07 April 2017) (MDNR 2017). The current permit expired on 07 April 2022. The Installation is in the process of receiving an updated Title V Permit from MDNR. The Installation is classified as a Synthetic Minor Source for nitrogen oxide and HAPS. Monitoring is conducted annually by contract (Bluestone 2021).

3.2.8 Climate

The installation is located within a humid, continental climatic area. While winters are cold, and summers are hot, prolonged periods of very cold or very hot weather are unusual. The average temperature in July and August ranges from mid-80s during the day to mid-60s at night (degrees Fahrenheit (F)). January is the coldest month, with an average temperature of 33 degrees F. However, temperatures have been known to fall below 0 degrees F at times. The average annual high temperatures for Waynesville, adjacent city to the Installation, is roughly 66°F and average annual low is 42°F. Annual average precipitation is about 46 inches, mostly rainfall, and ranges from 24 inches to 60 inches. About 20 inches of rainfall occurs during spring months and at times can cause flash flooding. Summer droughts often occur in July and August. Snowfall is generally of short duration, relatively light, and melts within a few days. Additionally, the LORA site is within 35 aerial miles and the climate is expected to be to be similar to FLW; however, the proximity to the lake can result in minor fluctuations in temperature and humidity (USCD 2016).

The monthly wind frequency distribution for Springfield, Missouri shows the prevailing wind direction to be from the south. Winds average six miles per hour at Forney Airfield. Violent storms can occur as a result of warm humid air masses from the Gulf of Mexico clashing with cooler continental air masses. Tornadoes, hail, lightning, and strong winds annually cause damage to the area. The greatest threat of severe weather is during spring and summer; however, severe winter weather can occur.

3.3 BIOLOGICAL RESOURCES

Biological resources include all living, native, or naturalized organisms and the habitats within which they occur. The INRMP manages all kingdoms of life through an ecological approach; however, it primarily focuses on plant and animals. Plant associations are generally referred to as vegetation or also known as flora. Whereas animal species are referred to as fish and wildlife, or also known as fauna. There are more than 1,300 species of flora and fauna are known to occur at FLW based on surveys and literature review.

3.3.1 Flora

3.3.1.1 Vegetation Communities

Forest. Forest is the principal vegetative type of FLW, covering about 75 percent of the installation. The oak-hickory association predominates, but the sycamore-elm-soft maple association is found on creek and river bottomlands. North-facing slopes are generally forested with black, red, and white oak with a scattered understory of flowering dogwood, serviceberry, and Carolina buckthorn. Species common to south-facing slopes are post oak, blackjack oak, and black hickory. Eastern red cedar forms small dense stands on former glade areas and is an invader of old farm fields and other highly disturbed sites. Shortleaf pine occurs naturally but only in small, isolated stands as central Missouri is the extreme northern range of the species. Shortleaf pine was planted extensively in plantations on the installation in the past and these plantings have become quite successful in establishing shortleaf pine communities. Additionally, the LORA is roughly 90 percent forested with similar oak-hickory tree species with patches of red cedar. See Figure 6 for forested land on FLW.

Grasslands. Old fields and grasslands occupy about 15 percent of the installation. Many of these sites, where they occur on the upland, were part of the original pre-settlement post oak flat woods. These sites are covered with a mix of herbaceous, low woody, and invading tree growth. Common herbaceous growth of old field areas are annual grasses; broom sedge; a mix of legumes, and composites; Kentucky bluegrass and tall fescue (both introduced); and tall, native, warm season perennial grasses, including Indiangrass, big bluestem, little bluestem, and switchgrass. Low woody growth is commonly dewberry, blackberry, coralberry, rose, sumac, plum, persimmon, and sassafras. Common trees species encroaching on grasslands are post oak, blackjack oak, black hickory, and eastern red cedar; creating a more open woodlands like vegetative condition. Additionally, the LORA site has little to no grasslands. Much of the open areas are developed as parking lots or manicured areas around buildings. See Figure 6 for grasslands on FLW.

Wetlands. Wetlands are a type of vegetative community and are further discussed in Section 3.3.2. The combined area of any potential wetlands at the LORA site would likely be less than a tenth of an acre, based on topography and aerial images. See Figure 6 for wetland locations on FLW.

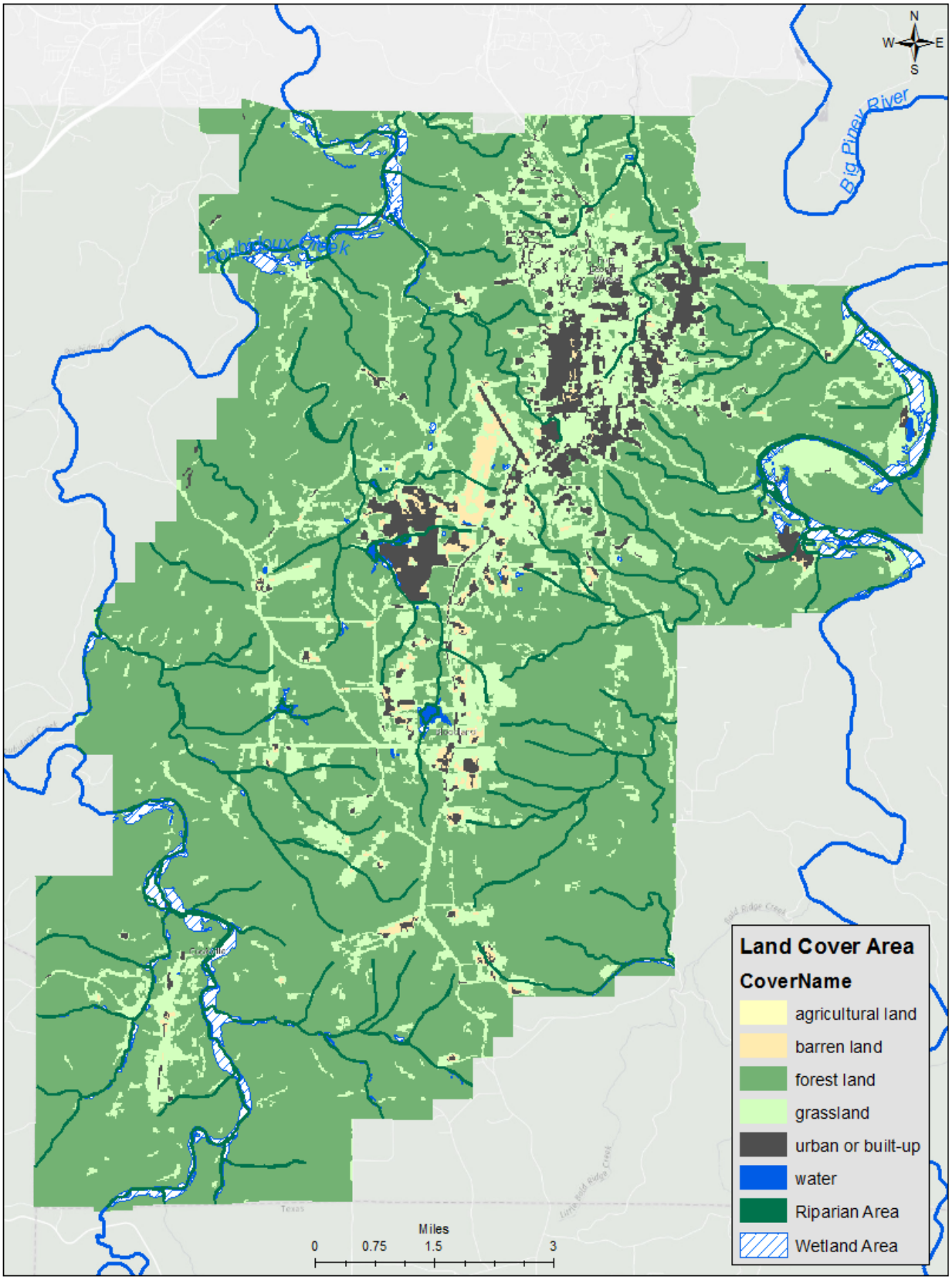


Figure 6. Land Cover

Landscaped, Developed, and Disturbed Areas. The remaining 10 percent, approximately, of FLW consists of improved to semi-improved grounds, recreational areas, structures, and paved areas. Most of the native vegetation has been removed from much of the cantonment area, heavy equipment training sites, and some of the firing ranges. Some landscaped areas still contain native tree species such as post and white oaks. Tall fescue and Kentucky bluegrass are the most common landscape grasses. An abundance of weed species exist in most turf areas. Additionally, the LORA site has roughly 35 acres of developed land that consists of buildings, parking areas, and manicured areas. See Figure 6 for developed or urban areas located on FLW.

3.3.1.2 Habitat Descriptions

Habitat descriptions for FLW are based on Physiographic Land Management Zones specific to the installation. Physiographic Land Management Zones are based on a concept of use capability and constraints to use. Figure 7 shows FLW Physiographic Land Management Zones. These zones are used for general land use planning.

Riparian Bluffs and Waterway Corridors. The riparian bluffs and waterway corridors zone, approximately 13,791 acres, is referred to as the “riparian zone”. It consists of streams and stream beds; floodplains up to the 100-year flood line; river terraces; rock cliffs and bluffs; short steep gradient tributaries; and ends (points) of flat and narrow ridge tops. This combination of floodplain and low terraces is locally referred to as bottomland. Streams and riparian hills in these areas are attractive to several unique and endangered species of wildlife in addition to fishes and amphibians. Several species of plants are also found almost exclusively in this zone. The riparian zone is the most diverse and environmentally sensitive zone on FLW.

Species of fish, mussels, crayfish, aquatic amphibians, and reptiles, and mammals, associated with streams, including common species (*e.g.*, bleeding shiner, largescale stoneroller, green sunfish, ellipse, spothanded crayfish, golden crayfish, bull frog, common map turtle, musk turtle, softshell turtle, muskrat) and rare species (*e.g.*, bluestripe darter, blacknose shiner, plains topminnow, elktoe), occur as expected in this habitat type. Common species associated with bottomland forests (*e.g.*, pickerel frog, green frog, yellow-crown night-heron, Northern parula warbler, green-backed heron, great blue heron, white-tailed deer, and beaver) and rare/listed species (*e.g.*, cerulean warbler, brown creeper, bald eagle, gray bat, Indiana bat, eastern small-footed myotis, golden mouse, butternut) also occur in this habitat type (Sternburg *et al*. 1996).

Stream beds commonly have sand and gravel bars vegetated with willow and sycamore stunted by frequent flooding. Annual floodplains are most commonly vegetated with sycamore, elm, soft maple, ash, and a mixture of other hardwood species. However, some open fields are maintained on floodplains.

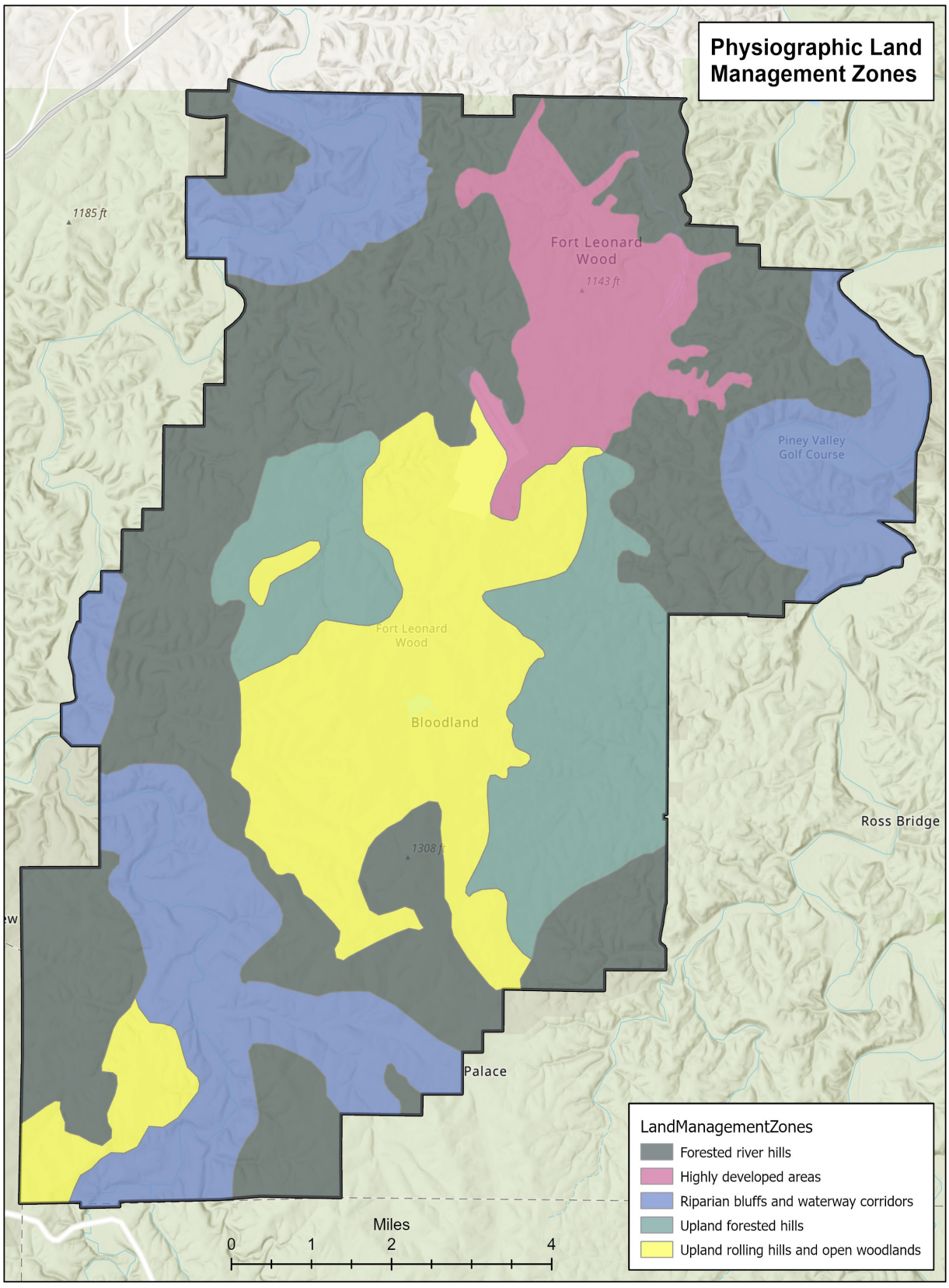


Figure 7. Land Management Zones

River terraces are most commonly vegetated with a mid-successional stage of young mixed hardwood forest growth consisting of bluegrass, raspberry, poison ivy, persimmon, elm, black walnut, and box elder.

Rock bluffs are sparsely vegetated but commonly support scattered eastern red cedar, glades (a prairie-like growth on small gently sloping or flat spots), and shortleaf pine in a few locations. Steep bluffs with a slope with a northern aspect are vegetated with a mixed oak forest, and slopes with a southern aspect are vegetated with a slower growing and shorter, almost scrub-like growth of mixed oak and eastern red cedar.

Ridge top points are vegetated most commonly with a mixed oak forest of moderate richness. However, old farm fields in mid-successional stages ranging to oak forest vegetation occur on some points.

River crossing training and water maneuvers, recreational activities and development, quarrying and associated training, bivouac area development to support water-associated training, land navigation and map reading, and wetland enhancement are current uses and operations in the riparian zone. In addition to these uses, the riparian zone is a highly valuable resource for fish and wildlife habitat, wetlands, historic and prehistoric cultural sites, potential prime farmlands, forest growth and timber, and its aesthetic qualities.

Forested River Hills. The forested river hills zone, referred to as the river hills (23,821 acres), consists of steep sloped forested hills; flat, but narrow, forested ridge tops; and narrow forested tributary stream bottomlands bordering the riparian zone. Moving away from the riparian zone are the more gently sloping upland hills and flats. Scattered historic farm field clearings occur, but most are now vegetated with brush. River hills are not suitable for most military operations but do contain most high-quality forests on the installation, providing an opportunity to manage for timber production, wildlife habitat, and outdoor recreation.

Species of wildlife associated with upland forest in this habitat type include common species (*e.g.*, southern redback salamander, eastern gray tree frog, American toad, ground skink, five-lined skink, western earth snake, western worm snake, southern coal skink, broad-winged hawk, downy woodpecker, red-eyed vireo, Kentucky warbler, big brown bat, little brown bat, striped skunk, white-footed mouse) as well as several listed species (*e.g.*, ringed salamander, Indiana bat, gray bat, eastern small-footed myotis). Glade communities within this habitat type include common species (*e.g.*, eastern narrowmouth toad, prairie racerunner, northern fence lizard, field sparrow, indigo bunting, American goldfinch, white-eyed vireo, and eastern cottontail) as well as several rare species (*e.g.*, Ozark dropseed) (Sternburg *et al*. 1996).

River hills are vegetated with oak and hickory. Black and white oak predominate all but the driest slopes. On slopes with a southern aspect, post oak and blackjack oak become more common. Dogwood and serviceberry are common understory species. Narrow bottomlands in this zone are most commonly forested with oak, but several

other hardwood species do occur; the most prominent are black walnut, black gum, and elm.

Current uses and operations are bivouac, land navigation/orienteering training, weapons range safety/buffer zones, commercial timber production, and hunting. In addition, river hills are valuable wildlife habitat, forest old growth, watersheds, and a source of aesthetic and recreational resource uses.

Upland Forested Hills. Upland forested hills (7,646 acres), referred to as upland hills, encompass the transition area between steep river hills and flatter upland prairies. Upland hills occur where the distance between the Big Piney River and the Roubidoux Creek is greatest. The terrain is not as steep or as deeply dissected as in river hills, and ridge tops are much broader and flatter. Forest cover is similar in species composition but generally of lesser quality and more interspersed with larger old farm fields and some prairie-like grasslands. Many old farm fields have been planted to shortleaf pine.

Vegetation of upland hills is much like that of river hills with black and white oaks on most slopes and blackjack and post oak on drier, south-facing slopes. However, hickory mixed with oaks becomes more common in this zone. On the broader flat ridge tops, post oak predominates. Old farm fields are succeeding to low timber quality oak and hickory where not planted to pine or controlled by prescribed fire. Old fields are commonly covered with broom sedge, blackberry, three-awn grass, eastern red cedar, and sassafras.

The largest block of upland hills is used for a small arms impact area. Beyond the outer fringes of this impact area is the buffer area where commercial timber production is the dominant use. A “no development” zone projects out from the center line of Waynesville Municipal Airfield in a southeasterly direction which runs through the northeastern portion of the upland hills zone. Since no ranges or occupied buildings are to be constructed in this approach zone, natural resources management there is relatively unhampered.

Hunting is a very popular use of upland hills since this zone is highly productive wildlife habitat. This zone, due to its use as impact area, is ideal for special natural diversity benefits from old growth forest. Timber stands not suitable for management due to light weapons projectile impacts are permitted to grow to the point of decay, thus providing old growth conditions.

Upland Rolling Hills and Open Woodlands. The upland rolling hills and open woodlands (post oak flat woods) zone (11,252 acres) occupies the highest uplands on FLW. The term open woodland is used commonly by land managers in Missouri to describe places where trees are widely spaced with a grass understory, rather than leaf litter, as the dominant ground cover. Open woodlands are a gently rolling to flat plains, although hills and forest stands are frequently prominent. Tree cover is quite different from that of the forested hills. Open woodland trees are significantly shorter than forests in forested hills. Also, the open woodland surface soils are commonly stone free. Large, nearly tree free, prairie-like grasslands commonly occur.

The predominant and distinguishing tree cover is post oak, though blackjack, black, and white oaks are also common on steeper slopes. Post and blackjack oaks, eastern red cedar, sassafras, and hickory are common invaders into old native grass farm fields. Tall, native, warm season prairie grasses spread into old fields from nearby open woodland areas. Also, native warm season grasses have been planted in the more open fields with suitable soil. Prescribed fire has had a positive effect upon the spread, abundance, and vigor of the prairie vegetation cover in the open woodlands zone. Wildlife and rare species associated with this habitat include common species (*e.g.*, eastern narrowmouth toad, ground skink, five-lined skink, red-tailed hawk, Northern bobwhite, Eastern wood-pewee, field sparrow, brown-headed cowbird, eastern chipmunk, and striped skunk) and rare species (*e.g.*, narrowleaf rushfoil, and buffalo clover).

The open woodlands zone is the site for most weapons firing and explosive demolition training range facilities on FLW, including support training areas for bivouac and field training exercises. Also, in this zone is the engineer equipment operators' course, Normandy Training Area. Most of the cantonment area falls within the open woodlands zone, but it is zoned separately due to the heavy development of the land. This zone is fully occupied by military operations. Consequently, any major new uses needing this type of terrain will require resetting current uses.

Vegetation on weapons impact areas and old fields is managed with prescribed fire whenever such fires are compatible with training uses. Pre-burning impact areas is especially beneficial for tracer ammunition firing, explosive detonation, and pyrotechnic use since it allows these operations during periods of high fire danger.

To maintain grassland conditions, prescribed burns are conducted on a three-year cycle in accordance with the FLW Integrated Wildland Fire Management Plan (IWFMP). On active tracer firing and explosive detonation impact areas bounded by a maintained firebreak, vegetation fires are handled on a prescribed "let burn" basis when practical. Prescribed fire is also beneficial for grassland development and wildlife habitat in the open woodlands zone.

Forest stands in the open woodlands zone are especially valuable for training operations concurrent with weapons range use, particularly for bivouac. Directorate of Plans, Training, Mobilization and Security (DPTMS) and DPW work together to schedule rotational use and plan restoration for bivouac and field training exercise areas to allow for sustained use of the land. Repeated bivouac and excavation under the canopy of trees causes increased mortality of trees. If these operations are not controlled and the land is not appropriately managed, the canopy is lost until new forest growth can replace it, which is a lengthy process.

The upland rolling hills and open woodlands zone is the best of the Physiographic Land Management Zones for military operations. The zone is most adapted to construction of facilities due to gentle slopes, good drainage, and moderate depth to bedrock. However, loess fragipan soils occurring predominantly in this zone are also prime farmland types. It is imperative that all uses be well planned and coordinated to conserve this highly

valuable and limited land type. Soil erosion is moderately high, and soil compaction is very high. Soil compaction causes greatly increased surface water runoff. Compaction also reduces air and water infiltration to root systems of trees, causing increased mortality of the plants.

Significant historic resource sites are very common in this zone. Prehistoric resource sites are mostly of the “isolated find” type. All cultural resource sites must be protected until properly evaluated for eligibility for the Register of National Historic Places.

Highly Developed Areas. Highly developed areas (4,901 acres), or cantonment area, is geologically made up of portions of the upland rolling hills and open woodlands, forested river hills, and upland forested hills zones. However, due to the great amount of alteration of the natural condition that occurred in developing FLW, this separate and distinct zone is delineated and described.

The open woodlands portion is occupied by Forney Army Airfield, troop housing and adjacent training support sites, recreation fields, industrial area, and administrative areas. The river hills portion is occupied by the Piney Hills family housing area. The upland hills portion is occupied by the family housing area in the northern portion known as the Lieber Heights. Relatively undisturbed hillside forested areas remain in the Lieber Heights area between housing blocks and in the northeastern portion of the developed area.

Natural vegetation in this zone has been greatly altered except for undisturbed forest areas. Most native trees and almost all native grasses have been replaced by landscaping on constructed terrain. Where not grossly disturbed by construction disturbance and heavy foot traffic, native trees have adapted rather well to the environment and add much to the landscape. Post and white oaks adapt and persist better than other native tree species to this situation. An abundance of midwestern native trees and shrubs and exotic trees and plants have been incorporated into the landscape.

Fescue and bluegrass have been planted and persist on most of the grounds. Bermuda grass has been planted or escaped into some sites and persists. An abundance of weed species persist in almost all turf areas.

Many military training, administration, and school operations occur in highly developed areas. One of the beneficial characteristics of the local terrain is forested hillsides. In the development of the cantonment area these have become very appealing as open spaces.

The terrain of the developed zone has the capability to support the development of a city. The basic constraint that is not widely acknowledged is that of runoff water quality. Degradation of water quality is occurring from runoff from the developed area. This is changing as the Army implements provisions of the Clean Water Act regarding point and non-point source water pollution.

It is likely that all new development and operation of already developed areas will be affected by requirements of the Clean Water Act. Due to rather large expanses of World War II building demolition areas, there is an abundance of already disturbed sites for future construction, thus preserving natural sites.

3.3.1.3 Floral Inventory

Skinner (1991) discussed the history of vegetation surveys in the FLW area. Little botanical work had been done prior to the *Floral Inventory of Fort Leonard Wood, Missouri* (Johnson *et al*. 1990), based on Land Condition Trend Analysis plant collections. This inventory collected 1,370 plants, representing 681 taxa.

Skinner (1991) surveyed for rare and endangered plants, which documented four rare plant species on FLW. In addition, Skinner investigated other plant records, besides rare and endangered species, and re-examined Johnson's 1990 survey noting only 647 taxa. Johnson's collection included some landscape ornamentals and plantation trees, which are not reproducing. Corrections were made by Oklahoma Biological Survey to Johnson's collection based on Skinner's information and were added to the FLW laminated collection. The NRB maintains a *Plant List* for FLW. This list currently contains 765 flora known to occur or possibly occur, based on literature review.

Forest inventories, based on a 10-year cycle, began in 1969. Several compartments were inventoried during 1981-1986 and a few additional compartments were inventoried in 1987. Most inventories were conducted through the Mark Twain National Forest. In 1995 the entire installation, excluding the cantonment area and Normandy Training Area, was inventoried. Data from the 1995 inventory were collected in a format compatible with an inventory and analysis program developed by MDC. The data format is electronic, and stand boundaries were digitized for geographic information system applications. Additionally, no floral inventories have occurred on the LORA site partly because of its designated use and minimal development footprint. The LORA site is expected to have similar plant species found in the upland hills located on FLW. See Appendix D for a list of flora found on FLW.

3.3.1.4 Special Status Flora

Federally Protected. An online review of USFWS Information for Planning and Conservation (IPaC) indicated Virginia sneezeweed (threatened) could be located on the installation (USFWS 2022a). However, despite surveys Virginia sneezeweed has not been confirmed to exist on FLW. No federally protected flora is expected to occur at the LORA site.

Missouri Plants of Conservation Concern. An online review of MDC's *Species and Communities of Conservation Concern Checklist* (2021) indicated an historic records of Bush's poppy mallow for Pulaski County, Missouri. Although this species has a state rank of imperiled the historic MDC record dates back greater than 25 years. Narrowleaf (thin) rushfoil has a state rank of critically imperiled and was identified on FLW during in 1932 (MDC 2021). Both Bush's poppy mallow and narrowleaf rushfoil have not been found in subsequent surveys since their previous discovery (Sternburg *et al*. 1998).

Plants of Special Interest. There are no flora currently listed or petitioned for listing under protection of the ESA for FLW (USFWS 2022b).

3.3.1.5 High-quality Natural Communities

The USFWS defines environmentally sensitive areas as those locations where a protected species or biological resource have been identified and need some measure of active protection during implementation of a project. Many protected species exist on or around the installation as well as unique biological resources. No sensitive or high-quality natural areas are expected to occur at the LORA site. FLW GIS staff maintain records and GIS layers of the locations of the following high-quality natural communities on FLW:

Glades. Skinner (1991) discovered high quality sandstone glades on FLW. The glades are of particular significance as they are the largest known from Missouri on the Ordovician Roubidoux geologic formation. The glades Skinner discovered included four glade areas now known as the Falls Hollow sandstone glades. A waterfall, sandstone arch, and a sandstone canyon enhance the glades, which total approximately four acres, and are considered exceptional natural features. The Falls Hollow Glades were evaluated for Natural Area status in 1995 and was classified as a significant Roubidoux sandstone glade of Grade B quality (MDC 2016b). This location is considered as an area that has recovered from light disturbances.

Several small, remnant high quality dolomite glade communities exist on the Roubidoux Creek. They are located at the southern end of the installation adjacent to Cannon Range, the bluff overlooking Cookeville crossing, adjacent to the Sapper Repel site, and south of the Devil's backbone near the Quesenberry Ford site. The northern end of the Roubidoux Creek contains glade complexes at Laughlin Cairns, Laughlin Bottoms, Kerr Cave, and the north side of Polla Road. The Big Piney River has several small high quality dolomite glade communities adjacent to the FLW Golf Course. One community is directly north across the river and the other is located south along the Ramsey Ridge Complex. There is also a small glade complex located adjacent to Stone Mill Spring hiking trail. The trail starts at the Stone Mill Spring parking lot and ends at the spring. Several small interior drainages contain remnant glade communities in Hurd Hollow, Ballard Hollow, and Smith Branch.

Eastern red cedar encroachment has occurred on most of the glades found on FLW. A cedar removal project was implemented in 2019 and cedars were removed from the Falls Hollow, Laughlin, Polla road, Tilley bottom, Hurd Hollow, and Smith Ridge glade complexes totaling 62.2 acres. FLW plans to continue successional woody plant removal to protect and enhance sandstone glades.

Pond Marsh. Pond Marsh is a collapsed sinkhole-pond approximately four acres in size that is located west of Forney Airfield near TA 246.

Caves. There are 68 caves on the installation. Boundary Pit Cave is a 125 feet deep cave formed by the collapse of a sinkhole. It has a MDC “notable” ranking as a natural community. Other notable caves include Miller, Brooks, Henshaw, Joy, Davis, Freeman,

Saltpeter, Martin, Maxey, Wolf Den, and Killman due to their uniqueness, archaeology, biologic conditions, and/or geologic formations. Of 45 caves inventoried, 35 contained invertebrates and ten of 45 caves contained amphibians. Previous surveys for bats either observed or found signs indicating bats had used 40 caves on the Installation. Eight of the caves indicated northern long-eared bat use. White nose syndrome has been confirmed at most of the major caves found on FLW and the bat population has been significantly reduced. Caves with potential northern long-eared bat activity were surveyed in 2016 and 2017, and a technical report was completed in January 2018 (ESI 2018). Additional surveys are planned to document current bat use of caves.

Training has previously been permitted in a few designated caves on the installation that are not biologically or culturally significant. Although no cave training currently takes place, those caves were determined to be safe and were effectively used to enhance training realism. All caves used for training have been approved by the DPW Environmental Office.

Caves make up a portion of the karst features found in the vicinity of FLW. As such, the MDC has identified an area that overlaps onto the southwest portion of the installation as a Conservation Opportunity Area (COA), which are based on rarity and diversity of habitats and species present. This area falls within the drainage areas of Roubidoux Creek, specifically Hurd, Bailey, and McCann Hallow and the vicinity of the Cannon Range.

Great Blue Heron Rookery. The great blue heron is federally protected as a migratory bird along with their nests and nest sites (rookery). A great blue heron rookery is located north of the Cannon Range along the Roubidoux. A second smaller rookery is located on the Big Piney River, just upstream of the Quarry Machine Operators Course (TA 256).

Big Piney River. The Wild and Scenic Rivers Act of 1968 was created to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Big Piney River was nominated for but has not obtained Wild and Scenic River Act status. However, in 1993, 102 river miles of the Big Piney River were identified in the Nationwide Rivers Inventory as a scenic river due to its scenery, recreation, geology, fish, and wildlife values (NPS 2016). Though not federally recognized as a wild and scenic river, the Big Piney River has been identified by MDC as a Stream Reach COA due to its unique diversity of habitat and species. Additionally, there has been approximately four historic crossings/fords on the Big Piney River at FLW, of which one located near west side of the installation’s golf course still remains in periodic use.

Roubidoux Creek. Roubidoux Creek is a losing stream that recharges Roubidoux Spring. A losing stream is defined as a stream that distributes 30 percent or more of their flow into the groundwater table through natural processes. Roubidoux Creek is considered unique for its recreational, cultural, and historical values. Additionally, there has been approximately six historic crossings/fords on Roubidoux Creek. Most of these remain active depending on stream and streambed conditions.

3.3.2 Wetlands

The U.S. Congress enacted the Clean Water Act in 1972 to *restore and maintain the chemical, physical, and biological integrity of the Nation's waters*. Section 404 of the Clean Water Act delegates jurisdictional authority over wetlands to the Corps of Engineers and the Environmental Protection Agency. Waters of the United States protected by the Clean Water Act include rivers, streams, estuaries, and most ponds, lakes, and wetlands. The USEPA and USACE jointly define wetlands as "*areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas*" (USEPA 2016).

Wetland functions and values include but are not limited to the following: groundwater recharge, groundwater discharge, flood flow alteration, sediment stabilization, sediment or toxicant retention, nutrient removal or transformation, production export, wildlife diversity/abundance, aquatic diversity/abundance, uniqueness/heritage, and recreation. Executive Order 11990, *Protection of Wetlands* (1977) and the Clean Water Act (1977) require no net wetland losses on federal lands in the United States.

The *Wetlands Inventory for Fort Leonard Wood, Missouri* (FLW 1995) identified 1,552 acres of potential jurisdictional wetlands on FLW. The largest sites occur in the Roubidoux Creek (848 acres), Big Piney River (530 acres), and Falls Hollow floodplains (30 acres). Collectively, these three drainages support 90 percent of the total wetland acreage identified for FLW. In 2014, a project was proposed in TA 250 and a site-specific wetland delineation and report was completed. The report determined the presence of ten separate emergent wetlands that totaled 3.5 acres as well as 7.69 acers of forested wetlands.

In 2019, the FLW DPW, Environmental Division provided funding for the USACE, Kansas City District to inventory wetlands across the installation. The first phase of the wetland investigation occurred in 2019 and encompassed approximately 20,000 acres of the cantonment area and Big Piney River drainages. The second phase investigated the remaining accessible areas of FLW. The subsequent Wetlands Determination Reports (USACE 2020, 2021a) identified 151.45 acres of wetlands eligible for jurisdictional wetlands on FLW. In addition to the true wetlands, 251.72 acres of artificial wetlands were identified. Artificial wetlands were defined as locations that exhibited wetlands conditions but were altered, drained, impounded, or found to be aquatic features such as a pond. Fourteen potential wetland sites were not able to be confirmed because they exist within restricted areas. The largest wetland areas occur along the Big Piney River and Roubidoux Creek floodplains. To be classified as a wetland, a site had to meet all three wetland parameters: 1) 50% of the dominant plant species had an indicator status of obligate, facultative wet, or facultative. 2) Soil characteristics met the defined hydric soil criteria. 3) If at least one primary indicator or two secondary indicators of hydrology/topography were met.

The Wetland Determination Reports identified the following five wetland types on FLW in order of decreasing area: Forested Wetlands, Emergent Wetlands, Forested/ Emergent/Shrub-Scrub Mix, Forested/Emergent/Wetland Mix, and Emergent/Shrub-Scrub Wetland Mix (USACE 2020, 2021a). The final report included plant community types and species, soil characteristics, hydraulic indicators, and hydrology/topography characteristics. In addition, a GIS layer with location, area, and category type was provided. Wetlands inventoried on FLW are displayed in Figure 6.

3.3.3 Fauna.

A diversity of habitats exists within and adjacent to FLW's boundaries that provide quality conditions for a wide variety of wildlife. More than 550 species of wildlife have been noted at FLW. Common fauna includes many species of mammals, birds, fishes, reptiles and amphibians, mussels, and invertebrates (cave survey) (Table 1). A majority of the species composition at the installation is similar to the surrounding Mark Twain National Forest. However, a couple of unique species are known to occur in the caves at FLW. Additionally, species found on the LORA site would be similar to those found in the uplands on FLW. A minor exception would be the lake and the shore birds as well as migratory birds associated to the Lake of the Ozarks that would likely be found near the shoreline at the LORA site.

Table 1 Species Diversity Breakdown

Fauna/Flora Type	Approximate Number of Species Documented
Mammals	57
Birds	216
Amphibians	24
Reptiles	43
Fish	78
Mussels & Clams	27
Invertebrates	142*
Crayfish	4
Plants	777
TOTAL	**1,368**

*Note: Invertebrates numbers associated to a cave inventory and rattlesnake master borer moth inventory.

Mammals. Mammals commonly occurring on FLW include the white-tailed deer, eastern gray squirrel, eastern fox squirrel, eastern cottontail rabbit, eastern chipmunk, beaver, Virginia opossum, coyote, raccoon, striped skunk, and four species of shrews and 12 species of bats. Section 3.3.1.2, *Habitat Descriptions* includes a discussion of terrestrial habitats and associated species of mammals.

Birds. Birds commonly occurring on FLW include the great blue heron, green-backed heron, wood duck, downy woodpecker, red-eyed vireo, Acadian flycatcher, American crow, northern cardinal, American goldfinch, rufous-sided towhee, great horned owl, red-tailed hawk, wild turkey, northern bobwhite, tufted titmouse, common grackle, eastern meadowlark, and house sparrow. Section 3.3.1.2, *Habitat Descriptions* includes a discussion of FLW habitats and associated species of birds.

Fishes. Fish commonly occurring on FLW include the largemouth bass, smallmouth bass, bluegill, green sunfish, bleeding shiner, channel catfish, and rock bass. Section 3.3.1.2, *Habitat Descriptions* includes a discussion of aquatic habitats and associated species of fish.

Sternburg *et al*. (1996) lists several regional or statewide studies of fishes and aquatic species of the FLW area. Sternburg *et al*. (1998) observed 57 species of fish on FLW. The report, *A Summary of Select Fisheries Management Activities and Planned Projects, 2003-2004, Report 7* (FLW Undated) states that FLW waters are home to more than 70 species of fish.

Reptiles and Amphibians. Reptiles and amphibians commonly occurring on FLW include the common map turtle, common musk turtle, three-toed box turtle, bull frog, pickeral frog, green frog, eastern gray treefrog, dwarf American toad, southern redback salamander, northern fence lizard, ground skink, five-lined skink, southern coal skink, western worm snake, western rat snake, and Eastern garter snake. Section 3.3.1.2, *Habitat Descriptions* includes a discussion of FLW habitats and associated species of reptiles and amphibians. Refer to Section 3.3.4 *Special Status Fauna* for hellbender details.

Freshwater Mussels and Crayfish. Mussel surveys have indicated 27 species of unionid mussels and the introduced Asiatic clam are known to occur in the Big Piney River and Roubidoux Creek on FLW. Four species of crayfish, golden crayfish, spothanded crayfish, northern crayfish, and devil crayfish are known to commonly occur in the waters of FLW (Sternburg *et al*. 1998). Two of the four crayfish species were observed and identified by natural resource managers on FLW.

Invertebrates. Insect and arachnid life is abundant on FLW. Commonly encountered are species of ticks, chiggers, mosquitoes, flies, and gnats. A wide variety of spiders occur. Two spiders venomous to humans, the black widow and brown recluse, are frequently encountered in buildings. The emerald ash borer (EAB), an invasive Asian species of beetle, has destroyed most of the mature ash trees on FLW since 2016. Regeneration of some top-killed trees and reproduction from seed is still occurring but larger stems are still in danger of re-infestation. Biological control in the form of parasitic wasps that target the larvae and eggs of EAB were released on FLW. The long-term effects of wasps and recovery of ash trees on FLW is unknown. The gypsy moth has not invaded Missouri; however, one stray male gypsy moth was trapped in a detection trap in 1984 on FLW. No other reports of gypsy moths have been reported but annual monitoring is ongoing. Missouri University of Science and Technology was contracted

to conduct the first comprehensive planning level survey of invertebrates on the installation and is expected to be competed in FY2023.

3.3.4 Special Status Flora and Fauna

Special status species include those listed as threatened, endangered, or proposed for listing under the federal ESA, state-listed threatened and endangered species, and state species of conservation concern. In total, there are 47 special status fauna species that have been recorded at FLW (Table 2). A study was conducted specifically to determine the existence of federally- and state-listed rare and endangered plants, animals, and exemplary natural communities between 1993 and 1995 (Sternburg *et al*. 1998). This study, Land Condition Trend Analysis, other surveys, and other past studies have identified special status species on FLW. Additionally, a USFWS IPaC was conducted for the LORA which listed the three federally protected bats and the monarch butterfly as potentially utilizing the area.

Table 2 Special Status Species

Common Name	Scientific Name	Status	General Area/Records
Mussels & Clams			
Spectaclecase	*Cumberlandia monodonta*	**FE, SE**	Roubidoux Creek & Big Piney River
Black Sandshell	*Ligumia recta*	**SCC**	Big Piney River
Elktoe	*Alasmidonta marginata*	**SCC**	Roubidoux Creek & Big Piney River
Northern Brokenray	*Lampsilis brittsi*	**SCC**	Roubidoux Creek & Big Piney River
Fish			
Blacknose Shiner	*Notropis heterolepis*	**SCC**	Roubidoux Creek
Plains Topminnow	*Fundulus sciadicus*	**SCC**	Big Piney River and Falls Hollow Creek
Bluestripe Darter	*Percina cymatotaenia*	**SCC, PLFE**	Roubidoux Creek & Big Piney River
Amphibians			
Eastern Hellbender	*Cryptobranchus alleganiensis*	**FE, SE**	Big Piney River
Eastern Tiger Salamander	*Ambystoma tigrinum*	**SCC**	1 Recorded Location
Grotto Salamander	*Eurycea spelaea*	**SCC**	Several caves on FLW
Ringed Salamander	*Ambystoma annulatum*	**SCC**	Multiple sites on FLW
Snakes			
Northern Scarlet Snake	*Cemophora coccinea copei*	**SCC**	1 Record Location
Birds			
American Bittern	*Botaurus lentiginosus*	**SE**	1 Record (Migratory)
Bachmans Sparrow	*Peucaea aestivalis*	**SE**	1 Record (Migratory)
Bald Eagle	*Haliaeetus leucocephalus*	**SCC USEPA***	One nest, Big Piney River
Bewick's Wren	*Thryomanes bewickii*	**SCC**	Multiple Records
Black-crowned Night-heron	*Nycticorax nycticorax*	**SCC**	1 Record (Migratory)

Common Name	Scientific Name	Status	General Area/Records
Black-throated Green Warbler	*Setophaga virens*	**SCC**	Multiple Records (Migratory)
Cerulean Warbler	*Setophaga cerulea*	**SCC**	Along Roubidoux Creek and Big Piney River
Common Gallinule	*Gallinula galeata*	**SCC**	1 Record
Great Egret	*Ardea alba*	**SCC**	1 Record (Migratory)
Greater Roadrunner	*Geococcyx californianus*	**SCC**	Multiple Records
Little Blue Heron	*Egretta caerulea*	**SCC**	1 Record (Migratory)
Loggerhead Shrike	*Lanius ludovicianus*	**SCC**	1 Record (Migratory)
Long-eared Owl	*Asio otus*	**SCC**	Multiple Records (Migratory)
Marsh Wren	*Cistothorus palustris*	**SCC**	1 Record (Migratory)
Mississippi Kite	*Ictinia mississippiensis*	**SCC**	1 Record (Migratory)
Northern Harrier	*Circus cyaneus*	**SE**	Multiple Records (Migratory)
Osprey	*Pandion haliaetus*	**SCC**	Multiple Records (Migratory)
Ruffed Grouse	*Bonasa umbellus*	**SCC**	80 Historic Releases
Sandhill Crane	*Grus canadensis*	**SCC**	1 Record (Migratory)
Sharp Shinned Hawk	*Accipiter striatus*	**SCC**	Multiple sites on FLW
Snowy Egret	*Egretta thula*	**SE**	1 Record (Migratory)
Sora	*Porzana carolina*	**SCC**	Multiple Records (Migratory)
Swainson's Hawk	*Buteo swainsoni*	**SCC**	Multiple Records (Migratory)
Virginia Rail	*Rallus limicola*	**SCC**	1 Record (Migratory)
Mammals			
Indiana Bat	*Myotis sodalis*	**FE, SE**	Caves, Resident Throughout
Gray Bat	*Myotis grisescens*	**FE, SE**	Caves, Resident Throughout
Little Brown Bat	*Myotis lucifugus*	**PLFE, SCC**	Caves, Resident Throughout
Northern Long-eared Bat	*Myotis septentrionalis*	**FE TH, SE**	Caves, Resident Throughout
Eastern Small Footed Bat	*Myotis leibii*	**SCC**	Rock Formations, Resident Throughout
Tricolored Bat	*Perimyotis subflavus*	**PLFE, SCC**	Caves, Resident Throughout
Silver-haired Bat	*Lasionycteris noctivagans*	**SCC**	Caves, Resident Throughout
Seminole Bat	*Lasiurus seminolus*	**SCC**	1 Record Location
Golden Mouse	*Ochrotomys nuttalli*	**SCC**	Multiple sites on FLW
Long Tailed Weasel	*Mustela frenata*	**SCC**	Multiple sites on FLW
Insects (Pollinators)			
American Bumble Bee	*Bombus pensylvanicus*	**PLFE**	Multiple Records
Monarch Butterfly	*Danaus plexippus*	**PLFE**	Multiple Records
Regal Fritillary	*Speyeria idalia*	**PLFE, SCC**	Multiple Records

Sources: Missouri Department of Conservation – Missouri Species and Communities of Conservation Concern, 2016. Status designators: *USEPA-The Bald & Golden Eagle Protection Act, FE- Federally Endangered, FE TH- Federally Threatened, PLFE- Petitioned for Listing as Federally Endangered, SCC- Species of Conservation Concern on FLW, SE- State Endangered, ST- State Threatened.

The installation is partnering with both state and federal agencies to improve conditions when possible and limit negative activities for all species of concern on the installation. Federal and state listed species are taken under environmental consideration during planning project processes and environmental reviews. Specific species location information is stored at the DPW Environmental Office and will not be disclosed in this document for the protection of special status species.

Bats. Caves located on FLW are extremely important to many bat species located on the installation for habitat, breeding/rearing, and hibernacula. Three federally listed threatened and endangered bats and two bats petitioned for listing are located on the installation as indicated on Table 2. In coordination with the USFWS, the installation has established a bat zoning system that defines the type of activities that can take place within certain distances of caves known to be used by these threatened and endangered bats for hibernacula and/or residency. These zones extend approximately 1.2 miles from known hibernacula caves. See Figure 8 for a location of these zones. Guidance from the NRB for construction and maintenance actions is to plan for needed tree removal during the period of 01 November through 31 March. Tree removal during this timeframe avoids direct effects to Indiana or northern long-eared bats that might be present.

The management zones have been defined as follows:

- **Endangered Bat Area (Restricted)** - These cave locations are extremely sensitive to disturbance from development, training activities, and noise, especially during the spring and fall migration periods. Disturbance of bats during hibernation can cause bat mortality. FLW would not conduct development activities in the 20-acre area surrounding these caves. Caves are off limits for military operations. The Directorate of Public Works, Environmental Division, in consultation with the USFWS must approve any activities within 1.2 miles of cave openings.
- **Bat Management Zone 1** - Bat Management Zone 1 is an area between a 0.1- and 0.28-mile radius of the cave (approximately 160 acres). The following guidelines are in place for Bat Management Zone 1:
  - No bivouac operations are permitted.
  - No chlorobenzylidene malononitrile, or tear gas, pyrotechnics, noise simulators, or smoke is permitted during the following periods from one hour before sunset to one hour after sunrise from:
    - 1 August to 31 May (Brooks, Davis No. 2, Joy, and Wolf Den Caves)
    - 1 April to 31 October (Freeman and Saltpeter #3 Caves).
- **Bat Management Zone 2 -** Bat Management Zone 2 is an area between a 0.28- and 1.2-mile radius of the cave. The following guidelines are in place for Bat Management Zone 2:
  - All disruptive activities should be given a low priority or restricted, especially during the spring and fall.
  - The DPW Environmental Office must approve any training activity which results in the loss of tree canopy.
  - Development of training facilities and sites should be given a low priority.

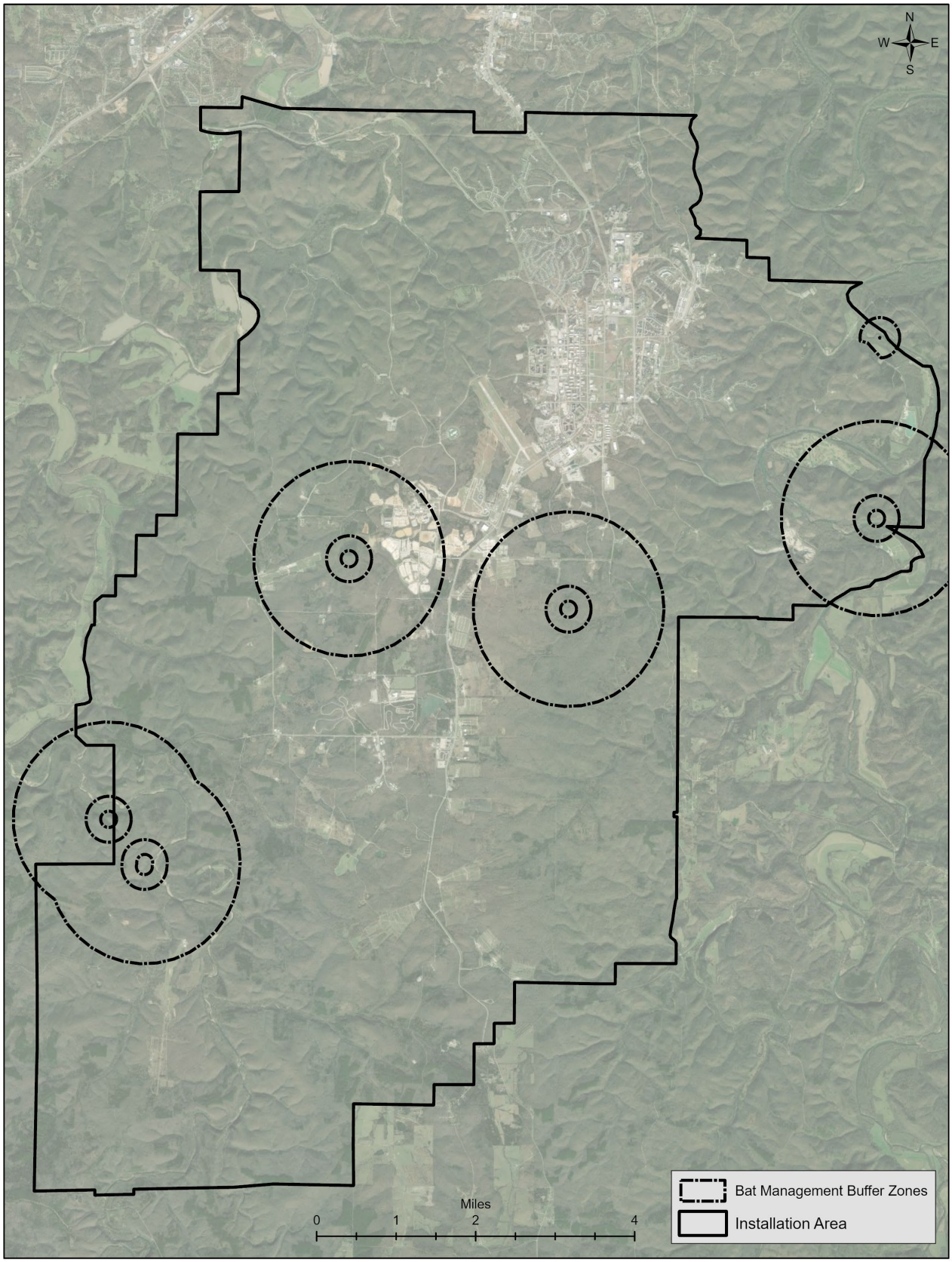


Figure 8. Bat Management Buffer Zones

The Indiana bat is an endangered species that has experienced serious population declines due to habitat loss and human disturbance. The loss of wetland and riparian habitat throughout its range has contributed to the loss of foraging and roosting habitat for this species. Indiana bats hibernate in caves during winter and roosts in trees with loose bark in the spring and summer. Female Indiana bats tend to roost in maternity groups of a single roost tree during the pup rearing season. The majority of Indiana bats are thought to migrate to summer habitats in northern Missouri and southern Iowa. Indiana bats were found during the summer and are evidently reproducing and foraging on the installation. The presence of Indiana bats on FLW during the summer makes them a concern of the installation year-round although their presence is not considered to be indicative of widespread summer habitat use (USFWS 1997).

Historical surveys have indicated that Indiana bats have been known to use Wolf Den, Brooks, Davis No. 2, and Joy caves on FLW and Great Spirit Cave, Ryden, and Knife Caves (MDC-owned and managed nearby) as winter hibernacula from about September through April. However, over the years numbers have drastically declined on FLW. In 1979 Brooks Cave supported 19,500 Indiana bats. By 1996 that number dropped to only 536 bats. Then by 2016, no Indiana bats were recorded using Brooks Cave. The other three Indiana bat caves on FLW had support populations ranging from 29 to 135 bats. Based on surveys conducted in January 2005, the winter population on or adjacent to the installation is roughly 500 individuals. Additionally, Indiana bats have been known to be susceptible to white nose syndrome, a fungal pathogen that is causing mortality in several bat species (USFWS 2022c).

Gray bats are an endangered species known to occur throughout the southern half of Missouri, except for the extreme southeastern counties. Gray bats experienced serious population declines due to habitat loss and/or disturbances of the caves they use. This bat typically resides in caves year-round and hibernates during the winter months. During the summer months gray bats forage for insects around water ways. Historically, three caves have been used by gray bats in the area. A maternity colony has been known to occupy Saltpeter No. 3 Cave and had an estimated population of 3,740 in 1994. The maternity colony is used primarily from April through October. Freeman Cave, a transient location, had roughly 3,740 gray bats during 1994. Great Spirit Cave (2.2 miles west of FLW) is also a maternity colony and supported about 12,250 bats in 1994. Additionally, gray bats have been known to be susceptible to white nose syndrome however, they appear to be less susceptible to white nose than other myotis species and the population seems to be stable on FLW.

The northern long-eared bat is a threatened species and have been experiencing rapidly declining populations due to white nose syndrome. This fungal pathogen seems to spread among the bats when they are in close contact with each other. During the winter months they are known to hibernate in tight colonies located in caves and abandoned mines. Summer habitat is not well defined, but it is believed that roosting habitat includes dead or live trees and snags with cavities, peeling or exfoliating bark, split tree trunk and/or branches. During the pup rearing season females have been known to group in colonies and frequently move around from maternity locations. Foraging habitat includes upland and lowland woodlots and tree lined corridors.

Occasionally, they may roost in structures like barns and sheds (USFWS 2022c). Currently eight caves have known and documented the presence of northern long-eared bats. As of March 23, 2022, under 50 CFR 17 the USFWS is proposing reclassification of the northern long-eared bat from threatened to an endangered species. Thus, the bats ESA 4(d) ruling is expected to be removed near future and the bat re-listed as endangered. Additionally, refer to Section 4.3 for information regarding current surveys being conducted on FLW.

In May 2015, IMCOM released *Informal Conference & Management Guidelines of the Northern Long-eared Bat (Myotis septentrionalis) for Ongoing Operations on Installations Management Command Installations*. This document is intended to be a programmatic informal consultation with USFWS under Section 7(a)(2) of the ESA requirements for the northern long-eared bat. Activities not covered in the document would be required to pursue separate Section 7(a)(2) consultation requirements (USAEC 2015). Other bat species known to occur on FLW that have seen drastic declines include the tricolored bat, formally known as the eastern pipistrelle, and the little brown bat. The tricolored bat was petitioned to be listed in June of 2016 by the Center of Biological Diversity and the Defenders of Wildlife organizations (USFWS 2016). The little brown bat currently has a discretionary status review to determine if listing under the ESA is warranted. The little brown bat is included in a 7-year work plan with an expected determination in 2023 (USFWS 2022c). Bat surveys were conducted in 2016 and 2017 and are further discussed in Section 4.3.

Historic bat surveys have also noted the presence of the following bat species:

- Red bat
- Small footed bat
- Big brown bat
- Hoary bat
- Seminole bat
- Evening bat
- Silver haired bat

Discussions between the USFWS and FLW regarding protected bats are currently ongoing. Coordination includes proposals of a BA/BO for the installation, alternations to timber management, and seeking to extend the installations operational range of August 1 to April 15 from the existing restrictions of November 1 to March 31. Furthermore, the FLW NRB is in the process of initiating both summer and winter (cave) surveys for not just the three federally listed bats, but other bat species of concern likely to occur on FLW. Proposed contracts are anticipated to conclude in 2026. The USFWS fully supports the continuation of summer and winter bat surveys and have indicated the agencies willingness to assist in survey plans, if requested.

Eagles. In 2007 the bald eagle was delisted as a threatened and endangered species by the USFWS. However, eagles remain federally protected by the Bald and Golden Eagle Protection Act as well as the Migratory Bird Treaty Act. The Bald and Golden Eagle Protection Act federally protects eagles, their nests as well as their eggs, and

body parts. Bald eagles typically perch along Roubidoux Creek and Big Piney River corridors. An active nesting site is located on the Big Piney River. Wintering bald eagles occur on FLW during the November thru March time period. Eagles have also been observed around the LORA site. Refer to Section 4.10.2 for eagle management.

Migratory Birds. Migratory birds such as neo-tropical birds, are federally protected under the Migratory Bird Treaty Act; with the exception of starlings, house sparrow, and rock dove. The installation has a current administrative record of 216 resident, neo-tropical, and wintering species that have been found and/or sighted on FLW and are listed in Appendix D. Additionally, the great blue heron is federally protected migratory bird that also has protection over their nesting sites known as rookeries. There are two active rookies on FLW. The DPW environmental staff maintains a record of these sensitive locations. Many of the same migratory birds known to occur on FLW are also found at the LORA site. Total bird numbers are likely greater at the LORA site due to additional species using the lake during migration.

Mussels. The spectaclecase mussel was listed as federally endangered in 2012 and currently persists on FLW. It can be found between rocks and crevasses away from the main current in large rivers, and research has found that fish of the Hiodontidae family (mooneye and goldeye) are host species to complete the spectaclecase life cycle. Dams and other water flow obstructions have altered the mussel's environment throughout its range. These alterations prevent the passage of fish and other aquatic species that the mussel uses as host species during part of its life cycle. The water supply weir on the Big Piney River is an example of an obstruction that has altered the natural geomorphology of the river and creates a barrier for mussel host fish species, influencing native mussels such as the spectaclecase.

Over the past 77 years, critical structural components of the existing Big Piney River weir have degraded, resulting in large cracks and voids. Meetings with USFWS, MDC, MDNR, and other Big Piney River stakeholders were conducted to discuss a weir repair or replacement project. Based on concerns, a biological assessment (BA) was completed by USACE discussing the spectaclecase mussel (USACE 2021b) and other species of concern. The BA for the weir project considers the structure as obstacle for host fish population movement and suggests an aquatic organism passage may improve ease of movement around the structure. Poor water quality has also negatively impacted spectaclecase mussels throughout its range because they are filter feeders. FLW continues to monitor water quality associated with the installation. Refer to Section 4.3 for information regarding current surveys being conducted on FLW.

Amphibians. The hellbender is the largest salamander in North America. Adults can reach lengths up to nearly 30 inches. The Missouri Distinct Population Segment of the eastern hellbender was listed as Federally Endangered in 2021. As adults, their primary diet consists of other aquatic organisms such as fish and crayfish. Hellbenders are found in swift, shallow streams around large rocks and boulders. Breeding occurs in the autumn months. Nests are created on the streambed by the males, which also have the responsibility of guarding the fertilized eggs (USFWS 2003). As a federally listed endangered species, the Installation works closely with MDC on intensive management.

Including activities such as habitat augmentation, captive rearing, and pit tagging. Known causes for Eastern hellbender decline include habitat loss and degradation from impoundments, ore and gravel mining, sedimentation, and runoff of nutrients and toxins. Hellbenders are habitat specialists that depend on constant levels of dissolved oxygen, temperature, and water flow. Even minor alterations to stream habitat can be detrimental. Compounding habitat degradation is the fact that rocks used by hellbenders for cover and nesting are disturbed by people using the rivers for recreation and by people specifically trying to capture hellbenders. The eastern hellbender was also included in the BA for the Big Piney River weir project. The BA suggested surveys, monitoring, relocation of hellbenders inhabiting the weir, and rock habitat placement during the projects construction to mitigate for adverse effects.

Fishes. Currently the bluestripe darter, listed as a species of conservation concern, has been petitioned to the USFWS for federal listing as a threatened or endangered species. FLW is working with MDC to determine the status and present distribution of the bluestripe darter within its' and nearby streams. The USFWS supports theses status and distribution efforts on FLW and offers its assistance, if requested. The USFWS will be reviewing this species and expects to make a finding in fiscal year 2027.

Pollinators. The monarch butterfly, regal fritillary, and American bumble bee have been petitioned to the USFWS for protection under the ESA. In 2020, after an extensive status assessment of the monarch butterfly, the USFWS determined that listing the monarch under the ESA is warranted but precluded at this time by higher priority listing actions. The American bumble is currently under status review by the USFWS. The regal fritillary has a state listed status as vulnerable (MDC 2021) and following a 90-day positive finding, is under status review by the USFWS. The monarch butterfly has been positively identified at FLW and the LORA site. There are no identifying records at FLW or the LORA site for either the regal fritillary or American bumblebee.

3.3.5 Invasive Species

Invasive species are those species which have been introduced, by any means, into an area from which they are not natively or historically known to occur. Many invasive species do not have natural predators to reduce their populations and expansion to other areas. Many invasive species out compete their native species counterparts, resulting in a decline in native species populations. Some invasive species may be poisonous and can be harmful to other organisms that unknowingly feed on them. Other invasive species can become super predators and disrupt the food web by over consuming native various native species. Invasive species at FLW include, but are not limited to, sericea lespedeza, callery pear, Chinese privet, Asian honeysuckle, Johnson grass, autumn olive, European starling, rock dove, feral hog, EAB (discovered winter of FY17), Asian clams, common carp, and reed canary grass. Many of these invasive species can also be found at the LORA site.

Invasive mussels, such as the zebra mussel, quagga mussel, and Asian clam have been documented in Missouri. However, only the zebra mussel has been documented in the Lake of the Ozarks and are present in the waters surrounding the LORA site. Neither the zebra nor the quagga mussels are found or known to occur on FLW. The

Asian clam is widespread in the state of Missouri including the Big Piney River and Roubidoux Creek providing a threat to native mussel species through competition. The zebra mussel has been documented in Lake of the Ozarks surrounding the LORA site. Neither the zebra nor the quagga mussels have been found on FLW.

3.4 HUMAN ENVIRONMENT

3.4.1 Cultural Resources

Cultural resources encompass a broad spectrum of resource types defined by various statutes. The most commonly applied legal statute is Section 106 of the NHPA, as amended, and it's implementing regulations 36 CFR Part 800, as amended. Section 106 defines the responsibility of federal agencies to consider the effects of their actions on cultural resources. Referred to as historic properties in 36 CFR Part 800.16, this resource type is defined as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior." It is important to note that the definition of "historic properties" in 36 CFR Part 800 also encompasses properties of traditional religious and cultural importance to an Indian tribe. The importance of this last site type is further underscored by Executive Order 13007, which reinforces the importance of the management and preservation of this resource category.

Other statutes that define various categories of cultural resources includes:

- Cultural items, as defined in the Native American Graves Protection and Repatriation Act
- Archaeological resources, as defined in the Archaeological Resources Protection Act
- Sacred sites, as defined in EO13007
- Collections, as defined in 36 CFR 79 "Curation of Federally Owned and Administered Collections."

The current FLW ICRMP (2017) contains guidance for cultural resources management program objectives, policies, and methods that FLW will follow and utilize to ensure compliance with legal and ongoing responsibilities. Objectively, the ICRMP has established Standard Operating Procedures (SOP) to implement the cultural resources management program. Under SOP #5: Assessing Effects, the Cultural Resource Manager for FLW will make a determination of potential effects on historic properties resulting from a proposed action. The processes laid out in the ICRMP SOPs and all INRMP activities that have the potential to affect cultural resources are subject to full review under the procedures defined in 36 CFR § 800. Per SOP #5 the Cultural Resources Manager will initiate consultation with the MOSHPO and federally recognized consulting tribes, as appropriate. If any INRMP actions are determined to have an adverse effect on a cultural resource, then the installation is responsible for consulting with the appropriate parties to either avoid, minimize, or mitigate the adverse effects in accordance with 36 CFR § 800.

As of 2020, the entirety of FLW and the LORA site, except for dud/hazardous areas and approximately 5-acres within the cantonment area, been subjected to Phase I survey and identification for cultural resources. However, SOP #5 would remain in effect concerning INRMP activities which may affect cultural resources. Information concerning known sites and surveys are maintained by FLWs DPW Environmental Division.

3.4.1.1 Location and Environment

FLW is located in south central Missouri, within a physiographic region known as the Ozark Highland. The central region of the installation consists of dissected uplands and the Big Piney River and Roubidoux Creek are located on the eastern and western boundaries of the installation, respectively. These two drainages generally have wide, deeply incised valleys with extensive floodplains and complex Holocene and remnant Pleistocene terrace systems that factor significantly into past human settlement patterns. The affected environment described here also includes the LORA site. The LORA is located 57 (highway) miles northeast of FLW on the Grand Glaize arm of the Lake of the Ozarks.

The period-specific discussions below give a context, as well as examples, of the types of cultural resources that FLW actively manages, both at the installation and at the LORA site. The information presented below is drawn from the ICRMP (2017).

3.4.1.2 Pre-Contact Context

Due in large part to ongoing compliance with federal preservation laws, the installation has generated an extensive volume of data related to the area's archaeological and historical resources. Evidence of human occupation at FLW and the surrounding areas suggests people have been living in the area since the late Pleistocene. Sites associated with the earliest evidence of human activity in North America come from the period known as the Paleo-Indian (13000-7800 B.C.). Although very early sites associated with the established Paleo-Indian Clovis period have not been recorded at FLW, they have been recorded in the region, and geomorphological studies suggests that caves and rock-shelters, along with specific remnant terrace formations, may yet contain material of this antiquity within the installation. Artifacts associated with the early and middle Paleo-Indian period often consist of isolated surface finds of distinctive projectile or spear points. While these types of finds have been reported in the region, they have not been recorded specifically within the installation. Late Paleo-Indian sites associated with the Dalton culture are well known for the region, and material corresponding to this time period has been recovered at three sites on the installation. Two of these sites are located in the interfluvial uplands, away from the major drainages.

With the onset of more modern environmental conditions during the Holocene, archaeologists note a shift in material culture used to exploit a more diversified set of resources. In large part people remained organized in small, highly mobile bands, but site types expand to reflect seasonal use of resources, increased reliance on plant resources, periodic coalescing of bands to take advantage of seasonally abundant

resources, some long-distance exchange, and an increase in local population. Again, the Archaic period is sub-divided into early, middle, and late expressions that correspond to observable adaptation over time (7800 to1000 B.C.). In large part, the early Archaic Period sites occur in similar settings as Paleo-Indian period sites. During the middle Archaic the settlement patterns demonstrate a shift toward major river valley margins and increasing use of aquatic resources, along with discernable patterning of site types (including base camps and resource specific camps) suggesting subsistence activities aligned to planned seasonal movements. Evidence from a number of sites on the installation has led to new scientific insight into this time period in the region, especially the late Archaic. The late Archaic shows a continuum along similar lines of increased population, but with increased inter-regional interaction and the appearance of domesticated plant use along with related technological adaptation. Again, site types associated with this time period are numerous on the installation, especially those dating to the late Archaic.

Transition out of the archaic period, and into the Woodland Period (1000 B.C.-A.D. 1500), is largely defined by the introduction of pottery and distinctive projectile point styles associated with cultures centered on the Mississippi and Illinois rivers. Also organized into early, late, and middle periods, these cultural and technological traits diffused quickly into the surrounding areas but are less well defined in and around FLW. During the early and middle sub-periods of the Woodland, the northern Ozarks were often thought to have represented a sparsely populated hinterlands, but more recent research on the installation has informed a reconsideration of aspects of this assumption. In particular, the Archaic populations appear to persist into this time period adopting only aspects of technological adaptation seen elsewhere, and only those most suited to the local environment. The last sub-period, the late-Woodland, which also overlaps with the Mississippian Period elsewhere, is defined by increased reliance on maize, diversified ceramic technologies, and the emergence of large permanent villages. This last sub-period is characterized as a time of reorganization and growth, based largely on the independence that came with reliable horticultural-based subsistence. Aspects of the post-Woodland, Mississippian cultures find their way into the region, but do not represent a complete replacement or transition away from earlier life-ways as seen elsewhere. The late Woodland represents the last, and most intensive prehistoric cultural manifestation on FLW.

The proto-historic period is described as the time when native inhabitants to the region first came into contact with European immigrants, and much of the information is derived from combining early historical accounts with archaeological research. The FLW area shows strong correlations with groups that would eventually be recognized as tribes like the Kaw, Omaha, Osage, Ponca and Quapaw (that are referred to as the Southern Dhegiha Tribes due to their shared linguistic traditions that are derived from the larger Central Siouan linguistic group). The proto-historic cultures were heavily influenced by historical trends including endemic disease introduced by European contact, inter-tribal conflict exacerbated by displaced eastern tribes moving into the area, and eventually American expansion and resettlement. The area comprising FLW would eventually fall under the influence and be utilized as a primary hunting and resource extraction zone of the Osage tribe whose permanent villages were located 70-

100 miles due North. The Osage tribe's physical proximity, seasonal utilization of resources as a hunting ground, and political influence in the FLW area continued until the beginning of the European-American influx of the late 1700's.

3.4.1.3 Historical European American Context

The earliest documented foray into the area by European explorers was that of the Frenchman Claude-Charles Dutisné who passed through the area in 1719. His path through the northern Ozarks would eventually become the primary transportation and immigration route through the area. Although not well documented, the balance of the 19th century probably saw sparse exploration of the area, likely by Anglo and French hunters. The first permanent settlement of the region started with the Josiah Turpin family in about 1815 or 1816. Thus began the period of gradual settlement of the area by immigrants of European heritage. The approximate modern boundaries of Pulaski County were largely fixed by 1860, yet it still had the lowest population of any Missouri county located in the northern Ozarks, with only about seven people per square mile. The slow settlement of the area has been attributed to the general isolation, and the lack of fertile farmland. In fact, the lack of strong government, political organization, and established society appears to have been one of the primary draws for early settlers who were highly independent pioneers. Subsistence for these early settlers likely consists of limited agriculture supplemented by hunting and gathering. Settlers looking to participate in a cash-crop economy were fewer, but many of this type of settler were responsible for creating some of the early mills and stores, and the formation of local governments. The lumber industry also developed during this same time period. Local sawmills provided points of sale for local timber harvest, and the rivers provided a means to move raw lumber to the mills until more dependable roads were established. Prior to the Civil War the community of Waynesville became the only town of any size, and eventually became the County Seat of Pulaski County in 1833.

Immediately prior to the Civil War, Pulaski County was poised to enter the modern era with the construction of the railroad through the area. The war would ultimately halt efforts to bring the railroad to southern Pulaski County. Although no major battles occurred in the FLW area, the area saw its share of violence. Smaller forces found the timbered valleys, and twisting roads offered good cover for small forces to engage in unconventional warfare. Many residents enlisted in both sides of the conflict, and those that stayed found their land, buildings, and resources were raided or burned, leaving them little choice but to leave the area. Eventually, Union forces would construct a fort near Waynesville, and from this fort they guarded the St. Louis to Springfield road, and worked to clear the surrounding area of guerilla forces. Although no large battles were fought in the immediate area, numerous smaller skirmishes have been noted, such as the raid on McCourtney’s Mill.

Many of the original settlers to the area never returned, others moved on, but efforts on the part of the post-war state of Missouri to encourage settlement led to a second influx of settlers, many of these from northern states such as Illinois, Ohio, and Indiana. County auctions and the 1862 Homestead Act provided the mechanism for the resettlement of many of the free and abandoned lands in Pulaski County. The railroad

also spurred settlement of the region, but its eventual location to the north of FLW concentrated settlement in those areas, leaving behind a more traditional settlement and subsistence pattern for the immediate area. That said, the exponential expansion of the railroad in the west did create opportunities for the local residents. Every mile of track that was laid required 3,000-hardwood crossties, and the immediate region had an abundance of hardwood forest to support the industry. Producing these crossties, or tie-hacking as it was called, became an important source of income for landowners in the FLW area. This model would persist into the middle of the 20th century, with the exception of some specialized dairy farming taking place in the upland plateau areas in southern Pulaski County. Population, and by extension production, did increase through the mid-20th century, giving rise to small hamlets and towns, and other services and infrastructure for local residents that can still be discerned on the landscape. Of particular note is the Rolling Heath School House, a structure located on the installation and declared eligible for listing on the NRHP.

3.4.1.4 Historical Military Context

In response to economic downturns during the 1930s, the federal government instituted a number of programs in the FLW region. In 1933 the USFS began purchasing land in the area that became part of the Mark Twain National Forest. Other federal programs such as the Agricultural Adjustment Act and the Sub-marginal Land Acquisition Act allowed the department of agriculture to directly acquire lands, or to pay farmers to take crop land out of rotation to prevent further degradation. Families were relocated or provided with loans or part-time employment for the loss of their livelihoods. The Civilian Conservation Corps also had a profound effect on the region in the 1930s by building and improving roads and bridges, installing telephone wires, and planting trees.

The Army would announce their intentions to purchase approximately 65,000 acres in October of 1940, in anticipation of looming involvement in the war in Europe. By December of that year, work had already begun on what would become FLW. In establishing the installation, the Army eliminated the rural communities of Cookville, Moab, Tribune, Wharton, and Bloodland in addition to numerous farmsteads and homes. The razing of the structures associated with these settlements took place in 1939 and 1940, and was so thorough that only two buildings were spared; the aforementioned Rolling Heath School House, and a historic house in the range area that is currently used for storage. Construction of the original cantonment area, and its 1,600 buildings, took only seven months and conformed closely to standard layout and design for Army facilities at the time. At its peak, more than 30,000 workers were camped within a 50-mile radius of the fort working on its construction. By the end of 1941, the Army was training 32,000 soldiers at the installation, and this number would increase throughout the war years. One of the significant components of these World War II-era facilities at the post was the prisoner-of-war camp constructed in 1942. This facility would house as many as 3,000 German and Italian prisoners at its height, with another 2,000 held in satellite camps. Prisoners were put to work and constructed numerous native stone retaining walls, sidewalks, and drainage structures that still exist today and comprise a vital component of the installation’s cultural resources. Other resources from this era include the World War II Temporary Building Historic District,

which now house museum facilities, and the World War II-era Cantonment/Big Piney River District. This latter district includes a number of more permanent structures, including the historic Black Officer's Club and a number of prisoner-built infrastructures.

FLW was closed on March 31, 1946, and the lands were leased for cattle grazing until August 1, 1950. The installation was reactivated during the Korean conflict. The installation's roles would evolve quickly after reactivation, eventually being designated as the United States Army Training Center - Engineer, which was followed immediately with a declaration that FLW would be a permanent facility. The latter declaration would allow the federal government to build permanent structures at the installation. Between 1958 and 1961, 2,829 housing units, a chapel, schools, a theater, bachelor enlisted and officer quarters, and in 1965 the General Leonard Wood Army Community Hospital were completed. Entry into the Vietnam War also saw a boom in construction that peaked in 1967, when the post was training about 123,000 soldiers at a time. Since the designation of FLW as a Training and Doctrine installation the training mission has continued to evolve and expand to its modern configuration, and with each change has come new facility requirements. Federal law generally mandates that cultural resources must be at least 50 years of age to be considered eligible for listing on the NRHP, and management of buildings associated with the installation's earlier periods of development is an on-going cultural resources management priority for the U.S. Army and FLW.

3.4.1.5 Cultural Resources Present at Fort Leonard Wood

Cultural resources located within the boundaries of FLW originate from all of the time periods discussed previously. They include archaeological sites, historic districts and structures, cultural landscapes, and cemeteries. As of 2022, 583 archaeological sites have been recorded across the installation, including 366 pre-contact sites, 191 historical sites, and 26 sites that contain both pre-contact and historical deposits. Of these sites, 326 are considered or have been determined eligible for listing on the NRHP (FLW 2017b). FLW has also identified two historic districts, the Rolling Pin Barracks Historic District and the World War II Temporary Building Historic District. In addition to the two districts, which encompass multiple buildings, six additional buildings have been individually determined eligible for the NRHP (FLW 2017b, 2014). The 253 extant World War II-era stone-work structures constructed by prisoners of war at FLW have also been determined NRHP eligible (FLW 2014). NRHP historic eligible landscapes have also been designated for Veterans Park, the World War II Temporary Building Historic District, Gammon Field, and the old Post Headquarters/old Red Cross Building (FLW 2016c). Survey at the LORA site identified seven pre-contact period sites, three historical sites, and one site that contains both pre-contact and historical deposits. Five of the sites are considered eligible for listing on the NRHP. (FLW 2017b; Ray et al. 2020).

3.4.2 Land Use

The cantonment makes up the portion of the installation where the widest variety of land uses occur. The remaining non-cantonment area is used primarily to support the installation's training functions. Table 3 provides a short definition for each land use

categories on FLW. Additionally, the LORA site is primarily used for recreational purposes such as camping, boating, hiking, and fishing. However, minor military training does occur in the southern portion of the site.

Table 3 Land Use Categories at Fort Leonard Wood

Category	Description
Administration	This category includes headquarters and office buildings to accommodate offices, professional and technical activities, records, files, and administrative supplies.
Airfield	This category includes landing and takeoff areas, aircraft maintenance areas, airfield operations and training facilities, and navigational and traffic aids.
Community Facilities	This category includes commercial and service support facilities similar to those associated with a civilian community. The commercial facilities include exchange and commissary facilities that would make up the commercial aspects of a community center. The service support facilities include educational, post office, library, childcare center, youth center, chapel, and religious educational functions.
Family Housing	This category consists of all types of residential units and developments occupied by enlisted and officer families, including temporary housing provided for arriving and departing families who are assigned to permanent quarters. Family housing has its strongest functional relationship with community facilities land use.
Industrial	This category includes activities for manufacturing Army equipment and material, utility plants, and waste disposal facilities.
Maintenance	This category includes facilities and shops for maintenance and repair of all types of Army equipment found at depot maintenance, installation maintenance, and organizational and equipment maintenance.
Medical Facilities	This category includes facilities providing for both inpatient and outpatient medical and dental care for active duty and retired personnel. This category may also include veterinary and Red Cross facilities.
Outdoor Recreational	This category includes outdoor athletic and recreational facilities of all types and intensities, including natural resources, outdoor recreation, and cultural values.
Supply/Storage	This category includes depot, terminal, and bulk-type storage for all classes of Army supply.
Training/Ranges	Two distinct types of facilities fall under this land use and are identified as cantonment and non-cantonment. Firing ranges and TAs make up a majority of the non-cantonment uses within this land use. Cantonment type Training/Ranges

	land use functions include all types of academic facilities, indoor firing ranges, U.S. Army Reserve and National Guard centers, range operation towers, ammunition breakdown and distribution sheds, target storage and maintenance buildings, range operation buildings, simulator buildings, training courses, and outdoor facilities.
Troop Housing / Unaccompanied Personnel Housing	This category consists of unaccompanied enlisted and officer barracks, and includes dining, administration, supply, outdoor recreation, and community retail and service facilities.
Open Space	This category includes safety clearances, security areas, utility easement, water areas, wetlands, conservation areas, forest stands, and grazing areas. Unoccupied land can be used to separate and define the various sections of the installation and create a natural setting for facilities. Open space may be undeveloped due to environmental or physical constraints such as floodplains, steep slopes, etc., or may be needed for functional uses such as aquifer recharge, well field, forest production area, and conservation area or protective area for endangered species.
Source: Master Planning Instructions, Fort Leonard Wood DPW and USACE	

Note: Categories as identified by USACE, Master Planning Instructions (USACE 1993).

3.4.2.1 Training

Training activities on FLW include Army basic combat training, advanced individual training, CBRN, engineer, military police courses, training, and schools, active-duty station personnel training courses, unit mobilization training, JIIM training, and ordnance and munitions training, handling, and use. Other training includes training requirements for mobilizing units. Much of the training outside of the classroom environment occurs on training areas and range complexes.

Training and Maneuver Areas. There are a variety of training areas (TA) and/or ranges located on FLW that fire or detonate small and large caliber arms, explosives, projectiles, and other training munitions, conduct drivers training, and/or equipment maneuvers. For security reasons, TAs are rolled up into Figure 9 which shows restricted areas, to include areas where live-fire ordnance has occurred known as “dudded areas”. Table 4 summaries acreage values lands classified as maneuver, TAs, and other restrictions. Note: Portions of the areas on Table 4 have overlapping acreages.

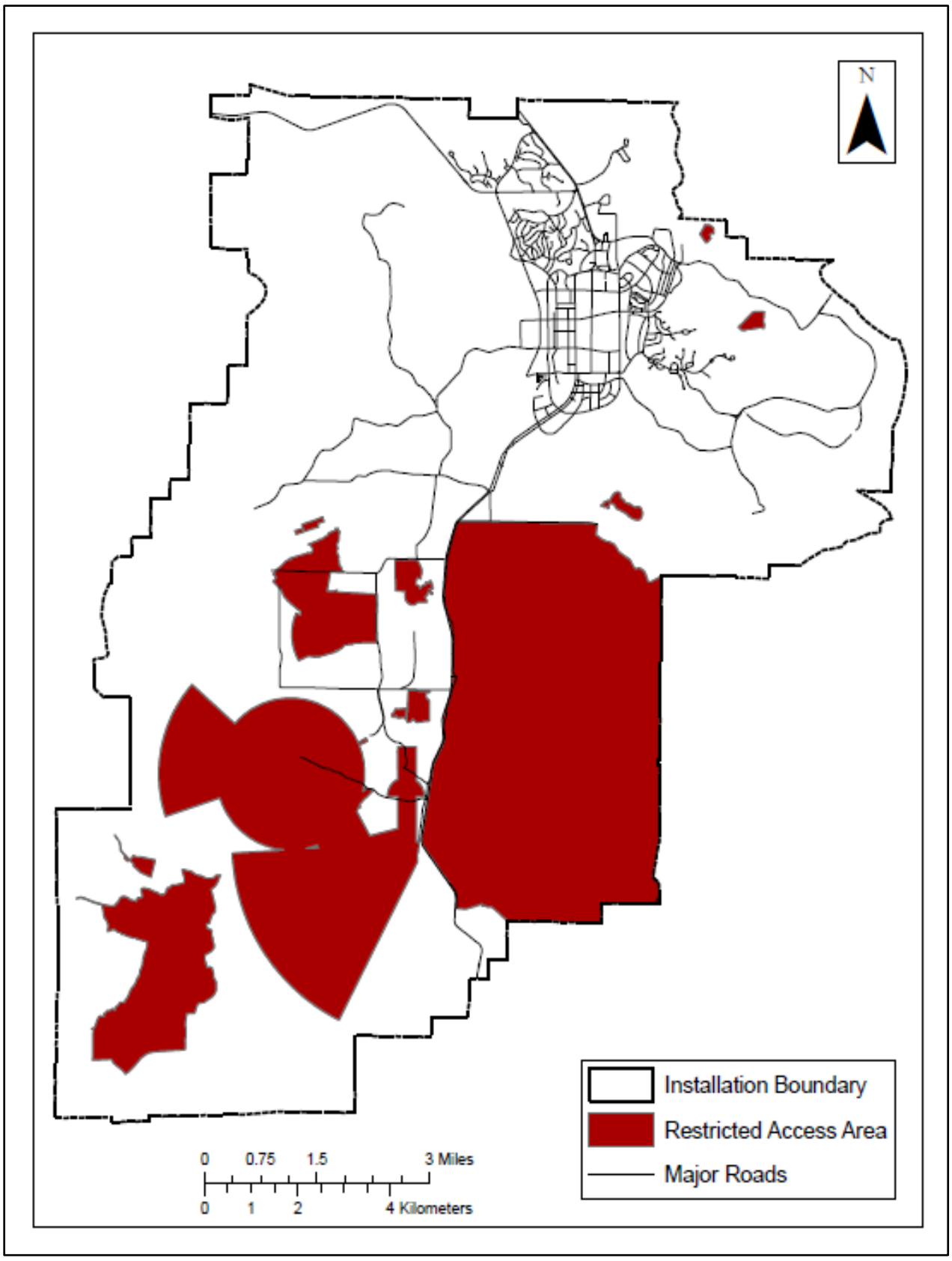


Figure 9. Restricted Areas

Table 4 Land Use Classifications at Fort Leonard Wood

Area Classification	Area (Acres)
Maneuver Area	43,999
Training Area	7,543
Surface Danger Zone	10,401
Impact Area	9,389
Military Range Area	3,519
Unexploded Ordinance Contamination	1,960

The following is a summary list of the general types of munitions that are used for various training scenarios and purposes. Each type of munition could have a dummy or practice munition that potentially is used:

- Smoke pots and smoke grenades
- Illumination rounds, flares, and other pyrotechnics
- Simulators
- CBRN training aids
- Ammunition (9mm, 5.56mm, 7.62mm, 40mm, shotgun cartridges, 0.38 Cal, 0.45 Cal, 0.50 Cal, etc.) to include tracer rounds and blanks
- 60mm, 81mm, and 120mm cartridges
- 84mm (AT4) rocket, 2.75 inch practice rocket, and other guided missiles;
- Flash-bangs; smoke, hand, and stun grenades
- Claymores, detonators, shape charges, and other demolition explosives
- Primers and propellants
- Flame fuel explosives
- Antipersonnel and antitank Mines (practice)
- Mine Clearing Line Charge
- 20mm, 30mm, 40mm, 105mm, 120mm, and other cartridges/projectiles/bombs

Erosion and sediment control BMP's are also located throughout the range complex and training areas. Some of these BMP's include silt fences, ditches, detention basins/sediment traps, and vegetative plantings. Range complex and training areas are compliant with the installation NPDES permit and Storm Water Management Plan.

Restricted Areas. Restricted areas on FLW are shown in Figure 9. These restricted areas reduce the available gross training and maneuver space. The term "restricted" does not always infer that there is inherent environmental, health, and/or safety hazards, or that these areas prohibit military training. Restricted areas are further defined as "Limited" and "Excluded". A "Limited" area is one where the safety of personnel within the area and in the surrounding area must be given the highest priority possible due to the types of activities being performed. For example, TA 190 is used for Robotics training, some historic landfills are used for land navigation activities, and lakes are used for bridge training. An "Excluded" area is one where training is not authorized or allowed and general access is not permitted. An example of this is Range 25 where unexploded ordnance concerns still exist. Other areas include impact and dud

areas where bombing, strafing, and cannon-fired ordinance impacts exist. Surface Danger Zones would also be considered excluded area.

3.4.2.2 Recreation

A wide variety of on-post recreational facilities are available to military personnel and their dependents, and to civilian employees on a space-available basis. The DFMWR is responsible for implementation of most outdoor recreation on FLW. The DFMWR rents outdoor recreation equipment (boats, canoes, tents, etc.), sponsors float trips, schedules picnic and camping areas, and issues Missouri hunting and fishing permits.

The primary outdoor recreational area consists of the Davidson Fitness Center located in the cantonment area. The center includes eleven softball fields, seven soccer fields, six tennis courts, two Sports Complexes with three Soft Ball Fields and batting cages, flag football fields, youth athletic fields, and a 400-meter all-weather track. During summer months, the sports staff oversees the operation of an Olympic-sized outdoor pool (with a 50-foot water slide). The Davidson Fitness Center is a state-of-the-art facility that provides fitness equipment and programs for the entire family. The 64,000 square foot facility has basketball, racquetball and volleyball courts, an indoor 25-meter swimming pool, an elevated indoor running track, and six locker rooms.

There are numerous playgrounds, multiple-use courts, and tracks associated with the schools and family housing areas within the cantonment. Other outdoor recreational facilities include:

- Trap, skeet, and archery range adjacent to the east side of the cantonment
- Frisbee golf
- Riding academy and horse stables adjacent to the west side of the cantonment
- 18-hole Piney Hills Golf Course
- Two paintball fields
- Rustic camping sites
- Happy Hollow Recreation Area with a picnic area along the Big Piney River
- Indiana and Colyer Parks
- Sportsman’s Club and East Gate Campgrounds
- Paw Park (dog park)
- Lieber Heights Pool
- Bloodland Lake and Penn’s Pond, which are major fishing areas; and numerous picnic areas and hiking trails
- 6.1 mile asphalt running/jogging trails
- 1.9 mile Fitness Trail
- 2.6 mile earthen Engineer Trail

Indoor recreational facilities include:

- Two movie theaters
- Bowling center
- Auto crafts shop

- Youth Activities Center
- Four large and six small gymnasiums

Hunting and Fishing Areas. FLW is divided into 49 hunting areas (Figure 10), to include associated archery and cantonment hunting areas. For ease of use and for orientation purposes, area boundaries follow established roads and trails. If this is not feasible, natural features, such as drainages, are used. Several areas are designated as no hunting or off-limits areas. FLW Regulation 210-21, *Hunting and Fishing Regulations* indicate hunting areas, fishing impoundments, off-limits areas, and no hunting areas. FLW has 19 impoundments and three streams/springs managed for fishing. See Figure 11 for designated fishing locations at FLW.

Recreation Off-Post. FLW is situated in a region that is nationally recognized for its outdoor recreational opportunities. The 506,862-acres Mark Twain National Forest, parts of which border FLW, features rugged terrain, forested countryside, clear streams, and rivers and lakes. There are numerous developed recreation areas provided for camping, canoeing, off-road recreational vehicles, fishing, hunting and other recreational opportunities. The National Forest has over 750 miles of trails, 350 miles of perennial streams, and more than 35 campgrounds (USFS 2016). See Figure 12 for an aerial map of Mark Twain Nation Forest adjacent to FLW. Also included in the region is the Ozark National Scenic Riverways, consisting of a number of Ozark streams that are federally protected for floating and other recreational uses. The area has numerous other conservation areas that provide hunting, fishing, and other outdoor recreation. Local facilities in Waynesville and St. Robert that provide a variety of recreational opportunities. Additionally, Stone Mill Spring trout management area is only accessible by vehicle through the installation; however, it is off post within USFS land along the Big Piney River.

LORA. The FLW LORA is managed by FLW MWR but is located at the Lake of the Ozarks. The LORA site averages approximately 76,000 users each year and is approximately 360 acres in size. LORA offers cabins and lodging, camping, boating, swimming, water skiing, fishing and other outdoor activities at Missouri's scenic playground. Other activities nearby include caves, amusement and water parks, golf courses, gift shops, as well as many fine restaurants and night clubs. See Figure 13 for the LORA site location and boundary.

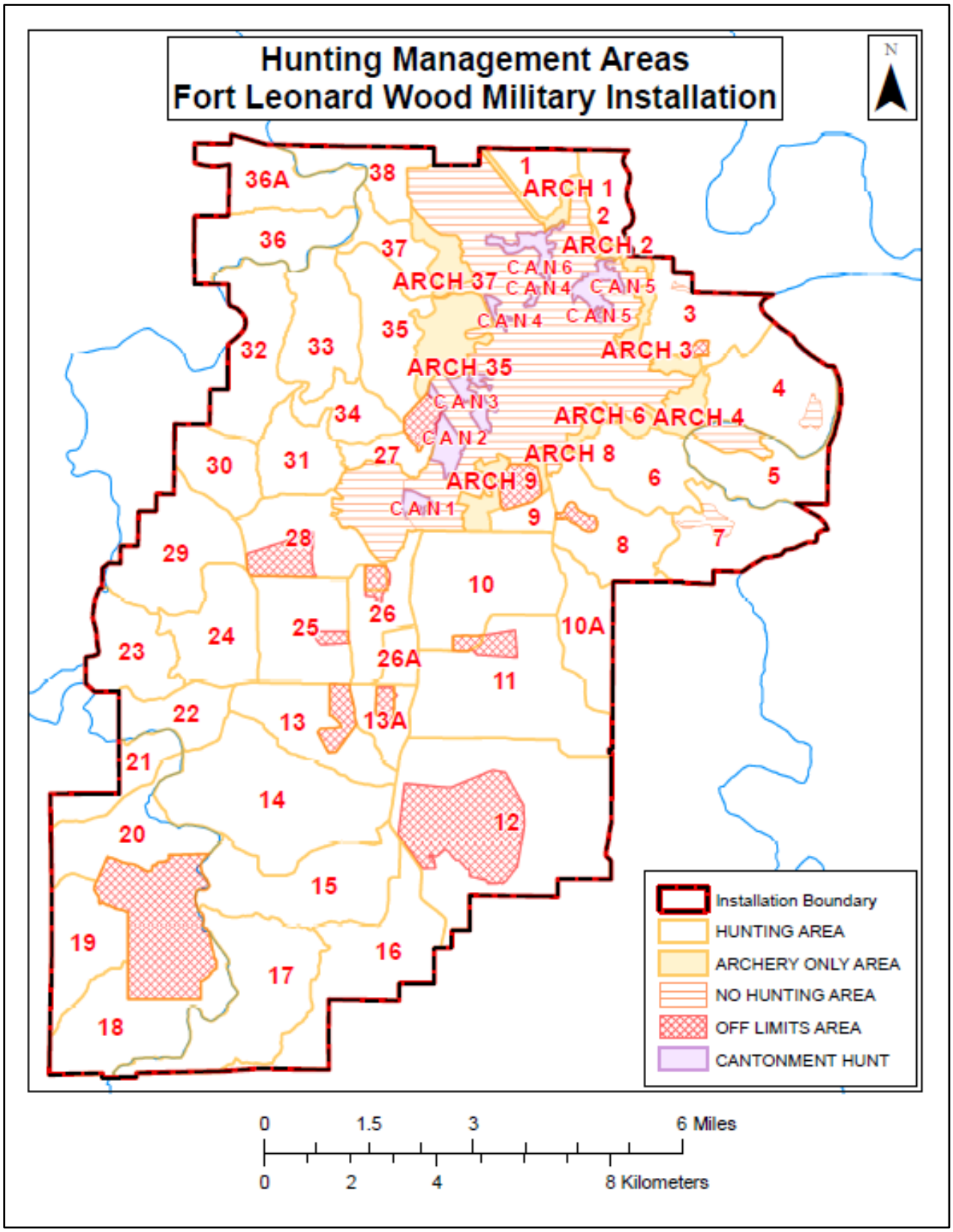


Figure 10. Hunting and Fishing Areas of FLW

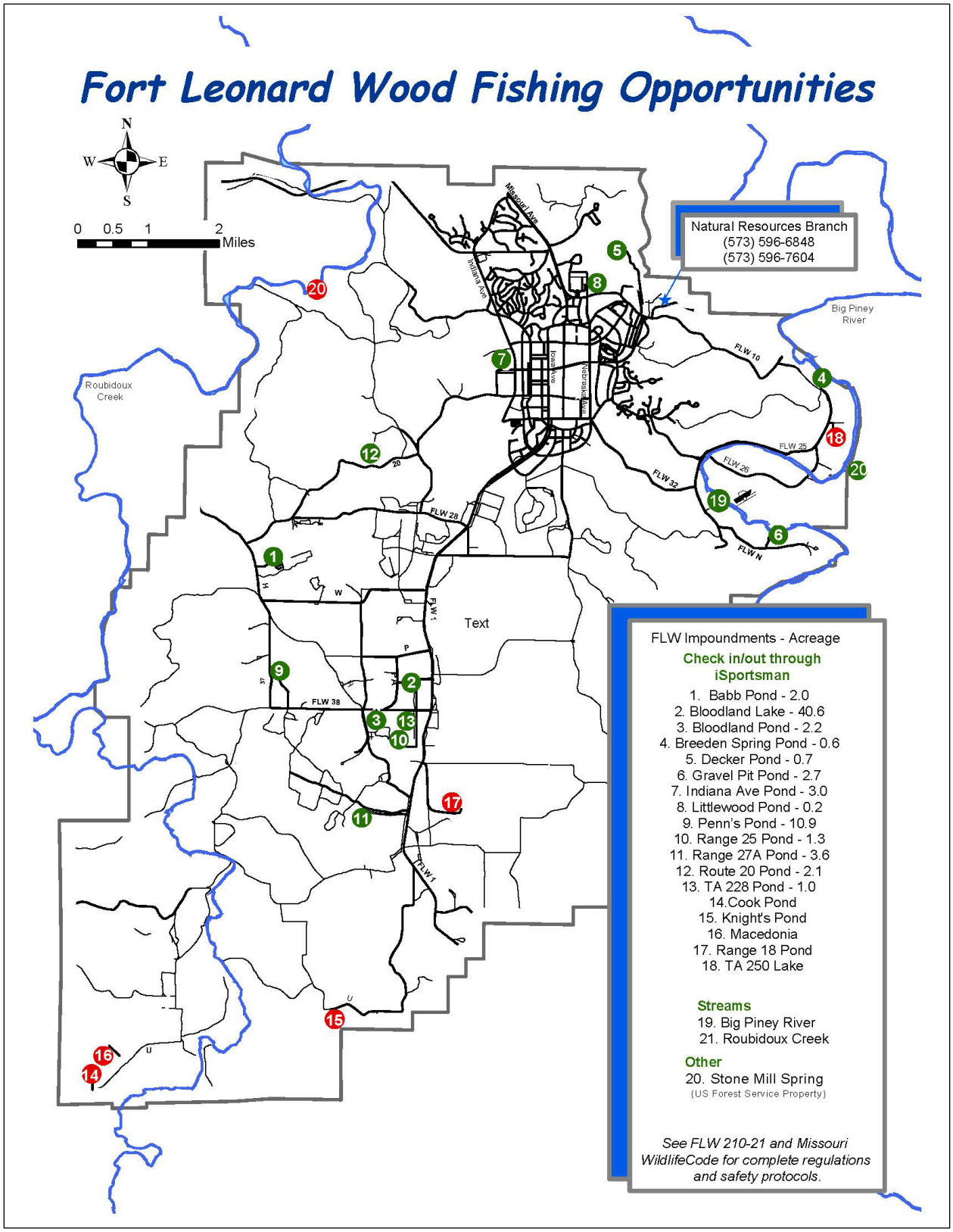


Figure 11. Fort Leonard Wood Fishing Opportunities

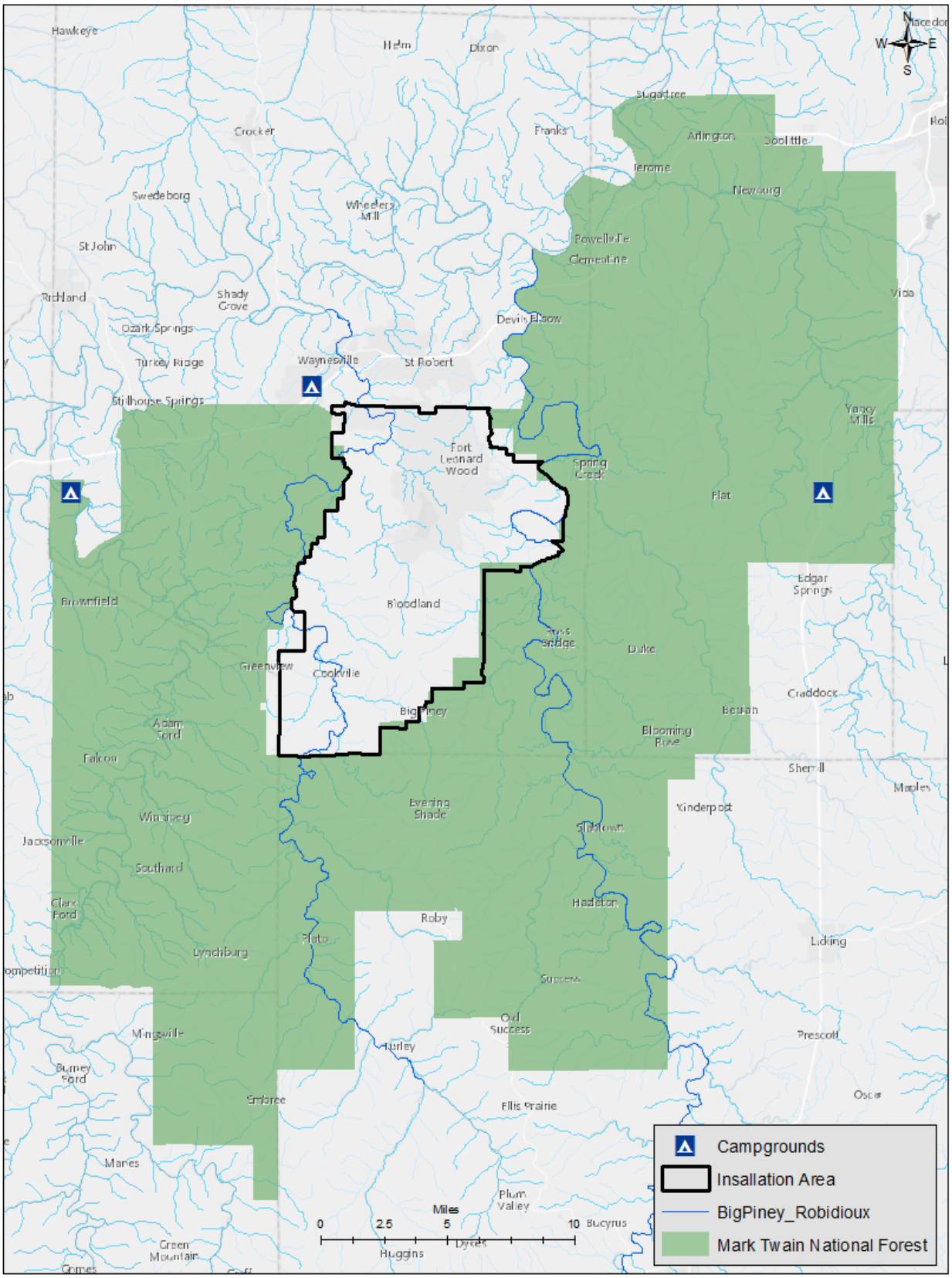


Figure 12. Mark Twain National Forest Lands

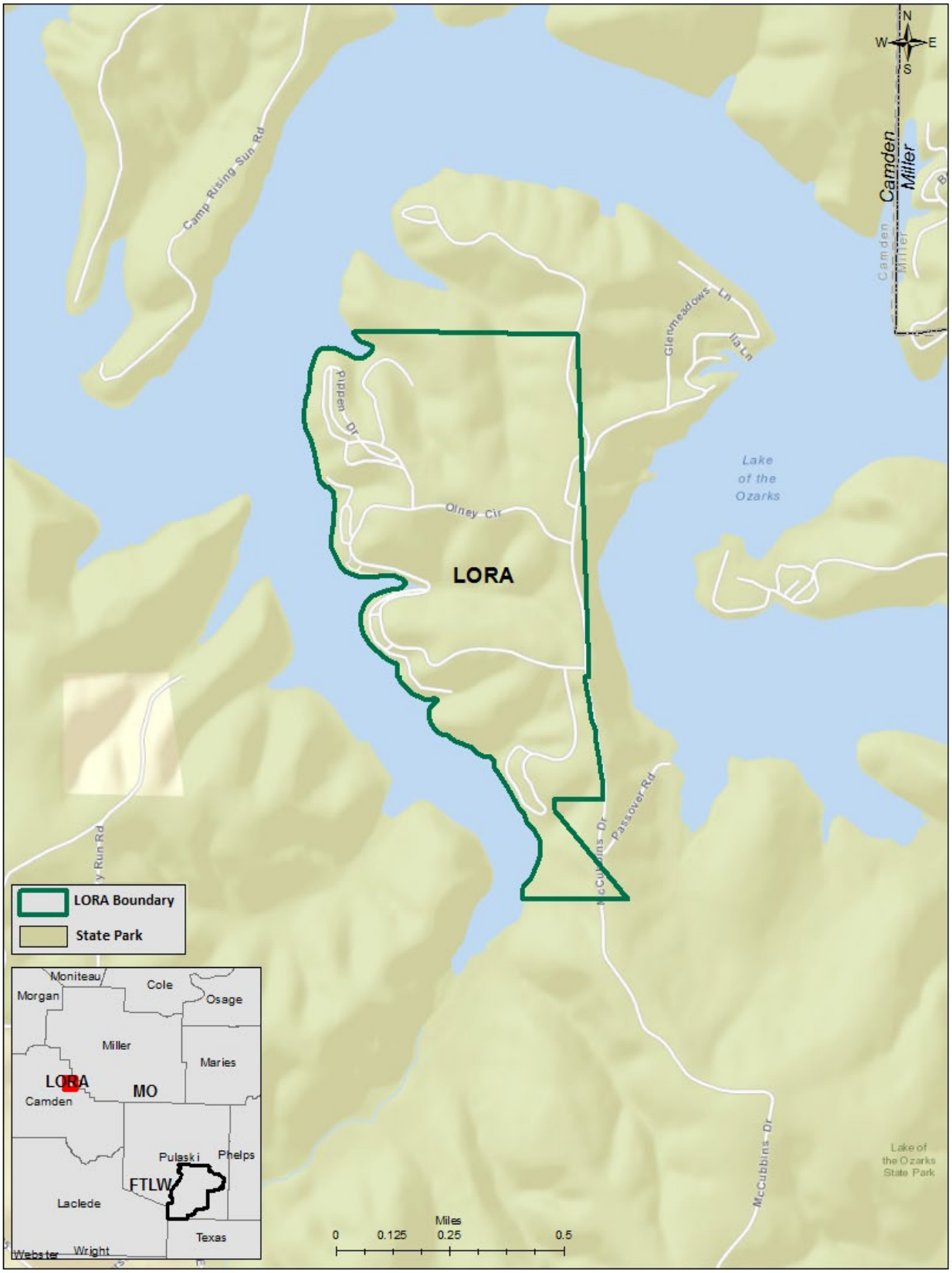


Figure 13. LORA Site Boundary

3.4.2.3 Forest Compartments

Until 2022 FLW was divided into 20 forest management compartments plus additional large areas not considered for forest management. Currently, 10 management compartments are used (Figure 14). Table 5 shows the 10 compartment sizes as well as projected management years for each. Compartments serve primarily as administrative subdivisions with boundaries following roads, streams, or other easily identifiable features. Stand boundaries are based primarily on timber composition and operational area. Prior to 2022, FLW was comprised of over 3,000 small acreage stands. Efforts are being made to combine these small acreage parcels into adjacent similar stands. Fewer and larger forest stands will simplify forest management. The LORA site is not part of commercial forest management.

Table 5 Compartment Acres and Management Schedule

Compartment	Acres	Projected Management Year
00 (Cantonment)	6,381	-
10	7,727	2027
20	611	2026
30	7,922	2025
40	15,316	2023/2027
50	2,765	2024
60	4,871	2026
70	5,078	2025
80	1,343	2024
90 (Riparian)	9,397	-
Total	**61,411**	

Information provided by FLW DPW Natural Resource Branch, 2022.

3.4.2.4 Physiographic Land Management Zones

Physiographic land management zones are based on a concept of use capability and constraints to use. Section 3.3.1.2, *Habitat Descriptions* discusses physiographic land management zones in detail, and Figure 7 delineates these zones for FLW. The zones are designed to be used for general land use planning. Land management at the LORA site is conducted differently than the lands on the installation. No Physiographic Land Management Zones are identified at the LORA site.

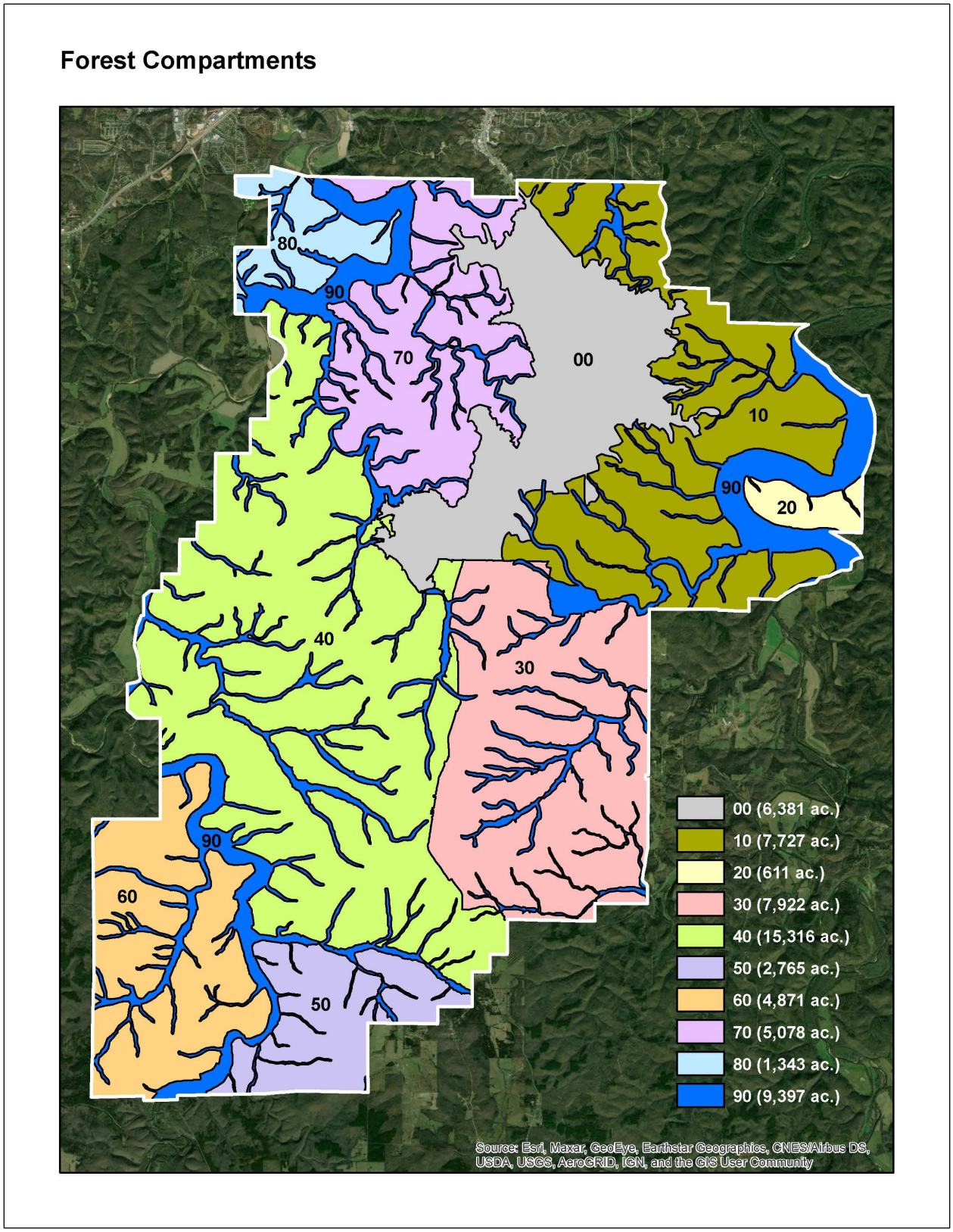


Figure 14. Forest Compartments of FLW

3.4.3 Facilities, Public Services, and Utilities

Improved grounds on FLW include acreage on which intensive maintenance activities are planned and performed annually as fixed requirements. These activities include lawns, athletic fields, golf course, parade and drill grounds, cemeteries, airfields and helicopter pads, ranges and training areas. There are about 2,000 acres of improved grounds on FLW.

Semi-improved grounds include areas on which periodic maintenance is performed but to a lesser extent than on improved grounds. Semi-improved grounds maintenance normally includes airfields and helicopter pads, ammunition storage, antenna fields, drop zones, fire trails (3rd and 4th class roads), firebreaks and fuel breaks, road shoulders, railroad rights-of-way, picnic areas, campgrounds and water access areas, wildlife food plots, remote training areas and ranges, and irregular terrain within cantonment and family housing areas. Periodic maintenance is necessary on about 8,000 acres of land at FLW.

Unimproved grounds include all acreages not classified in the two previous categories. Activities on unimproved grounds do not occur on a regular basis and are generally unpredictable, depending upon mission activities and changing conditions due to flooding, fire, insects, and other variables. There are about 53,000 acres of unimproved grounds on FLW. These include ponds, lakes and streams, pavement and railroads, buildings and structures, non-forest land, and commercial forestland. Additionally, the LORA site has roughly 35 acres of developed land that consists of buildings, parking areas, and manicured areas.

3.4.3.1 Transportation System

Road System. FLW is served from the east and west by Interstate 44. Missouri Avenue is a divided highway from the installation to the interstate. State Highway 17 approaches the installation from the west and State Highway AW (Route 1) provides direct access to FLW from the south.

FLW has a good system of roads to access most areas of the installation. The road system includes over 284 miles of roads of which more than 100 miles are paved and the remainder are loose surface roads, unimproved all weather roads, or unimproved dry weather only roads. Despite the extensive road system, vehicle accessibility to many areas is limited, especially during wet weather. Additionally, most roads at the LORA site are improved; however, some secondary graveled roads are utilized.

Railway System. The Army owns an 18-mile railroad spur connecting the installation to a commercial main line north of the installation. No rail exists at the LORA site.

Aircraft Facilities. Waynesville Municipal airport at Forney Field, located directly southwest of the cantonment area, provides limited service for military aircraft assigned to the installation and provides daily commercial commuter service. The installation has one other landing strip and numerous helipads. Most of the non-forested areas on the installation is accessible by helicopter. The LORA site has no aircraft capabilities.

3.4.3.2 Water Supply

The Big Piney River provides a quality, high volume water supply for the installation. Water is pumped from the Big Piney River to the treatment plant, which has an estimated maximum capacity of 9.8 MGD; however, the plant has an average daily design flow of about 2.5 MGD. Surface water resources occurring on FLW are discussed further in Section 3.2.5.1, *Surface Water*.

The Indiana Well is the only major production well that serves as a supplement to the Big Piney River intake. It is tied directly into the distribution system for the Installation and provides approximately three percent of the potable water supply. The Indiana Well has three pumps, each with a capacity of 400 gallons per minute, and a 2.25-million-gallon ground storage tank. In addition to the primary potable water system, 13 small satellite wells are capable of providing potable water for remote areas and small clusters of buildings including the training ranges, the golf course, and the rock quarry. Some of these wells are currently inactive and none are interconnected with the main distribution system. Water samples are periodically collected from potable groundwater wells for analysis, and all wells are in compliance with federal and state drinking water standards. Groundwater resources of FLW are discussed further in Section 3.2.5.2, *Groundwater*. The LORA site uses commercial water supply.

3.4.3.3 Wastewater

The wastewater treatment plant is located northeast of the main cantonment and discharges into Dry Creek, a tributary of the Big Piney River. Dry Creek receives much of its summer flows from this discharge source. Wastewater comes from the main cantonment area and the North Lieber Heights area. The system primarily uses gravity flow; however, lift stations are located where needed throughout the main cantonment. The wastewater treatment plant was recently upgraded to meet regulatory requirements. It is designed for an average daily flow of 5.0 million gallons with a maximum treatable design flow of 8.4 MGD. Currently, the plant operates at approximately 60 percent of capacity, treating about 1.4 MGD on average. The effluent discharge is in compliance with NPDES permit number MO-0117251. Additionally, the LORA site has two sewage lagoons on the south side of the property. These lagoons are permitted and in compliance with state and local requirements.

3.4.3.4 Stormwater

FLW can be divided into 16 major drainage areas; however, no separate storm sewer trunk system exists at the installation. Storm drainage is captured into open ditches and culverts that then flow into subsurface storm sewers pipes. These stormwater control structures convey water from the main cantonment to several tributaries, including Dry Creek and Pond Hollow, with eventual discharge into the Big Piney River on the east and Roubidoux Creek on the west.

FLW currently implements a Storm Water Management Program and maintains a Municipal Separate Storm Sewer System permit to comply with the Clean Water Act and with the MDNR State Operating Permit. All of the various land disturbance sites on the installation are permitted (when applicable), and routinely inspected for erosion

control, and FLW routinely monitors the outfalls from the installation. All installation outfalls discharge to either the Big Piney River or the Roubidoux Creek, and FLW monitors both upstream and downstream of the installation. In addition, the Municipal Separate Storm Sewer System permit requires having controls in place to prevent or minimize water quality impacts during construction and operation. Figure 5 shows water monitoring locations. Additionally, stormwater at the LORA site drains into the Lake of the Ozarks through a system of natural and manmade drainages.

3.4.3.5 Buildings and Structures

FLW has over 2,800 family housing units for officers and enlisted personnel in four main family housing areas on the installation. However, roughly 50 percent or more of the permanent military personnel at FLW live off the installation in communities surrounding the installation, especially in the nearby cities of St. Robert and Waynesville, Missouri (FLW 2016b). The installation has multiple dining facilities, snack bars, shops, service-clubs, childcare facilities, gymnasiums, maintenance, and administrative buildings. Medical facilities on FLW include the General Leonard Wood Community Hospital. The installation also maintains and supports the facilities at the LORA site that has roughly 20,000 square feet of space. Additionally, FLW has a number of historic buildings, one pre military, and some with World War II-era stonework, within the cantonment area. These buildings have been surveyed and are managed under a plan to protect significant archaeological and historic resources.

3.4.4 Socioeconomics

The population at FLW fluctuates around 12,000 active military and the installation supports an additional 11,000 family members and nearly 49,000 retirees. Typically, the installation trains and temporarily houses approximately 80,000 active component military and roughly 12,000 annually from other non-tenant units. The 2020 population census estimated approximately 10,600 people living in the St. Robert and Waynesville, Missouri areas. The nearby State Capital of Jefferson City was estimated to contain a population of approximately 43,000 (U.S. Census Bureau [USCB] 2021). Table 6 summarizes county population, demographics, and economics.

FLW is a top employer in the state of Missouri with an approximate economic impact of $3 billion (FLW 2020a). The installation pays out nearly a billion dollars annually to military salaries to permanent party and soldiers in training (FLW 2016c). According to the U.S. Census Bureau (2020), 30.4% of the workforce in Pulaski County, Missouri is composed of local, state, or federal government positions, while private wage and salaried jobs made up roughly 54.3% percent of all jobs. Educational services, and health care and social assistance jobs make up the largest industry in the county with approximately 21.1 percent of all jobs and public administration is the second largest industry with roughly 16.7 percent of all jobs (USCB 2021).

Roughly 76,000 users visit the LORA site each year and much of the economics associated to the facility is integrated into the local Lake of the Ozarks economy. Generally, commerce here is related to recreational activities.

Table 6 Socioeconomic and Population Summary of the Region of Influence

County/ State	Population	Median Household Income	Below Poverty Level	Ethnicity				
				White	African American	Hispanic/ Latino	Asian	Native American
State of Missouri	6,168,187	$57,290	12.1%	82.9%	11.8%	4.4%	2.2%	0.6%
Camden	43,436	$53,520	14%	96.4%	0.7%	2.9%	0.7%	0.7%
Laclede	36,133	$46,582	16.3%	95.5%	0.9%	2.6%	0.6%	0.8%
Miller	24,909	$47,964	13.9%	96.3%	0.8%	2.1%	0.4%	0.6%
Maries	8,406	$48,276	12.9%	96.3%	0.7%	1.5%	0.4%	0.8%
Phelps	44,937	$44,987	17.5%	90.7%	2.2%	2.8%	3.7%	0.9%
Pulaski	**53,816**	**$58,426**	**12.5%**	**78.2%**	**12.5%**	**11.8%**	**3.0%**	**1.2%**
Texas	24,987	$35,758	20.3%	92.8%	3.8%	2.2%	0.4%	0.9%

Information taken from US Census Bureau; population data was collected for 2021, remaining data was collected during on or about 2016-2020.

4.0 INTEGRATED NATURAL RESOURCES MANAGEMENT AND MISSION SUSTAINABLITY

The primary focus of natural resources management on FLW is to support and sustain the military mission. However, supporting and sustaining the mission takes many forms. For example, it may be a very direct action such as construction of support facilities, increasing maneuverability across the landscape, or making personnel at FLW aware of the environment. Supporting the mission may be accomplished through minimizing encroachment or ensuring federal and state regulations are met. Supporting the mission can also be more indirect and subtle by improving relations with cooperating agencies and neighboring communities.

Implementation of natural resource management plans as discussed in this Section of the INRMP regarding the LORA site would be coordinated and agreed upon through formal agreements with the State of Missouri. Any natural resource actions by FLW will only occur as approved by the State of Missouri. However, FLW natural resource manager will conduct biological surveys/inventories, as needed, throughout the LORA site and maintain records at the natural resource office on FLW.

4.1 HISTORY OF FISH AND WILDLIFE MANAGEMENT ON FLW.

The history of fish and wildlife management on FLW is closely linked to the development of the natural resources program and as such follows its history closely. Records of the fish and wildlife program prior to 1962 are fragmented. Following this, annual installation natural resources reports give a detailed historical view of the fish and wildlife program.

In 1941 a memorandum of understanding relative to fishing, hunting, and wildlife programs on post was established between FLW and the MDC. This agreement stated that the Big Piney River and Roubidoux Creek would be open to public fishing except

certain portions during training use, that FLW would be a wildlife producing refuge, and that hunting would be allowed in the future only as mutually agreed upon.

Active wildlife management as a “wildlife producing refuge” did not begin until 1960 when a cooperative agreement between the Department of Interior and the Department of Army was signed. Initial efforts were carried out by the FLW Rod and Gun Club and included planting food plots (125 acre goal), pond construction, and wildlife stocking. In 1965 this responsibility was transferred to the Post Engineer and was managed by the forester. In 1968 the *Cooperative Plan Agreement for the Conservation and Development of Fish and Wildlife Resources on Fort Leonard Wood Military Reservation* was signed by representatives of the MDC, U.S. Bureau of Sport Fish and Wildlife, and FLW.

Closely working with MDC, Post Engineers performed habitat improvement work beginning in 1966. *The Fish and Wildlife Management Plan for Fort Leonard Wood* was published in 1970 and became the guide for further development of the fish and wildlife management program. Its emphasis was habitat improvement and harvest control. Also in 1970, the Directorate of Facilities Engineering, previously known as the Post Engineer, assumed responsibility of issuing hunting, fishing, and trapping permits from the FLW Rod and Gun Club.

The Directorate of Facilities Engineering’s first major change was to open the installation to controlled public hunting and fishing. Permit fees soon provided a fund for fish and wildlife management activities. Along with the added responsibility came a provision for a fish and wildlife management staff. A military fish and wildlife technician was assigned in 1970 followed by assignment of military aides and a military fish and wildlife biologist. In the program’s peak developmental years, 1970-1973, the Forestry and Wildlife Operation Office had as many as nine military personnel assigned at one time. In 1973 the issuing of permits and collection of fees was transferred to the Directorate of Personnel and Community Activities, Outdoor Recreation Branch. Most military staff was retained by Directorate of Facilities Engineering but was gradually reduced by attrition.

A civilian Fish and Wildlife Conservationist was hired in 1974 after departure of the military wildlife biologist. Establishment of this position solidified the fish and wildlife management program, leading to intensive management and close coordination between natural resources programs.

A major project, Bloodland Lake, was built during 1975-80 using military construction equipment operators. Fish were stocked and fishing began in 1981. Periodic fish stocking has continued since that time. Currently, fish stocking at FLW occurs annually and is based on population data.

In 1981 the installation boundary was redrawn to exclude 5,300 acres of National Forest land, reducing the acres available for wildlife management and hunting by the same amount. From September 1982 through March 1983 a second Fish and Wildlife Conservationist position was filled. In 1982 the USFWS terminated fisheries

management assistance due to funding cuts; however, MDC took over this responsibility in 1983. Other projects from 1982 through 1992 included assistance to MDC in release of ruffed grouse on Mark Twain National Forest, planting native warm season perennial grasses instead of food plots, constructing multi-purpose ponds, applying herbicides to control woody vegetation, and enhancing the firebreak planting program for wildlife habitat benefits.

River otters were re-established in Pulaski County, Missouri beginning in 1990. FLW maintained incidental siting records for several years following re-establishment. River otters expanded in population and range to the point of legalizing otter trapping. Black bear surveys were performed on FLW beginning in 1991 to document the extent of the bear's range expansion from Arkansas into Missouri. Bear bait station surveys were discontinued in 1994. Bear sightings have increased with time and MDC opened the first bear season in 2021. Additionally, ruffed grouse were introduced during the 1980's and 1990's; however, management efforts ended in the early 2000's.

From 1993 through 1997 management emphasis included such projects as establishing multi-purpose, 0.10 to 0.25-acre ponds, completing baseline surveys of threatened and endangered species and wetlands, developing BA's, and performing numerous Base Realignment and Closure-related activities associated with moving the Chemical and Military Police schools to FLW. The addition of a Fisheries Biologist to the natural resources staff in 1999 resulted in improvements in fisheries program accomplishments. Numerous surveys; fishing facilities, access, and habitat improvements; fishing and aquatic education and outreach; and detailed fisheries program reviews and reporting have occurred since 1999.

Additional history details regarding land use, forestry, agricultural involvement, and military presence on FLW is discussed in Chapter 3.0 Natural Resources.

4.2 NATURAL RESOURCES NEEDED TO SUPPORT THE MILITARY MISSION

Natural resources on FLW supports the military mission by providing quality training grounds in which the mission is critically dependent. This includes the nearly 3,000 acres in the cantonment area used for training and parade grounds to the nearly 53,000 acres outside of the cantonment area used for field activities such as ranges, general training areas, bivouac sites, and maneuver areas. The quality and realism of the field environment, in which a majority of the training mission takes place, greatly determines the level of success of the mission on FLW. Natural resources that provide this degree of realism includes vegetation, soils and topography, and water resources. These same conditions, to include fish and wildlife, also provide for opportunities of outdoor recreation that are important assets to both military and civilian communities associated with FLW.

The primary military mission use of natural resources is associated with firing ranges, demolition areas, impact areas, and dud areas. The area outside of the cantonment area is considered training areas; some of which is inaccessible while others can be low impact training areas. Bivouac sites have concentrated activity affecting natural

resources, and the Heavy Equipment Operator Course (Normandy Training Area or Training Area 244) is partially denuded of vegetation, but impacts are contained within the immediate area. However, heavy disturbed areas such as these continue to present control erosion challenges despite management efforts. Vehicular movement, and associated impacts on natural resources, are restricted not only by regulation but also by the natural terrain and forested areas.

Training missions of the U.S. Army Chemical and Military Police schools affecting the use of FLW natural resources primarily involve construction, renovation, modernization, and alteration of some range and training areas. Many of these requirements have been met by existing installation ranges and training areas.

4.3 BIODIVERSITY CONSERVATION AND ECOSYSTEM MANAGEMENT

Biological diversity (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 Department of Defense (DoD) Biodiversity Management Strategy* (DoD 1996). This Strategy identifies five reasons to conserve biodiversity on military lands:

(1) ***sustain natural landscapes*** required for the training and testing necessary to maintain military readiness
(2) ***provide the greatest return on the Defense investment*** to preserve and protect the environment
(3) ***expedite the compliance process*** and help avoid conflicts
(4) ***engender public support*** for the military mission
(5) ***improve the quality of life*** for military personnel

The Keystone Center report (DoD 1996) 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 protection 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 INRMP and other planning protocols
- Involve internal and external stakeholders up front
- Emphasize the regional (ecosystem) context
- Use adaptive management
- Involve scientists and use the best science available
- Concentrate on results

FLW will use ecosystem management to guide its program for the foreseeable future. This management strategy enables the installation to conduct military training while conserving natural resources upon which the quality of training ultimately depends.

Adaptive management. Adaptive management is an important component of ecosystem management. It becomes a useful management strategy when there is an elevated likelihood of uncertainty associated with implementation of the best option. Generally, adaptive management involves assessing the problem, designing a solution, implementing the best option, monitoring and evaluating the results, and modifying implementation accordingly. Based on those results adaptive management would continue this cycle if the intended outcome is not achieved. FLW implements adaptive management when appropriate and feasible as part of its natural resources management strategy.

Priorities in adaptive management would be conducted as they impact mission followed by impacts related to federal and state laws, regulations, and/or agreements. Secondly its projected benefit to the overall ecosystem followed by the cost, funding, and staff availability. Finally, the time frame with which the adaptive management activity would take place and the expected timing of its end result.

Surveys. Surveying is a valuable method used to gather information on actual conditions of the targeted species, location, or habitat. Information gathered from surveys are taken under consideration and used to make conservation and ecosystem management decisions. Multiple surveys have been conducted by FLW natural resources staff, state agencies, and contracted colleges/universities starting in the mid-1980s to the present. Surveys are routinely conducted by FLW natural resource managers; however adaptive management is implemented when new listings or changes in policy regarding state and federally protected species require time frame or technique changes to surveying activities. Close cooperation with federal and state agencies to conduct species surveys, report new species records, update databases, and assist with access to the installation is ongoing. FLW natural resource managers have also maintained records of observations for special status species when conducting ordinary field work activities.

Historically, resident wildlife species have been recorded, inventoried, and updated yearly by the DPW Natural Resource Branch personnel. DPW Natural Resource Branch personnel work in close cooperation with Federal and State agencies to conduct species surveys, report new species records, update databases and assist with access to the installation. Natural Resource Branch managers also routinely conduct a variety of survey and monitoring work that includes, but is not limited to, mussels, calling anurans, bird breeding, caves (bat activities), deer spotlight counts, eagle surveys, carnivore track counts, and annual fish surveys. Additionally, the iSportsman web-based tool also is used to provide natural resource managers with hunting/fishing information regarding recreational users, areas utilized, and harvests.

FLW participated in a Monitoring Avian Productivity and Survival (MAPS) project up until 2011, when funding limited the program. This program had supported the conservation and management of neo-tropical migratory birds and their habitats on DoD lands at FLW. Six Monitoring Avian Productivity and Survival project stations were established on the installation during 1993 to monitor production and survival.

In 2016 and 2017, bat and mussel surveys were conducted through contract with the University of Missouri. The two surveys were conducted separately at FLW and are targeted toward spectaclecase mussels and northern long-eared bats. Other mussel and bat species of concern that are found and/or identified during these surveys were recorded. Subsequently, a BA was generated concerning the spectaclecase survey; however, a BA was not generated from the final bat survey report. Installation natural resource managers own and are trained on acoustic equipment to monitor bat activity on FLW.

A BA for freshwater mussels with a focus on the federally endangered spectaclecase was conducted on the Big Piney River and Roubidoux Creek with surveys and habitat evaluations conducted in June and September 2016. All of the following information for mussels on FLW is from the BA conducted by Maynard et al. (2017) unless otherwise cited. Living mussels of ten species were recorded at four of the 28 sites sampled on the Big Piney River, and four live mussels of one species were found on the Roubidoux creek from 11 sites. This is a drastic change from surveys conducted in 2004 when 168 live mussels of 16 species were found at the same sampled sites, and 149 live mussels of seven species were found on the Roubidoux Creek (Maynard et al. 2017).

It was reported that stream bed instability from high flow events may influence extreme habitat change leading to a decrease in live mussels and habitat change will continue to be a threat to mussels on FLW within the Big Piney River and Roubidoux Creek. Therefore, it is essential to protect restore and protect exist riparian habitat to prevent further habitat losses. Another limitation for mussel recruitment and distribution is the weir on the Big Piney River. The installation of a fish passage/aquatic organism passage allowing movement around the weir may improve upstream movement for fish host species that may increase distribution and diversity of mussel beds on the Big Piney River (Maynard et al. 2017).

The federally endangered spectaclecase was found living at one location on the Big Piney River, but no evidence of successful recruitment was observed. Protection of this site is important, but it is likely that the remaining adults will die out at the end of their lifespan.

Mooneye (*Hiodon tergisus*) and goldeye (*Hiodon alosoides*) were found to be a compatible fish host species for spectaclecase mussels (Sietman el al. 2017) that are susceptible to instream barriers (e.g., FLW weir on the Big Piney River). There is only one record of mooneye found on the Big Piney River within the reach of FLW, but the spectaclecase and other mussel populations may depend on migration of host species bearing glochidia attached from large source populations in the Gasconade River. The construction of an aquatic organism passage may allow for Hiodon species to improve the Big Piney River spectaclecase and other mussel populations upstream of the weir on FLW (Maynard et al. 2017).

Fish surveys within the Gasconade River drainage were conducted between 2019 and 2021 with an emphasis on the Big Piney River tributary, including the reach that flows through Fort Leonard Wood. Survey methods used by Kim et al. (2022) seines, fyke

nets, hoop nets, gill nets and pole and line angling. Additionally, surveys used molecular methods that sampled environmental DNA (eDNA) using the eDNA metabarcoding technique, targeting Hiodon species. The survey indicated that either Hiodon species are at low abundance across the Gasconade River drainage or are challenging to detect by all of the methods deployed.

One hundred eighty-four detector nights at 92 sites and 162 net nights at 20 sites were completed based on recommendations from USFWS and the 2017 Range-wide Indiana Bat Summer Survey Guidelines. No northern long-eared bats or Indiana bats were captured during the summer survey; however, two northern long-eared bats captured in mist nets during the 2016 survey. The two bats, which were caught separately but in close proximity, were radio tracked and roosting documented. One hundred fifty-two federally endangered gray bats were captured and acoustically recorded throughout the area. Acoustic surveys identified call sequences from two northern long-eared bats at two sites. Three Indiana bats were recorded at three sites; however, none were captured during the survey. Three hundred fifty-five individual bats were captured representing seven species: gray, little brown, evening, big brown, eastern red, hoary, tricolored, and silver-haired bats. Captures indicate abundant and diverse habitats, capable of supporting an abundant and diverse bat community, are present in the area.

Cave surveys were completed during spring and fall of 2017. No caves were surveyed during the summer months. Acoustic surveys were conducted at 39 cave entrances and these data were used to identify 10 caves for harp and mist net surveys for fall and spring surveys. Bats were captured at eight cave entrances during the spring and at four entrances during the fall. Captures included northern long-eared bat and multiple gray, little brown, big brown, and tricolored bats. A northern long-eared bat was identified in David’s cave during the winter surveys. Additionally, upcoming surveys are planned for 2022 and 2023, and potentially out to 2026.

Rattlesnake master borer moths are an elusive species that feeds exclusively on rattlesnake master plants. They were considered for listing under the ESA, but their listing was deemed unwarranted in 2019. However, surveys for the species were conducted from 2019 to 2021, targeting the rattlesnake master plants. The survey concluded an ample amount of host plants exist on FLW to support adult moth populations. The survey found a small population of larvae, but no confirmed adult moths. However, a healthy and robust native moth community was observed at the installation. Methods include identifying and flagging host plant locations, observing larval borings, collecting larvae and lab culturing, and genetic testing. Attempts to capture adults include blacklight bucket and sheet trapping during the potential emergence and flight timeframes (July-October). Pheromone traps using volatile extracts from the host plant were also attempted (Verble 2021).

The survey report concluded that given the presence of larvae, their removal from candidacy for the ESA list, and their apparent resiliency to current conservation management on FLW, land management modifications are not warranted. Continued persistence of the moth at FLW is dependent on continued persistence of its host plant, rattlesnake master. The plant requires full sunlight and open habitats, which are

maintained with prescribed burning and mowing, so prioritization of these management techniques and maintenance of open areas is recommended.

A comprehensive report regarding the status of the bluestripe darter is currently in progress by the FLW Fisheries program, which conducted surveys in 2020 and 2021. The FLW Fisheries program focused on areas within the boundaries of FLW, e.g., Big Piney River and Roubidoux Creek, and nearby streams. At this time data for the draft report indicates the bluestripe darter is located in both streams; however, population stabilities are unknown.

4.4 ECOSYSTEM MANAGEMENT COORDINATION AND PLANNING

4.4.1 Current Management

Natural resources management on military installations must be coordinated with the military mission to provide the support needed for the mission as well as effectively conserve natural resources. At FLW this coordination is accomplished primarily through DPTMS, Range Division. DPTMS relationship to the implementation of this plan is discussed in Section 1.3, *Responsibilities*.

FLW has a cooperative relationship with the USFWS and MDC, representing federal and state signatory cooperators respectively, in implementation of this INRMP. Section 1.3.3, *Other Federal Agencies* and Section 1.3.4, *State Agencies* discuss these respective agencies responsibilities in regard to this INRMP. FLW also has cooperative relationships with other federal agencies, most notably the U.S. Forest Service and Natural Resources Conservation Service, and other state agencies, such as the Missouri State Historic Preservation Office and Department of Natural Resources. FLW's relationships with other federal and state agencies, with regard to natural resources management, are also discussed in these sections. Cooperative relationships also exist with American Indian Tribes, as discussed in Section 1.3.5, *American Indian Tribes*.

Encroachment Buffers. Under authority of the Readiness and Environmental Protection Initiative authorized by 10 U.S. Code § 2684a, *Agreements to Limit Encroachments and Other Constraints on Military Training, Testing, and Operations*, installations may enter into formal agreements with a partnership of various federal, state, and private organizations to protect and manage land around military installations. This authority is implemented under the Army Compatible Use Buffer (ACUB) program. Usually, a non-governmental organization, such as The Nature Conservancy or The Trust for Public Lands, acquires either the land or easements on the land from willing sellers on behalf of the partnership. If an easement is purchased, the landowner can usually remain on the land and conduct their preferred lifestyle, whether it is forest management, ranching, or whatever activity is compatible with the military mission on adjoining Army lands. These lands will be managed in perpetuity in a manner to conserve the ecosystem and limit urbanization along military installation boundaries. FLW will consider requirements and feasibility for using this mechanism to provide encroachment protection and at the same time provide a mechanism for mitigation.

If mitigation banking and/or conservation agreements are considered, there must be early involvement of USFWS and other agencies. Such agreements include mechanisms by which future Section 7 (Endanger Species Act) consultations and accompanying biological opinions will direct mitigation requirements. For example, terms and conditions of future biological opinions that involve the set-aside or special management of habitat would draw on a mitigation bank or conservation agreement. This would allow comprehensive long-term mitigation planning, rather than project-specific or activity-specific mitigation.

Additionally, the 2016 Readiness and Environmental Protection Integration Program prepared a report to the Second Congress. From this report the Second Congress recently expanded the DoD authorities under the Sikes Act, 10 U.S.C. §670c-1, matching a similar authority in Section 2684a of Title 10, U.S.C., to provide for the maintenance or improvement of natural resources beyond installation boundaries. This authority allows the DoD to support natural resource management without unnecessary investment in land acquisition when doing so benefits the military mission. Multiple military installations are modifying or creating new agreements to implement both of these natural resources management authorities as a way of reducing the burdens on testing and training lands to support threatened and endangered species.

4.4.2 Ecosystem Management Goals and Objectives

Goal 1. Use coordinated planning to manage natural resources to sustain the military training capability.

Objective 1. Coordinate natural resources planning with planning for the sustainment of the military mission.

Goal 2. Promote and participate in regional planning for natural resources conservation at scales larger than the installation.

Objective 2*.* Coordinate with and support regional planning and programs.
Objective 3. Consider requirements and feasibility for using the encroachment buffer mechanism to provide encroachment protection and at the same time provide a mechanism for mitigation on FLW.

4.4.3 Ecosystem Management Planning

This INRMP must be reviewed annually by FLW, as stipulated in DoDI 4715.03 and AR 200-1 and inferred by the Sikes Act. The list of goals and objectives (Appendix A) can be used to guide the review and adjust programs, per the adaptive management process. Revise projects and budgets as required and update the INRMP at least every five years or when major changes are made to the natural resources program. Coordinate significant changes with the USFWS and MDC as appropriate.

4.5 SOILS MANAGEMENT

4.5.1 Current Management

Soils on FLW have been inventoried (Wolf 1989). Soil descriptions are discussed in Section 3.2.4, *Soils*. Soil erosion, due mainly to water and wind driven influences, has been a major concern of FLW because of highly erodible soils throughout the Installation. Highly erodible soils on FLW are shown on Figure 3, respectively.

The primary erosion control measure is establishment and maintenance of vegetative cover. This is supplemented by silt containment barriers at pre-authorized digging and construction sites, concrete low water crossings, and rehabilitation and rest of roadside corridors and bivouac sites. Water diversion outlets are maintained along access ways and firebreaks. Newly established sod areas are protected by mulching, terraces, and contour planting. Both native and naturalized species of vegetation are used, based on their effectiveness and site conditions.

The LRAM (Section 5.1.2) involves repair and prevention of damage to military training lands, but it specifically precludes soil erosion control for environmental compliance. As described in Section 4.6, *Water Resources Management*, various laws and regulations prohibit actions that elevate water turbidity significantly. The following discussion specifically deals with compliance aspects of erosion and soil management associated with FLW's training areas.

Roads and Trails. The DPW, Operations Division, Civil Section, has responsibility for maintenance of roads on FLW. In addition to this section of the DPW, the ITAM in DPTMS program has the responsibility to upkeep maneuver trails in training area lands. Maintenance and upgrade of range roads and trails are substantial soils management projects since drainage associated with roads and trails often considerably affects erosion. DPW and the ITAM in DPTMS personnel are continuing to upgrade and maintain range roads and maneuver trails. The following guidelines should be used during construction and maintenance of roads.

- Whenever possible, existing roads/trails will be used, minimizing new construction
- Best management practices will be followed in construction and maintenance projects
- Whenever possible, roads/trails will be constructed at natural ground level following natural contours, which are less likely to restrict natural water flow

Firebreaks. Firebreaks are maintained through a cooperative agreement with USDA Wildlife Services which provides an equipment operator that uses heavy equipment owned and maintained by FLW NRB. Additional budget is incorporated into the agreement for purchase of seed, materials, and other supplies. Firebreaks on Cannon Rang are maintained by Missouri Air National Guard personnel. Firebreaks are managed according to the FLW IWFMP. (FLW 2020b).

Firebreak maintenance exposes the least amount of bare ground at any one time. The complete firebreak system is mowed and/or disked annually. Firebreaks surrounding range impact areas and old fields scheduled for burning are disked 10 to 40 feet wide and seeded to wheat or clover. The combination of disked ground and mowed grass (or later, after the seeded area begins to grow, mowed grass and growing wheat and clover) provide wildfire control and prescribed burning boundaries. This modified firebreak maintenance plan decreases soil erosion, saves time and money, and provides wildlife food.

Riparian Areas and Wetlands. Gully erosion may affect downslope wetlands, thus becoming a compliance issue. This has been an issue in many areas across FLW, especially in the Normandy Training Area. The primary solution has been the construction of sedimentation basins and terraces to slow water flow and allow sediments to settle on-site before runoff enters wetlands or riparian areas. Revegetation of drainages leading to these basins and terraces has been a successful program. Construction sites are also required to incorporate sediment basins, silt fences, riprap, or hay bales in drainages, depending on site characteristics, to minimize soil erosion from construction activities as well as in ditches and roadsides.

4.5.2 Soils Management Goals and Objectives

Goal. Use soil parameters to manage military activities, protect soil stability, restore training lands, and conserve wildlife habitat.

Objective 1. Use soil inventory data to make decisions regarding land use, rehabilitation options, and wildlife habitat management options.
Objective 2. Identify erosion control projects, develop appropriate repair designs, and implement repairs, as needed.
Objective 3. Support implementation of the LRAM component of ITAM in DPTMS.
Objective 4. Coordinate with DPW Roads and Grounds Section and ITAM in DPTMS personnel to ensure guidelines for construction and maintenance of roads and trails are followed.
Objective 5. Ensure firebreaks are maintained annually according to the IWFMP.
Objective 6. Ensure that construction sites incorporate sediment basins, silt fences, riprap, hay bales, etc. in drainages, depending on site characteristics, to minimize soil erosion from construction activities.
Objective 7. Establish additional and maintain existing hardened low water crossings, as needed, and monitor the success of the Geo-web crossing of Roubidoux Creek.
Objective 8. Coordinate with ITAM in DPTMS to ensure incorporation of best management practices when developing new training sites.

4.6 WATER RESOURCES MANAGEMENT

Use of FLW waters include human consumption, military training, and recreation. Laws and regulations associated with pollution control and abatement in Waters of the United States that may affect FLW include:

- Clean Water Act of 1972, 1977, and 1987
- U.S. Fish and Wildlife Coordination Act

- National Environmental Policy Act of 1969
- Executive Order 11988, Floodplain Management
- Executive Order 12608, Protection of Wetlands: Amends Executive Order 11990
- Executive Order 11752, Prevention, Control, and Abatement of Environmental Pollution
- Executive Order 12088, Federal Compliance with Pollution
- AR 200-1, U.S. Army Environmental Protection and Enhancement
- Technical Bulletin 55-1900-206-14, Control and Abatement of Pollution by Army Watercraft

Many of these laws and regulations are applicable at FLW but are not the responsibility of the NRB and are thus not within this INRMP. Groundwater management consists of restoration projects associated with individual sources of pollution. These projects are not considered natural resources management and are not included within this INRMP.

AR 200-1, *Environmental Protection and Enhancement*, establishes the following objectives for water resources on Army lands.

- Conserve all water resources
- Control or eliminate sources of pollution to surface or ground waters through conventional or innovative treatment systems
- Demonstrate leadership in attaining the national goal of zero discharge of water pollutants
- Provide drinking water that meets applicable standards
- Cooperate with federal, state, and local regulatory authorities in forming and implementing water pollution control plans
- Control or eliminate runoff and erosion through sound vegetative and land management practices
- Consider nonpoint source pollution abatement in all construction, installation operations, and land management plans and activities

An additional Army requirement is the preparation and implementation of a Stormwater Management Plan. Attainment of most of the above objectives is not the responsibility of Army installation natural resources programs, but some of them, especially the last two, are clearly natural resources management concerns. The following subsection discusses specific actions taken by the installation with regard to water quality.

4.6.1 Current Management

Monitoring. Water quality monitoring is an important component to measuring ecosystem health at FLW. Land-based environmental degradation eventually affects water quality and aquatic ecosystems dependent upon good water quality. The Environmental Branch is responsible for monitoring pollution levels and pollution control. Erosion control is the responsibility of the Environmental Division, , ITAM within DPTMS program, Operational Range Assessment Program (ORAP) and the proponent or contractor of any given project. The ORAP evaluates whether a release or substantial threat of release of munitions constituents of concern (MCOC) from an operational

range to the surrounding areas creates a potentially unacceptable risk to human health or the environment.

Surface water and groundwater quality monitoring are required as part of various compliance programs, particularly those regarding the Clean Water Act. Surface water quality monitoring beyond those aspects that may affect the fisheries management program are not natural resource responsibilities.

Management. Erosion may locally produce substantial impacts. The single most evident example on FLW is Normandy Training Area (TA 244). Before catchment basins and terraces were constructed at TA 244, local erosion was severe. Implementation of the LRAM component of ITAM in DPTMS has improved FLW's ability to protect water quality from sedimentation, high turbidity, and increased suspended solids. Regulations, such as stormwater permits or other Clean Water Act permits/certifications, contribute to protecting water resources and reducing erosion related discharges. Specifically when permits are required, which also require BMPs, when implementing projects on FLW.

Provisions within this INRMP that will specifically reduce negative impacts to water quality or mitigate such damage are found in Sections 4.8.2 - *Wetlands Management*, 4.13 - *Pest Management*, 5.1.2 - *Land Rehabilitation and Maintenance*, and NEPA documentation associated with previous INRMPs (Section 5.6 *National Environmental Policy Act Implementation* and Chapter 8.0 *Environmental Consequences* of the 2006 INRMP) and Appendix B of the current INRMP. Additionally, the natural resource branch conducts project reviews for Clean Water Act Section 404 permit requirements.

4.6.2 Water Management Goals and Objectives

Below are general objectives to most projects described in this Chapter of the INRMP, and they do not require funding beyond what is in other projects. Thus, a specific project for the use of water quality information for project decisions is not required. However, below goal and objectives are appropriate to list.

Goal. Protect surface water quality at FLW.

Objective 1. Control or eliminate runoff and erosion that could affect surface waters; to include the use of native plants, such as forbs, cover crops, or grasses, to reduce erosion.
Objective 2. Ensure nonpoint source pollution abatement is considered in construction, installation operations, and land management plans and activities. Obtain appropriate permits for construction/land-disturbing activities and ensure that approved best management practices are implemented and maintained.
Objective 3. Use site-specific water testing for natural resources programs, LRAM, and erosion control projects, as needed.
Objective 4. Use water-related inventory data to make decisions regarding land use, restoration options, and fish and wildlife habitat management options.

4.7 FOREST MANAGEMENT

Forest management at FLW is conducted in accordance with the current INRMP, AR 200-1, and Forest Management Plan for FLW (2016f). Production and sale of forest products are important parts of the forestry program and provide funding for management actions; however, ecosystem management and support of the military mission on FLW are emphasized.

4.7.1 Current Management

4.7.1.1 Forest Management Strategy.

About three-fourths of FLW is forested, and most of the forest is in the oak-hickory type, dominated by several species of oaks. Silvicultural treatments therefore emphasize oaks in most of the forest. Both even-age and uneven-age management are employed. In most cases stand condition, type of land use, or special requirement determine which system to apply to a particular stand. Pine plantations are relatively small and scattered throughout FLW and are treated separately. Most forest management actions will involve cutting trees, so cutting when a merchantable product can be produced is the most economically feasible method to achieve the desired results. Standing timber is real property, so timber sales contracts are administered by USACE, who is the real property agent. The installation commander is authorized to approve timber sales, on an individual basis, valued at less than $5,000, up to sales totaling $30,000 throughout a single year. Currently, approximately 439,828 board-feet/5,574 tons of timber are expected to be harvested from 2020 to 2023. The forester also sells some forest products from downed timber, primarily through permits for individuals to cut firewood. Firewood permits were made available electronically in 2021, generating approximately $500 to $1,100 annually.

Army policy with regard to commercial forest products includes the following requirements:

- Continue the evolvement from commercial-oriented forest management to ecosystem-oriented forest management that gives first priority to the mission requirements
- Include planning and NEPA analysis in all timber sale decisions
- Incorporate forest management into INRMPs
- Assure natural resources managers are available and as free as possible of commercial influence
- Ensure natural resources professionals need not rely exclusively on the economic returns of commodity production to accomplish landscape management, compliance, and stewardship
- Eliminate pressure to conduct unsustainable forest management

FLW's forestry program emphasizes support of the military mission, forest health, enhancement of ecosystem integrity, production of commercial forest products, protection of watersheds, management of wildlife habitat, and provisions for outdoor recreation.

Even-age Management. Even-age management (EAM) has been the primary silvicultural system used on FLW. All management is intended to eventually result in a clear-cut and subsequent natural regeneration of the stand. At harvest time, all merchantable timber in a stand is cut for sale, and most remaining trees in the stand over a given size, such as 1-2 inches diameter at breast height, are felled or girdled. A new even-aged stand regenerates from the combination of advanced reproduction (seedlings and saplings that developed under the partial shade of the forest canopy) and sprouts from cut stumps.

Some standing trees are retained in a clear-cut stand. Dead trees are left standing unless they are still sound enough to be merchantable. Some areas may be excluded, such as along streams or around any sensitive site needing protection. Individual trees may also be excluded, such as den or nesting trees and adjacent trees needed to help protect them. All other standing trees under 16 inches diameter at breast height (dbh, measured at 4.5 feet above ground) are cut, and those over 16 inches are sometimes girdled to produce snags. This follow-up work is typically done through a contract. Standing trees to be retained after the harvest are identified prior to the harvest to ensure an adequate number and arrangement is achieved.

Clearcutting is an effective and efficient method of regenerating an even-aged oak-hickory stand, provided the regeneration potential is high enough. This potential is a combination of advance reproduction present in the stand prior to a harvest and anticipated stump sprouts that will develop after the harvest. Oak seedlings tend to accumulate under oak canopies, but on more mesic sites there is a likelihood of dense layers of shade tolerant vegetation forming under the oak canopy, preventing oak seedlings from fully regenerating the stand once the canopy is removed. The relatively low site quality of most upland oak-hickory stands on FLW tends to result in high levels of oak advance reproduction and little shade-tolerant competition developing under the canopy. Regeneration potential therefore tends to be high.

The decision to clear-cut a stand is based on stand age, condition, and composition. A stand will be clear-cut when it is determined that the best course of action is to regenerate the stand. Mature, suppressed, or declining black oak stands will be clear-cut. Stands with a mostly white oak or post oak canopy will not be clear-cut unless a majority of the trees are culls or in poor condition. Stands which have become dominated by non-oaks of minor commercial value (hickory, elm, etc.) will be clear-cut if it is determined that oaks will form the replacement canopy. Stands that are understocked (sparse) may be clear-cut if a fully stocked replacement stand can be achieved either from natural regeneration or as supplemented by planted or seeded shortleaf pine.

Shelter-wood, another EAM stand regeneration method, is useful especially where regeneration may be a problem. Part of the canopy is removed to assist in the development of advanced reproduction before the remainder of the canopy is removed. Although no situations exist where a shelter-wood cut is anticipated, it could be applied if needed.

For several years after a clear-cut, the stand will provide a thick growth of herbaceous vegetation, reachable browse, and dense cover not generally available in the closed-canopy forest. It will also become nearly impenetrable to humans for several years, which can be detrimental if troop movement through the area is required, so long-term military use of an area must be considered prior to clearcutting.

Uneven-age Management. Uneven-age management (UAM) systems, although not applicable to all stands, allow for periodic harvesting of portions of a stand without complete canopy removal. The time between cutting entries will vary but will always be less than a rotation length and at least 20 years. UAM is used in upland hardwood stands wherever conditions are suitable.

A true UAM system involves maintaining a specified distribution of trees of all size classes up to a specified maximum diameter. Inventory data indicate which size-class trees will be selected for harvesting to achieve or maintain the size-class distribution. Small openings are made to allow for regeneration to develop but does not include complete canopy removal across an entire stand. Some non-commercial cuts may be required to achieve the desired size-class distribution in stands. Many stands have developed into and can be maintained in two-age or three-age conditions. Some even-age stands can also be managed to produce multiple-age stands by selective cuts prior to maturity.

UAM should only be used where healthy, well stocked stands can be left after harvest. Trees are selectively cut to remove those that are low quality or not expected to survive until the next possible rotation. Trees chosen not to be cut are good quality white and post oaks, immature black oaks with good crowns and overall good condition, some den trees, and some large diameter over-mature trees. Dead trees are left standing unless still merchantable, and some cull trees are girdled to produce additional snags. Suppressed and damaged trees in the area that had been affected by the crowns of harvested trees may be cut. In areas where several neighboring trees are cut, these follow-up activities can produce a small clear-cut.

Multiple-age stands, stands heavily stocked with white or post oak, and immature even-age stands are targeted for UAM. After an UAM harvest, areas within a stand in which regeneration openings are to be created are treated as in EAM. Throughout the remainder of the stand, damaged trees may be cut; selected culls may be girdled; and shade-tolerant and suppressed trees may be cut. Additional treatments may also be applied.

UAM will be emphasized and used wherever appropriate on FLW. Black oaks that are mature or stressed are unlikely to endure disturbances created by UAM harvests. Black oaks that have been suppressed for long periods are also unlikely to recover and become vigorous; rather they are more likely to die from the disturbance. White oaks and post oaks are longer lived and more likely to either recover from being suppressed or at least not die from the disturbance of a UAM harvest. These factors will guide decisions on where and how UAM will be applied.

4.7.1.2 Scope of Forest Management.

Forest inventory provides data useful for training, planning, silvicultural, and wildlife habitat information. The last FLW-wide forest inventory was completed in 1995. Subsequent inventories have concentrated on selected stands/compartments where management activities were planned. Army Regulation 200-1 requires forest inventories be conducted and maintained every 10-years (DOA 2006). Inventories will be planned to provide updated information to guide decisions for management activities. Inventories will be contracted when not practical for in-house personnel. Inventories will occur dependent on funding and availability. Additionally, according to the Forest Management Plan (FLW 2016a) there has not been sufficient funding for a large-scale inventory since 1995. Instead, the forestry program uses GIS information and using prism plots (10 basal area factor). At each plot, species, diameter, merchantable height, and condition were recorded for each tree in the plot. For the overall stand, general information was recorded to allow categorization and to provide a stand description.

4.7.1.3 Management Units.

The “stand” is the basic unit for identifying individual units land for forest management. A stand contains similar site and/or forest characteristics throughout. Over the years, 3,019 forest stands have been identified and inventoried. Prescriptions for management actions are made at the stand level. Inventory data are also maintained at the stand level. Besides typical forest stand information, the inventory data also categorize each stand according to manageability criteria that can change for some stands. Becoming part of a range impact area can makes the existing timber no longer commercially valuable and may make a stand no longer manageable relatively permanently, whereas land use changes that do not affect the timber but make access impractical would be a less-than-permanent change.

For forest management and planning, stands have been grouped into 10 compartments of varying size. Figure 14 shows forest compartments for FLW as well as other large areas generally not included in forest management planning, such as stands within the cantonment area and riparian zones. Compartments also contain non-forest lands and some unmanageable lands, so compartments serve primarily to help with keeping track of all the forest stands in an area. Compartments must be periodically redrawn as land use and accessibility change how or if certain stands are manageable. Table 5 shows the planned schedule for management actions during the period covered by this plan.

Set-aside Stands. Two large tracts of land containing most of FLW’s range impact areas have been designated as “set-aside”. This designation is to indicate they are “set aside” from the forestry program. Most of this land is not manageable for timber due to limited safe access and the risk of metal in trees. Set-aside lands are about 70% forested. Wildfires caused by training on ranges are expected in parts of the set-aside areas, and much of it is also under prescribed fire management. Fire has thus been a major factor in influencing habitat in these areas. Forest inventory data were collected on most set-aside forests in 1995 prior to the set-aside designation being implemented. The forestry program will periodically collect inventory data on set-aside lands whenever funding and access are feasible.

Limited Stands. Due to such constraints as safety concerns or lack of access, some forested areas present little prospect for management within the foreseeable future. The constraints are mostly manmade and not necessarily permanent. Most stands designated as “Limited” are in or near range impact areas, which could contain metal (projectiles) or safety concerns due to proximity to active ranges. Restricting entry accessibility and durations. Some Limited stands have been designated at the edge of the cantonment. Access to them is only through family housing or other developed areas. Although this may not preclude some minor activities, harvests will most likely be difficult and limited.

Standard. Stands designated as Standard include all remaining areas. These stands are generally easier to access and are not impacted by daily range fire. Forested lands in and around many military training areas fall within this category, so there are varying degrees of manageability within it.

4.7.1.4 Commercial Forest Products.

Hardwood sawtimber is the primary raw product expected from timber harvests, which is then used for such products as oak flooring, hardwood dimensional lumber, railroad ties, and pallets. Few markets exist for small-diameter trees other than firewood, which produces only minimal income. Pine markets include utility poles, fence posts, sawtimber and pine shavings for animal bedding.

4.7.1.5 Emphasized Species.

Black oak is the most dominant overstory species on FLW, occurring as a component of most upland stands and dominating many of them. In most cases, 80 years is used as a rotation age or approximate age of maturity for EAM in black oak. Beyond 80 years, and often even earlier, timber value and tree health begin to degrade, and mortality rates increase. Some black oak stands also exhibit signs of maturity at an early age and begin to decline due to high stand densities. UAM in stands dominated by black oak is generally useful where most of the trees are healthy and not showing signs of decline

White oak is the most valuable upland hardwood species because it is also used for barrel staves. It dominates some of the better sites where it occasionally develops in almost pure stands, but usually it will have black oak as a major stand component. White oak is very long lived and less subject to decline in the uplands than black oak and is managed with a rotation length or maturity of 80-100 years in EAM. A high proportion of white oaks in a stand presents good opportunities for using UAM instead.

Post Oak dominates many flat ridgetops. Its fire resistance makes it a preferred species in fire-managed woodlands, and it stands up to the drought and compaction conditions of ridgetop training areas better than most other oaks. It is managed with a rotation length or maturity of 80-100 years in EAM. It is very resilient and able to survive harsh conditions and presents good opportunities for using UAM.

Many other hardwood species are found in the upland forests but are either a minor component of stands or have no commercial value. Northern red oak is not widespread

in the uplands and tends to occur most often on lower slopes or in bottomlands that are part of or bordering riparian zones. Blackjack oak is widespread, grows on the poorest upland sites, and is not commercially valuable. Several hickory species occur within most oak-hickory stands

Shortleaf pine is the only pine species native to the installation, and few native stands remain. Shortleaf pine is the primary species used by the forestry program for reforestation. It grows even on some of the worst disturbed areas, is drought hardy, and is much easier and cheaper to use for reforestation than oaks. About 2,000 acres of old fields were planted to shortleaf pine in the 1960s, including 36 acres of a mix of shortleaf and loblolly pine. In more recent years an additional 100 acres of seedlings have been planted on old fields cleared specifically for reforestation. Since this process is expensive it has been used only when funds were available and areas to reforest were available. There is no plan to convert hardwoods to pine, but pine may be seeded or planted into them after fires or when understocked.

4.7.1.6 Timber Stand Improvement.

Timber stand improvement (TSI) involves actions to improve growing conditions of a stand, usually by thinning over-stocked stands to an appropriate level or by cutting selected trees to improve the growth of others. While UAM harvests may accomplish some TSI, most of the need for TSI is in stands with trees below commercial size. In the past, TSI was rarely implemented due to expense; however, the poor conditions of many dense black oak have shown that TSI may be necessary to help ensure stand survival and reduce susceptibility to decline, insects and disease.

TSI will be utilized more heavily in the future on FLW if funding allows. Cutting prescriptions will be made for individual stands but will essentially be directed at cutting to reduce competition in overstocked stands, freeing higher quality trees from competition, cutting or girdling culls, or other actions needed to put the growth onto the best trees. TSI will also result in fewer declining stands of black oak, possibly increasing the opportunities for UAM.

4.7.1.7 Harvests.

In order to ensure sustainable harvesting, a maximum allowable harvest will be determined for each fiscal year. Based on available forest inventory data, the annual allowable harvest is approximately 175 acres by clear-cut and 425 acres by UAM methods. Considerable oak decline has occurred throughout the installation since most inventory data were collected, and some data indicating UAM potential may no longer be valid. Newer data may indicate higher levels of harvest can be achieved and still be sustainable due to the decline in overall harvests since the early 2000's. Land use changes have also occurred that may change the manageability of many stands. Regardless of the results, it is doubtful that total harvests in the period covered by this plan will approach the maximum allowable.

Most pine plantations on FLW have been thinned once and are ready for a second thinning or a regeneration cut. Seed tree regeneration cuts can be utilized with attempts

to lower direct seeding costs but will need funding for TSI in future years. Clearcutting of pine would be followed by applicable site prep and direct seeding. Past pine thinnings were accomplished through installation authority timber sales valued at less than $1,000. Today, even though Army regulations have changed, the more valuable products that come from larger pine harvests will make installation authority sales difficult and most future sales will likely be contracted through USACE.

A firewood permit system was initiated on FLW in 1978 and continues today. This system allows individuals to cut downed wood in designated areas. The cutting of standing trees is prohibited. Firewood permits are an excellent way to generate forest revenue from products that would otherwise be wasted. Most small installation projects that have minor tree removal do not justify a timber sale. These trees can be taken to a designated wood cutting area and permit holders can harvest the remains. Today, permits are purchased online, and revenues range from $500-$1,100 annually.

4.7.1.8 Reforestation.

Most reforestation on FLW is natural. Advanced regeneration is usually present in sufficient amounts in upland forests. Small trees and sprouts from cut stumps combine to reforest the stand.

Shortleaf pine is the primary species used by the forestry program for reforestation on non-forest sites because it is easier to establish than are oaks. Currently, no pine reforestation is planned but may be conducted whenever areas to reforest become available, seed or seedlings are available, and funding is adequate.

4.7.1.9 Records and Reporting.

The NRB maintains general forestry files, including information on harvest, reforestation, and inventories. Data are incorporated into a GIS system used for mapping and decision-making associated with the forestry program.

Timber harvests utilizing USACE contracting require a declaration of availability prepared at the installation and submitted through the appropriate channels to USACE, announcing that sales contracting services will be needed. USACE district offices servicing multiple installations in major timber-producing regions may then provide a number of timber harvest contract services. For FLW, USACE provides only the sale contract service, and the FLW forestry program handles all other matters.

A number of environmental reports submitted throughout the year by the installation may include some forestry data; however, the majority of forestry data reported to headquarters are related to finances (forestry income production and forestry expenses) and are reported to Army Environmental Command directly.

4.7.1.10 Special Considerations

Outside influences (*e.g.*, economic, social, or political) may alter various aspects of the forestry program. Harvest and forest management strategies will be altered as needed to accommodate these influences, based on Army policy.

Old-growth Forests. Old-growth forests are valuable for wildlife habitat, plant diversity, and aesthetics. Characteristics of old-growth in the Ozarks include large diameter trees beyond standard rotation ages, dominant trees of diverse species, standing snags and cavity trees, fallen logs in various stages of decay, and canopy gaps, which have allowed development of understory and herbaceous vegetation.

No old-growth stands have been designated on FLW; however, areas that cannot be managed for timber production, are inaccessible, or not subject to heavy disturbances have good potential for developing old-growth characteristics. Stands categorized as old-growth will not necessarily be completely restricted from other management. If ranges that have caused metal contamination in the timber should be removed, contaminated stands may be regenerated. Other activities in old-growth stands than might enhance their quality may be considered.

Unique Plant Communities. Plant communities that are relatively uncommon have high potential for rare or endangered plant species. These unique areas will be identified and noted as such, so they can be further protected or enhanced.

Riparian Areas. The riparian zones shown in Figure 14 were drawn as a “toe-to-toe” zone along the major stream corridors to designate where considerations for timber management would stop. Some typical characteristics of these zones are:

- Access limitations
- Unique plants or plant communities are likely to occur
- Cultural resource sites may be concentrated there
- Disturbance has a high potential for affecting stream water quality
- Threatened and endangered species are highly associated with stream corridors

Threatened and Endangered Species. Since three-fourths of FLW is forested, maintaining healthy forests is essential to all species on FLW, including those listed as threatened or endangered. Maintaining a healthy, productive, and diverse forest will continue to be the primary principal for FLW forest management. Retaining snags and cavity trees and excluding the designated riparian zones are examples of practices already implemented into the program that will benefit listed species. Through additional listings, research, and regulatory guidance, additional measures to protect and enhance listed species are anticipated.

Cultural Resources. All harvest areas of the installation are Phase I-surveyed for cultural resources under the installation cultural resources program. Areas containing sites that are considered eligible or eligible for listing on the NRHP are avoided, or other measures are taken to avoid an adverse effect to the site. The forester consults with the cultural resources manager prior to all sales to determine if such sites are in proposed sales areas.

Wildlife Considerations. Forest management is one of the primary activities that impacts wildlife habitat. Many forest management practices are beneficial to wildlife habitat, and periodic harvesting produces a variety of forest life cycle stages, providing habitat to many species. The forester consults with the wildlife biologist prior to

management actions to determine if specific actions are needed in sales to accomplish habitat goals.

4.7.1.11 Forest Health.

Maintaining forest health through the management described in this plan is the best overall protection against current and future threats from insects, diseases, environmental changes, and other stressors. Declines periodically appear in the red oak group, especially after periods of summer droughts, but are particularly prominent in areas where the trees are already in poor condition. The native red oak borer, generally kept in check in healthy forests, flourished among declining black oak trees on FLW. A more recent decline has been appearing in white oaks but is less widespread.

Non-natives pose a different threat, having no natural controls other than the ability of individual trees to withstand attacks. Gypsy moth populations have not been found on FLW. FLW participates with the MO Department of Agriculture in an annual monitoring program, placing about 60 pheromone-baited traps across the installation. An EAB infestation is considered widespread throughout FLW and most of the mature ash trees have been infested and are now deceased, though the extent has not been quantified. FLW is working with the state entomologist to use parasitic bio-controls for EABs on FLW. Specifically, in July 2018 three species of parasitic wasp species endemic to northern Asia were released on FLW, which include *Spathius agrili*, *Tetrastichus planipennisi*, and *Oobius agrili*. Multiple ash tree species occur on FLW. Cut or fallen ash trees requiring removal are placed in a quarantined location on FLW for a period of at least 2-years before use. Such as Army unit training that requires chainsaw certification.

4.7.2 Forest Management Goals and Objectives

Goal 1. Manage the forest ecosystem to support the military mission, maintain ecosystem integrity, and produce forest products on a sustainable basis.

Objective 1. Use ecosystem-focused management with emphasis on the military mission, enhancement of ecosystem integrity, production of commercial forest products, protection of watersheds, management of wildlife habitat, and provisions for outdoor recreation.
Objective 2. Ensure that natural resources personnel are as free as possible of commercial influence to accomplish landscape management, compliance, and stewardship.
Objective 3. Use UAM and EAM harvest strategies, as appropriate under suitable conditions to meet silviculture objectives.
Objective 4. Perform forest inventories to provide updated information to guide decisions for management activities, contracting inventories if necessary.
Objective 5. Produce commercial timber within biodiversity and ecosystem management directives.
Objective 6. Ensure FLW projects requiring timber removal are reviewed and merchantable timber is reimbursed at fair market value.
Objective 7. Evaluate each fiscal year's harvest plan to determine sustainable forestry across FLW's ownership.

Objective 8. Continue the firewood program.
Objective 9. Perform direct seeding reforestation efforts on applicable final rotation harvests, bare ground, disturbed ground, or otherwise unmanaged lands.
Objective 10. Maintain forestry files and other related materials.
Objective 11. Follow appropriate timber harvest reporting procedures.
Objective 12. Alter harvest and forest management strategies, as appropriate, to accommodate new information and outside influences, based on Army policy and legal mandates, such as those that may be included in future BAs/opinions.
Objective 13. Monitor insects, diseases and natural disasters affecting forests on FLW.

Objective 14. Perform mid-rotational prescriptions such as TSI, Pre-commercial thinning, herbicide release, etc. to enhance forest growth and species composition when project funding is available.

4.8 HABITAT MANAGEMENT

General fish and wildlife habitat management programs are described in this section, including wetland management. Specific management of fish and wildlife is further discussed in Section 4.9 *Fish and Wildlife Management*. Other habitat-affecting management practices are described in Section 4.7, *Forest Management*; Section 4.10, *Special Status Species Management*; Section 4.11, *Special Interest Area Management*; Section 4.14, *Cantonment Area Management*; and Section 4.15, *Fire Management*.

4.8.1 Inventory and Monitoring

4.8.1.1 Current Management

Flora and Fauna Inventory. As discussed in Section 3.3 *Biological Resources*, numerous surveys have been conducted and recorded on FLW for both flora and fauna. DPW Natural Resource Branch maintains the records and tracks current changes to species lists. Surveys, as described in Section 4.3, provide specific guidance to improve or sustain habitat conditions for special status species. However, survey guidance is integrated holistically into the ecosystem management approach of this INRMP. Surveys currently proposed or in the process of funding include bats (summer and winter/caves) and invertebrates.

Mapping. FLW does have a general vegetation map as seen on Figure 6. As surveys and information becomes available the NRB assists in updating the GIS database for vegetative mapping. GIS information regarding fauna is primary associated to special status species such as federally protected bats, mussels, or state protected species.

4.8.1.2 Habitat Management Goals and Objectives

Goal 1. Inventory FLW floral resources and monitor species or communities that are indicators of ecosystem integrity, capability of lands to support military missions, status of sensitive species or communities, and other special interests.

Objective 1. Update the flora inventory (including herbarium mounts) as new species are found during surveys, field work, and/or other project activities.
Objective 2. Update fauna populations that influence habitat conditions as appropriate.

Objective 3. Maintain the FLW plant and animal lists.
Objective 4. Continue assist GIS personnel on updating vegetation and special status maps.
Objective 5. Partner with other state and federal agencies to assist in habitat surveys.

4.8.2 Wetland Management

4.8.2.1 Current Management

Inventory. In 2021 USACE updated FLW's wetland inventory through a two-phased approach. Phase 1 and 2 Installation Wetlands Determination report (USACE 2020, 2021) provides details on determined wetland locations, types, acreage, associated plant species, and management strategies. The 2020 and 2021 surveys and reports utilized information from the previous USACE Report (1988) and Harland Bartholomew and Associates Report (1995). Results of wetlands inventories are summarized in Section 3.3.2, *Wetlands*.

Management. Wetland protection is required by Executive Order 12608, *Protection of Wetlands* as well as the Clean Water Act (1977). Protection and maintenance of habitat are the primary means of wetlands management on FLW. The quality of wetland watersheds affects the quality of downstream wetland plant and animal communities.

Environmental clearance reviews are the primary means of detecting impacts to wetlands on FLW. The NRB reviews actions that may affect wetlands using the 2020 and 2021 wetland reports. Requests for reviews come from work orders, service orders, military mission plans, NEPA documentation, major construction plans, etc. Project specific wetland delineations are conducted, as appropriated, during these reviews. Wetland impacts should be minimized through the project planning process and mitigated as appropriate. Exceptions are if an activity is determined to have limited effects on wetlands and the activity falls under a nationwide permit category. However, this does not necessarily exempt the project from any possible delineation and mitigation requirements.

The Clean Water Act, Section 404, requires that a permit be obtained for any activity that may affect "waters of the United States, including wetlands." The U.S. Army Corps of Engineers has the primary responsibility for administering the Section 404 permitting process. If necessary, projects with potential impacts are referred to the Corps of Engineers Kansas City District, typically the Truman Regulatory Office, to determine if jurisdictional wetlands are implicated, establish mitigation procedures, and/or obtain permits. Wetland-affecting projects require NEPA documentation. Additionally, the Corps of Engineers permit process requires coordination with the USFWS and the State Historic Preservation Office to allow for the assessment of potential impacts to protected species and cultural resources. State Clean Water Act permits may also apply to ground or water disturbance activities/projects.

Additionally, FLW manages and protects wildlife that are influential to wetland ecosystems. Beavers are one such animal that is considered one of nature's biological engineer. They build dams creating localized wetlands. However, beavers can become

a nuisance and are removed in locations that damage or create unwanted issues to mission as well as infrastructure.

4.8.2.2 Wetland Management Goals and Objectives

Goal. Manage and delineate wetlands to ensure “no net loss” and potentially mitigate for environmental impacts.

Objective 1. Maintain a database on wetland resources at FLW.
Objective 2. Use site-specific surveys to evaluate wetland resources if potential wetland impacts are proposed.
Objective 3. Use the environmental review process to protect wetlands.
Objective 4. If necessary, refer projects with potential impacts to the Corps of Engineers Kansas City District to determine if jurisdictional wetlands are implicated, establish mitigation procedures, and/or obtain permits.
Objective 5. Obtain the necessary state and federal Clean Water Act permits as required and implement best management practices as appropriate and/or required.
Objective 6. Manage and protect wildlife that provide influential benefits to wetlands.

4.8.3 Terrestrial Habitat Management

The military mission and resource management practices, such as forest management and wildland fire management, have the greatest effects on habitat. In general, impact areas, such as Cannon Range, are regularly disturbed by both direct shelling and associated wildfire, and Normandy Training Area is regularly disturbed by heavy equipment operators training. Low successional stages are maintained as a result in these areas.

4.8.3.1 Current Management

Forest Management and Habitat Implications. Forest management practices are a significant factor in habitat quality as roughly three-fourths of FLW is forested. Many wildlife species require a mix of forest size classes and openings to complete their life cycles. It is important to consider the potential effects of any forest or land management practices on habitats that may be shared by different wildlife species. FLW’s forest management strategies are discussed in Section 4.7, *Forest Management*.

Forest management actions that involve removal of canopy trees result in increased sunlight to the forest floor, promoting an abundant growth of low browse not readily available in the closed-canopy forest. In a clear-cut, this will happen across the entire stand, producing several years of a thick growth of grasses, forbs, woody sprouts, and soft mast. Examples of soft mast includes, but is not limited to, berries and fleshy fruits. Past bird surveys showed the highest diversity and numbers for this habitat. Deer use this stage for foraging and escape cover. Scattered dead trees provide snags for cavity nesters. This “brushy” condition will exist until trees once again form a canopy that shades the ground. Similar results can be expected in openings made during TSI or UAM harvests but in a significantly smaller extent and for a shorter period.

Oaks provide hard mast that is important to such species as deer, turkey, and squirrels, and up to a point, the larger oak trees produce the most acorns. Years of mast crop failure are more likely due to climatic factors (temperature and precipitation) than to local actions; however, forest management actions that improve tree health should also benefit mast production.

A variety of migratory birds utilize a variety of forest conditions, from those that require a closed-canopy forest to those that use the forest edge or forest openings. Threatened or endangered species, particularly the Indiana and northern long-eared bats, require special consideration when planning forest management activities. Refer to Section 4.10, *Special Status Species Management* for management details.

Supplemental Plantings/Wildlife Openings. Portions of firebreaks are seeded with a mixture of cool season wheat and clover (see *Firebreaks*). In addition, about 61 acres of cover crops are planted annually. Species of wildlife are also taken into account for LRAM-related plantings on FLW.

In an old runway area that makes up a portion of the Normandy Training Area (TA 244), a series of terraces designed for erosion control have been established through the LRAM program. These terraces have been successful in controlling erosion but also benefit wildlife. After initial ground work was completed, terraces and areas between terraces were revegetated with fescue, switch grass, and flat pea, providing food and cover to wildlife. However, in recent years an invasive, primarily sericea lespedeza, has dominated the revegetation efforts. During wet periods these terraces also hold water and release it slowly downslope, thus providing an additional water source for wildlife. Sediment basins established in TA 244 also provide a source of water, and drainages leading to basins provide food and cover for wildlife.

Trees have been planted for streambank restoration in some riparian areas. Species, such as willow, have been planted to re-establish woody vegetation along eroding stream banks. Green ash, silver maple, and other natives have also been planted in riparian corridors. In some other riparian areas, discontinuing mowing has allowed regeneration of forest species. Additionally, potential wetland enhancement projects include damming off a small drainage to expand on existing wetlands. This may also include planting millets to increase waterfowl and dove use. These activities will continue dependent on funding and availability.

Nesting Structures. Artificial nests are a recognized management tool for wood ducks, geese, and other waterfowl species as well as various small mammals and songbirds. Birds, such as the purple martin, can help reduce pests such as insects that damage gardens, flowers, trees to disease carrying mosquitoes. These birds are also considered aesthetically pleasing. Other similar structures include bat roost houses. These nesting structures were historically constructed, installed, and maintained with the assistance of local Scout groups and/or other public outreach activities. Nesting structure activities and programs would depend largely on funding and public interest.

Natural tree cavities and den trees are left standing within harvest cut areas and as part of the firewood program. Depending on the harvest prescription, trees may be girdled within the timber cut area. These girdled trees provide additional snags for wildlife.

Prescribed Burning. Prescribed burning has the potential to be one of the most cost effective and efficient management tools for habitat and training area manipulation. The forester is the FLW Wildland Fire Program Manager who oversees the IWFMP and plans and leads prescribed fire actions. The NRB personnel comprise the prescribed burn team. The FLW Fire department frequently assists. Prescribed burning produces multiple benefits including reducing the incidence of wildfires through fuel reduction, maintaining open training lands, enhancing ecosystem diversity, and enhancing wildlife habitat. The Wildland Fire Program Manager prepares a firebreak maintenance and prescribed burning plan each year in cooperation with the Fire Department and Range Operations.

Opportunities for prescribed burning are dependent on a combination of adequate weather, personnel, and access to burn areas. Fire season occurs mostly during the dormant/leaf-off time, but wildfires are possible at any time of the year during dry periods. Prescribed burning is generally planned from late October through early April. The timing of leaf fall, the first killing frosts, spring green-up, and spring nesting help guide the beginning and ending dates. The early April cut off avoids disturbing northern long-eared bats, which begin emerging from hibernacula locations. However, prescribed burning can extend into mid-April taking into account bird nesting and potential bat disturbances, to include verifying the absence of protected bats. Natural resource managers follow current DoD and USFWS guidance. Ranges where wildfires are likely, are scheduled for burning every year at the earliest opportunity (if possible) to reduce military training and range down time from wildfires or high fire danger restrictions.

Most areas designated for burning are range impact areas or old fields in various stages of succession. Fire helps to maintain areas in early successional stages of grasses and forbs. In suitable areas, prairie like conditions with warm season grass stands with a diverse component of flowering plants are desired to improve habitat for pollinators. In forested areas, fire helps to produce and maintain woodland conditions with open understory and more widely spaced trees. Fire and the additional sunlight reaching the ground help to develop a grass and forb ground layer.

Annual burn acreage prescriptions vary between 1,500 and 2,000 acres with an approximate yearly average of 1,100 acres, but actual acreage burned can vary based on weather, staff availability, and access to ranges. Most areas are schedule for burning on a 3-year rotation except for some ranges that are always on the schedule to burn as often as possible. When an area is schedule but cannot be burned, it will be rescheduled for the following year and then put back into a 3-year rotation. Areas that can be burned without firebreak maintenance may be burned outside of a schedule year if the opportunity arises. Burn areas on ranges can be considered “let burn” so that if a wildfire ignites, the Fire Department has the option of letting it continue rather than attempting to extinguish it.

Weather and fuel conditions in which prescribed burning will be accomplished are as specified in the IWFMP. In general, those are conditions under which a fire will produce the desired results and be safely manageable. Prescribed burning is further discussed in Section 4.15, *Fire Management*.

Figure 15 shows the expected schedule for prescribed burning. Several areas are designated as unscheduled, primarily because of safety issues from unexploded ordnance, lack of adequate firebreaks that would permit safe prescribed burning operations, or other concerns. If the limiting situations change, these areas may be included into burn plans.

Firebreaks. Firebreaks, as briefly described in Section 4.5, are essential to prescribed burning and wildfire control. The FLW firebreak system is about 77 miles long. About two-thirds of the total acres occupied by firebreak are for military purposes such as fire management on firing ranges and training areas.

Roads, trails, and streams also act as firebreaks. In many instances, maintained roads help to contain wildland fires better than firebreaks and provide better access for prescribed burning or fire suppression.

Impoundments. Construction of multi-purpose impoundments is an integral part of the fish and wildlife program. These impoundments function as recreational fisheries, wildlife water units, and sedimentation basins. FLW has roughly 110 impoundments, of which 18 are major fishing impoundments ranging in size from 0.1 to 40.6 acres. Many remaining impoundments are smaller basins scattered throughout the installation. Lakes and ponds are further discussed in Section 4.8.4, *Aquatic Habitat Management*.

Smaller basins (0.1 - 0.5 acres and less than six feet deep) function primarily as wildlife water holes. Natural Resource Managers at FLW determined that availability of permanent water was a limiting factor in habitat quality on many upland areas of FLW. To meet this need, a drainage area is dammed off at the upper ends creating an impoundment for water. Basin areas and depths are dependent upon individual site location. Once a dam is complete, the pond is left to fill naturally. The dam and surrounding disturbed areas are typically planted with a ground cover, usually orchard grass, red clover, and Korean lespedeza, to stabilize soils and provide food and cover for wildlife. These fishless water sources also compliment the upland forage areas used by bats and provide habitat for amphibians. Additionally, these impoundments serve as erosion control structures; many of the upper ends of drainages on FLW are points of origin for erosion problems. Construction of these impoundments are dependent upon funding and availability.

Prescribed Fire

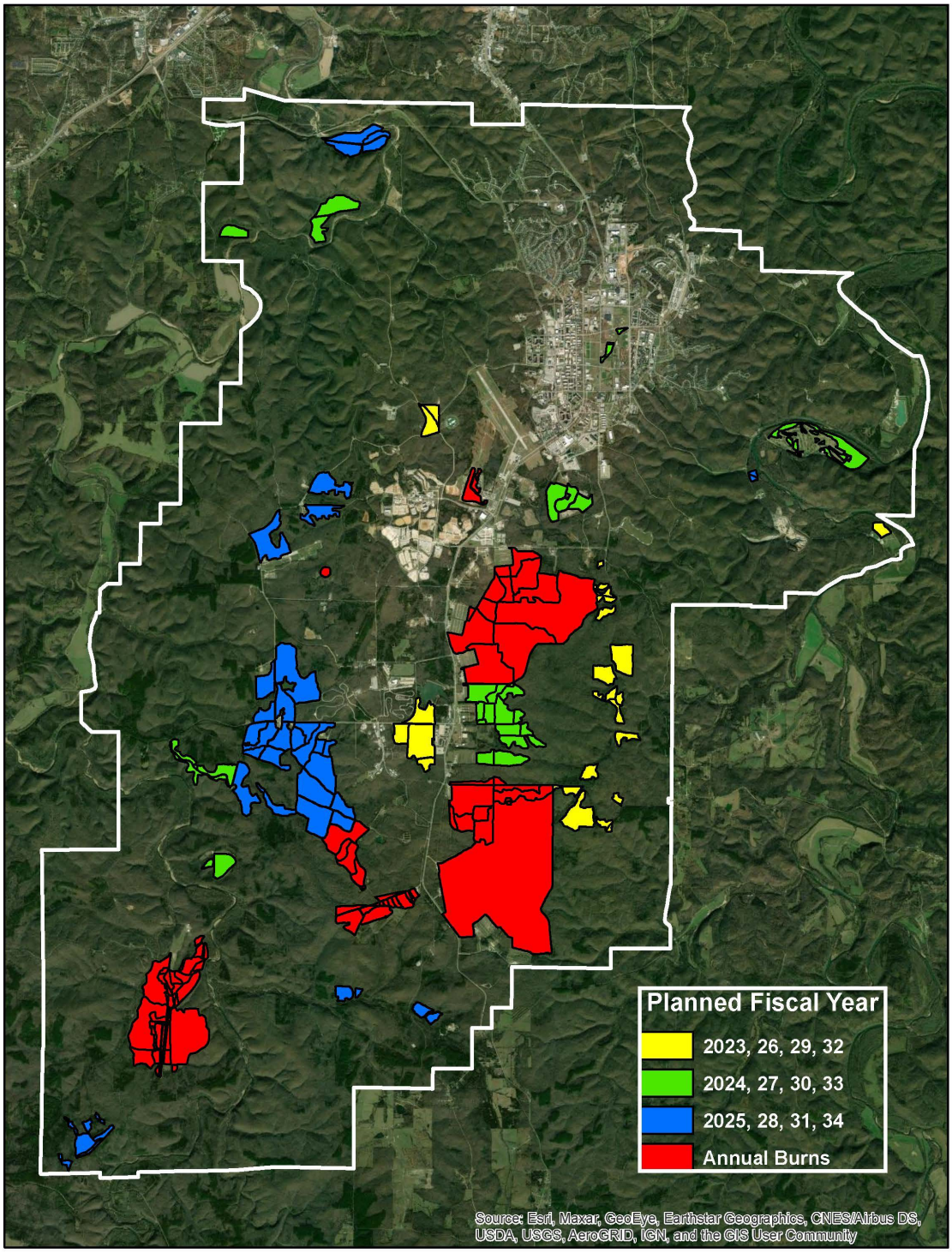


Figure 15. Prescribed Burn Areas

Cave Management. About 68 caves are known to exist on FLW. Brooks, Wolf Den, Freeman, Joy, Davis No. 2, and Saltpeter No. 3 caves as well as eight other northern long-eared bat hibernacula caves are designated as restricted-use caves due to the presence of federally protected bats. Management of these caves is discussed in Section 4.10, *Special Status Species Management*. Remaining caves are under no specific management programs other than the fact that many are located in riparian areas, are difficult to access, and some have restricted access related to cultural or other environmental resource implication. Previous surveys have indicated that over half of these caves contained invertebrates and ten contained amphibians. Surveys from 2016 and 2017 indicated locations of northern long-eared bats on FLW and other bat species as they were detected. Refer to Sections 3.3.4 and 4.10 concerning bats and cave management.

All caves used for training have been approved by the Environmental Division. Caves utilized for approved training are monitored pre-training and post training by the Environmental Division to determine if training impacts are having potential negative effects on the resource.

4.8.3.2 Terrestrial Habitat Management Goals and Objectives

Goal 1. Manage wildlife species based on conservation needs, distribution and threats, population trends, importance of areas to species, potential for population and/or habitat management, and human interests.

Objective 1. Consider wildlife species and habitat requirements when prescribing forest management practices.
Objective 2. Preserve structural features, such as cavity trees, unless they present a hazard.
Objective 3. Annually plant cover crops in areas accessible for handicapped hunters.
Objective 4. Maintain and monitor established nesting structures, and if possible, install additional structures as part of local Scout group and community outreach activities.
Objective 5. Prepare and submit the annual prescribed burning plan to the Commander.
Objective 6. Use prescribed burning as a major wildlife habitat management tool to reflect a landscape management perspective on FLW.
Objective 7. Maintain permanent firebreaks through annual mowing, tilling, and planting.
Objective 8. Develop additional impoundments.
Objective 9. Complete biological and cultural inventories of caves and adopt the appropriate recommendations developed from recent inventories.
Objective 10. Conduct management activities that align with IPMP, such as animal or pest damage control.
Objective 11. Conduct public outreach through community projects, media sources, and event venues.

Goal 2. Collect terrestrial habitat information and conduct management efforts through interagency coordination.

Objective 12. Monitor, research, survey, and maintain records of terrestrial habitats and the associated species.
Objective 13. Disseminate collected field data and reports to appropriate agencies and/or stakeholders.
Objective 14. Maintain communication and coordination with state and federal agencies and other stakeholders on applicable terrestrial habitat management issues and activities.

4.8.4 Aquatic Habitat Management

4.8.4.1 Current Management

Stone Mill Spring. The area is designated as Stone Mill Spring Trout Management Area. It is managed under an interagency agreement (12-IA-11090500-010) signed in 2012 between the U.S. Forest Service and FLW. MDC cooperates by providing trout stocking resources and assistance as agreed upon during annual meetings. FLW conducts daily maintenance such as mowing, trash removal, and cleaning. USFWS contributes funding and other administrative support as agreed upon during annual interagency meetings. As of 2022, the 2012 interagency agreement is under an intergovernmental review. Parties involved are seeking a resolution that includes a land transfer or exchange proposal.

Pond Construction. Lakes and ponds on FLW are generally multi-purpose. Many were constructed under contract, but some smaller basins were built with troop support. Generally, lake and pond construction projects are considered erosion control in the planning and construction process, unless for specific recreational purposes. New construction or expansion of existing impoundments would be dependent of funding and availability. Adequate funding is the prime deterrent to constructing additional fishing ponds. Potential construction sites are determined by acceptable soil traits, such as, porosity, clay/silt ratio, shrinkage, compactability, etc. The preferred design for fishing ponds is to construct them at least one acre with a minimum average depth of eight feet.

Aquatic Weed Control. Aquatic vegetation is essential in a healthy pond ecosystem. While 10-20% coverage is acceptable/desirable, excessive growth can present significant problems to small pond management. First, growth of predator fish (largemouth bass) is diminished due to their inability to feed effectively on their primary prey species (bluegill). The result is a bass population containing a high proportion of slow growing 10-12 inch fish and few larger fish. Second, the prey population (bluegill) is high, but fish size is less than desirable. Third, anglers are frustrated by the reduced accessibility to the pond/stream and entanglement with “moss.”

Control methods include chemical (herbicides), biological (grass carp), mechanical/ physical (pulling, cutting, shading, dredging, pond design), and water level manipulation (drawdown). Effectiveness of these methods depends on the type of plant (algae, free floating, submergent, emergent, or floating leaf), extent of control desired, and season of the year. These methods have been used with varying degrees of success on FLW. Their use is determined on a case-by-case basis. Another method of control is

managing the watershed above the impoundment to reduce nutrient inflows that can increase aquatic weed and algal growth. However, this could be limited due to range complex and training area uses as well as funding and staff availability.

A field survey of the aquatic plant communities in 186 ponds and lakes was conducted as part of a comprehensive impoundment inventory in 2002. Of the 56 impoundments classified as having fisheries or possessing fisheries management potential, 53 had notable aquatic vegetation. Thirty-nine species of aquatic or semi-aquatic plants were identified from these 53 impoundments. Of these, 8 were shoreline or moist soil type, such as buttonbush; 14 were characterized as emergents, such as cattails; 8 were floating vegetation, such as water shield; and 9 were classified as submergents, such as milfoil.

The only moist soil plant species that is adversely affecting angler access is water willow in Bloodland Lake. Of the emergent plants, cattails are considered the only species that needs control. Cutting of cattails at Bloodland, Babb, and TA228 ponds resulted in limited long-term success. One of the most difficult floating plant species to control on FLW is water shield. FLW implemented an intensive spot eradication campaign against water shield along select areas of Penn's Pond shoreline using regular cutting without long-term success. Several impoundments have submergent plants at nuisance levels, and some have more than 25% coverage of the impoundment area.

FLW has come to the realization that the most effective way to gain long-term control of unwanted aquatic vegetation in fishing impoundments is by using herbicides. To this end, a summary of the chemicals needed was incorporated into the IPMP. The use of chemical control is most effective for controlling emergent vegetation, such as cattails and bulrush. It can be used for complete control or spot treatment. Registered herbicides are applied at the specified rate by licensed applicators in accordance with the IPMP.

Grass carp (*Ctenopharyngodon idella*) can provide some biological control; however, it is not a preferred method. They do not eat other fish, can eat 2-3 times their body weight in plants per day, and typically do not reproduce in ponds. They can control some forms of aquatic vegetation, however, their effectiveness diminishes after reaching 10 pounds and they do not always consume targeted aquatic plants. Future stockings of grass carp may be done on a site-specific basis.

Mechanical and physical controls are labor intensive, and control is often only temporary. Covering an area with black plastic can shade out submergents and be effective in a relatively short time, 18-30 days. Dredging, raking, and pulling also reduce shoreline vegetation. Mechanical controls used at Stone Mill Spring Branch have been primarily by a boat-mounted mechanical cutter and a hand cutter. Riprap has been used at the spring branch mainly for bank stabilization to fill holes left by muskrats and beavers, but it has also reduced aquatic vegetation.

Water level manipulation (drawdown) exposes aquatic vegetation to drying or freezing depending on the time of year. This is effective for longer term control of floating leaf plants. Depth of drawdown is dependent upon the desired level of control and varies from 4-8 feet. Drawdown capability can be designed into a pond or done through the use of a 4-6 inch diameter siphons. This method can negatively impact localized fish populations and alter established impoundment related ecosystems. Other methods are preferred over this method and drawdowns are not typically used on FLW.

Proper pond design and construction would reduce the potential for some aquatic vegetation problems. Adequate depth, degree of slope on banks, etc. are important aspects of pond design. This is the most economical method overall.

Pond Maintenance. After an impoundment is completed, filled with water, and stocked with fish, maintenance and repair of the impoundment are required for its long-term preservation. Pond maintenance constitutes a wide array of activities with emphasis on mechanical actions. Dam maintenance is foremost to maintaining the integrity of the impoundment, as well as bank stabilization on larger ponds as needed for erosion and sedimentation issues.

Fishing access was considered when the two major fishing lakes on post were constructed. Bloodland Lake has two fishing peninsulas and a concrete boat ramp. Through cooperative agreements with MDC, facilities at Bloodland Lake were updated to provide disabled fishing access. Specifically, an agreement signed in 2002 provided funds to construct concrete sidewalks, picnic pavilion building, dock, and disabled-accessible privy. In November 2021, MDC chose to terminate the cooperative agreement and the lake was removed from association with MDC. FLW continues to conduct maintenance and upkeep of these facilities. Penn’s Pond has a semi-improved rock boat ramp and facilities are maintained as needed.

Big Piney River has numerous access points for shore anglers and two concrete boat ramps. Access roads, parking lots, and adjacent grounds are maintained regularly. Shoreline vegetation is generally not a concern unless problems are reported, such as with dead trees being safety hazards. In that event a contract would be used to resolve the problem. Fishing impoundment directional signs are maintained regularly.

Fishing enjoyment can be enhanced through the addition of picnic facilities, such as grills, shelters, and tables. The intensity of public development is dependent upon scenic beauty, distance, road access, etc. Some access points to Big Piney River are well equipped with picnic facilities. Further development of picnic facilities is dependent upon funding and project priority. Trash collection points will be implemented where appropriate.

Habitat Structures. Sunken brush piles, pipes, barrels, and other environmentally friendly structures provide cover, aggregate bait fish, can increase spawning habitat, and add substrate for aquatic invertebrate production in any body of water. These structures provide security for larval fish as well as make defense of nests easier. Structure also concentrates larger predator fish. Additionally, natural structures, such as

logs, root balls, and large boulders removed during new construction are stockpiled at the site. Once construction is complete natural structures are placed back after to provide fish habitat.

Another method of adding structure is to place weighted tree or brush bundles on the ice. When the ice melts, the bundles sink, creating fish structure. This is somewhat more labor intensive than putting structure in at the time of construction, but it is a good option to provide structure for ponds where fish habitat was not originally considered, or the structure has decayed. Most ponds that support fisheries have adequate structure. However, fish attractors have been placed within casting distance of the disabled-accessible fishing dock and at bank fishing areas at several ponds on FLW. Maintenance of fish structures is dependent upon funding and availability.

4.8.4.2 Aquatic Habitat Management Goals and Objectives

Goal. Maintain and enhance the natural diversity of aquatic communities on FLW.

Objective 1. Continue to manage Stone Mill Spring under agreements (in review) with U.S. Forest Service and coordination with MDC.
Objective 2. Develop additional fishing ponds following the preferred design for fishing ponds on FLW.
Objective 3. Control aquatic weeds following an integrated approach using chemical, biological, and cultural methods as appropriate for each impoundment as determined on a case-by-case basis.
Objective 4. If herbicides are used, ensure that application of registered herbicides are at the specified rate and by licensed applicators in accordance with the IPMP.
Objective 5. Maintain and repair impoundments as necessary for the long-term preservation and to encourage recreation use as applicable.
Objective 6. Incorporate fish structure at the time of pond construction and maintain and replace structure as needed in existing impoundments.
Objective 7. Partner with state and federal agencies for fish stocking; as applicable.

4.9 FISH AND WILDLIFE MANAGEMENT

Native species biodiversity conservation is a cornerstone of ecosystem management. FLW is taking appropriate steps via this INRMP, surveys, studies and reports that have preceded it to ensure that overall biodiversity is not compromised at the installation. Wildlife population management directly influences populations as opposed to soil, water, and vegetation management practices and protective measures, which indirectly affect populations, as discussed in other sections of this INRMP.

General fish and wildlife population management programs are described in this section. Other pertinent fish and wildlife management sections include Section 4.7, *Forest Management*; Section 4.8, *Habitat Management*; Section 4.10, *Special Status Species Management*; and Section 4.13, *Pest Management*.

4.9.1 Current Management

There are many opportunities for the general public to participate in installation activities and access natural resource areas. AR 200-1 contains provisions for public access for recreational use of natural resources on Army installations. In maintaining a policy of public access, FLW relies on a responsible public to adhere to restrictions placed on range access. FLW's policies toward public access are within both the spirit and letter of Army and Defense policies. The military mission has priority over outdoor recreation involving access to training lands. Availability of areas for hunting, fishing, and other outdoor recreation activities is determined by the DPTMS.

FLW hunting, trapping, and fishing programs are open to military personnel, dependents, civilian employees, and the public with a Missouri hunting, trapping, or fishing license. These individuals need only obtain a Sportsman's Permit, appropriate post stamp(s) (firearms deer, firearms turkey, and/or archery), and appropriate federal permits (*e.g.*, duck stamp). There are no restrictions on number of permits issued to the public, nor are permits issued in such way to give special treatment/priority to individuals, groups, and/or clubs. Special considerations may be given to senior citizens, children, and handicapped. More military than civilians participate in most hunting and fishing activities on FLW. These opportunities are available to handicapped persons at designated locations on the installation. FLW continues to improve access for handicapped persons. In addition, hunters with a special permit (supported by a medical statement) issued by MDC are allowed to hunt from a vehicle (except all-terrain vehicles).

Census of game species is required for the establishment of harvest regulations that allow for sustained use of game species. The MDC provides the framework within which FLW must harvest game species. Harvest numbers provide an inexpensive means to monitor game populations. Sportsmen harvesting game on FLW are required to report harvest in iSportsman and MDC telecheck systems. Combining harvest data with hunter effort provides information adequate to manage most game species.

Mammals

White-tailed Deer. Physical and physiological well-being is an index to population size relative to range carrying capacity. Data collected during hunting seasons for deer through the state requirement to "tele-check" harvests and FLWs requirement to report in iSportsman has eliminated the need for traditional check stations.

Diseases, parasites, various body measurements, and internal and external body conditions are indicative of herd health. Healthy herds are generally either at or below carrying capacity while unhealthy herds may be indicative of overpopulation. Spot checks of harvested deer and investigations of sick deer will be conducted by NRB personnel.

Historically, white-tailed deer were post-harvest censused on FLW and even used MDC aerial survey techniques. FLW has since relied on spotlight counts each October to

monitor deer population status and obtain classification data. From 2010 to 2021, the annual average harvest is approximately 371 deer for all seasons/methods.

Small Mammals. Small game species are not formally censused because of expense and limited usefulness in setting seasons and bag limits. General trends of small game populations are informally monitored by Natural Resources personnel using personal observations.

Furbearers. Most common furbearers such as raccoon, coyote, opossum, red and gray fox, striped skunk, bobcat, mink, muskrat, beaver, and otter are not specifically monitored. Natural resource managers make observations during routine field work; however, furbearer population densities have historically not been a concern on FLW. Populations are sustained and require little management primarily because of remote areas hard to access, hunting/trapping pressure has declined, and restricted areas where hunting is not permitted. Additionally, much of land surrounding the installation is protected Mark Twain National Forest, and furbearers are free to move to and from FLW.

Furbearers are monitored using a scent station survey. A scent station is a three-foot diameter circle of bare soil with an artificially scented post (cotton-tipped swab) placed in the center. The soil is sifted to allow observance of tracks left by visiting animals. The survey consists of segments totaling roughly 15 miles and includes approximately 50 total stations. Stations are prepared one day, and a confirmation of tracks are recorded the next. Survey technique and segments/station locations, remain consistent. FLW data are combined with other survey routes to determine statewide population trends. Standardized census of aquatic furbearers, otters, muskrats, beavers, etc. are not conducted on FLW.

FLW natural resource managers work closely with state and federal agencies to monitor specific mammals such as mountain lions and black bears. This is conducted through field observations such as sightings or tracks. Potential future management techniques may include the use of stationary cameras (game/trail cameras) to record the presence or absence of the targeted species and to determine if there is potential resident populations or breeding occurring on FLW.

Birds

Turkeys. FLW hunters are required to check harvested turkeys on the installation. Data is collected on sex, weight, beard length, and spur length. Population status information is obtained from late summer brood survey data from MDC. The current state requirement to “tele-check” harvested turkeys has eliminated the traditional check stations. The average annual harvest, from 2011 to 2021, was around 56 turkeys, of which approximately 90 percent are taken in the spring hunting season.

Waterfowl. Waterfowl were censused in conjunction with the annual bald eagle survey conducted on the major river (Gasconade, Big Piney, Roubidoux) of Pulaski County, Missouri. The primary survey method is aerial using a helicopter, but observations by

boat or fixed-point counts may also be used. Data recorded include the location, number of individuals, and species composition for each citing.

Ruffed Grouse. Grouse are no longer released or monitored on FLW.

Neotropical Birds. There is considerable continent-wide concern over declining numbers of many neotropical bird species. FLW natural resource managers work closely with state and federal agencies to collect information to determine the status of these birds, using avian surveys. Additionally, FLW was participating in the Monitoring Avian Productivity and Survival (MAPS) project, which is part of the Partners in Flight program. Six MAPS stations were established on FLW. Monitoring took place from 1993 to 2011 to monitor avian production and survival. Due to funding availability the MAPS project is currently suspended. However, FLW continues to send periodic migratory bird species updates and information to the DoD Partners in Flight Program.

Great Blue Herons. There are two great blue heron rookeries located on FLW. One can be found north of the Cannon Range, which is off-limits to the public, and a second rookery is located near Training Area 256 (Quarry) on the Big Piney River. Both locations remain active during the spring nesting season.

Other Native Birds. Other common native birds, to include songbirds, are primarily managed within the cantonment area through constructed nesting structures as discussed in Section 4.8.3 *Terrestrial Habitat Management.* Feeding stations are not managed by FLW staff; however, some are maintained by local residents. Additionally, the NRB conducts an annual breeding bird survey for monitoring purposes. Results from that survey is voluntary shared with the USGS as part of their monitoring efforts and data collection.

Fish

Fisheries surveys for FLW are conducted by the FLW fisheries biologist. Sampling is conducted annually on an as needed basis using an electro-fishing boat or occasionally using hoop-nets. Targeted species in most impoundments include largemouth bass, bluegill, and channel catfish. From the data collected, stocking needs, stocking rates, creel limits, etc. are determined. FLW's electro-fishing has greatly enhanced the ability to monitor installation fish abundance on a more frequent and timelier basis.

An impoundment resources survey, which began in 1999, used old files, aerial photography, and on-site verification to identify and summarize information on impoundments and streams on FLW. This survey resulted in a total of 260 impoundments being included in the database and delineations being completed for more than 50 impoundments identified as having fisheries or fisheries potential. However, since that time GIS data was developed resulting in 110 total impoundments identified on FLW.

Survey and analysis efforts by FLW fisheries personnel resulted in a change to the FLW Hunting and Fishing Regulations (Reg. 210-21) in 2003 allowing year-round fishing at nine additional ponds equaling about 11 acres. Impoundment surveys for channel

catfish and Centrarchid fishes, specifically largemouth bass, were conducted in 2021 at Bloodland Lake and Penn's Pond and Indiana Pond and Bloodland Lake, respectively. Results indicated current management should remain relatively the same, with the exception of reducing channel catfish stocking size from 30–38 cm (10–12 in), to > 22 cm in ponds greater than two habitat acres and surveys occur in late spring. For Centrarchid fish, the survey report recommended 20-40% removal over the course of the next five years depending on population estimates, growth rates, and age lengths.

4.9.2 Population Management

The manipulation of fish and wildlife populations is an important aspect of fish and wildlife management. Human use of sustainable resources is a critical aspect of ecosystem management. Fish and wildlife population management for selected species is discussed in the following sections specific to each species or group of species.

Regulated harvest during established seasons is the primary population management tool for fish and wildlife resources. Provisions of the State of Missouri Wildlife Code are applicable to all harvests on the installation under 10 USC Section 2671 (a). The Missouri Conservation Commission annually sets season methods, dates and length, creel/bag limits, among other regulations. The annual version of *Missouri Hunting and Trapping Regulations*, gives complete information such as seasons and bag limits, and these regulations apply to FLW. Additionally, FLW Regulation 210-21, *Hunting and Fishing Regulations* (2021) establishes policies, procedures, and responsibilities that govern hunting, fishing, and trapping on FLW. This regulation also applies to weapons and methods used as well as their registration on the installation. According to this regulation, centerfire (high power) rifles are prohibited for safety reasons. Shotguns with slugs and muzzleloaders are quite effective in the topography/cover of the installation. Hunter distribution has proven to be self-regulating, offering hunters a reasonable degree of solitude and good safety. This has precluded assignment of a specific number of hunters to a given area. However, access control procedures are required.

The FLW wildlife biologist annually provides DPTMS, Training Division, Scheduling Branch, with dates/lengths of hunting seasons, preferred hunting areas, and harvest objectives. This coordination assists the Scheduling Branch in providing maximum recreational opportunity within training requirements. However, training requirements for the past several years have resulted in many preferred hunting areas being closed during key hunting seasons. With prime hunting areas closed, many hunters are unwilling to deal with the inconvenience of not knowing from one day to another if their preferred areas will be open or closed.

White-tailed Deer. Dates for firearms deer season is statewide and determined by MDC. This season is eleven days and typically opens on the second weekend in November. These dates provide adequate hunting opportunities for most deer hunters and allow for a sufficient harvest during good years with adequate protection during years of low productivity. Centerfire rifles are not allowed for hunting on FLW, but hunters can participate in the firearms season using a muzzle loading rifle or shotgun. An alternative weapons season runs for an additional ten days beginning on the last Thursday in December which is open to all weapons types except centerfire rifles and

shotguns. Hunters are limited to one buck and one antlerless deer on a firearms deer or muzzle-loading deer hunting permit on the installation. The basic permit allows harvest of one buck deer.

Statistics for historical deer season harvests from around 1964 through 2004 are listed in Appendix 4.8.1.2 of the 2006 INRMP for reference. Table 7 provides recent harvest data for the last decade for archery and firearms.

Table 7 Total White-tail Harvest Numbers

Year	Archery	Firearms/Alternative Methods	Year Totals
2011-2012	116	163	279
2012-2013	134	229	363
2013-2014	146	166	312
2014-2015	134	207	341
2015-2016	217	277	494
2016-2017	174	213	387
2017-2018	242	225	467
2018-2019	171	166	337
2019-2020	229	209	438
2020-2021	154	73	227
2021-2022	245	192	437

In Missouri archery deer and archery turkey are combined seasons. The archery season is open from 15 September to the day before the firearms deer season and from the day following the firearms deer season through 15 January. The typical bag limit for deer is unlimited antlerless deer and two antlered deer. Bag limits for turkeys is usually two of either sex. However, bag limits are subject to change and regulated by MDC. Archery deer harvest and opportunity is primarily dependent on hunting area availability. The longer archery season (four months, minus 11 days) tends to buffer the area closure effect. However, closures could require hunters to hunt in areas with less success rates. In 2007, nine “archery only” hunting areas were established to provide additional opportunities. In 2018, six special cantonment hunting units were established in and around the cantonment area. These cantonment areas are archery only and have special rules and regulations which are authorized through FLW Garrison Command Policy 39.

The percentage of area open to hunting (area availability) is the single biggest determinant to harvest success on FLW. The NRB and DPTMS will work together to improve recreational hunting opportunities. Coordinated scheduling improves the quality of life for FLW soldiers while supporting quality military training.

Eastern Wild Turkey. Spring turkey season should begin soon after most hens have been bred and are largely separated from more vulnerable toms. This period changes slightly from year to year. Typically, the firearms season for spring turkey hunting lasts

three weeks with a bag limit of two males. Fall firearms season is typically conducted the month of October. However, season dates, bag limits, and methods are announced annually by MDC.

Spring turkey hunting has long been a tradition at FLW. Hunt records go back as far as 1970, but spring turkey hunting started long before then. Typically, the number of spring turkey hunters exceeds over 300 individuals. Spring turkey harvest has ranged from as few as 14 birds in 1970 to 91 in 1983; historic harvest data can be found in Appendix 4.8.1.2 of the 2006 INRMP. For recent harvest data from 2011 to 2021 refer to the following table, Table 8.

Table 8 Total Turkey Harvest Numbers

Year	Archery	Firearms (fall)	Firearms (spring)	Year Totals
2011-2012	3	15	27	45
2012-2013	4	9	33	46
2013-2014	3	7	58	68
2014-2015	5	8	39	52
2015-2016	10	7	67	84
2016-2017	9	4	43	56
2017-2018	11	4	35	60
2018-2019	3	4	45	52
2019-2020	7	2	51	60
2020-2021	5	4	36	45
2021-2022	4	3	42	49

Small Game. Cottontail rabbits, gray/fox squirrels, doves, and bobwhite quail are the most commonly pursued small game on FLW. Woodcocks are mostly harvested by quail hunters. Grain based food plots provide great opportunities and success for the fall dove hunting season. Small game hunting on FLW follows statewide regulations. These species are not significantly affected by typical harvest within these regulations. Small game hunters are required to report harvest data during check-out in the iSportsman system. Any additional survey outreach by NRMs would be dependent on funding and staff availability. General information obtained includes the number of hunters, days afield, species hunted, and number of animals taken.

Furbearers. Furbearer species on FLW may be taken by state regulated methods. Regulations may require trapping only techniques. Hunting and trapping pressures are primarily dependent upon current pelt prices or the forecast of those prices. While the most common species pursued are raccoon and muskrat, demand for long-hair fur (raccoon, fox, and coyote) or short-hair fur (muskrat, beaver, otter, and mink) generally directs furbearer harvest activity.

Furbearer harvest has declined significantly on FLW, a few people still trap, but mostly as a hobby. It is unlikely that interest in furbearer hunting will increase unless pelt prices

rebound. Trapping on FLW typically is restricted by training activities. Similar to small game, furbearer trappers and hunters are required to report harvest data in iSportsman. Hunting and trapping pressure and resultant harvest are thought to be relatively inconsequential to furbearer populations.

Waterfowl. Big Piney River, Roubidoux Creek, Bloodland Lake, and Penn's Pond provide some duck hunting opportunity, but waterfowl habitat is limited. Waterfowl harvest is minimal; wood ducks are the most common species. Jump shooting of small ponds, wildlife water units, and sedimentation basins accounts for some duck harvest. Increases in waterfowl may be achieved by enhancing available habitat on the installation, water level manipulation of some wetlands, and creating wetland habitat through other natural resources activities. The installation is located within the Mississippi flyway; however geographically FLW is in between the major migration patterns for waterfowl.

Fish. The primary fish management practices on FLW include habitat structures, chemical, biological and/or mechanical control of aquatic plants and algae, relative abundance monitoring, harvest restrictions, stocking, removal, impoundment construction, and angler access. Fish sampling is used to periodically update data. Each lake may experience population fluctuations over the short- and long-term stemming from fish harvest, regulations, stocking, fish kills, pond productivity, aquatic weed infestation, etc. MDC assists the FLW fish management program through technical assistance efforts as needed.

Fish management areas include lakes, ponds, streams, and rivers on FLW and are available for recreational fishing provided they are not closed due to military training, fisheries management, renovation, or other activity. Fishing pressure and harvesting at these locations is considered relatively high. Fishing regulations are as specified in the Missouri Wildlife Code regulations with certain exceptions. These exceptions, which allow for more specific management of individual species and resources, are listed in FLW Regulation 210-21.

There is no length limit for channel catfish, but a creel limit of four daily applies to offset possible over harvest. Special restrictions apply to all impoundments with regard to black bass. The daily limit is four. All black bass more than 12 inches, but less than 15 inches, must be released.

Year-round trout fishing is available at Stone Mill Spring Recreation Area adjacent to FLW. Anglers are required to have a Missouri fishing permit and a trout permit to possess and/or transport trout. From the last Saturday in February through 31 October, the daily creel limit is four trout; only a single rod can be used; and no fishing is permitted on stocking days. During this period, it is managed as a "put and take" fishery. Ultimately, almost all trout are harvested. The period from 1 November through the last day of February is designated as catch and release season; bait restrictions apply.

Fish population survey data may indicate the need to remove undesirable fish species or stunted individuals of desired fish species. Removal options include seining, water

drawdown, rotenone (pesticide), or competition manipulation. Electro-shocking and removal is another technique that could be used to control fish populations and species. Electro-shocking is the primary means to identify fish populations for stocking; however, hoop-nets are occasionally used.

Fish population management primarily involves harvesting fish through fishing and fish stocking. Stocking includes fish put into bodies of water to add to existing populations or species that are purely “put and take”. The number stocked per pond is dependent upon pond characteristics. There is little reproduction, likely attributed habitat conditions, but some fish grow fairly large before being caught by anglers. The primary species that are stocked at designated recreational fishing impoundments include largemouth bass, bluegill, and channel catfish. Other species include green and hybrid sunfish.

Stocking generally occurs annually in most all recreational impoundments and is based on electro-fishing surveys. Fingerling largemouth bass, channel catfish, and bluegill are stocked in newly developed ponds. Newly stocked ponds are generally closed to fishing for a period of time to allow population establishment. Trout stocking in Stone Mill Spring also occurs annually. The Stone Mill Spring Branch became the responsibility of the U.S. Forest Service in 2001 as part of the land transfer between FLW and the USFS. MDC provides hatchery-reared trout for Stone Mill Spring Branch. MDC stocks trout every three weeks, beginning in March for a total of eleven stockings equaling 3,300 trout with a mean length of 11.6 inches. However, stocking quantities and time may vary year to year.

Feral Wildlife. Feral hogs were first observed on FLW in spring 1997 in the southwestern portion of the installation. Their primary activity has been along riparian corridors and is directly related to the availability of food, such as acorns. Annual hard mast (primarily acorns and hickory nuts) studies would help natural resource managers predict food supply availability during the winter months for feral hogs and other wildlife, such as deer and turkey.

Feral hogs can seriously impact rare and endangered species, other fish and wildlife species, native plant communities, row and forage crops, domestic livestock health, and potentially human health and safety. Immediate and aggressive action is critical to reducing this environmental threat. The population on the installation is unknown, but over 2,300 have been dispatched between 2015 and 2022.

Through a signed Memorandum of Understanding with USDA in 2017, a dedicated USDA trapper has been contracted and assigned to systematically locate, capture, and dispose of feral hogs on the installation. Locating specific areas of activity is the primary difficulty in control. Once activity areas are identified, shelled corn is used as bait to attract and concentrate hogs group captures. In addition, a “Judas hog” (a hog fitted with a radio transmitter) has been used to lead installation personnel to remaining hogs. The ultimate goal is complete removal of feral hogs from FLW. As part of this agreement, FLW has currently prohibited hunting of hogs on the installation, except as incidental to legal deer and turkey hunting activities. Efforts are being made to eradicate the entire population statewide. Individual hunting tactics tend to scatter and stress

groups of hogs; thus, making the hogs more elusive and harder to remove. Management efforts on FLW are geared toward eliminating entire groups. Aerial gunning of feral hogs by USDA Wildlife Services was initiated during the holiday break 2018 - 2020 and will be evaluated for subsequent years as needed. In 2017, FLW entered a MOU titled *Missouri Feral Hog Elimination Partnership* which is an intergovernmental agreement to work together and eliminate feral swine from Missouri.

Other nuisance animals on FLW, particularly in the cantonment area, include groundhog, beaver, muskrat, raccoon, opossum, skunks, and a variety of other bats, birds, and snakes.

Other Species. Protection and habitat management are the primary tools used to manage non-game species. Non-game populations are seldom managed directly at FLW; however, non-game species may not be willfully taken. These non-game species often benefit from management practices undertaken for game species as well as benefiting from a variety of vegetative habitats management activities. This is consistent with ecosystem management.

Re-introduction is another management practice conducted at FLW. Species re-introduced on or adjacent the installation include hellbender salamanders and river otters. An expansion of black bears in Missouri is likely the result of re-introduction efforts in Arkansas. Presence of black bears and mountain lions is being monitored by FLW Natural Resource Managers; however, no mountain lions have been confirmed at this time although un-confirmed sightings are reported annually. Additionally, cave access restrictions are also part of management efforts to protect cave dwelling species such as cave salamanders, cave crayfish, and bats.

4.9.3 Fish and Wildlife Management Goals and Objectives

Goal 1. Inventory FLW native faunal communities and regularly monitor indicator species for ecosystem integrity and special interests.

Objective 1. Collect white-tailed deer and turkey harvest data through MDC tele-check procedures and iSportsman data.
Objective 2. Conduct annual furbearer scent station surveys and monitor aquatic furbearer damage complaints.
Objective 3. Census waterfowl in conjunction with the annual bald eagle survey.
Objective 4. Construct additional nesting structures for resident and migratory birds; maintain existing structures.
Objective 5. Monitor neotropical migratory birds and send updated information to the DoD Partners in Flight Program.
Objective 6. Conduct annual breeding birds survey.
Objective 7. Verify great blue heron rookeries remain active.
Objective 8. Frequently monitor native fish communities using appropriate sampling methods to detect community changes and the presence/absence of species of interest (e.g., SOCC and ESA candidate species).
Objective 9. Conduct annual hard mast studies to predict food availability for deer, turkey, and feral hogs.

Objective 10. Seek partnership agreements with state, federal, and stakeholders to inventory and conduct surveys as applicable.

Goal 2. Manage fish and wildlife to maintain optimal populations in accordance with species priorities, population ecology, population health considerations, and habitat capacities.

Objective 12. Use regulated harvest during established seasons as the primary population management tool for fish and wildlife resources to maintain populations at or slightly below carrying capacities.
Objective 13. Ensure coordination occurs between the NRB and the DPTMS Scheduling Branch to provide the maximum recreational opportunity while avoiding impacts to training requirements on FLW.
Objective 14. Manage small impoundment fisheries to sustain populations for recreational angling and non-commercial harvest.
Objective 15. Annually stock fish species in small impoundments at determined rates based on relative abundance, harvest, and outreach events.
Objective 16. Coordinate with MDC and USFWS to continue annual trout stocking and general maintenance at Stone Mill Spring Recreation Area.
Objective 17. Systematically locate, capture, and dispose of feral hogs in accordance with the 2017 Memorandum of Understanding with USDA and the 2017 *Missouri Feral Hog Elimination Partnership*, with an ultimate goal of complete removal. Request assistance from MDC as needed.
Objective 18. Protect all species listed by any federal or state law from illegal harvest.
Objective 19. Seek funding for additional stationary (game) cameras.

Goal 3. Comply with Executive Order 13443, Facilitation of the Hunting Heritage and Wildlife Conservation.

Objective 20. Implement management tactics and opportunities that “expand and enhance hunting opportunities for the public.”
Objective 21. Consider programs and recommendations of comprehensive planning efforts such as State Wildlife Action Plans.
Objective 22. Use the iSportsman web-based tool to assist in fish and wildlife management, record data as applicable.

Goal 4. Promote recreational fishing to align with DFMWR benefits.

Objective 23. Conduct public outreach and notifications regarding fishing derbies.

Objective 24. Keep DFMWR informed on fishing opportunities, species present, and stocking if available on the installation and the LORA site.
Objective 25. Promote recreational fishing and access to the public and residents on FLW on the installation and the LORA site.

4.10 SPECIAL STATUS SPECIES MANAGEMENT

4.10.1 Federal-listed Species Management Practices

The federal ESA of 1973, as amended (Act) requires lands under the jurisdiction of the Department of the Army to conserve federal-listed species. As defined in the Act,

conservation is the use of all methods and procedures necessary to bring any listed species to the point where protections provided by the Act are no longer necessary. Section 7 of the Act requires the Army to formally consult and confer with the USFWS if any action by the Army may affect a listed species or critical habitat. Additionally, in concurrence with the Sikes Act, FLW avoids negative impacts, protects, and improves habitat conditions for state listed species of concern when possible.

The Army has five primary requirements under the ESA:

1) to conserve listed species
2) not to “jeopardize” listed species
3) to “consult” and “confer”
4) to conduct a BA
5) not to "take" listed fish and wildlife species or to remove or destroy listed plant species

FLW is committed to these five primary requirements.

4.10.2 Current Management

Critical Habitat

The ESA, Section 4 (a)(3) states that, “*The Secretary [of the Interior], by regulation promulgated in accordance with subsection and to the maximum extent prudent and determinable shall, concurrently with making a determination … that a species is an endangered species or a threatened species, designate any habitat of such species which is then considered to be critical habitat; and may, from time-to-time thereafter as appropriate, revise such designation. The Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation.* Based on this, the USFWS has determined that, where applicable, federal critical habitat designation is not warranted if the INRMP includes the following three criteria:

1. The plan provides a conservation benefit to the species. Cumulative benefits of the management activities identified in a management plan, for the length of the plan, must maintain or provide for an increase in a species’ population or the enhancement or restoration of its habitat within the area covered by the plan [*i.e.*, those areas deemed essential to the conservation of the species]. A conservation benefit may result from reducing fragmentation of habitat, maintaining or increasing populations, ensuring against catastrophic events, enhancing and restoring habitats, buffering protected areas, or testing and implementing new conservation strategies.

- Flora and fauna inventory and monitoring, habitat management, wildlife population management, federal-listed species protection, and numerous other

projects discussed in this INRMP will provide a cumulative conservation benefit to federal-listed species.

2. The plan provides certainty that the management plan will be implemented. Persons charged with plan implementation are capable of accomplishing objectives of the management plan and have adequate funding for the management plan. They have the authority to implement the plan and have obtained all necessary authorizations or approvals. An implementation schedule (including completion dates) for the conservation effort is provided in the plan.

- The Commander has the authority to implement the INRMP, which will be accomplished primarily by the Natural Resources staff and budgeted (Section 7.5, *Implementation Funding*).

3. The plan provides certainty that the conservation effort will be effective. The following criteria will be considered when determining the effectiveness of the conservation effort. The plan includes (1) biological goals (broad guiding principles for the program) and objectives (measurable targets for achieving the goals); (2) quantifiable, scientifically valid parameters that will demonstrate achievement of objectives and standards for these parameters by which progress will be measured are identified; (3) provisions for monitoring and, where appropriate, adaptive management; (4) provisions for reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort are provided; and (5) a duration sufficient to implement the plan and achieve benefits of its goals and objectives.

- Goals, objectives, and long-term ecosystem needs, based on land use sustainability for the FLW mission, have been analyzed and considered extensively in collaboration with persons contacted while preparing this plan. Goals and objectives are defined for the plan as a whole (Section 1.4) and each project within the plan, as summarized in Appendix A. The INRMP will be evaluated through monitoring programs, including the Environmental Compliance Assessment System, the Environmental Quality Report, Environmental Performance Assessment System by IMCOM at the Army Environmental Command, and reviews by the Northwest Region Installation Management Agency and other interested parties.

Management

Protection and management of threatened and endangered species is conducted in accordance with the ESA, NEPA, AR 200-1, USFWS regulations and agreements, and other applicable laws or guidance from higher headquarters. Species of fish, wildlife, and plants that are listed as threatened or endangered are protected and managed, but it is difficult to obtain high priority funding for species proposed for listing. Consideration is given to species listed by the state of Missouri.

Management and protection of listed species are given priority in natural resource management. In cases where endangered species management in accordance with the appropriate guidance conflicts with other mission activities, consultation with the

USFWS/MDC is initiated to avoid jeopardizing any listed species or its critical habitat. Formal consultations with the USFWS are coordinated with the installation Staff Judge Advocate. Proposals to enter into formal consultation are coordinated through the installation Staff Judge Advocate and referred to Department of the Army Headquarters through the Northwest Region Installation Management Agency.

An Endangered Species Management Plan was prepared by BHE Environmental, Incorporated in 2007. However, the plan has become outdated due to new listings and changes in management. Natural resource managers would follow current state, DoD, and other federal guidance and/or biological opinions/assessments in conjunction with other management efforts as described in the INRMP regarding threatened or endangered species.

Bald Eagle. Bald eagles remain protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Act. Natural resource managers annually conduct surveys to monitor eagle activity on FLW and data is sent to MDC. Winter surveys are typically conducted around the first week of January. MDC collects this data in cooperation with the USFWS as part of their wintertime eagle and waterfowl survey. Natural resource managers would continue to follow current state and federal guidance, conduct surveys, and other management opportunities. Nest disturbance avoidance is conducted through posted signs and flight restrictions. The active nest on the Big Piney was built near an active recreational area of the river and monitoring has shown that nesting pairs are unaffected from routine human activities at this location. Riparian corridors/habitat protection for protected bats and migratory birds also provides a benefit to eagles which utilizes these areas to forage and conduct nesting activities. Stone Mill Spring is managed for recreational trout fishing; however, provides a steady fish supply to eagles and their young during the nesting season. Refer to Table 9 for recent survey results.

Table 9 Eagle Survey Numbers

Year	Adults	Juveniles	Total
2016**	7	1	8
2017	45	11	56
2018*			
2019	8	8	16
2020	24	12	36
2021	28	9	37
2022	24	7	31

*Flight cancelled due to bad weather; no survey conducted.
**Flight cancelled due to bad weather/helicopter support unavailable; survey conducted by boat/auto from fixed point.

Gray Bat. The key management practice for Indiana, gray, and northern long-eared bats on FLW is protection of caves or other hibernacula during critical bat use periods, to include maternity roost areas and seasons. Critical use periods include August 1 to May 31 for Indiana bats and northern long-eared bats and between April 1 and October 31 for gray bats. This is accomplished by posting signs at affected cave entrances

designating these caves as off-limits during critical periods. Increased law enforcement monitoring during these periods is a deterrent to violators of the off-limits posting. The possibility of constructing cave gates or fences to further deter pot-hunters (archaeological artifact thieves) and deter access to protect bats may be considered if disturbance levels become significant.

Management of Brooks, Wolf Den, Davis No. 2, Joy, Freeman, and Saltpeter No. 3 caves follow MDC and U.S. Forest Service guidelines. Specifics of these management guidelines include:

- Maintaining a contiguous forest canopy by uneven-age timber management or protection in the immediate 20 acres above and around cave openings
- Providing travel corridors of continuous forest canopy 200 feet wide, from cave openings to riparian foraging areas and potential Indiana bat summer habitat
- Maintaining an optimum number of snags and canopy trees
- Posting caves as off-limits during critical bat use periods
- Designating caves as off-limits to military operations
- Stopping development in the 20 acres surrounding cave openings, the restricted zone
- Prohibiting smoke, CS gas, pyrotechnics, and noise simulators during August 1 - May 31 for Wolf Den, Brooks, Davis No. 2, and Joy caves and during April 1 - October 31 for Saltpeter No. 3 Cave

In addition to the restricted zone, two additional bat management zones are in effect on FLW. Bat Management Zone 1 extends from 531 feet to 1,498 feet around applicable caves. Bivouac, CS gas, or use of noise simulators are prohibited from one hour prior to sunset and one hour after sunrise between March 15 - May 31 and August 1 - October 15 for Wolf Den, Brooks, Davis No. 2, and Joy caves. Bat Management Zone 2 encompasses an area from 1,498 feet to 6,337 feet from the caves. Disruptive activities are minimized within this zone especially during spring and fall. Actions which reduce forest canopy within this zone require approval from the NRB. Bat management zones 1 and 2 are also applied to Saltpeter and Freeman caves during the maternity period. Figure 8 shows sensitive bat management zones.

Further management activities include prescribed burns (Section 4.14) outside of important bat active times for habitat enhancement, acoustic surveys and analysis at project development areas, urban tree removal during winter cut-time, cave monitoring (hibernacula and maternity), snag creation and retention at timber harvests, riparian corridor protection, and potential corridor clearing around ponds.

Indiana Bat. Management recommendations for Indiana bats are discussed above with gray bats. If further studies should locate a maternity roost, guidelines restricting activity in the roost area would be developed and implemented. Guidelines for timber harvest in potential Indiana bat habitat have been developed by MDC and USFWS. Outreach to local scout troops to construct bat houses. Houses would provide roosting opportunities for a broad range of bat species that includes Indiana bats.

Northern Long-eared Bat. Management recommendations for northern long-eared bats are discussed above with gray bats. If current studies should locate a maternity roost, guidelines restricting activity in the roost area would be developed and implemented. Guidelines for timber harvest in potential northern long-eared bat habitat have been developed by MDC and USFWS. Additionally, FLW natural resource managers take in account the avoidance and conservation measures described in the IMCOM northern long-eared bat programmatic biological evaluation conservation measures document released in 2015. Similar to Indiana bats, outreach to scouts to build bat houses to promote northern long-eared bats and roosting opportunities.

Spectaclecase Mussel. Improvements to water quality, especially sedimentation, are an important part of management efforts for spectaclecase mussels. Improvement measures include water quality monitoring and management as described in Section 4.6 as well as BMPs associated to stormwater management. Mussels, in general, were found in greater abundance stream reaches with stable conditions. Thus, land management through upland retention ponds or other BMPs to improve stream stabilization is expected improve habitat conditions for mussels. Other management activities include surveys and monitoring of populations as well as aquatic organism passage considerations during planning phase's construction projects. Specifically, for the Big Piney River water intake weir an aquatic organism bypass channel is proposed as part of a restoration or replacement project. Additionally, vehicles are restricted from driving in waters containing spectaclecase mussel habitat and/or areas that disturb water quality or increase turbidity upstream of habitat areas.

Hellbender. Management efforts for the eastern hellbender would be similar to those described for the spectaclecase mussel. Surveys, and potentially relocation efforts, would be conducted concerning proposed projects within the Big Piney River or Roubidoux Creek in conjunction with MDC and USFWS coordination. The BA and Biological Option (2018) associated to the Big Piney River weir repair project provides an example of avoidance and protection measures that could be implemented for other proposed FLW projects within the Big Piney River or Roubidoux Creek. Natural resource managers at FLW work closely with MDC and other stakeholders through annual monitoring and habitat management activities such as captive rearing/releases and habitat augmentation.

4.10.3 Special Status Species Management Goals and Objectives

Goal 1. At a minimum, sustain residential or migratory populations of endangered, threatened, or candidate species and their habitats at current levels, with the long-term goal of conserving listed species and their habitats in accord with specific Recovery Plans and the ESA.

Objective 1. Implement requirements of the ESA.
Objective 2. Update the INRMP to reflect current changes for protected species and implement management requirements therein.
Objective 3. Implement reasonable and prudent measures and conservation measures specified in biological studies by the USFWS (USFWS 1996, 1997) and current federal guidelines under the ESA, as well as the 2015 IMCOM northern long-eared bat

biological evaluation conservation measures until specific guidelines are determined from 2016-2017 surveys.
Objective 4. If federal-listed species are found on FLW or if species already known on FLW become federal-listed, FLW will consult with the USFWS and develop an inventory/monitoring program and management plan for these species.
Objective 5. Monitor bat species as needed using acoustic or other modern surveying equipment.
Objective 6. Monitor spectaclecase mussel and hellbender populations and habitat conditions.
Objective 7. Continue water quality monitoring and management (Section 4.6.2).
Objective 8. Consider aquatic organism passage planning in applicable construction projects.
Objective 9. Conduct case-by-case consultation (Section 7 of ESA) with USFWS on activities that may impact eagles, migratory birds, and/or listed federally protected species.
Objective 10. Implement measures to improve stream stabilization. Specifically, in areas with known established mussel beds.

Goal 2. Protect and enhance habitat conditions for eagles.

Objective 11. Upkeep posted signs, ensure fight restrictions are adhered to, and monitor/survey eagle populations as well as nest activity.
Objective 12. Protect riparian forests and foraging habitat; to include fisheries.
Objective 13. Promote implementation of new electric telephone pole guidelines and awareness for new construction projects.

4.10.4 Other Sensitive Species Management Practices

Candidate and petitioned species for ESA listing include the bluestripe darter, little brown bat, tricolor bat, American bumble bee, monarch butterfly, and regal fritillary butterfly. Current management for ESA listed species are mutually beneficial for the bluestripe darter and bat species. Efforts to provide water quality improvements and aquatic organism passage would benefit the darter, likewise, efforts to improve gray, Indiana, and northern long-eared bat habitat would benefit the little brown and tricolor bat.

The American bumble bee, monarch butterfly, and regal fritillary butterfly can be grouped into management efforts directed at pollinators. Efforts to improve pollinator habitat includes grassland and wildfire management as well as integration of forbs into grass seed mix used in firebreaks, erosion control, and ground cover plantings. Approximately 15 percent of the installation is occupied by old fields and grasslands; however, many of these areas are being invaded by woody re-growth which limits the amount of high-quality habitat for many pollinating species. Prescribed fire is used as one of the tools to help promote pollinator habitat on FLW. Periodic burning helps reduce woody encroachment and helps promote re-growth of many flowering plants. An autumn olive removal program was started in 2019 with an emphasis on restoring degraded pollinator habitat. Approximately 100 acres of habitat have been treated to

favor open grassland habitat. Warm season grass stands are promoted whenever possible.

Grotto salamanders have been documented in Henshaw and Martin caves (Sternburg *et al*. 1998). They have also been recently documented by FLW NRB managers in Dead Rat Cave. The area these caves occupy cannot be entered without special permission. This designation appears adequate for protection and management of grotto salamanders on FLW.

Golden mouse, long-tailed weasel, eastern small-footed myotis, blacknose shiner, plains topminnow, elktoe, cerulean warbler, brown creeper, and ringed salamander have all been found on FLW. Specific management for these species is not anticipated; however, through project environmental review process negative impacts to these species are avoided and/or minimized as well as coordination efforts with state agencies as applicable. Furthermore, similar to the federally petitioned and candidate species, these species would likely benefit from existing ESA management efforts. Additionally, the federally endangered scaleshell mussel (*Leptodea leptodon*) is listed downstream of FLW and could benefit from the aquatic organism bypass channel for the Big Piney River weir repair project.

Migratory Bird Treaty Act. The Migratory Bird Treaty Act is an international agreement protects designated species of birds as stated in Section 2.2.3 *Migratory Bird Treaty Act*. A complete list of all species of migratory birds protected by the Migratory Bird Treaty Act is in 50 CFR 10.13 (USFWS 2000). FLW NRB maintains records of these species sighted on FLW. All persons, organizations, and agencies are liable for prosecution for violations and must follow permitting requirements for taking migratory birds. Special purpose permits may be requested and issued that allow for the relocation or transport of migratory birds for management purposes.

MBTA management measures include: avoid mowing firebreaks and other areas during the nesting season, avoid prescribed fires during nesting season, Wildlife Aircraft Strike Hazard guidelines, conduct annual breeding bird surveys, riparian corridor protection, and habitat preservation of trees related to bat tree restrictions (Section 4.10.2).

Executive Order 13186. Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* requires that DoD and the USFWS establish a memorandum of understanding that will promote the conservation of migratory bird populations. A MOU was signed in 2014 and NRB managers would adhere to that agreement.

A summarized list of DoD responsibilities under the MOU (consistent with military mission requirements and readiness, to the extent reasonable and practicable, on DoD lands) include:

- Follow all migratory bird permitting requirements for activities subject to 50 CFR
- Encourage incorporation of comprehensive migratory bird management objectives into relevant DoD planning documents, management plans, and other relevant documents, to include policies and procedures for facility design

- Manage military lands and perform activities in manner that supports migratory bird conservation, habitat protection, restoration, and enhancement
- Inventory and monitor bird populations as feasible to facilitate decisions related to conservation efforts
- Work with the USFWS and the state for effective reviews and revisions of the INRMP; to include regional or state conservation measures/plans
- Allow USFWS and other partners access for surveys/sampling
- Allow the public access for recreational bird watching/activities
- Prior to implementing any activity that has or may have a negative impact on migratory birds, avoid and minimize through conducting surveys, NEPA, and early planning considerations
- Promote the conservation of migratory birds on military lands, to the extent permitted by law, subject to the availability of appropriations, within administration budgetary limits, and where in harmony with DoD missions
- Use best-practices approach for routine maintenance, retrofitting, and management actions

Proposed Rule - Migratory Bird Permits; Take of Migratory Birds by Department of Defense. Section 21 of 50 CFR was discussed in Section 2.2.3 *Migratory Bird Treaty Act* and prescribes regulations to exempt the Armed Forces for the incidental taking of migratory birds during military readiness activities authorized by the Secretary of Defense or the Secretary of the military department concerned. The Authorization Act further requires the Secretary to promulgate such regulations with the concurrence of the Secretary of Defense.

This proposed rule only includes military readiness activities. It specifically does not include routine operation of installation operating support functions (*e.g*., administrative offices, military exchanges or commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, laundries, recreation activities, shops, mess halls), operation of industrial activities, or construction or demolition of facilities relating to these routine operations. It does not exempt the NEPA process to determine whether an 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.*" If such significant adverse effects are likely, an installation would be required to confer with the USFWS to develop appropriate conservation measures to minimize or mitigate such significant adverse effects.

4.10.5 Other Sensitive Species Management Goals and Objectives

Goal. Monitor and manage nonfederal-listed, special status plant and animal species, and migratory birds on FLW to the degree possible with available funding.

Objective 1. Consider state and federally protected species, and migratory birds to include eagles, in all FLW actions.
Objective 2. Seek guidance and concurrence with USFWS on federally listed species management activities that are based on BA's and/or opinions.

Objective 3. Whenever possible, use actions designed for federal-listed species to protect or manage other sensitive species.
Objective 4. Avoid, minimize, and protect special status species on FLW.
Objective 5. Follow agreements and MOUs with the USFWS.
Objective 6. Provide guidance to contractor and other entities working on FLW lands to avoid removal of active bird nests. Comment on scope of work plans and request contact with NRB if unavoidable as appropriate.
Objective 7. Seek partnership agreements with state, federal, and stakeholders to assist with sensitive species management such as survey and habitat efforts as applicable.

4.11 SPECIAL INTEREST AREAS MANAGEMENT

Wetland management is described in Section 4.8.2; cultural resources protection is included in Section 5.5, *Cultural Resources Protection*. Below sections describe programs to protect other special interest areas on FLW.

4.11.1 Current Management

Designation of special protection status for important or fragile areas is an important management tool. It is more cost effective to establish use restrictions on some areas to minimize damage or disturbance than to mitigate damage or disturbance.

As part of the NEPA process (Section 5.6 and Chapter 8.0 in 2006 INRMP), the NRB reviews proposed projects at FLW to identify concerns and recommend measures to minimize environmental impacts. Examples include avoiding cultural resources and wetlands, filling excavations after exercises, and adjusting training missions to areas still suitable to the mission while avoiding environmental concerns.

FLW has several areas with special natural features, as briefly discussed within this section. They harbor sensitive or unique wildlife species or have unique plant communities. These areas have been digitized in the GIS and are shown on various figures in Chapter 3.0.

Caves. Each cave has its own unique features. FLW has 68 caves within its boundaries. Eight caves are seasonally restricted due to the presence of the endangered Indiana bat, gray, and/or northern long-eared bat. Nine caves have restrictive gates to prevent entry, and two more caves expected to be gated October of 2022. The remaining caves' restrictions are not as specific, but they are generally off-limits to all military training. A few caves have been approved by the DPW, to be eligible for training because they are safe and do not have any biologic or cultural significance. Most, if not all, caves on FLW are in riparian areas, which affords them some additional protection. Many caves are also important archaeological sites deserving protection. Additional caves are being evaluated for possible erection of gates to restrict access.

Riparian Zones. Riparian zones are important for wildlife and protection of water quality and wetlands. Management within riparian zones is quite limited, and major resources-altering operations, such as forestry, are not conducted in riparian areas without full

environmental review. Management for these areas may include invasive or pest species eradication methods that do not impact federally protected species or result in negative impacts to the riparian ecosystem.

Glades. Within glades, sinks, seeps, sheltered coves, and other unique areas, plant communities often occur which are not represented in neighboring areas. Such areas have high potential for rare or endangered plant species. These unique areas receive protection due to their locations, primarily in or near riparian areas. These areas also may receive protective management efforts to remove invasive or pest species similar to *Riparian Zones*. An eastern red cedar removal project was completed on most of the major glades in 2019. Future management of the Falls Hollow Sandstone Glades will include practices that are designed to decrease the amount of sediment eroding from Range 22. Additional management activities will include such things as planting native vegetation west of the glade along the road, removing exotic and weedy vegetation, remove, cull, and/or reduce red cedar encroachment, and prescribe burning the area to mimic a natural burn regime. Management of other glade areas should include similar practices to enhance and improve their quality.

MDC COA's. MDC has identified two COAs located on FLW, karst areas along Roubidoux Creek and the Big Piney River. The COAs do not have a regulatory role, but merely reflect a special interest by multiple government agencies and citizen groups. The MDC and its stakeholders have an interest with working with FLW to regenerate and conserve native flora and fauna, and natural communities associated with these two COAs. More information regarding COAs can be found on MDC's online website under Missouri Comprehensive Conservation Strategy (MDC 2022). See page 45 of the strategy plan for an ArcGIS link to an interactive map.

4.12 PEST MANAGEMENT

4.12.1 Current Management

Responsibility for pest management on FLW is within the Directorate of Public Works. A Pest Management Coordinator and Quality Assurance Evaluator has been designated to plan, coordinate, and monitor the program. However, golf course and contract personnel also are involved in the pest management program. FLW has an IPMP upon which most of the discussion in this section is based on (FLW 2017c). This plan is designed to be reviewed annually. The IPMP identifies and prioritizes pests and their destructive effects to determine appropriate levels of protection.

The IPMP is used at FLW to resolve pest problems on a sustained basis. IPMP includes the implementation and coordination of optimum sanitation and good structural design and maintenance of facilities with mechanical control, cultural control, biological control, and regulatory (pesticide) control. The IPMP comprehensive approach to pest control or prevention, using methods of pest control in a compatible manner, avoids damage and minimizes adverse side effects to non-target organisms and the environment.

The pest management program emphasizes surveillance before pesticide application, the use of physical barriers to reduce the need for pesticide use, preventative outreach, and more efficient equipment and techniques to reduce pesticide volume and toxicity. The program is consistent with DoD Instruction 4150.07 to reduce pesticide use by using IPM practices. FLW has a policy of only using chemical control as a last resort and in combination with other control methods. Furthermore, chemical control will not be used as a substitute for good sanitary practices or proper building maintenance.

Army pest management programs have the following general goals:

- Enhance FLW training and readiness goals and objectives
- Safeguard the environment and human health from injury, disease, and exposure risk from pesticides and other pest management materiel
- Protect property from damage and destruction
- Comply with applicable laws, regulations, and policies

FLW general objectives to achieve these goals include the following:

- Operate and maintain an effective pest management program
- Emphasize human health protection and human safety
- Use principles of IPMP to effectively control pests with judicious use of chemical and non-chemical control techniques
- Minimize environmental contamination
- Consider economics in pest management decisions
- Comply with pertinent laws and regulations

FLW has eight priorities of pest control operations:

- Disease vectors and medically important pests (*e.g.,* ticks, mosquitoes, chiggers, bees, wasps)
- Quarantine pests (emerald ash borer)
- Real property pests (*e.g.,* subterranean termites, mice, groundhogs)
- Stored product pests
- Ornamentals plant and turf pests (*e.g.,* bagworms, white grubs, pill bugs, sod webworms)
- Undesirable vegetation
- Vertebrate pests (*e.g.,* rats, mice, moles, beavers, bats, squirrels, feral hogs, undesirable fish)
- Household and nuisance pests (*e.g.,* ants, cockroaches, spiders)
- Other pest management requirements (adhering to Executive Order 13112)

FLW adheres to the IPMP and follows all applicable laws and guidelines. Sensitive areas listed on pesticide labels are considered before pest control operations are conducted. Wetlands and recreational areas often require special precautions when applying pesticides. No pesticides are applied directly to wetlands or water areas unless precautionary statements on labels regarding contamination of water are carefully followed during application. Recreational areas are well-known, and special requirements for their protection are implemented, as needed. Other sensitive areas,

such as daycares and areas where children play, weather conditions, and protected and endangered species, among others, are taken into consideration prior to implementation of control measures. Specifically, with the use of Malathion applications. Malathion presents risks to both the Indiana, gray, and northern long-eared bats as these bats forage along riparian corridors and surrounding uplands. FLW prohibits Malathion being sprayed any earlier than one hour after sunrise and no later than one hour prior to sunset between March 15 and October 31.

The FLW IPMP and the Stray Animal Management Plan discusses many aspects of pest management that are not directly within the scope of this INRMP. The designated IPM Coordinator is responsible for all pest management activities. The following discusses animal and plant control that are specific to the management of natural resources on FLW.

Animal Pests. The pest contractor(s), under supervision of the IPM Coordinator, are responsible for include trapping of nuisance skunks, opossums, raccoons, snakes, and groundhogs, in addition to stray cats and dogs. If the contractor is not available, the Directorate of Emergency Services and/or Installation Law Enforcement would provide services as applicable. Contractors through the city of Waynesville are responsible for the care and management of stray animals taken to the Stray Animal Facility located at Building 2396. Removal of nuisance beaver and muskrat is periodically performed by Natural Resources personnel. During the open season, trappers are solicited to assist in removal of problem animals. Natural Resources personnel also remove feral hogs in coordination with USDA and MDC.

Non-Native/Noxious Plants. Non-native and/or noxious weeds pose threats to native habitats, endangered species, and plant community composition and diversity. More specifically, they threaten wetland ecosystems, complicate land management projects, add to the cost of pest management, and in general, threaten ecosystem functionality. One of the abundant nuisance aquatic plant species on FLW is the water shield. Control of aquatic weeds is discussed in Section 4.8.4, *Aquatic Habitat Management.* FLW is dedicated to the prevention of introduction of invasive species as well as their control, per Executive Order 13112, *Invasive Species*.

4.12.2 Pest Management Goals and Objectives

Goal 1. Control plant and animal species that affect natural resources management (*e.g.*, reduce ecosystem functionality, displace native species) or directly affect the military mission on FLW.

Objective 1. Maintain an updated IPMP annually.
Objective 2. Emphasize IPMP techniques to reduce the use of pesticides.
Objective 3. Ensure pesticide applicators are fully certified.
Objective 4. Control nuisance wildlife as needed to protect facilities, infrastructure, and to maintain the military mission.
Objective 5. Obtain appropriate permits for the control of nuisance wildlife.
Objective 6. Prevent the introduction of and control invasive species, per Executive Order 13112, *Invasive Species*.

Objective 7. Seek partnership agreements with state, federal, and stakeholders in pest management efforts as applicable.

Goal 2. Ensure that invasive species are not introduced onto FLW or the LORA site from the receipt of military and installation support equipment, to included civilian vehicles.

Objective 8. Provide inspection recommendation, guidelines, and checklists to FLW personnel.
Objective 9. Inquire about wash stations, temperatures, and chemicals if applicable.
Objective 10. Public outreach and education about invasive species, to include avenues of introduction (e.g., firewood, plantings, transportation on clothes and vehicles).

4.13 CANTONMENT AREA MANAGEMENT

4.13.1 Current Management

Cantonment area landscape is maintained to provide a functional and aesthetically pleasing city environment with wildlife and natural or semi-natural areas scattered throughout. A general trend in cantonment area habitat management is planting native trees and shrubs instead of ornamentals. Indiscriminate tree cutting is not allowed, and snag trees are not always removed, especially if they are in natural areas and pose no safety or maintenance concerns.

FLW, like most military installations, keeps the grass mowed short, often, and everywhere. An easily implemented practice and cost saving measure is the reduction or cessation of grass mowing to provide cover and allow native grasses to re-establish. In a mowing reduction effort, 12 acres in the cantonment were seeded to wildflowers and native grasses and are burned about every 2-years as part of the prescribed fire program. Other areas where buildings have been removed and that are not planned for future development could be managed similarly. Reductions in lawn watering could also be incorporated to conserve water resources and associated expenses.

In managing natural resources in the cantonment area, FLW acknowledges its responsibilities as listed in the White House Memorandum, *Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds* (The White House 1994). The memorandum's requirements include:

- Using regionally native plants for landscaping
- Using construction practices that minimize adverse effects on the natural habitat
- Reduce pollution by reducing the use of fertilizer and pesticides, using integrated pest management, recycling green waste, and minimizing runoff
- Implementing water-efficient practices
- Creating demonstrations of these practices to promote their use elsewhere

Landscaping should use native drought-tolerant plant species to reduce water usage and maintenance activities as well as promote habitat for native wildlife species. Especially flowering plants to promote pollinators such as honeybees, bumble bees,

and butterfly's that have seen recent declines. As stated in the in a June, 2014 White House Memorandum, *Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators*, for the heads of executive departments and agencies, pollinators are vital to our ecosystems and our national economics. Furthermore, the use of exotic species that can outcompete native vegetation and become naturalized should not be used.

Original Army-constructed landscaped areas are occupied by tree species indigenous to old upland field sites, such as oaks, hickories, and eastern red cedar. Tall fescue and Kentucky bluegrass are the most common landscape grasses. A great variety of shrubs and trees, mostly introduced species, have been planted in landscaping permanent construction areas since about 1958. Most prominent are pin oak, ash, thornless honey locust, various introduced elms, Austrian pine, pfitzer juniper, caneart juniper, scotch pine, flowering crabapple, dogwood, redbud, shortleaf pine, eastern white pine, and sweet gum. Many of these common landscaped areas have no consistency in the arrangement or relation of one area to another or to the overall theme of the landscape. In the future, special consideration will be given to creating a landscape with continuity and an aesthetic blend of trees, shrubs, and flowering plants. Landscape plans reviewed by NRB would improve much of these inconsistencies as align the plan with the INRMP.

About 10,000 acres of FLW is classified as improved grounds to semi-improved grounds, including industrial, services, and utilities areas. For purposes of grounds maintenance, management of improved grounds is largely performed by regular mowing throughout the growing season. Semi-improved areas are mowed less frequently, usually once a month. Mowing covers over 2,000 acres and includes such areas as lawns around administrative buildings, some officer housing areas, athletic fields, golf courses, parade and drill grounds, private cemeteries, and airfield and heliport landing and parking areas. Only about eleven acres within the cantonment area are irrigated regularly. The acreage of area mowed and irrigated is higher if housing areas cared for by residents is included.

Lawns requiring irrigation are watered by building occupants. Gammon Field has an automatic timed underground watering system. Lawns at FLW should not be watered until showing signs of wilting and then watered to the point of runoff. The soil should be watered to a depth of three to six inches, no more than once a week. More frequent light waterings encourage the growth of crabgrass. The golf course is irrigated regularly and managed by golf course employees. In addition to mowing and irrigation, other management practices in the cantonment area include weed control, fertilizing, and planting. Most landscaping is accomplished by outside maintenance contract. However, U-Do-It and troop projects make up the remaining landscape work.

Seeding usually consists of cool season species, such as tall fescue, red fescue, and Kentucky bluegrass. In some eroded areas, such as in drainage ditches and areas requiring soil stabilization, bluegrass or tall fescue is used via sod or seeding. The ideal time to seed turf grasses is late summer/early fall. Seeded areas should be mulched with oat or wheat straw at the rate of two to three bales per 1,000 square feet. Mulching

prevents soil erosion, reduces evaporation from the soil, protects young grass seedlings, provides control of dust, and prevents excess freezing and thawing of fall-seeded areas. On steep slopes, mulch should be anchored to the soil by forcing the straw into the soil at 6-inch intervals with the blade of a shovel. The straw should not be removed since it will naturally decay and also prevent erosion.

Proper soil preparation should be accomplished by thoroughly raking lawns to remove thatch, followed by tilling of bare spots to a depth of several inches, and fertilizing at a rate of 20 pounds of 12-12-12 per 1,000 square feet. The fertilizer is then tilled into the soil. Seed and fertilizer should be applied with a cyclone hand seeder or push type fertilizer spreader. The ideal procedure to apply the seed is to sow half the seed in an east-west direction and half in a north-south direction and cover lightly with a rake. Additionally, the practice of dumping topsoil on lawns instead of tilling existing soil should not be done except when approved by the Facility Engineer. Yearly build-up of soil in lawn areas interrupts the drainage around quarters and introduces undesirable seeds into established lawns.

All improved grounds areas should be fertilized annually. A general purpose fertilizer, such as 12-12-12, is recommended because soil tests show a very low supply of phosphorous and nitrogen. This fertilizer is issued to the troops on a self-help basis. Fertilizer should be applied at seven pounds per 1,000 square feet or 300 pounds per acre. It is best to apply half in September and the other half in February or March. If one application is to be made, it should be in September to prevent the lush growth that a spring application usually causes. Fertilizer should be applied when the grass is dry, followed by thorough watering to prevent burning of the lawn. In general, soils at FLW are deficient in lime. Agricultural stone (finely ground) may be applied at a rate of 120 pounds per 1,000 square feet.

Control of diseases, insects, and undesirable vegetation regarding the landscape is critical if high quality plant materials are to be maintained in the long-term. The primary method of control for most of these problems is by use of chemicals, although some biological methods have shown some success. Control work has been accomplished under contract and is discussed Section 4.13, *Pest Management*. Additionally, the Armed Forces Pest Management Board (online) provides a list of approved list of pesticides.

A continual program of policing grounds around facilities throughout the cantonment area, along roadways, around lake facilities, and in picnic areas has been accomplished by troop details and building occupants. Trash cans have been located at strategic points for proper disposal of litter. These have been maintained using troop details. An anti-litter attitude by employees and residents of FLW helps keep the post clean. Additionally, support services for DPW are provided by maintenance contracts. Pest control services, with the exception of the golf course, are subcontracted by a DPW maintenance contractor.

4.13.2 Cantonment Area Management Goals and Objectives

Goal. Provide support to maintain an aesthetically pleasing cantonment landscape that preserves natural ecosystem functions as much as possible.

Objective 1. Provide professional advice regarding the use of native species and pollinators to assist the grounds landscaping and maintenance program.
Objective 2. Manage natural resources occurring within the cantonment area to meet appropriate natural resources objectives.
Objective 3. Implement requirements listed in the DoD Policy to use Pollinator-Friendly Management Prescriptions (2014) and MOU between DoD and Pollinator Partnership (2015).
Objective 4. Encourage wildlife, such as songbirds, to utilize the cantonment area for habitat, while discouraging species that could problematic pests for the installation.
Objective 5. Encourage cantonment area whitetail deer hunts to manage populations and reduce automobile accidents.

4.14 FIRE MANAGEMENT

4.14.1 Current Management

Fire is both a threat to natural resources and, if used properly, a valuable ecosystem management tool. Fire management is conducted according to the IWFMP. Under the IWFMP, FLW uses three means to limit the extent of wildfires: early detection and monitoring using Fire Danger Classification, firebreak maintenance, and fuel reduction via prescribed burning, the latter being the wildfire prevention technique. Prescribed burning and firebreaks were previously discussed in Section 4.8.3 *Terrestrial Habitat Management*. The remainder of this section describes means used by FLW to protect natural and human resources from wildfires and use fire to ensure continued ecosystem functionality.

Fire control is the primary mission of the Fire Department. Natural Resources personnel may assist in wildfire control if requested but are not the first responders. The NRB is responsible for making daily calculations of fire danger potential and disseminating that information to DPTMS and the Fire Department. Military units are also responsible for firefighting duties.

For the most part, areas prone to periodic training related fires have been incorporated in the prescribed burn plan. Outside these areas, wildfires are aggressively suppressed due to damage they can have on wildlife habitat and commercially valuable timber. FLW Regulation 210-14, *Ranges and Training Areas*, identifies fire danger classes and training restrictions associated with each class. Without adequate wildfire control, many acres of valuable forest land and grassland could be damaged by indiscriminate fires throughout the year.

In accordance with the IWFMP, the 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. They are also responsible for issuing, signing, maintaining, and tracking of National Wildfire Coordination Group Qualification Card/Incident Command System (also known as “Red Cards”) for NRM personnel. In 2022, an appointment letter was presented to the Garrison Commander appointing K.J. Petry as the Wildland Fire Program Manager.

4.14.2 Fire Management Goals and Objectives

Goal 1. Prevent and suppress wildfires to maintain ecosystem biodiversity and functionality.

Objective 1. Provide natural/cultural resources management-related recommendations relative to fire suppression activities to FLW Fire Department personnel.
Objective 2. Respond to wildfires as soon as possible and begin immediate suppression, consistent with safety requirements.
Objective 3. Maintain the FLW prescribed burn plan to maintain training mission capabilities and enhance ecosystem biodiversity and functionality on FLW.

Goal 2. Conduct fire management according to the IWFMP.

Objective 4. Conduct prescribed burns annually (whenever possible) on as much of the 2,328 acres as possible of land designated Fuel Priority.
Objective 5. Conduct prescribed burns each year on approximately one-third of the 2,443 acres designated Fuel Non-Priority utilizing a 3-year fire rotation; burn more frequently whenever possible or needed.
Objective 6. When or if possible, to safely do so, conduct prescribed burns on any of the 2,668 acres of burn area currently not being managed with fire due to UXO, lack of firebreaks, and other restrictions.
Objective 7. Annually maintain approximately 34 miles of firebreaks to provide wildfire control and permit prescribed fire on areas managed for fuel.
Objective 8. DPW and Range Maintenance maintain roads within and adjacent to range impact areas in a fuel-free state (vegetation not growing in the road surface and tall grass mowed on road shoulders, at least on the side from which wildland fires may approach).
Objective 9. Seek resolutions for the lack of sufficient firebreaks on ranges, which prevents adequate containment of wildfires and prescribed fires.
Objective 10. Monitor and report changes to fire danger classifications.
Objective 11. Provide timely reports to Range Operations on changes in firebreak conditions and “pre-burned” status of ranges and training areas.
Objective 12. Conduct prescribed burns each year on approximately one-third of the 1,246 acres designated to maintain as open (early successional vegetation) training lands utilizing a 3-year fire rotation.
Objective 13. As needed, conduct prescribed burns on the 244 acres designated for range cleanup on Cannon Range (approximately every 5 years).
Objective 14. Maintain approximately 9 miles of firebreaks as needed to carry out prescribed burning for maintaining open training lands, tilling the firebreaks in the year prescribed burning is scheduled.

Objective 15. Conduct prescribed burns each year on approximately one-third of the 1,016 acres designated for habitat management utilizing a 3-year fire rotation.
Objective 16. Every other year, conduct prescribed burns on 12 acres in the cantonment.
Objective 17. Conduct prescribed burns annually (if determined necessary) on as much of the 104 acres as possible designated for golf course Pest Management.
Objective 18. Maintain approximately 28.0 miles of firebreaks as needed to carry out prescribed burning for maintaining vegetation and landscape characteristics, tilling the firebreaks in the year prescribed burning is scheduled.

Other Management Options Considered

Virtually every major natural resource program at FLW (*e.g.*, wildlife management, forest management, pest management) has options other than ones selected for the INRMP. For example, there are many different strategies for white-tailed deer harvest management, just as there are many different options for managing small pond fisheries and a wide variety of forest resource management options. Many of these interact with each other. For example, changing the forest resource management program would impact upon turkey, deer, and other game species management, and impacts would be different among those species.

Possible options create almost countless potential combinations, each of which could be an alternative management option. Various laws, compliance documents, Army regulations, etc. prohibit the implementation of many of these possibilities. For example, closing FLW to hunting is not a viable option due to public law and Department of Army policy. On the other hand, selecting management techniques for rehabilitating disturbed land is an option, and there are many choices. The same would be true of changing the monitoring program for vegetation condition trends or changing the timber management strategy.

Other management options were considered and dismissed from further consideration for various reasons (*e.g.*, ecological value, cost/benefit analyses, military mission compatibility) during development of the INRMP. Management programs and projects selected implementation are based on knowledge and experience from years of professional management of FLW natural resources and the best scientific knowledge, research, and opinions available. The other management options were considered; however, they were eliminated and will not be further discussed.

4.15 CLIMATE CHANGE CONSIDERATION

The science of climate change has continued to evolve since the 1970s and global atmospheric greenhouse gas (GHG) emission concentrations are significantly affecting the Earth’s climate. These conclusions are built upon a scientific record that has been created with substantial contributions from the United States Global Change Research Program (USGCRP), formerly the Climate Change Science Program, which informs responses to climate and global change through coordinated federal programs of research, education, communication, and decision support. Broadly stated, the effects

of climate change observed to date and projected to occur in the future include more frequent and intense heat waves, more severe wildfires, degraded air quality, more heavy downpours and flooding, increased drought, greater sea-level rise, more intense storms, harm to water resources, harm to agriculture, and harm to wildlife and ecosystems (Intergovernmental Panel on Climate Change (IPCC) 2014).

USGCRP (2022) key messages about the mid-west, where FLW is located, suggests longer growing seasons which could increase yields of some crops; however, benefits are likely to be offset by extreme weather events (e.g., droughts, floods, severe weather). Overall, USGCRP (2022) suggests that climate change stresses are expected to decrease agriculture productivity. Likewise, the changing temperatures are expected to influence forest species compositions. Specifically, southern latitude species survivability in northern areas. Excessive precipitation events and flooding are expected to continue, similar to trends documented over the last century. Contributing to increases in erosion, decreases in water quality, degradation of agriculture production, and adverse effects to human health, transportation, and infrastructure.

In addition, a USGCRP report (2014) stated that direct climate change effects in the mid-west include heat stress and late spring freezes on natural and managed ecosystems. These effects may be multiplied by changes in pests and disease prevalence, increased competition from invasive species or opportunistic native species, ecosystem disturbances, land-use change, landscape fragmentation, atmospheric pollutants, and economic shocks such as crop failures. Key messages from the report that are relevant to natural resources and their management at FLW were: the potential changes to forest composition due to increasing temperatures; potential public health risks resulting in heat wave-related deaths; fossil-fuel dependent electrical systems, upon which local economies rely, that also contributes to increases in GHGs; and increases in rainfall and flooding-related damages and repairs (USGCRP 2014). Additionally, with the potential for increased heat wave-related deaths, it also likely that would decrease outdoor recreation related activities.

The best estimates of the IPCC are that the global mean surface temperature change between 2016 and 2035, relative to 1986 to 2005, will likely be in the range of roughly 0.5°F to 1.2°F (with medium confidence). This assessment is based on multiple lines of evidence and assumes there will be no major volcanic eruptions or secular changes in total solar irradiance. Relative to natural internal variability, temperature ranges are expected to be larger in the tropics and subtropics than in mid-latitudes (with high confidence). The report indicated that the global surface temperature change for the end of the 21st century is likely to exceed 2.7°F relative to 1850 to 1900 (IPCC 2014). Even small increases in global temperatures could have considerable detrimental impacts on natural and human environments.

In 2019, the Assistant Secretary of Defense released a memorandum regarding climate adaptation for DoD NRMs. The memorandum provides information regarding a guide NRMs can access for a six-step process for incorporating adaptation strategies into INRMPs and NRM planning processes. Available online at www.denix.osd.mil/nr/DoD AdaptationGuide.

4.15.1 Climate Change Management Goals and Objectives

Goal 1. Follow current federal guidelines and regulations as well as current science associated to climate change.

Objective 1. Adhere to DoD Directive 4715.21 *Climate Change Adaptation and Resilience*.
Objective 2. Adhere to Executive Order 13653 *Preparing the United States for the Impacts of Climate Change.*
Objective 3. To the extent practical and within the bounds of state and federal regulations conduct management activities that reflect current science released by the IPCC.

Goal 2. Use adaptive management to compensate for changes in climatic conditions.

Objective 4. Conduct more frequent surveys and monitoring of natural resources if significant climatic conditions arise.
Objective 5. Continue to reprioritize natural resource management based on changing conditions; such as sensitive areas and endangered species.
Objective 6. Adjust prescribed burn plans if wildfires become an increased risk.
Objective 7. Consult with agencies and stakeholders on major changes in adaptive management.
Objective 8. Use more drought tolerant native plant species as possible.
Objective 9. Use less non-renewable fuels.

5.0 NATURAL RESOUCES-RELATED PROGRAMS AND ACTIVITIES

This chapter includes those programs that are directly related to natural resources management but are not being implemented solely for that purpose. Some, such as ITAM in DPTMS, enforcement, and outdoor recreation, are totally or partially within responsibilities of organizations other than the NRB, Environmental Division.

Projects may be environmental submissions or submissions through another organization's budget process (*e.g.*, ITAM's Installation Workplan) to integrate implementation of this INRMP to the budget process (see Section 7.5).

5.1 SUSTAINABLE RANGE PROGRAM

AR 350-19 assigns the responsibilities and policy concerning the SRP, which is the ITAM is a core program. The SRP is the Army's overall approach for improving the way in which it designs, manages, and uses its ranges and training lands to ensure long-term sustainability. SRP is defined by its core programs, the Range Program and the ITAM Program, which focus on the doctrinal capability of the Army's ranges and training land. The Range planning process integrates mission support, environmental stewardship, and economic feasibility and defines procedures for determining range projects and training land requirements to support live-fire and maneuver training.

ITAM is a core component of the SRP and is responsible for maintaining training land to help the Army meet its training requirements. To accomplish this mission, ITAM relies on its four components (Training Requirements Integration (TRI), LRAM/RTLA, SRA,

and GIS) and management by HQDA, Training Proponent Organization for Ranges ITAM (Lead Agent), Army Execution and Supported Commands, and installations. Excluding minor maintenance activities, such as target repair, the ITAM program does not include range maintenance, though range maintenance does fall under the SRP. Most of the range maintenance is implemented by the Installations DPW.

Range Maintenance. The maintenance of ranges and range complexes is performed by DPTMS Range Maintenance and Range Cadre. The range operations staff works directly with Natural Resource Branch managers, as needed or requested, to provide additional technical support. The NRB provides technical and environmental guidance for revegetation efforts, drainage and erosion control issues, and tree removal.

Ranges and/or training areas that typically require recurring repair and maintenance include Ranges 12 (Fire and Maneuver) and 26 (Engineer Qualification Range Complex: ranges 26A-26H), and Training Area 244 (Heavy Equipment Operators). The DPW and Engineer Brigade are primarily responsible for Training Area 244. Repairs will be in the form of small-scale grading (to improve drainage), installation or repair of erosion/sediment control structures, hardening of road networks, and revegetation of berms and fighting positions.

5.1.1 Integrated Training Area Management

ITAM in DPTMS is an Army-wide program to provide quality training environments to support the Army's military mission and help ensure no net loss of training capability (a Sikes Act requirement). The ITAM in DPTMS program was initiated with the realization that Army training lands were being degraded to the point where their capabilities to sustain military missions were in jeopardy. Proper management to support both the military mission and other multiple-use activities is a challenge unique to Defense among managers of public lands.

The integration of stewardship principles into training land and conservation practices ensures that Army lands support training missions in a sustainable manner. Force readiness depends on the availability of high quality, realistic training lands.

Scope of ITAM. ITAM program is coordinated with DOD civilian employees and an IMCOM centralized contract and focuses on training land management. Training lands include the following facility category groups: impact areas, maneuver areas, ordnance ranges, other mission-related training facilities (*e.g.*, bivouacs, helicopter landing zones, pick up zones, fire points, and observation points, etc.), as well as maneuver trails. ITAM in DPTMS funding is not intended to address or correct statutory compliance or conservation requirements, perform routine range maintenance or modification, or replace normal base operations activities on training lands normally funded by the Real Property Maintenance Account (DOA 1999b). Furthermore, to assist in streamlining the ITAM Program a Programmatic Environmental Assessment (PEA) was completed in 2021 by FLW. The PEA provides NEPA coverage regarding routine ITAM Program activities, which assessed potential effects on environmental resources (e.g., natural resources) at FLW and the LORA.

The ITAM Program at FLW has two primary goals with supporting objectives as presented in the ITAM PEA (FLW 2021b):

Goal 1. Provide maneuver land capability to support the Installation's training mission and requirements.

Objective 1. Ensure no net loss in the capability of Military Installation land to support the military mission of the Installation.
Objective 2. Ensure sustained accessibility, capability and capacity of maneuver training land.
Objective 3. Quantify training land capabilities and capacity to support maneuver training.
Objective 4. Monitor training land conditions to identify land maintenance and repair requirements.
Objective 5. Maintain existing training land capabilities by conducting land reconfiguration projects to support validated mission requirements.
Objective 6. Improve existing training land capacity by conducting land maintenance and repair projects to support existing and future mission needs.

Goal 2. Provide decision support capability based on the integration of training requirements, land conditions, maneuver ranges, and land management requirements.

Objective 7. Provide geospatial capabilities to support range operations, range modernization, the ITAM Program, and long-term planning in the range and training area complex.
Objective 8. Promote awareness of mission land capabilities and management issues to avoid unnecessary maneuver damage and environmental impacts.
Objective 9. 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.
Objective 10. Ensure mission needs are considered in cultural and environmental plans (ICRMP, INRMP, annual burn plan, and timber harvest plan), facilities planning, and that training land capabilities and constraints are considered in mission planning.

5.1.1.1 Range and Training Land Assessment

RTLA component is a long-term program to evaluate land conditions and trends on Army lands and the capability of those lands to support long-term multiple use, including military training. Primary objectives of RTLA are:

- To assist evaluation of land capability to meet multiple use demands on a sustained basis
- To inventory conditions and monitor changes of natural resources
- To provide information for land management decisions
- To implement a standard data collection, analysis, and reporting method enabling the compilation of data at an Army-wide level

5.1.1.2 Land Rehabilitation and Maintenance

LRAM component consists of strategies and resource allocations for resting and repairing training lands on a rotational basis as well as repairing damaged training areas as the need arises. The LRAM program includes programming, planning, designing, and executing land rehabilitation and maintenance projects based on requirements and priorities identified by Training Requirements Integration and RTLA components of ITAM in DPTMS.

LRAM is used to stabilize soils and provide long-term vegetative cover to support military land use. LRAM repairs damaged lands and uses structural and nonstructural approaches to avoid future damage to training lands. Although LRAM is designed specifically for military training, its use is virtually universal with regard to land management. The program involves cost-effective technologies (*e.g.*, revegetation, site hardening, blockades, etc.) to prevent training site degradation, soil erosion, and excessive road/trail damage. As a primary link between environmental and training considerations, LRAM integrates projects with related programs to maximize resources allocations.

LRAM project funding applies to sites that are not currently out of compliance and are negatively impacting training. If environmental Notices of Violation are either pending or existing on a given site, project is not eligible for LRAM funding. Likewise, if a degraded site is not affecting training capability, the project is not eligible for LRAM funding. If land is degraded through erosion and vegetative loss not caused by training and if it is either in noncompliance with environmental laws or not affecting training, it may be eligible for environmental funding.

Projects, such as concrete low water crossings, pre-authorized digging sites with silt barriers, rehabilitation and restoration of roadside corridors, training guidelines (slope ascent and descent markers on tracked vehicle corridors), bivouac rehabilitation and rotation, hardening of training sites, prescribed burning as opposed to mechanical clearing of some training areas, creating better training environments, and dispersing military use patterns over entire training areas were implemented to minimize non-point source pollution associated with military training.

5.1.1.3 Training Requirements Integration

The TRI component of the ITAM in DPTMS program is the direct interface between training requirements for land use and the capability of land and natural resources to support that training. Training Requirements Integration is a major land protection phase of ITAM in DPTMS. It uses information from RTLA and the GIS to determine viable training load carrying capacities and to locate military training exercises accordingly. Load carrying capacity takes into account the status of natural and cultural environments of training areas at the time training activities take place.

5.1.1.4 Sustainable Range Awareness

Sustainable Range Awareness improves troop awareness of environmental issues that affect field training exercises. By providing installation-specific guidance about

environmental issues, severe environmental damage and its associated costs can be prevented. The Sustainable Range Awareness program uses multimedia presentations, posters, field cards, and handbooks designed to educate soldiers, leaders, and commanders of their responsibilities to integrate environmental and natural resources conservation procedures, policies, and requirements into mission training events. During briefings, an ITAM in DPTMS representative can present information to incoming user unit leaders on terrain protection measures and resource management requirements.

A 10-min video, *Training and the Environment, Fort Leonard Wood, MO,* has been developed and provides guidelines for minimizing environmental damage during field training. Additionally, three types of written materials have been produced and distributed: 1) *Leader's Handbook: Environmental Awareness at Fort Leonard Wood*; 2) *Field Card for Soldiers*; and 3) various posters with environmental awareness and training land conservation themes. An information display kiosk was developed for use at public events.

5.1.1.5 Geographic Information System

Data collected provides information to effectively manage land use and natural resources. A GIS is an organized collection of computer hardware, software, spatial data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. The information generated is used to help prioritize potential LRAM projects. The FLW ITAM in DPTMS GIS has extensive data layers on FLWs natural resources. The ITAM in DPTMS GIS is also the "clearing house" for training-related spatial data for the FLW community and updates its data layers continuously to reflect changing missions and land use.

The ITAM in DPTMS GIS provides both hard and electronic copies of installation maps, aerial photography, and special use maps and other coverages upon request. The ITAM in DPTMS GIS works closely with the DPW-CAD/GIS Librarian and staff to regularly develop and update data coverages and provides the ITAM in DPTMS Coordinator with all of the graphic products utilized by the program.

5.1.2 Integrated Training Area Management Goals and Objectives

Goal. Maintain communications between ITAM in DPTMS program manager, GIS support staff, and DPW to align ITAM in DPTMS projects with INRMP goals and objectives.

Objective 1. Maintain good working relationships with ITAM in DPTMS program manager.
Objective 2. Schedule regular meetings regarding upcoming ITAM in DPTMS and natural resource projects.
Objective 3. Provide ITAM in DPTMS program manager with updated federal and state environmental resource guidance and regulations.
Objective 4. Provide ITAM in DPTMS program manager with updated installation natural resource information, such as those regarding federally protected species.

5.2 NATURAL RESOURCES ENFORCEMENT

Many aspects of natural resources management require effective environmental law enforcement (*e.g.*, protection of rare or unique species; protection of sensitive areas; hunting, trapping, and fishing recreation; protection of cultural resources). Natural and cultural resources on the installation are protected by the Conservation Law Enforcement Program (CLEP). The CLEP is conducted in accordance with DoDI 5525.17; which establishes policy, assigns responsibilities, and provides direction for the CLEP under the authority in DoD Directive 5124.02 (DoD 2013).

5.2.1 Current Management

Wildlife law enforcement game warden functions on FLW are historically the responsibility of the Provost Marshal. Enforcement of laws aimed at protection of natural resources and recreational activities that depend on natural resources are an integral part of any natural resources program. It is generally recognized that this area of law enforcement requires cross functional management and should be considered environmental law enforcement. Operational functions of environmental enforcement include such duties as dealing with cultural and historic resources, sensitive endangered species habitat, hazardous waste dumping, destruction or theft of government property, hunting and fishing violations, and reports on fire damage and road conditions. Hunting and fishing activities require the most natural resources enforcement on FLW. In addition, there are cultural resources and nongame species which require protection. Related illegal activities include unauthorized dumping, unauthorized wood cutting, unauthorized entries, off-road vehicle operation, metal scraping or detecting, growing illegal plants, etc. To facilitate this expanded role in environmental law enforcement DoDI 5525.17 supports wildlife law enforcement function within the DPW NRB. Game Wardens have basic wildlife law enforcement authority granted as FLW commissions.

FLW game wardens assist natural resource managers on fish/wildlife surveys and other special projects. In addition, they should receive training in Archaeological Resource Protection Act, ESA, Migratory Bird Treaty Act, Lacey Act, and others as directed by DoDI 5525.17. Continued use of civilian enforcement personnel and close coordination between the Game Warden Section and Natural Resource Branch will provide an efficient environmental law enforcement function.

Jurisdiction. Exclusive federal jurisdiction exists on all areas of FLW. Laws are enforceable by federal-commissioned personnel. Game law enforcement officers are classified within the DoD Police Series (083), which enables them to enforce all laws and regulations applicable on FLW. FLW officers use the Federal Magistrate Court to adjudicate soldiers and civilian violators who are issued a DD Form 1805 and Military Police Report citations (DD Form 1408), generally used for state and/or federal law violations. In most cases, 1408 citations are issued to military and civilian violators of FLW regulations and administrative procedures. These violations are administratively handled by military commanders and civilian supervisors. More serious cases are handled using the Military Police Report, DA Form 3975.

Training. The Sikes Act mandates that DoD installations employ adequate numbers of professionally trained natural resources personnel, including law enforcement personnel to implement the INRMP. The Act authorizes DoD to enforce all federal environmental laws and regulations when violations occur on the installation. FLW would be best served by sending new wardens to Federal Law Enforcement Training Center, which offers an intensive, yet lengthy nine-to-eleven-week course covering the basics an incoming warden requires. However, funding and availability may limit this training opportunity. There is a generally recognized requirement for a 40-hour-minimum annual refresher training for enforcement officers. The National Military Fish and Wildlife Association offers annual training for experienced wardens.

Enforcement personnel must qualify with individual weapons twice annually. Additional in-house training includes the use of enforcement videos and cardio-pulmonary resuscitation training. On-the-job-training is used by permanent civilian enforcement personnel to train new game wardens on duties specific to wildlife law enforcement. Additionally, with the Military Police School located at FLW, refresher training designed for game wardens has a possibility of being integrated into the schools training program. FLW will evaluate this possible avenue of annual refresher training for wardens.

5.2.2 Natural Resources Enforcement Management Goals and Objectives

Goal. Assure legal compliance of military and civilian activities with regard to natural and cultural resources on FLW.

Objective 1. Conduct the Conservation Law Enforcement Program as directed in DoDI 5525.17.
Objective 2. Maintain a law enforcement program for military and civilian activities that relates to natural and cultural resources protection on FLW.
Objective 3. Coordinate enforcement activities with other agencies, particularly MDC, USDA, and the USFWS.
Objective 4. Provide NRB support, as appropriate, to Law Enforcement Command, Game Warden Section regarding natural/cultural resources law enforcement activities on FLW.
Objective 5. Provide quality basic and annual refresher training to FLW game wardens.

5.3 CONSERVATION AWARENESS

Conservation awareness is instrumental in creating conditions needed to manage natural resources. Education provides military personnel and the public with insights into installation natural environments and conservation challenges. A conservation awareness program must be directed to both installation and external interests if it is to be effective. Military personnel awareness is discussed in Section 5.1.4, *Sustainable Range Awareness*; a component of the ITAM in DPTMS program. The more people know about FLW's unique and valuable natural resources, the more responsibly they act toward them. Other forms of outreach on FLW includes the Environmental Control Committee, FLW Conservation Counsel, and the Environmental Compliance Officer Training.

5.3.1 Current Management

Use of Media. FLW's weekly electronic newspaper, the *Guidon*, is an efficient way for Natural Resources personnel to access the installation community. This electronic newspaper is used to explain programs and gain support for their implementation. The NRB uses the paper to inform users of recreational opportunities, hunting seasons, angling opening dates, season summaries, and special interest articles. Furthermore, news releases and interviews with outside media are coordinated with Public Affairs Office. Natural resources information is also made available on a FLW environmental website.

Hunting and Fishing Awareness. FLW puts considerable effort into increasing the level of awareness of opportunities to hunt, fish, and otherwise enjoy the out-of-doors on the installation. Notices of activities, program management, regulations, and maps are posted and updated regularly on the iSportsman website. FLW Regulation 210-21, *Hunting and Fishing Regulations*, is the primary source of information regarding regulations for these activities. NRB provides hunters/anglers required fishing and hunting information prior to issuing installation permits. DRMWR personnel assist NRB by coordinating special events, assisting with updates and improvements, and briefings. Special events may include Earth Week activities, youth fishing derbies such as the annual catfish derby in June, and the February trout fishing derby at Stone Mill Spring.

Access and Outreach Projects. Access to natural resources is a valuable technique to allow the public to view and enjoy natural resources on FLW. This can be accomplished through projects to improve access to sites in the river bottomlands to viewing areas in the river bluffs and highlands. Linking these areas to activities as river fishing, canoeing, hiking, picnicking, and wildlife viewing can also enhance the public's experience with the natural resources on FLW.

Construction of bird and bat houses and/or nesting boxes for songbirds, migratory birds, and other resident species provide outreach opportunities for natural resource managers. These projects can be constructed in the cantonment areas for day-to-day view to recreation/access areas where more private views can occur. Other outreach projects could include planting native flower areas or beds for not only visual aesthetics but for pollinators. Additionally, natural resource managers are committed to cultivating a conservation ethic in local youth. This includes outreach to youth groups and schools on conservation programs and projects. Scouts, in particular, benefit from support with projects, merit badges, and conservation talks.

5.3.2 Conservation Awareness Management Goals and Objectives

Goal. Provide information to FLW and external interested communities regarding natural resources and associated management programs at FLW.

Objective 1. Improve the general program knowledge of all persons associated with the NRB, particularly those who come into regular contact with interested persons.
Objective 2. Provide prepared talks, dependent upon personnel and time availability. Whenever possible, use these opportunities to explain contemporary natural resources issues and management.

Objective 3. Use newspapers, television, radio, and the internet to inform the FLW and surrounding community of matters important to the FLW natural and cultural resources program.
Objective 4. Participate in activities, such as Earth Week and youth fishing derbies, to promote the NRB image and/or programs.
Objective 5. Pursue interactions between FLW and surrounding communities and professional organizations to exchange information and knowledge on environmental subjects.
Objective 6. Investigate the development of the access points to enhance watchable wildlife and awareness opportunities on FLW.
Objective 7. Conduct community outreach projects such as planting native tree and flowers, food plots for handicapped hunters, or removal of invasive species.

5.4 OUTDOOR RECREATION

5.4.1 Current Management

FLW has a plethora of natural resources-related recreational activities other than hunting, trapping, and fishing. Individual activities such as bicycling, hiking, and camping are done regularly. One of the most popular activities on post is canoeing on Big Piney River. The Outdoor Adventure Center offers canoe camping trips for groups, or individual canoes can be rented. General horseback riding and equestrian events are mainly linked to DFMWR's Riding Academy. The Academy offers horse and stall rentals, hayrides, ride cookouts, riding arena facilities, etc. The use of recreational off-road vehicles is prohibited on FLW per Regulation 210-14 Ranges, Training Areas, and Training Facilities and is enforced under 50 USC 797. Exceptions to this policy include military use, law enforcement, and land management activities.

DFMWR includes off-post trips, such as skiing, or other activities through their Information, Tour and Travel program. The LORA site offers many activities for the FLW community and is only 45 highway miles from post. Additionally, Mark Twain National Forest offers major outdoor recreational opportunities, which takes away some recreational pressure off FLW. These opportunities include hiking, camping, nature study, nature photography, birding, and similar activities.

5.4.2 Outdoor Recreation Management Goals and Objectives

Goal. Manage outdoor recreation to provide safe and pleasing outdoor experiences consistent with the needs of the FLW military mission while maintaining ecosystem integrity and function.

Objective 1. Support the development of facilities that improve use and enjoyment of fishing, hunting, and other natural resources-based recreation.
Objective 2. Support the FLW policy for the designated off-road vehicle area.
Objective 3. Work with DFMWR for outdoor recreational opportunities.

5.5 CULTURAL RESOURCES PROTECTION

Cultural resources management at FLW is provided in accordance with Section 106 and Section 110 of the National Historic Preservation Act (54 USC 300101 *et seq*.), the Archaeological Resources Protection Act (16 USC Section 470aa-470mm), the American Indian Religious Freedom Act (42 USC 1996), the Native American Graves Protection and Repatriation Act (25 USC Section 3001 *et seq*.), Executive Order 11593 (*Protection and Enhancement of Cultural Environment*), and DoD Directive 4710.1 (*Archaeological and Historic Resources Management*, 1984).

5.5.1 Current Management

Management of FLW cultural resources is a mission of the NRB. The installation updated its ICRMP in 2017, which describes inventories, work plans, management, tribal access to sites and resources, and coordination of cultural resources with all applicable state and federal laws and regulations. This includes consultation and coordination with Native Americans and Tribes and the SHPO. Cultural resources were further discussed in Section 3.4.1.

It is important to ensure that provisions of this INRMP are also consistent with the protection of cultural resources. Prior to any ground-disturbing, natural resources activity, FLW evaluates proposed activities for compliance with all appropriate cultural resource laws and regulations. Natural resources management practices have the potential to adversely affect cultural resources and archaeological sites. Examples of these activities include land rehabilitation and maintenance/erosion control, forest management, road and firebreak maintenance/construction, prescribed burning, and outdoor recreation programs. Proposed projects should be submitted, as part of standard NEPA review, to the FLW Cultural Resources Manager for approval, determinations of effect, and Section 106 consultation, as necessary.

Additionally, members of tribes associated with sites and resources that are of religious importance, or that are important to the continuance of their culture, on FLW would be allowed access to these cultural resource areas in accordance with DoDI 4715.03. However, military mission considerations and constraints may apply dependent on the location and military mission activities. Access to areas that are unsafe, restricted, or under constraint due to military mission activities would require coordination with FLW's NRB. Furthermore, requests by Native American tribes for the purposes of non-commercial gathering of botanical and mineral resources would be coordinated with the NRB. Likewise, access will be granted in a manner consistent with the military training schedules at FLW. Tribes have been notified that access is available to them upon request.

5.5.2 Cultural Resources Management Goals and Objectives

Goal 1. Implement this INRMP in a manner consistent with the protection of cultural resources at FLW.

Goal 2. Comply with all laws, regulations, and Army guidance regarding cultural resources on FLW.

Objective 1. Review ICRMP updates.
Objective 2. Implement provisions of the ICRMP that relate to natural resources management.
Objective 3. Consider natural resources projects when planning cultural resources surveys and use results of cultural resources surveys to plan natural resources projects.
Objective 4. Avoid or mitigate adverse effects to cultural resources from natural resources management through proper review and planning. Submit proposed projects, as part of NEPA review, to the FLW Cultural Resources Manager for approval, determinations of effect, and Section 106 consultation, as necessary.
Objective 5. Take the following protective measures upon discovery of sites.

- Cease ground disturbing activities immediately and report to the FLW Cultural Resources Manager upon discovery of potential cultural deposits
- Consider alternatives for moving the project to another location
- If the site or deposits are determined by the FLW Cultural Resources Manager to be of no cultural significance, do no further investigation and resume the project. Protect the site until such time that it is determined not eligible for the NRHP if remains are determined to be of cultural significance.

Objective 6. Use natural resources techniques and projects to protect cultural resources sites.
Objective 7. Conduct tribal consultations as necessary.
Objective 8. Allow access to members of tribes associated with sites and resources that are of religious importance, or that are important to the continuance of their culture.

6.0 UNRESOLVED ISSUES

It is not unusual for some natural resources-related issues to be at a stage where the path to issue resolution is unknown or uncertain. Reasons for this status might be the political environment, a lack of scientific information, conflicting agendas, costs, constraints, contemporary DoD/Army policies, or other roadblocks. Issue resolution difficulties will not prevent FLW from continuing to work on resolutions. Recognition and a willingness to deal with such issues are a part of the process itself.

Competing Land Uses. Probably the most difficult issue to resolve on FLW with regard to natural resources is competing uses of natural resources. Ecosystem management is a strategy that seeks to meet many objectives, including human values, and maintain ecosystem functionality. Military training is a valid land use, but certain aspects of the military mission impact ecosystem functionality. Natural resources activities are integrated into military mission training requirements to minimize ecosystem impacts.

Ecosystem Management Partnerships. FLW should continue to forge more partnerships with neighbors and organizations interested in managing ecosystems that extend beyond installation boundaries. While this ecosystem management approach has potential to improve natural resources management, it also has potential to create bio-political issues.

It would be fairly easy for FLW to form partnerships with natural resources-based state and federal agencies. These organizations understand the need for such partnerships,

and often they are mutually beneficial. The USFWS, U.S. Forest Service, and MDC are good examples of organizations with whom shared ecosystem management is happening. However, these are agencies that share goals and objectives with FLW with regard to natural resources but, with exception of U.S. Forest Service, don't share boundaries.

Most other neighbors, however, are private landowners. As many published discussions of ecosystem management point out, the matter of private property rights often conflicts with objectives of managing ecosystems. Urban neighbors often have priorities very different than ecosystem needs. Urban areas, both large and small, are concerned about trying to acquire the funding to comply with federal environmental (and other) mandates. FLW would need to follow the Army Compatible Use Buffer Program as well as the Information System Security Program as applicable.

Major Threats, Obstacles, or Issues. Managing natural resources has its changes at FLW. Whether it is destructive invasive species such as feral hogs, EABs, various terrestrial or aquatic organisms; or diseases such as chytrid (fungus), white nose syndrome, or chronic wasting disease. Non-biological factors that arise can also be problematic, such as vandalism, water quality pollutants, and impacts associated to road and ditch erosion. Other challenges include external impacts such as climate change that can result in Army or DoD policy shifts and ecosystem impacts. Additionally, funding availability also presents its limitations through staff reductions or hiring freezes, fewer administrative resources and equipment, funding projects, outreach, and the ability NRB managers to attend developmental classes and/or conferences.

7.0 IMPLEMENTATION

This INRMP is only as good as FLW's capability to implement it. This INRMP was prepared with a goal of 100% implementation. Below are described the organization, personnel, and funding needed to implement programs described in Chapters 4 and 5.

7.1 ORGANIZATION

The NRB and the Range Division at FLW can implement most of this INRMP and fulfill general goals and policies established in Chapter 1 and more specific goals and objectives within Chapters 4 and 5. Other organizations identified in Section 2.1 are also capable of implementing their portions of this INRMP with no organizational changes, although they may elect to make changes in upcoming years to improve operations efficiency.

7.2 PERSONNEL

7.2.1 INRMP Implementation Staffing and Training

7.2.1.1 Current Management

The following staffing is needed to implement this INRMP at FLW:

- Natural Resource Management Specialist (1X)
- Wildlife Biologist (2X)
- Forester (1X)
- Biological Science Technician (1X)
- Prehistoric Archaeologist (1X)
- Historical Archeologist (1X)
- Fisheries Biologist (2X)
- Natural Resource Specialist (1X)
- Supporting contractors (5X)

Above personnel do not include personnel within DPTMS, DFMWR, and other personnel within DPW who have roles in implementation of this INRMP. Some of these positions are subject to change or additional positions may be added as applicable to the installation funding, needs, requirements, and/or reorganization.

FLW has a goal to continuously improve the success of natural resources management activities through professional development and information exchange. Dependent on funding availability this will be accomplished by:

- Maintaining staff knowledge of management strategies, and updated DoD as well as state policies and requirements; this will be accomplished through training and participation in workshops, meeting/conferences, research presentations, and other activities of regional and national professional natural resources research and conservation programs
- Sharing information with natural resources experts to ensure maximum benefits of adaptive management and research efforts

FLW plans to send at least one person to each of the following annual workshops or professional conferences if schedules and budgets allow:

- National Military Fish and Wildlife Association annual workshop
- North American Natural Resources Conference
- Society of American Foresters annual meeting
- ITAM workshop
- The Wildlife Society annual conference
- Midwest Fish and Wildlife Conference meeting
- Missouri Natural Resources Conference annual meeting

Other conferences/workshops will be evaluated for their usefulness, and decisions will be made based on appropriateness to ongoing projects and funding availability. Projects that may be especially useful include forestry workshops, RTLA training, GIS basic and advanced training, wetlands training, and endangered species training.

The Wildlife Society, Society of American Foresters, American Society of Agronomy, and National Military Fish and Wildlife Association are among the professional societies applicable to meeting the needs of FLW's natural resources managers. Membership in these societies is encouraged. They have some of the best scientific publications in their professions, and literature review is a necessary commitment to maintain

standards. Attending meetings of these societies also provides excellent opportunities to communicate with fellow professionals as well as maintain professional standards. Membership costs and attendance would be dependent on funding availability.

7.2.1.2 Proposed Management

Project: INRMP Implementation Staffing and Training

Justification: Compliance with Sikes Act (implementation of INRMP), Executive Orders, and other federal laws affected by this INRMP, support of the military mission and stewardship of natural resources.

Project Timing: Objective - ongoing indefinitely

Regulatory Coordination: None directly

Goal 1. Provide staffing of natural resource management professionals required to effectively manage natural resources on FLW (AR 200-1).

Objective 1. Use funding and available budge to the greatest extent possible to support INRMP and natural resource managers.
Objective 2. Provide staffing for the FLW natural resources program to effectively implement this INRMP.

Goal 2. Provide training to natural resources personnel implementing this INRMP.

Objective 3. Encourage NRB personnel to join professional societies and their state/regional chapters as well as be active in them. Funding support for these memberships or certifications would be provided based on availability.
Objective 4. Send at least one person to each of the annual workshops or professional conferences discussed above.
Objective 5. Evaluate other conferences/workshops for their usefulness as training tools, and send personnel to those most justified, based on current training needs and those most related to FLW activities.
Objective 6. Actively participate in training sessions to disseminate knowledge learned at FLW.

Goal 3. Coordinate with state and federal agencies, and other stakeholders.

Objective 7. Maintain close relationships with state and federal agencies through approved social media, meetings, and natural resource related programs.
Objective 8. Work with colleges and universities and other related stakeholders to further support natural resources of FLW.

7.2.2 External Assistance

7.2.2.1 Current Management

The demands of natural resources management have resulted in the need for outside assistance with natural resources programs on FLW. The growth of environmental compliance requirements has increased many of these needs and have added considerably to the need for specialized external assistance in other areas, including on-the-ground personnel support.

Implementation of this INRMP will require active assistance from FLW's partners, both signatory and otherwise. Chapter 2 indicates agencies, organizations, and others in this category. Specific needs from organizations external to FLW are indicated throughout this document. It is difficult for FLW to hire the specialized expertise needed for some projects within this INRMP. FLW will require considerable expertise from universities, agencies, and contractors to accomplish some tasks within this INRMP.

7.2.2.2 Proposed Management

There is no requirement for a specific project for external assistance since objectives within this area are included within other projects of this INRMP. However, the below goal and objectives are appropriate to list.

Goal. Provide external specialized skills, personnel, and resources to support the FLW natural resources program.

Objective 1. Implement external support projects, which are described in more detail in appropriate sections of this INRMP.
Objective 2. Use state and federal agencies, particularly INRMP signatory partners, the USFWS and MDC to assist with implementation of this INRMP.
Objective 3. Use universities, volunteers, and other interested persons and organizations to assist with implementation of this INRMP.
Objective 4. Use contractors to assist with implementation of this INRMP.

7.3 DATA STORAGE, RETRIEVAL, AND ANALYSIS

The capability to store, retrieve, and analyze data is central to professional management of natural resources, and it is essential to implementing the adaptive management aspect of ecosystem management. FLW is committed to providing efficient, cost-effective systems for data storage and analysis.

7.3.1 Current Management

Data collected are statistically analyzed and stored in the NRB. Data are available for use by FLW personnel and are integrated into the GIS system.

Computer Systems. Computers are essential to the routine operation of efficient natural resources management organizations. The volume of data is too substantial to handle without computers, and routine administrative tasks are accomplished considerably more efficiently with computers.

The NRB is well-equipped with computers, having quality personal computers with appropriate printers and other peripherals. However, the inability to connect specialized electronic devices such as data recorders to the computers and to use specialized software prevents the Natural Resources Branch from fully utilizing much of the available technology.

Geographic Information System. A GIS allows users to manipulate, compare, analyze, and display various layers of spatial data. GIS has been in use in the NRB

since 1989, with ArcMap being the current software. Most NRB personnel have access to the software and a large number of data layers. Natural resources data continually increase and now cover most of the programs managed by the NRB. GIS has become an essential tool in using the extensive amount of information necessary for managing installation resources. Additionally, GIS information can be used to reflect current security and related information requirements as well updated/new DoD guidance.

Remote Imagery. The NRB maintains a collection of printed aerial photographs taken periodically from as early as 1938, although not always covering the entire installation. Some photographs have been scanned and geographically oriented for GIS use, allowing managers to see changes that have occurred over time. The newest imagery acquired by FLW is recorded digitally, and imagery is updated frequently. Having both historic and recent imagery is a significant benefit to managers.

Stationary Cameras. Stationary cameras also known as game or trail cameras, with data storage devices, can be extremely value added to natural resource management. Especially in remote areas where access can be challenging. Cameras are motion censored primarily focus on large to medium sized wildlife; however, can be used to specifically target as species such as mountain lions, black bears, or even feral hogs. Images can help natural resource managers determine these species are resident and/or if a breeding population exists. Additionally, some cameras have video recording abilities that can be used to monitor behavioral activities and patters.

7.3.2 Proposed Management

Project: Data Storage, Retrieval, and Analysis

Justification: Sikes Act (implementation of INRMP) and other federal laws affected by this INRMP, support of the military mission, stewardship

Project Timing: All objectives - ongoing indefinitely

Regulatory Coordination: None

Goal. Store, analyze, and use data in an efficient, cost-effective manner.

Objective 1. Upgrade microcomputer hardware and software as needed.
Objective 2. Develop or obtain databases needed to support FLW natural and cultural resources programs.
Objective 3. Create user-friendly interfaces to enable a wider use of GIS databases specific to needs of installation users.
Objective 4. Regularly replace or upgrade GIS and imagery hardware and software to maintain the capability to use developing GIS technology.
Objective 5. Require all spatially related data be stored on, or accessible to, the GIS.
Objective 6. Use remote imagery for improved decision-making for military activities, environmental management, and natural and cultural resources management and protection.
Objective 7. With available funding, purchase and use stationary cameras to assist in natural resources management.

7.4 PROJECT/PROGRAM SUMMARY

Projects, goals, and objectives within this INRMP can be used to monitor the effectiveness of natural resources management at FLW. Appendix A contains a list of projects, goals, and objectives for this INRMP in the order they appear. Goals and objectives are abbreviated from chapters 4, 5, and 7.

7.5 IMPLEMENTATION FUNDING

Natural resources management on FLW primarily relies on environmental funds as well as training funds from the ITAM in DPTMS program. These funds are not integrated and are allocated separately. However, multiple funding mechanisms from non-natural resource management organizations do contribute to INRMP implementation. These additional funds often fluctuate, and exact numbers are hard to determine. Therefore, these funds are not shown in this Section. Additionally, many of these non-environmental funds have different application rules and regulations.

7.5.1 Environmental Funds

Environmental funds are a special subcategory of Operations and Maintenance funds. They are set aside by the Department of Defense for environmental purposes but are still subject to restrictions of Operations and Maintenance funds. Compliance with laws is the key to getting environmental funding. Environmental funds are most commonly used for projects that return the installation to compliance with federal or state laws, especially if noncompliance is accompanied by Notices of Violation or other enforcement agency actions.

“Must fund” classifications include mitigation identified within *Findings of No Significant Impact* and items required within Federal Facilities Compliance Agreements. This INRMP is a Federal Facilities Requirement Agreement, and some projects and programs within it are used to mitigate various military activities. In addition, 1997 amendments to the Sikes Act require implementation of INRMPs, which make implementation of this INRMP a priority for funding.

Table 10 provides a breakdown of environmental funds. While these figures reflect validated (approved) funding requests for FY22, the remaining years are estimated using a 2% annual increase and based on past projections. Funding amounts are subject to change and may be redistributed among programs based on priorities. Thus, the total environmental funds budget for this INRMP is estimated at $9,146,049 for 2022-2026.

Table 10 Natural Resource Management Expenditures

Expenditures	FY22	FY23*	FY24*	FY25*	FY26*	Totals*
Ecosystems	175749	179,264	182,850	186,507	190,237	914,606
Planning	87875	89,632	91,425	93,253	95,118	457,303

Soils	35149	35,852	36,569	37,301	38,047	182,918
Water Resources	87875	89,632	91,425	93,253	95,118	457,303
Flora Inventory and Monitoring	17575	17,926	18,285	18,650	19,023	91,459
Wetlands	87875	89,632	91,425	93,253	95,118	457,303
Wildlife Habitat	87875	89,632	91,425	93,253	95,118	457,303
Aquatic Habitat	87875	89,632	91,425	93,253	95,118	457,303
Federal Listed Species	175749	179,264	182,850	186,507	190,237	914,606
Non-federal Listed Species	87875	89,632	91,425	93,253	95,118	457,303
Special Interest Areas	87875	89,632	91,425	93,253	95,118	457,303
Pests	87875	89,632	91,425	93,253	95,118	457,303
Grounds	87875	89,632	91,425	93,253	95,118	457,303
Fire Management	87875	89,632	91,425	93,253	95,118	457,303
Natural Resources Law Enforcement	35149	35,852	36,569	37,301	38,047	182,918
Conservation Awareness	35149	35,852	36,569	37,301	38,047	182,918
Natural Resources Related Recreation	17575	17,926	18,285	18,650	19,023	91,459
Cultural Resources	175749	179,264	182,850	186,507	190,237	914,606
National Environmental Policy Act	35149	35,852	36,569	37,301	38,047	182,918
INRMP – General Implementation	87875	89,632	91,425	93,253	95,118	457,303
Administrative	87875	89,632	91,425	93,253	95,118	457,303
Totals	1,757,490	1,792,640	1,828,493	1,865,063	1,902,364	9,146,049

*In U.S. dollars.

7.5.2 Training Funds

FLW is a Category II installation with regard to ITAM in DPTMS implementation and funding (DOA 1995b). ITAM in DPTMS requirements are submitted annually via the ITAM Workplan, which is submitted as a part of the Range Complex Master Plan. Approved/Accepted projects and requirements are resourced primarily through a centralized IMCOM contract. While these figures (Table 11) reflect validated (approved) funding requests for FY22, the remaining years are estimated using a 2% annual increase and based on past projections. Funding amounts are subject to change and may be redistributed among programs based on priorities.

Table 11 Training Funds Expenditures (ITAM)

Project	FY22*	FY23*	FY24*	FY25*	FY26*	Totals*
RTLA	188,652	192,426	196,274	200,200	204,204	981,755
LRAM	1,392,435	1,420,284	1,448,689	1,477,663	1,507,216	7,246,288
TRI	131,158	133,782	136,457	139,186	141,970	682,554
SRA	3,593	3,665	3,739	3,813	3,890	18,700
GIS	184,161	187,844	191,601	195,433	199,342	958,380
Totals	1,900,000	1,938,000	1,976,760	2,016,295	2,056,621	**9,887,676**

*In U.S. dollars.

Thus, the total ITAM in DPTMS budget for this INRMP is estimated at $9,887,676 for 2022-2026. These estimates will be adjusted as needed each year and are dependent upon funding availability.

7.5.3 Forestry Funds

Forestry funds are generated from the sale of forest products. Individual installations can be reimbursed for approved forest management expenses. Forty percent of excess revenue produced by an installation is provided to the state for distribution to the counties in which the installation is located. The remainder is deposited into the DoD Forest Reserve Account, which funds approved natural resources projects.

7.5.4 Other Funding

The portions of the outdoor recreation program that are not directly involved with hunting and fishing are funded through the non-appropriated fund and are not included within this INRMP costs.

Thus, estimated five-year total to fund the implementation of this INRMP is roughly $19,033,725 between training and environmental funds.

7.6 COMMAND SUPPORT

Command support is essential to implementation of this INRMP. Many projects for natural resources management within the next five years require command support. This INRMP has the support of the FLW Commander and other personnel in command

positions who are needed to implement this INRMP. The Command is dedicated to implementation of this INRMP as required by the Sikes Act and other federal laws. Just as importantly, the Command is dedicated to maintaining and improving the military mission at FLW. Implementation of this INRMP is a means to that end.

8.0 ENVIRONMENTAL CONSEQUENCES

This INRMP is an update from the 2006 and 2017 INRMPs. The previous INRMPs have prepared NEPA documentation and associated FONSIs, which are stored FLWs NRB files and can be reviewed for refence. Furthermore, in compliance with NEPA a REC has been prepared for this current INRMP and is provided in Appendix B.

9.0 COMPLIANCE WITH ENVIRONMENTAL QUALITY STATUTES

Table 12 INRMP Compliance with Environmental Quality Statutes.

Federal Policy	Compliance
Archaeological Resources Protection Act, 16 U.S.C. 470, et seq.	Full Compliance
Bald and Golden Eagle Protection Act of 1940, 16 U.S.C. 668-668d, et seq.	Full Compliance
Clean Air Act, as amended, 42 U.S. C. 7401-7671g, et seq.	Full Compliance
Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Full Compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not Applicable
Endangered Species Act, 16 U.S.C. 1531, et seq.	Full Compliance
Environmental Justice (Executive Order 12898)	Full Compliance
Estuary Protection Act, 16 U.S.C. 1221, et seq.	Not Applicable
Farmland Protection Policy Act, 7 U.S.C. 4201, et. seq.	Full Compliance
Federal Water Project Recreation Act, 16 U.S.C. 4601-12, et seq.	Full Compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	Full Compliance
Floodplain Management (Executive Order 11988)	Full Compliance
Invasive Species (Executive Order 13122)	Full Compliance
Land and Water Conservation Fund Act, 16 U.S.C. 4601-4, et seq.	Not Applicable
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, et seq.	Not Applicable
Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712	Full Compliance
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Full Compliance (Appendix B)
National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470a, et seq.	Full Compliance
Protection of Wetlands (Executive Order 11990)	Full Compliance
Rivers and Harbors Act, 33 U.S.C. 403, et seq.	Full Compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Full Compliance
Wild and Scenic River Act, 16 U.S.C. 1271, et seq.	Not Applicable

10.0 CONCLUSIONS, FINDINGS, AND RECOMMENDATIONS

INRMP Summary.

Based on the NEPA analysis performed in the 2006 and 2017 INRMPs, implementation of the Proposed Actions, which remain applicable to this updated INRMP, would have in general less than significant direct, indirect, and cumulative effects on the quality of the natural or human environment as determined at that time. A REC has been prepared in accordance with 32 CFR §651.12 (Army CXs) and is provided in Appendix B. Implementation of the Proposed Actions would allow FLW to continue ongoing mission activities and provide the necessary support actions to accomplish its training missions and goals; while avoiding and minimizing impacts to resources on the installation.

11.0 LIST OF PREPARERS

Name	Title	Education	Experience/Role
USACE – KANSAS CITY DISTRICT			
John Atkinson	Geographer	B.S. Geography and Natural Recourses and Environmental Science - Kansas State University; M.A. Geography; Kansas State University	8 Years GIS
Michelle Wilson	Project Manager	B.S. Chemistry	14 Years, Project Manager, Reviewer
Chris Name	Biologist	B.S. Biology; Environmental Northwest Missouri State University	10 Years, Primary Writer
FLW – DIRECTORATE OF PUBLIC WORKS			
Kenton Lohraff	Wildlife Biologist	B.S. Fish and Wildlife; M.S. Biology	26 Years, Reviewer
Robert J. Proffitt	Natural Resources Specialist	B.S. Forestry	30 Years, Reviewer
Jeff Pebworth	Wildlife Biologist	BS, MA Wildlife Ecology and Management	34 Years, Reviewer
John Brant	Fisheries Biologist	B.S. Fisheries, Wildlife, and Conservation Biology, M.S. Natural Resources Fish Ecology	8 Years, Reviewer
K.J. Petry	Forester	B.S. Forestry, B.S. Fisheries & Wildlife	9 Years, Reviewer
Dustin Moss	Biologist	B.S. Fish and Wildlife	12 Years, Reviewer

Martha M. Miller	NEPA Program Manager	CHMM; B.A. Biology	7 Years, Reviewer
Taylor Hale	NEPA Contract Support	B.A. Entomology	1 Year, Reviewer
Stephanie Nutt	Historical Archaeologist	B.A. Anthropology, M.A. Anthropology	30 Years, Reviewer
FLW – DPTMS-SRP			
Justin Fenton	DPTMS, ITAM Coordinator	B.S., M.S. Forest Natural Resource Management	12 Years; Reviewer

12.0 REFERENCES

Bluestone 2021 Bluestone and Burns & McDonnell. 2021.Fort Leonard Wood Air Quality Monitoring Reports. Contract number W912DQ-21-D-3010 to 22F3008 for MDNR Permit Number OP2017-033.

DOA 2007 Department of the Army. 2007. *Environmental Protection and Enhancement*. Army Regulation 200-1. Produced by Training Command for Headquarters, Department of Army, Washington D.C.

DOA 2006 Department of the Army. 2006. Memorandum: Army Forest Inventory Guidance.

DOA 2005 Department of the Army. 2005. *The Army Sustainable Range Program*. Army Regulation 350-19. Produced by Training Command for Headquarters, Department of Army, Washington D.C

DOA 2002 Department of the Army. 2002. *Environmental Analysis of Army Actions*. 32 CFR Part 651. Produced by Training Command for Headquarters, Department of Army, Washington D.C.

DOA 1999b Department of the Army. 1999. *Integrated Training Area Management*. Procedural Manual, Implementing Draft, Headquarters, Washington D.C.

DOA 1995b Department of the Army. 1995. *Integrated Training Area Management (ITAM) Program Strategy*. Headquarters, Washington D.C. 66pp + appendicies.

DoD 2021 Department of Defense. 2021. DoD Legacy Resource Management Program. DoD Environment, Safety, and Occupational Health Network and Information Exchange. Accessed June 7, 2022. https://denix.osd.mi

DoD 2015 Department of Defense. 2015. Memorandum of Understanding between the DoD and the Pollinator Partnership.

DoD 2014 Department of Defense. 2014. Memorandum for Assistant Secretary of the Army, Navy, Air Force, and Staff Director for the Defense Logistics Agency. DoD Policy to Use Pollinator-Friendly Management Prescriptions.

DoD 2013 Department of Defense. 2013. DoD *Conservation Law Enforcement Program*. Instruction Manual Number 5525.17.

DoD 2011 Department of Defense. 2011. *DoD INRMP Implementation Manual*. Instruction Manual Number 4715.03.

DoD 2006 Department of Defense. 2006. *DoD Interactions with Federally-Recognized Tribes*. Instruction Number 4710.02.

DoD 1996 Department of Defense. 1996. *Biodiversity Management Strategy.* Keystone Center Policy Dialogue on DoD Biodiversity, Final Report. Keystone, CO. 37 pp.

DoD 2014 Department of Defense. 2014. 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. Signed 10 July 2014.

ESI 2018 Environmental Solutions & Innovations, Inc. 2018. *Acoustic and Mist Net Survey for Threatened and Endangered Bats at Fort Leonard Wood, Missouri.* In conjunction with

Missouri State University, the report was prepared for the U.S. Army Maneuver Support Center and Fort Leonard Wood, MO.

FLW 2021a Fort Leonard Wood. 2021. *Hunting and Fishing Regulation*. FLW Reg 210-21. Department of the Army Headquarters, MSCoE, Fort Leonard Wood, MO.

FLW 2021b Fort Leonard Wood. 2021. Integrated Training Area Management Program Programantic Environmental Assessment. Prepared by the U.S. Army Corps of Engineers, Kansas City District.

FLW 2020a Fort Leonard Wood. 2020. *Unique Capabilities Facts Sheet*. U.S. Army Maneuver Support Center of Excellence. Commanding Generals Initiatives Office, Fort Leonard Wood.

FLW 2020b Fort Leonard Wood. 2020. *Integrated Wildland Fire Management Plan.* U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared by DPW, FLW.

FLW 2019 Fort Leonard Wood. 2019. *Preparing, maintaining, and enforcing Post Range Regulations*. FLW Reg 210-14. Department of the Army Headquarters, MSCoE, Fort Leonard Wood, MO

FLW 2017a Fort Leonard Wood. 2017. *Ranges, Training Areas, and Training Facilities*. FLW Reg 210-14. Department of the Army Headquarters, MSCoE, Fort Leonard Wood, MO.

FLW 2017b Fort Leonard Wood. 2017. *Programmatic Environmental Assessment, Ongoing Mission Activities*. Prepared by United States Army Corps of Engineers, Kansas City District.

FLW 2017c Fort Leonard Wood. 2017. *Integrated Pest Management Plan*. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared by United States Army Corps of Engineers, Kansas City District.

FLW 2016a Fort Leonard Wood. *2016. Forest Management Plan: Fiscal Years 2017 – 2021.* U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared by DPW, FLW.

FLW 2016b Fort Leonard Wood. 2016. *Real Property Master Plan*. U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared by Louis Berger Group, Inc.

FLW 2016c Fort Leonard Wood. 2016. *Unique Capabilities Facts Sheet*. U.S. Army Maneuver Support Center of Excellence. Commanding Generals Initiatives Office, Fort Leonard Wood.

FLW 2014 Fort Leonard Wood. 2014. *Fort Leonard Wood Real Property Master Plan—Installation Development Plan.* Prepared for Fort Leonard Wood, in coordination with the Northeast Regional Installation Management Command and the U.S. Army Corps of Engineers, Philadelphia District. Prepared by Louis Berger, Kansas City, MO. December 31, 2014.

FLW 2006 Fort Leonard Wood. 2006. *Programmatic Environmental Assessment of the Ongoing Mission*, 2006-2010. U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared for U.S. Army Corps of Engineers by Parsons Corporation.

FLW 2017 Fort Leonard Wood. 2017. *Integrated Cultural Resources Management Plan.* Prepared by the U.S. Army Corps of Engineers.

FLW 1996 Fort Leonard Wood. 1996. Fort Leonard Wood Post Guide. Public Affairs Office. U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. 36pp.

FLW 1995 Fort Leonard Wood. 1995. *Wetlands Inventory for Fort Leonard Wood, Missouri*. Prepared by Harland Bartholomew and Associates, Inc.

FLW 1990 Fort Leonard Wood. 1990. *Master Plan for the U.S. Army Engineer Center and Fort Leonard Wood*. Prepared by Harland Bartholomew and Associates, Inc.

FLW Undated Fort Leonard Wood. Undated. *A Summary of Select Fisheries Management Activities and Planned Projects, 2003-2004, Report 7*. DPW, Fort Leonard Wood.

INRMP 2006 *Integrated Natural Resources Management Plan*, 2006–2010. U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared by Gene Stout and Associates Loveland, CO and Blythe & Trousil Inc. Cheyanne, WY.

IPCC 2014 Intergovernmental Panel on Climate Change. 2014. *Fifth Assessment Report*. Three working groups' reports. Accessed online at: http://www.ipcc.ch/report/ar5/

Johnson et al. 1990 Johnson, F.L. et al.1990. *Floral Inventory of Fort Leonard Wood, Missouri.* U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared by Oklahoma Biological Survey, Norman OK. 108pp.

Kim et al. 2022 Kim, H., Schmidtz, G., Phelps, Q., Duvernell, D., Newburry, J., Lee, V. 2022. *Ichthyofaunal Survey of the Gasconade River Drainage with a Focus on the Big Piney River, and the Detection of Hiodon Spp.* Cooperative agreement number W912DQ-18-2-0008--Mussel Habitat Survey and Assessment, Fort Leonard Wood, Missouri, Modification 2, Task 8: Hiodontidae Surveys.

Maynard et al. 2017 M, B., C. Barnhart, and R. T. Pavlowsky. 2017. Freshwater Mussel Survey of the Big Piney River and Roubidoux Creek, Fort Leonard Wood, Missouri. Prepared under Agreement W912DQ-14-2-004-0005 for Fort Leonard Wood, Missouri, US Army Corps of Engineers, Kansas City, Missouri.

MDC 2022 Missouri Department of Conservation. 2022. MDC Management Plans: Missouri Comprehensive Conservation Strategy. Accessed September 26, 2022. https://mdc.mo.gov/wildlife/mdc-management-plans

MDC 2021 Missouri Department of Conservation. 2021. *Missouri Species and Communities of Conservation Concern Checklist.* Accessed June 8, 2022. https://education.mmdc.mo.gov/sites/default/files/downloads/2021_SOCC.pdf

MDC 2016b Missouri Department of Conservation. 2016. *Gasconade River, Habitat Conditions*. Accessed February 23, 2016. http://mdc.mo.gov/sites/default/files/resources /2011/05/130hctxt.pdf

MDNR 2020 Missouri Department of Natural Resources. 2020. Department of Water Quality: Impaired Waters. Accessed June 8, 2022. https://dnr.mo.gov/document/2020-epa-approved-section-303d-listed-waters

MDNR 2017 Missouri Department of Natural Resources. 2017. Issued and Pending Air Permits. U.S. Army MANSCEN and Fort Leonard Wood, 169-0004 Air Quality Permit Numbers: OP2017-033. Accessed June 8, 2022. https://dnr.mo.gov/air/business-industry/permits/issued-pending

MDNR 1982 Missouri Department of Natural Resources. 1982. *Springs of Missouri.* Division of Geology and Land Survey Water Resources, Report No. 29, 1982.

NPS 2016 National Park Service. 2016. Rivers: Missouri. Accessed June 9, 2022. https://www.nps.gov/subjects/rivers/missouri.htm

Owen et al. 2021 Owen, M.R., Hess, J. W., Pavlowsky, R. T. 2021. Sediment and Erosion Control Assessment, Fort Leonard Wood: Best Management Practices for Ranges 33H, Ranges 2 & 3, and Roadway Drainage for FLW E. Prepared under Agreement W912DQ-19-2-0004 for Fort Leonard Wood, Missouri, U.S. Army Corps of Engineers, Kansas City, Missouri.

Pavlowsky et al. 2022 Pavlowsky, R. T., J. W. Hess, J. Nash, S. A. Lecce. 2022. Geomorphic Habitat Assessment of the Big Piney River and Roubidoux Creek within Fort Leonard Wood, Missouri. Agreement W912DQ-18-2-0008 for Fort Leonard Wood, Missouri, US Army Corps of Engineers, Kansas City, MO.

Ray et al. 2020 Ray, Jack H., Neal H. Lopinot, and Jennifer A. Rideout. 2020. An Intensive Survey of Selected Tracts at Fort Leonard Wood and Lake of the Ozarks Recreation Area, Pulaski and Camden Counties, Missouri. For Fort Leonard Wood, Missouri, Kansas City District, U.S. Army Corps of Engineers.

Sietman el al 2017 Sietman, B., M. Davis, M. Hove, M. Pletta, T. Wagner, S. Marr, Z. Secrist, M. Freeburg, A. Scheunemann, K. Krupp, E. Hagemeyer, A. Franzen, C. Swanson, and A. Sampson. 2017. Cumberlandia monodonta—host enigma resolved. Ellipsaria 19:18–20.

Skinner, M. 1991 *Rare and Endangered Plant Survey of Fort Leonard Wood Military Reservation*. Missouri Department of Conservation, Jefferson City, MO. 21 pp. + maps.

Sternburg *et al*. 1998 Sternburg, J.E. et al. 1998. *Fauna, Flora, and Sensitive Habitat Study*. For the Kansas City District, U.S. Army Corps of Engineers. Sponsored by Fort Leonard Wood, MO

Sternburg *et al*. 1996 Sternburg, J.E. et al. 1996. *Threatened and Endangered Faunal and Sensitive Habitat Survey of Fort Leonard Wood Military Reservation, Pulaski County, Missouri.* Missouri Department of Conservation, Jefferson City, MO. Interim Report sponsored by Fort Leonard Wood, MO.

The White House The White House, Office of the Press Secretary. 1994. Memorandum of the Heads of Executive Departments and Agencies. Environmentally and Economically Beneficial Practicies on Federal Landscaped Grounds.

USACE 2020 U.S. Army Corps of Engineers. 2020. Wetlands Determination Report: Phase 1. Prepared for Fort Leonard Wood Directorate of Public Works, Environmental Division. July 2020.

USACE 2021a U.S. Army Corps of Engineers. 2021. Wetlands Determination Report: Phase 2. Prepared for Fort Leonard Wood Directorate of Public Works, Environmental Division. February 2021.

USACE 2021b U.S. Army Corps of Engineers. 2021. *Biological Assessment: Gray Bat (Myotis grisescens), Northern Long-Eared Bat (Myotis septentrionalis), Indiana Bat (Myotis sodalis), Spectaclecase Mussel (Cumberlandia monodonta), and Eastern Hellbender (Cryptobranchus alleganiensis alleganiensis).* Prepared for Fort Leonard Wood Directorate of Public Works, Environmental Division. January 2021.

USACE 1993 U.S. Army Corps of Engineers. 1993. *Master Planning Instructions*. Engineering Division, Directorate of Military Programs. July 1993.

USAEC 2015 U.S. Army Environmental Command. 2015. *Informal Conference & Management Guidelines of the Northern Long-eared Bat (Myotis septentrionalis) for Ongoing Operations on Installations Management Command Installations*. Fort Sam Houston, Texas. May 2015.

USCB 2021 U.S. Census Bureau. U.S. Department of Commerce. Accessed 15 August 2022. http://www.census.gov/

USEPA 2016 U.S. Environmental Protection Agency. 2016. *Section 404 of the Clean Water Act: How Wetlands are Defined and Identified.* Accessed on the web on December 29, 2016. https://www.epa.gov/cwa-404/section-404-clean-water-act-how-wetlands-are-defined-and-identified

USFS 2016 U.S. Forest Service. U.S. Department of Agriculture. Accessed February 17, 2016. http://www.fs.usda.gov/recmain/mtnf/recreation

USFWS 2022a U.S. Fish and Wildlife Service. 2022. IPaC, Information for Planning and Conservation. USFWS. Accessed April 1, 2022. https://ipac.ecosphere.fws.gov/

USFWS 2022b U.S. Fish and Wildlife Service. 2022. ECOS, Environmental Conservation Online System. Accessed June 8, 2022. https://ecos.fws.gov/ecp/

USFWS 2022c U.S. Fish and Wildlife Service. 2022. Find a Species. Accessed on the web June 8, 2022. https://www.fws.gov/species/search

USFWS 2016 U.S. Fish and Wildlife Service. 2016. *New Jersey Species Being Evaluated for Possible Listing under the Endangered Species Act*. https://www.fws.gov/northeast/njfieldoffice/pdf/Evaluated_Species.pdf

USFWS 2003 U.S. Fish and Wildlife Service. 2003. *Eastern Hellbender Status Assessment Report*. 2013. Prepared by the Natural Resources Institute, Duluth, MN and the Illinois Natural History Survey, Champaign, IL. June 2003

USFWS 2000 U.S. Fish and Wildlife Service. 2000. *List of Migratory Birds*. (50 CFR 10.13) Department of the Interior.

USFWS 1997 U.S. Fish and Wildlife Service. *Biological Assessment on the Effects of Certain Master Plan and Ongoing Mission Actions on the Indiana Bat, Gray Bat, and Bald Eagle*. December 31. Ecological Services, Columbia, MO.

USFWS 1996. U.S. Fish and Wildlife Service. 1996. *Biological Opinion on the Effects of Certain Master Plan and Ongoing Mission Actions on the Indiana Bat, Gray Bat, and Bald Eagle*. December 31. Ecological Services, Columbia, MO.

USCD 2016 U.S. Climate Data. 2016. Accessed October 19, 2016. http://www.usclimatedata.com/climate/waynesville/missouri/united-states/usmo0922

USGCRP 2022 U.S. Global Change Research Program. 2022. *Midwest: Key Messages About the Midwest from the National Climate Assessment*. Accessed online on June 02, 2022. https://www.globalchange.gov/

USGCRP 2014 U.S. Global Change Research Program. 2014. *Climate Change Impacts in the United States: Chapter 18 Midwest*. Accessed September 16, 2016. http://nca2014.globalchange.gov/report/ regions/midwest

USGS 2016 U.S. Geological Survey Current Water Data for the Nation. 2016. Accessed April 22, 2016. http://waterdata.usgs.gov/nwis/rt

Verble 2021 Verble, Robin M. 2021. *Final Report: Surveys for Rattlesnake Master Borer Moth (Papaipema eryngii, Lepidoptera: Noctuidae) at Fort Leonard Wood*. U.S. Army Maneuver Support Center and Fort Leonard Wood, MO. Prepared by Missouri University of Science and Technology.

Wolf 1989 Wolf, D.W. 1989. *Soil Survey of Pulaski County Missouri.* U.S. Department of Agriculture, Soil Conservation Service.

13.0 ACRONYMS

Army	U.S. Department of the Army
ACUB	Army Compatible Use Buffer
AR	Army Regulation
BA	Biological Assessment
BO	Biological Opinion
CBRN	Chemical, Biological, Radiological, and Nuclear
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Comprehension, and Liability Act
CLEP	Conservation Law Enforcement Program
COA	Conservation Opportunity Area
CX	Categorical Exclusion
DOA	Department of the Army
DoD	Department of Defense
DFMWR	Directorate of Morale, Welfare, and Recreation
DPTMS	Directorate of Plans, Training, Mobilization and Security
DPW	Directorate of Public Works
EAB	emerald ash borer
EAM	even-age management
eDNA	environmental DNA
EMS	Environmental Management System
EPAS	Environmental Performance Assessment System
ESA	Endangered Species Act
F	Degrees Fahrenheit
FLW	United States Army Garrison Fort Leonard Wood
FONSI	finding of no significant impact
FY	fiscal year
GHG	greenhouse gas
GIS	geographic information system
ICRMP	Integrated Cultural Resources Management Plan
IMCOM	Installation Management Command
INRMP	Integrated Natural Resources Management Plan
IPaC	Information for Planning and Conservation
IPCC	Intergovernmental Panel on Climate Change
IPMP	Integrated Pest Management Plan
ITAM	Integrated Training Area Management
IWFMP	Integrated Wildland Fire Management Plan

JIIM	joint Intergovernmental and military, interagency, and multinational
LORA	Lake of the Ozarks Recreation Area
LRAM	Land Rehabilitation and Maintenance
MAPS	Monitoring Avain Productivity and Survival
MCOC	munitions constituents of concern
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MGD	million gallons per day
MSCoE	Maneuver Support Center of Excellence
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NPDES	National Pollutant Discharge Elimination System
NRB	Natural Resources Branch
ORAP	Operational Range Assessment Program
PEA	Programmatic Environmental Assessment
RTLA	Range and Training Land Assessment
REC	Record of Environmental Consideration
Sikes Act	Sikes Act Improvement Act
SHPO	State Historic Preservation Office
SOP	Standard Operating Procedure
SRP	Sustainable Range Program
TA	Training Area
TSI	timber stand improvement
UAM	uneven-age management
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	United States Global Change Research Program
USGS	United States Geological Survey
USC	United States Code
USCB	United States Census Bureau

Appendix A
Objectives and Goals

Section	On-Going Project/Goals/Objectives
1.4	**Overall INRMP (Sikes Act)**
	Goal 1. Provide quality natural resources as a critical training asset upon which to accomplish the military mission of FLW.
	Objective 1. Ensure no net loss in the capability of installation lands to support existing and projected military training and operations on FLW.
	Objective 2. Maintain quality training lands through range and training area monitoring, damage minimization, mitigation, and rehabilitation (*i.e.* , execution of the ITAM in DPTMS program).
	Goal 2. Comply with laws and regulations that pertain to management of FLW natural resources.
	Objective 1. Manage natural resources within the spirit and letter of environmental laws, particularly the Sikes Act upon which this INRMP is predicated.
	Objective 2. Protect, restore, and manage sensitive species (e.g., imperiled species and endemic species) and ecosystems (e.g., wetlands, glades, and riparian zones).
	Objective 3. Use procedures within the NEPA to make informed decisions that include natural resources considerations and mitigation.
	Objective 4. Ensure FLW's natural resources program is consistent with the protection of cultural and historic resources.
	Objective 5. Implement this INRMP within the framework of Army policies and regulations. *Integrated Natural Resources Management Fort Leonard Wood Plan/Environmental Assessment Missouri.*
	Objective 6. Protect and manage threatened and endangered species and critical habitat in accordance with the Endangered Species Act, NEPA, AR 200-1, USFWS regulations and agreements, and other applicable laws or guidance from higher headquarters.
	Objective 7. Implement the INRMP within the assessment and design of Remedial Action Plans projects including those funded through the Comprehensive Environmental Response, Comprehension, and Liability Act (CERCLA). Assessments and actions should follow USFWS guidance: CERCLA Site Cleanup 63 related to imperiled species and the U.S. Environmental Protection Agency (USEPA) CERCLA Compliance with Other Laws Manual: Interim Final 65.
	Goal 3. Manage natural resources on FLW to assure good stewardship of public lands entrusted to the care of the Army.
	Objective 1. Use adaptive ecosystem management strategies to protect, conserve, and enhance native fauna, flora and associated habitats.
	Objective 2. Monitor and manage soils, water, vegetation, and wildlife on FLW with a consideration for all biological communities and human values associated with these resources.
	Objective 3. Give special management consideration to species listed by the state of Missouri in the natural resources management program.

	Objective 4. Allow harvest of human-valued (e.g., hunting, fishing, and foraging) when such products can be managed in a sustainable fashion without significant negative impacts.
	Objective 5. Ensure the FLW natural resources program is coordinated with installation organizations, other agencies, and conservation organizations with similar interests.
	Objective 6. Support professional enforcement of natural resources-related laws.
	Objective 7. Ensure environmental quality efforts and opportunities are met to the extent practical.
	Goal 4. Improve the quality of life of the FLW and surrounding communities through quality natural resources-based recreation opportunities.
	Objective 1. Provide high quality opportunities for hunting, fishing and other consumptive recreational activities within biological and recreational carrying capacities of the resources.
	Objective 2. Provide opportunities for non-consumptive outdoor recreation, such as picnicking, camping, nature study, etc.
	Objective 3. Provide conservation education opportunities.
	Objective 4. Use the iSportsman program to improve communication for recreational access on FLW.
4.4.2	**Ecosystem Management Coordination and Planning**
	Goal 1. Use coordinated planning to manage natural resources to sustain the military training capability.
	Objective 1. Coordinate natural resources planning with planning for the sustainment of the military mission.
	Goal 2. Promote and participate in regional planning for natural resources conservation at scales larger than the installation.
	Objective 2. Coordinate with and support regional planning and programs.
	Objective 3. Consider requirements and feasibility for using the encroachment buffer mechanism to provide encroachment protection and at the same time provide a mechanism for mitigation on FLW.
4.5.2	**Soils Management**
	Goal. Use soil parameters to manage military activities, protect soil stability, restore training lands, and conserve wildlife habitat.
	Objective 1 **.** Use soil inventory data to make decisions regarding land use, rehabilitation options, and wildlife habitat management options.
	Objective 2. Identify erosion control projects, develop appropriate repair designs, and implement repairs, as needed.
	Objective 3. Support implementation of the LRAM component of ITAM in DPTMS.
	Objective 4. Coordinate with DPW Roads and Grounds Section and ITAM in DPTMS personnel to ensure guidelines for construction and maintenance of roads and trails are followed.
	Objective 5. Ensure firebreaks are maintained annually according to the IWFMP.

	Objective 6. Ensure that construction sites incorporate sediment basins, silt fences, riprap, hay bales, etc., in drainages, depending on site characteristics, to minimize soil erosion from construction activities.
	Objective 7. Establish additional and maintain existing hardened low water crossings, as needed, and monitor the success of the Geo-web crossing of Roubidoux Creek.
	Objective 8. Coordinate with ITAM in DPTMS to ensure incorporation of best management practices when developing new training sites.
4.6.2	**Water Resources Management**
	Goal. Protect surface water quality at FLW.
	Objective 1. Control or eliminate runoff and erosion that could affect surface waters; to include the use of native plants, such as forbs, cover crops, or grasses, to reduce erosion.
	Objective 2. Ensure nonpoint source pollution abatement is considered in construction, installation operations, and land management plans and activities. Obtain appropriate permits for construction/land-disturbing activities and ensure that approved best management practices are implemented and maintained.
	Objective 3. Use site-specific water testing for natural resources programs, LRAM, and erosion control projects, as needed.
	Objective 4. Use water-related inventory data to make decisions regarding land use, restoration options, and fish and wildlife habitat management options.
4.7.2	**Forest Management**
	Goal. Manage the forest ecosystem to support the military mission, maintain ecosystem integrity, and produce forest products on a sustainable basis.
	Objective 1. Use ecosystem-focused management with emphasis on the military mission, enhancement of ecosystem integrity, production of commercial forest products, protection of watersheds, management of wildlife habitat, and provisions for outdoor recreation.
	Objective 2. Ensure that natural resources personnel are as free as possible of commercial influence to accomplish landscape management, compliance, and stewardship.
	Objective 3. Use UAM and EAM harvest strategies, as appropriate under suitable conditions to meet silviculture objectives.
	Objective 4. Perform forest inventories to provide updated information to guide decisions for management activities, contracting inventories if necessary.
	Objective 5. Produce commercial timber within biodiversity and ecosystem management directives.
	Objective 6. Ensure FLW projects requiring timber removal are reviewed and merchantable timber is reimbursed at fair market value.
	Objective 7. Evaluate each fiscal year's harvest plan to determine sustainable forestry across FLW's ownership.
	Objective 8. Continue the firewood program.

	Objective 9. Perform direct seeding reforestation efforts on applicable final rotation harvests, bare ground, disturbed ground, or otherwise unmanaged lands.
	Objective 10. Maintain forestry files and other related materials.
	Objective 11. Follow appropriate timber harvest reporting procedures.
	Objective 12. Alter harvest and forest management strategies, as appropriate, to accommodate new information and outside influences, based on Army policy and legal mandates, such as those that may be included in future biological assessments/opinions.
	Objective 13. Monitor insects, diseases and natural disasters affecting forests on FLW.
	Objective 14. Perform mid-rotational prescriptions such as TSI, Pre-commercial thinning, herbicide release, etc. to enhance forest growth and species composition when project funding is available.
4.8.1.2	**Habitat Management - Inventory and Monitoring**
	Goal. Inventory FLW floral resources and monitor species or communities that are indicators of ecosystem integrity, capability of lands to support military missions, status of sensitive species or communities, and other special interests.
	Objective 1. Update the flora inventory (including herbarium mounts) as new species are found during RTLA surveys, site-specific surveys, and other projects.
	Objective 2. Update fauna populations that influence habitat conditions as appropriate.
	Objective 3. Maintain the FLW plant and animal lists.
	Objective 4. Continue assist GIS personnel on updating vegetation and special status maps.
	Objective 5. Partner with other state and federal agencies to assist in habitat surveys.
4.8.2.2	**Habitat Management - Wetlands**
	Goal. Manage and delineate wetlands to ensure “no net loss” and potentially mitigate for environmental impacts.
	Objective 1. Maintain a database on wetland resources at FLW.
	Objective 2. Use site-specific surveys to evaluate wetland resources if potential wetland impacts are proposed.
	Objective 3. Use the environmental review process to protect wetlands.
	Objective 4. If necessary, refer projects with potential impacts to the Corps of Engineers Kansas City District to determine if jurisdictional wetlands are implicated, establish mitigation procedures, and/or obtain permits.
	Objective 5. Obtain the necessary state and federal Clean Water Act permits as required and implement best management practices as appropriate and/or required.
	Objective 6. Manage and protect wildlife that provide influential benefits to wetlands.

	Habitat Management - Terrestrial
	<u>Goal 1.</u> Manage wildlife species based on conservation needs, distribution and threats, population trends, importance of areas to species, potential for population and/or habitat management, and human interests.
	Objective 1. Consider wildlife species and habitat requirements when prescribing forest management practices.
	Objective 2. Preserve structural features, such as cavity trees, unless they present a hazard.
	Objective 3. Annually plant cover crops in areas accessible for handicapped hunters.
	Objective 4. Maintain and monitor established nesting structures, and if possible install additional structures as part of local Scout group and community outreach activities.
	Objective 5. Prepare and submit the annual prescribed burning plan to the Commander.
	Objective 6. Use prescribed burning as a major wildlife habitat management tool to reflect a landscape management perspective on FLW.
4.8.3.2	***Objective 7.*** Maintain permanent firebreaks through annual mowing, tilling, and planting.
	Objective 8. Develop additional impoundments.
	Objective 9. Complete biological and cultural inventories of caves and adopt the appropriate recommendations developed from recent inventories.
	Objective 10. Conduct management activities that align with IPMP, such as animal or pest damage control.
	Objective 11. Conduct public outreach through community projects, media sources, and event venues.
	<u>Goal 2.</u> Collect terrestrial habitat information and conduct management efforts through interagency coordination.
	Objective 12. Monitor, research, survey, and maintain records of terrestrial habitats and the associated species.
	Objective 13. Disseminate collected field data and reports to the appropriate agencies and/or stakeholders.
	Objective 14. Maintain communication and coordination with state and federal agencies and other stakeholders on applicable terrestrial habitat management issues and activities.
	Habitat Management - Aquatic
	<u>Goal.</u> Maintain and enhance the natural diversity of aquatic communities on FLW.
	Objective 1. Continue to manage Stone Mill Spring under agreements (in review) with U.S. Forest Service and coordination with MDC.
	Objective 2. Develop additional fishing ponds following the preferred design for fishing ponds on FLW.
4.8.4.2	***Objective 3.*** Control aquatic weeds following an integrated approach using chemical, biological, and cultural methods as appropriate for each impoundment as determined on a case-by-case basis.

	Objective 4. If herbicides are used, ensure that application of registered herbicides are at the specified rate and by licensed applicators in accordance with the IPMP.
	Objective 5. Maintain and repair impoundments as necessary for the long-term preservation and to encourage recreation use as applicable.
	Objective 6. Incorporate fish structure at the time of pond construction and maintain and replace structure as needed in existing impoundments.
	Objective 7. Partner with state and federal agencies for fish stocking; as applicable.
4.9.3	**Fish and Wildlife Management**
	<u>Goal 1.</u> Inventory FLW native faunal communities and regularly monitor indicator species for ecosystem integrity and special interests.
	Objective 1. Collect white-tailed deer and turkey harvest data through MDC tele-check procedures and iSportsman data.
	Objective 2. Conduct the annual furbearer scent station surveys and monitor aquatic furbearer damage complaints.
	Objective 3. Census waterfowl in conjunction with the annual bald eagle survey.
	Objective 4. Construct additional nesting structures for resident and migratory birds; maintain existing structures.
	Objective 5. Monitor neotropical migratory birds and send updated information to the DoD Partners in Flight Program.
	Objective 6. Conduct annual breeding birds survey.
	Objective 7. Verify great blue heron rookeries remain active.
	Objective 8. Frequently monitor native fish communities using appropriate sampling methods to detect community changes and the presence/absence of species of interest (e.g., SOCC and ESA candidate species).
	Objective 9. Conduct annual hard mast studies to predict food availability for deer, turkey, and feral hogs.
	Objective 10. Seek partnership agreements with state, federal, and stakeholders to inventory and conduct surveys as applicable.
	<u>Goal 2.</u> Manage fish and wildlife populations to maintain optimal populations in accordance with species priorities, population ecology, population health considerations, and habitat capacities.
	Objective 12. Use regulated harvest during established seasons as the primary population management tool for fish and wildlife resources to maintain populations at or slightly below carrying capacities.
	Objective 13. Ensure coordination occurs between the NRB and the DPTMS Scheduling Branch to provide the maximum recreational opportunity while avoiding impacts to training requirements on FLW.
	Objective 14. Manage small impoundment fisheries to sustain populations for recreational angling and non-commercial harvest.
	Objective 15. Annually stock fish species in small impoundments at determined rates based on relative abundance, harvest, and outreach events.
	Objective 16. Coordinate with MDC and USFWS to continue annual trout stocking and general maintenance at Stone Mill Spring Recreation Area.

	Objective 17. Systematically locate, capture, and dispose of feral hogs in accordance with the 2017 Memorandum of Understanding with USDA and the 2017 Missouri Feral Hog Elimination Partnership, with an ultimate goal of complete removal. Request assistance from MDC as needed.
	Objective 18. Protect all species listed by any federal or state law from illegal harvest.
	Objective 19. Seek funding for additional stationary (game) cameras.
	Goal 3. Comply with Executive Order 13443, Facilitation of the Hunting Heritage and Wildlife Conservation.
	Objective 20. Implement management tactics and opportunities that "expand and enhance hunting opportunities for the public."
	Objective 21. Consider programs and recommendations of comprehensive planning efforts such as State Wildlife Action Plans.
	Objective 22. Use the iSportsman web-based tool to assist in fish and wildlife management; record data as applicable.
	Goal 4. Promote recreational fishing to align with DFMWR benefits.
	Objective 23. Conduct public outreach and notifications regarding fishing derbies.
	Objective 24. Keep DFMWR informed on fishing opportunities, speices present, and stocking if available on the installation and the LORA site.
	Objective 25. Promote recreational fishing and access to the public and residents on FLW on the installation and the LORA site.
4.10.3	**Special Status Species Management**
	Goal 1. At a minimum, sustain residential or migratory populations of endangered, threatened, or candidate species and their habitats at current levels, with the long-term goal of conserving listed species and their habitats in accord with specific Recovery Plans and the Endangered Species Act.
	Objective 1. Implement requirements of the Endangered Species Act.
	Objective 2. Update the INRMP to reflect current changes for protected species and implement management requirements therein.
	Objective 3. Implement reasonable and prudent measures and conservation measures specified in biological studies by the USFWS (USFWS 1996, 1997) and current federal guidelines under the Endangered Species Act, as well as the 2015 IMCOM northern long-eared bat biological evaluation conservation measures until specific guidelines are determined from 2016-2017 surveys.
	Objective 4. If federal-listed species are found on FLW or if species already known on FLW become federal-listed, FLW will consult with the USFWS and develop an inventory/monitoring program and management plan for these species.
	Objective 5. Monitor bat species as needed using acoustic or other modern surveying equipment.
	Objective 6. Monitor spectaclecase mussel and hellbender populations and habitat conditions.
	Objective 7. Continue water quality monitoring and management (Section 4.6.2).

	Objective 8. Consider aquatic organism passage planning in applicable construction projects.
	Objective 9. Conduct case-by-case consultation (Section 7 of Endangered Species Act) with USFWS on activities that may impact eagles, migratory birds, and/or listed federally protected species.
	Objective 10. Implement measures to improve stream stabilization. Specifically, in areas with known established mussel beds.
	Goal 2. Protect and enhance habitat conditions for eagles.
	Objective 11. Upkeep posted signs, ensure fight restrictions are adhered to, and monitor/survey eagle populations as well as nest activity.
	Objective 12. Protect riparian forests and foraging habitat; to include fisheries.
	Objective 13. Promote implementation of new electric telephone pole guidelines and awareness for new construction projects.
4.10.5	**Other Sensitive Species Management Practices**
	Goal. Monitor and manage nonfederal-listed, special status plant and animal species, and migratory birds on FLW to the degree possible with available funding.
	Objective 1. Consider state and federally protected species, and migratory birds to include eagles, in all FLW actions.
	Objective 2. Seek guidance and concurrence with USFWS on federally listed species management activities that are based on BA's and/or opinions.
	Objective 3. Whenever possible, use actions designed for federal-listed species to protect or manage other sensitive species.
	Objective 4. Avoid, minimize, and protect special status species on FLW.
	Objective 5. Follow agreements and MOUs with the USFWS.
	Objective 6. Provide guidance to contractor and other entities working on FLW lands to avoid removal of active bird nests. Comment on scope of work plans and request contact with NRB if unavoidable as appropriate.
	Objective 7. Seek partnership agreements with state, federal, and stakeholders to assist with sensitive species management such as survey and habitat efforts as applicable.
4.12.2	**Pest Management**
	Goal 1. Control plant and animal species that affect natural resources management (*e.g.* , reduce ecosystem functionality, displace native species) or directly affect the military mission on FLW.
	Objective 1. Maintain an updated Installation Pest Management Plan annually.
	Objective 2 . Emphasize IPMP techniques to reduce the use of pesticides.
	Objective 3. Ensure pesticide applicators are fully certified.
	Objective 4. Control nuisance wildlife as needed to protect facilities, infrastructure, and to maintain the military mission.
	Objective 5. Obtain appropriate permits for the control of nuisance wildlife.
	Objective 6. Prevent the introduction of and control invasive species, per Executive Order 13112, *Invasive Species* .

	Objective 7. Seek partnership agreements with state, federal, and stakeholders in pest management efforts as applicable.
	Goal 2. Insure that invasive species are not introduced onto FLW or the LORA site from the receipt of military and installation support equipment, to included civilian vehicles.
	Objective 8. Provide inspection recommendation, guidelines, and checklists to FLW personnel.
	Objective 9. Inquire about wash stations, temperatures, and chemicals if applicable.
	Objective 10. Public outreach and education about invasive species, to include avenues of introduction (e.g. firewood, plantings, transportation on clothes and vehicles)
4.13.2	**Cantonment Area Management**
	Goal. Provide support to maintain an aesthetically pleasing cantonment landscape that preserves natural ecosystem functions as much as possible.
	Objective 1. Provide professional advice regarding the use of native species and pollinators to assist the grounds landscaping and maintenance program.
	Objective 2. Manage natural resources occurring within the cantonment area to meet appropriate natural resources objectives.
	Objective 3. Implement requirements listed in the DoD Policy to use Pollinator-Friendly Management Precriptions (2014) and MOU between DoD and Pollinator Partnership (2015).
	Objective 4. Encourage wildlife, such as songbirds, to utilize the cantonment area for habitat, while discouraging species that could problematic pests for the installation.
	Objective 5. Encourage cantonment area whitetail deer hunts to manage populations and reduce automobile accidents.
	Fire Management
	Goal 1. Prevent and suppress wildfires to maintain ecosystem biodiversity and functionality.
	Objective 1. Provide natural/cultural resources management-related recommendations relative to fire suppression activities to FLW Fire Department personnel.
	Objective 2. Respond to wildfires as soon as possible and begin immediate suppression, consistent with safety requirements.
	Objective 3. Maintain the FLW prescribed burn plan to maintain training mission capabilities and enhance ecosystem biodiversity and functionality on FLW.
	Goal 2. Conduct fire management according to the IWFMP.
	Objective 4. Conduct prescribed burns annually (whenever possible) on as much of the 2,328 acres as possible of land designated Fuel Priority.
	Objective 5. Conduct prescribed burns each year on approximately one-third of the 2,443 acres designated Fuel Non-Priority utilizing a 3-year fire rotation; burn more frequently whenever possible or needed.

4.14.2	***Objective 6.*** When or if possible to safely do so, conduct prescribed burns on any of the 2,668 acres of burn area currently not being managed with fire due to UXO, lack of firebreaks, and other restrictions.
	Objective 7. Annually maintain approximately 34 miles of firebreaks to provide wildfire control and permit prescribed fire on areas managed for fuel.
	Objective 8. DPW and Range Maintenance maintain roads within and adjacent to range impact areas in a fuel-free state (vegetation not growing in the road surface and tall grass mowed on road shoulders, at least on the side from which wildland fires may approach).
	Objective 9. Seek resolutions for the lack of sufficient firebreaks on ranges, which prevents adequate containment of wildfires and prescribed fires.
	Objective 10. Monitor and report changes to fire danger classifications.
	Objective 11. Provide timely reports to Range Operations on changes in firebreak conditions and “pre-burned” status of ranges and training areas.
	Objective 12. Conduct prescribed burns each year on approximately one-third of the 1,246 acres designated to maintain as open (early successional vegetation) training lands utilizing a 3-year fire rotation.
	Objective 13. As needed, conduct prescribed burns on the 244 acres designated for range cleanup on Cannon Range (approximately every 5 years).
	Objective 14. Maintain approximately 9 miles of firebreaks as needed to carry out prescribed burning for maintaining open training lands, tilling the firebreaks in the year prescribed burning is scheduled.
	Objective 15. Conduct prescribed burns each year on approximately one-third of the 1,016 acres designated for habitat management utilizing a 3-year fire rotation.
	Objective 16. Every other year, conduct prescribed burns on 12 acres in the cantonment.
	Objective 17. Conduct prescribed burns annually (if determined necessary) on as much of the 104 acres as possible designated for golf course Pest Management.
	Objective 18. Maintain approximately 28.0 miles of firebreaks as needed to carry out prescribed burning for maintaining vegetation and landscape characteristics, tilling the firebreaks in the year prescribed burning is scheduled.
	Climate Change Consideration
	Goal 1. Follow current federal guidelines and regulations as well as current science associated to climate change.
	Objective 1. Adhere to DoD Directive 4715.21 *Climate Change Adaptation and Resilience* .
	Objective 2. Adhere to Executive Order 13653 *Preparing the United States for the Impacts of Climate Change.*
	Objective 3. To the extent practical and within the bounds of state and federal regulations conduct management activities that reflect current science released by the IPCC.

4.15.1	**Goal 2.** Use adaptive management to compensate for changes in climatic conditions.
	Objective 4. Conduct more frequent surveys and monitoring of natural resources if significant climatic conditions arise.
	Objective 5. Continue to reprioritize natural resource management based on changing conditions; such as sensitive areas and endangered species.
	Objective 6. Adjust prescribed burn plans if wildfires become an increased risk.
	Objective 7. Consult with agencies and stakeholders on major changes in adaptive management.
	Objective 8. Use more drought tolerant native plant species as possible.
	Objective 9. Use less non-renewable fuels.
	ITAM Program
	Goal 1. Provide maneuver land capability to support the Installation's training mission and requirements.
	Objective 1. Ensure no net loss in the capability of Military Installation land to support the military mission of the Installation.
	Objective 2. Ensure sustained accessibility, capability and capacity of maneuver training land.
	Objective 3. Quantify training land capabilities and capacity to support maneuver training.
	Objective 4. Monitor training land conditions to identify land maintenance and repair requirements.
	Objective 5. Maintain existing training land capabilities by conducting land reconfiguration projects to support validated mission requirements.
	Objective 6. Improve existing training land capacity by conducting land maintenance and repair projects to support existing and future mission needs.
5.1.1	**Goal 2.** Provide decision support capability based on the integration of training requirements, land conditions, maneuver ranges, and land management requirements.
	Objective 7. Provide geospatial capabilities to support range operations, range modernization, the ITAM Program, and long-term planning in the range and training area complex.
	Objective 8. Promote awareness of mission land capabilities and management issues to avoid unnecessary maneuver damage and environmental impacts.
	Objective 9. 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.
	Objective 10. Ensure mission needs are considered in cultural and environmental plans (ICRMP, INRMP, annual burn plan, and timber harvest plan), facilities planning, and that training land capabilities and constraints are considered in mission planning.

5.1.2	**ITAM & Geographic Information Systems**
	Goal. Maintain communications between ITAM in DPTMS program manager, GIS support staff, and DPW to align ITAM in DPTMS projects with INRMP goals and objectives.
	Objective 1. Maintain good working relationships with ITAM in DPTMS program managers.
	Objective 2. Schedule regular meetings regarding upcoming ITAM in DPTMS and natural resource projects.
	Objective 3. Provide ITAM in DPTMS program manager with updated federal and state environmental resource guidance and regulations.
	Objective 4. Provide ITAM in DPTMS program manager with updated installation natural resource information, such as those regarding federally protected species.
5.2.2	**Natural Resources Enforcement**
	Goal. Assure legal compliance of military and civilian activities with regard to natural and cultural resources on FLW.
	Objective 1. Conduct the Conservation Law Enforcement Program as directed in DoDI 5525.17.
	Objective 2. Maintain a law enforcement program for military and civilian activities that relates to natural and cultural resources protection on FLW.
	Objective 3. Coordinate enforcement activities with other agencies, particularly MDC, USDA, and the USFWS.
	Objective 4. Provide NRB support, as appropriate, to Law Enforcement Command, Game Warden Section regarding natural/cultural resources law enforcement activities on FLW.
	Objective 5. Provide quality basic and annual refresher training to FLW game wardens.
5.3.2	**Conservation Awareness**
	Goal. Provide information to FLW and external interested communities regarding natural resources and associated management programs at FLW.
	Objective 1. Improve the general program knowledge of all persons associated with the NRB, particularly those who come into regular contact with interested persons.
	Objective 2. Provide prepared talks, dependent upon personnel and time availability. Whenever possible, use these opportunities to explain contemporary natural resources issues and management.
	Objective 3. Use newspapers, television, radio, and the internet to inform the FLW and surrounding community of matters important to the FLW natural and cultural resources program.
	Objective 4. Participate in activities, such as Earth Week and youth fishing derbies, to promote the NRB image and/or programs.
	Objective 5. Pursue interactions between FLW and surrounding communities and professional organizations to exchange information and knowledge on environmental subjects.
	Objective 6. Investigate the development of the access points to enhance watchable wildlife and awareness opportunities on FLW.

	Objective 7. Conduct community outreach projects such as planting native tree and flowers, food plots for handicapped hunters, or removal of invasive species.
5.4.2	**Outdoor Recreation**
	Goal. Manage outdoor recreation to provide safe and pleasing outdoor experiences consistent with the needs of the FLW military mission while maintaining ecosystem integrity and function.
	Objective 1. Support the development of facilities that improve use and enjoyment of fishing, hunting, and other natural resources-based recreation.
	Objective 2. Support the FLW policy for the designated off-road vehicle area.
	Objective 3. Work with DFMWR for outdoor recreational opportunities.
5.5.2	**Cultural Resources Protection**
	Goal 1. Implement this INRMP in a manner consistent with the protection of cultural resources at FLW.
	Goal 2. Comply with all laws, regulations, and Army guidance regarding cultural resources on FLW.
	Objective 1. Review ICRMP updates.
	Objective 2. Implement provisions of the ICRMP that relate to natural resources management.
	Objective 3. Consider natural resources projects when planning cultural resources surveys and use results of cultural resources surveys to plan natural resources projects.
	Objective 4. Avoid or mitigate adverse effects to cultural resources from natural resources management through proper review and planning. Submit proposed projects, as part of NEPA review, to the FLW Cultural Resources Manager for approval, determinations of effect, and Section 106 consultation, as necessary.
	Objective 5. Take the following protective measures upon discovery of sites.
	• Cease ground disturbing activities immediately and report to the FLW Cultural Resources Manager upon discovery of potential cultural deposits;
	• Consider alternatives for moving the project to another location; and
	• If the site or deposits are determined by the FLW Cultural Resources to be of no cultural significance, do no further investigation and resume the project. Protect the site until such time that it is determined not eligible for the NRHP if remains are determined to be of cultural significance.
	Objective 6. Use natural resources techniques and projects to protect cultural resources sites.
	Objective 7. Conduct tribal consultations as necessary.
	Objective 8. Allow access to members of tribes associated with sites and resources that are of religious importance, or that are important to the continuance of their culture.
	Implementation - Personnel
	Goal 1. Provide staffing of natural resource management professionals required to effectively manage natural resources on FLW (AR 200-1).

7.2.1.2	***Objective 1.*** Use funding and available budge to the greatest extent possible to support INRMP and natural resource managers.
	Objective 2. Provide staffing for the FLW natural resources program to effectively implement this INRMP.
	Goal 2. Provide training to natural resources personnel implementing this INRMP.
	Objective 3. Encourage NRB personnel to join professional societies and their state/regional chapters as well as be active in them. Funding support for these memberships or certifications would be provided based on availability.
	Objective 4. Send at least one person to each of the annual workshops or professional conferences discussed above.
	Objective 5. Evaluate other conferences/workshops for their usefulness as training tools, and send personnel to those most justified, based on current training needs and those most related to FLW activities.
	Objective 6. Actively participate in training sessions to disseminate knowledge learned at FLW.
	Goal 3. Coordinate with state and federal agencies, and other stakeholders.
	Objective 7. Maintain close relationships with state and federal agencies through approved social media, meetings, and natural resource related programs.
	Objective 8. Work with colleges and universities and other related stakeholders to further support natural resources of FLW.
7.2.2.2	**Implementation - External Assistance**
	Goal. Provide external specialized skills, personnel, and resources to support the FLW natural resources program.
	Objective 1. Implement external support projects, which are described in more detail in appropriate sections of this INRMP.
	Objective 2. Use state and federal agencies, particularly INRMP signatory partners, the USFWS and MDC to assist with implementation of this INRMP.
	Objective 3. Use universities, volunteers, and other interested persons and organizations to assist with implementation of this INRMP.
	Objective 4. Use contractors to assist with implementation of this INRMP.
7.3.2	**Data Storage, Retrieval, and Analysis**
	Goal. Store, analyze, and use data in an efficient, cost-effective manner.
	Objective 1. Upgrade microcomputer hardware and software as needed.
	Objective 2. Develop or obtain databases needed to support FLW natural and cultural resources programs.
	Objective 3. Create user-friendly interfaces to enable a wider use of GIS databases specific to needs of installation users.
	Objective 4. Regularly replace or upgrade GIS and imagery hardware and software to maintain the capability to use developing GIS technology.
	Objective 5. Require all spatially related data be stored on, or accessible to, the GIS.
	Objective 6. Use remote imagery for improved decision-making for military activities, environmental management, and natural and cultural resources management and protection.

	Objective 7. With available funding, purchase and use stationary cameras to assist in natural resources management.

Appendix B
NEPA Documentation
[placeholder for checklist and REC]

Appendix C
Cooperating Agency Agreements

Items of Cooperation between the U.S. Fish and Wildlife Service, Missouri Department of Conservation, and Fort Leonard Wood, Missouri

PURPOSE: The purpose of this document is to specifically list items to be provided by the Missouri Department of Conservation (MDC), U.S. Fish and Wildlife Service (USFWS), and Fort Leonard Wood (FLW) for cooperative implementation of the FLW Integrated Natural Resources Management Plan. Items not specifically listed will generally be the responsibility of FLW unless the other agencies agree to assist with their implementation.

AUTHORITY: In accordance with the authority contained in Title 10, U.S. Code, Section 2671, and Title 16, U.S. Code, Section 670a, the Department of Defense, Department of Interior, and the state of Missouri, through their duly designated representatives whose signatures appear on the FLW Integrated Natural Resources Management Plan (INRMP), approve the INRMP and the below specific items of cooperation among the three agencies.

MUTUAL AGREEMENT:

- Persons hunting, trapping, or fishing the lands or waters of FLW shall be required to obtain special FLW hunting or fishing licenses unless exempt by FLW regulations. Funds derived from the sale of these licenses will be used exclusively for the implementation of the fish and wildlife portions of the FLW INRMP in accordance with Army regulations and the Sikes Act. Fees charged shall be established by the installation in accordance with Army regulations. Persons guilty of violating the requirement for these special licenses may be prosecuted under 10 USC 2671(c).
- Persons hunting, trapping, or fishing the lands of FLW must purchase state licenses, tags, and stamps as required by MDC, unless exempt by MDC regulations. The MDC agrees that military personnel of the National Guard/Army Reserve while on active duty or those on temporary duty status, if the period of time stationed at FLW exceeds thirty days, may purchase hunting, trapping, and fishing licenses at resident prices.
- A federal waterfowl stamp is required for hunting waterfowl, as prescribed by federal laws.
- All hunting, trapping, and fishing on FLW will be in accordance with federal and state fish and game laws.
- Representatives of the MDC and the USFWS will be admitted to the installation at reasonable times, subject to requirements of military necessity and security. Such personnel may use U.S. Army transportation on a non-reimbursable basis, to include aircraft, for wildlife related functions on FLW provided such transportation is available without detriment to the military mission.
- The MDC and USFWS shall furnish technical assistance for development and implementation of professionally sound natural resources programs on FLW provided funding for such support is available.
- FLW shall furnish assistance and facilities to the MDC and/or USFWS for mutually agreed upon natural resources research projects.
- No exotic species of fish or wildlife will be introduced on FLW lands without prior written approval of the Army, MDC, and the USFWS.
- The MDC shall establish season and bag limits for harvest of game species on FLW. FLW may make special requests for such regulations according to procedures

established by MDC. Requests for regulations not in accordance with those established statewide will be based on data specific to FLW or designed to meet FLW's training schedules.

- Hunting, trapping, and fishing on FLW will be authorized and controlled by the installation commander in accordance with locally published installation regulations promulgated in compliance with applicable federal and state laws, Army regulations, military requirements, and the INRMP.
- Public access for hunting, trapping, and fishing is approved under a system of controls established by FLW in cooperation with MDC. Civilians will be considered on an equal basis with military and Army civilian employees for hunting, trapping, and fishing permits.
- Hunting, trapping, and fishing will be allowed only in areas where there is no conflict with military training activities and no unreasonable safety hazard to participants, military personnel and dependents, or Army civilian employees. Certain areas will be closed to hunting, trapping, and fishing, including, but not limited to, impact areas containing unexploded ordnance.
- All areas of FLW are under exclusive federal jurisdiction where state of Missouri laws relative to game and fish are operative only as federal law and are enforceable only by federal officials.
- FLW agrees to cooperate with USFWS and MDC for management of threatened or endangered species residing on the installation. Such efforts will be in compliance with federal and state laws and applicable Army regulations.
- The MDC and the USFWS will provide technical and professional advice on all matters concerning wildlife and fish management when necessary.
- FLW has the option to directly transfer funds to the MDC and USFWS for implementation of this INRMP.
- It is understood that implementation of this INRMP requires certain latitude with regard to professional decisions. However, FLW agrees that any land use change, which significantly impacts natural resources must include modification of this INRMP in addition to any other environmental compliance requirements.

LIMITATIONS:

The military mission of FLW supersedes natural resources management and associated recreational activities, and such activities must be compatible with the military mission. However, where there is conflict between the military mission and provisions of the Endangered Species Act, the Sikes Act, or any other law associated with natural resources conservation, such conflicts will be resolved according to statutory requirements.

REQUIRED REFERENCES:

- Nothing contained in this agreement shall modify any rights granted by treaty to any Native American tribe or to members thereof.
- The possession of a special permit for hunting migratory game birds will not relieve the permittees of the requirements of the Migratory Bird Stamp Act, as amended.
- This INRMP is a Federal Facilities Compliance Agreement.
- As required by the Sikes Act, the following agreements are made:

(1) This FLW INRMP is the planning document required by the Sikes Act, as amended. This INRMP contains those items specifically required by law. In the event the Sikes Act is amended after this INRMP is signed, this plan will be amended to conform with new requirements within the Sikes Act, if needed.

(2) This plan will be reviewed by the MDC, USFWS, and FLW on a regular basis, but not less often than every five years.

(3) No land or forest products from land on FLW will be sold under Section 2665 (a) or (b), Title 10 USC and no land will be leased on FLW under Section 2667 of such Title 10 unless the effects of such sales or leases are compatible with the purposes of the INRMP.

(4) With regard to implementation and enforcement of the FLW INRMP, neither Office of Management and Budget Circular A-76 nor any successor circular thereto applies to the procurement of services that are necessary for that implementation and enforcement, and priority shall be given to the entering into of contracts for the procurement of such implementation and enforcement services with federal and state agencies having responsibility for the conservation or management of fish or wildlife.

(5) The FLW INRMP is not, nor will be treated as, a cooperative agreement to which Chapter 63 of Title 31, United States Code applies.

(6) This INRMP will become effective upon the date subscribed by the last signature and shall continue in full force for a period of five years or until terminated by written notice to the other parties by any of the parties signing this agreement. This agreement may be amended or revised by agreement between the parties hereto. Action to amend or revise may originate with any of the other participating agencies.

Appendix D
Migratory Birds List

Common Name	Scientific Name
Acadian flycatcher	*Empidonax virescens*
Alder flycatcher	*Empidonax alnorum*
American bittern	*Botaurus lentiginosus*
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*
American redstart	*Setophaga ruticilla*
American robin	*Turdus migratorius*
American tree sparrow	*Spizella arborea*
American white pelican	*Pelecanus erythrorhynchos*
American wigeon	*Anas americana*
American woodcock	*Scolopax minor*
Bald eagle	*Haliaeetus leucocephalus*
Baltimore oriole	*Icterus galbula*
Barn owl	*Tyto alba*
Barn swallow	*Hirundo rustica*
Barred owl	*Strix varia*
Bay-breasted warbler	*Dendroica castanea*
Bell's vireo	*Vireo bellii*
Belted kingfisher	*Ceryle alcyon*
Bewick's wren	*Thryomanes bewickii*
Black Vulture	*Coragypus atratus*
Black-and-white warbler	*Mniotilta varia*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Blackburnian warbler	*Dendroica fusca*
Black-capped chickadee	*Parus atricapillus*
Black-crowned night-heron	*Nycticorax nycticorax*
Blackpoll warbler	*Dendroica striata*
Black-throated green warbler	*Dendroica virens*
Blue grosbeak	*Guiraca caerulea*
Blue jay	*Cyano cittacristata*
Blue-gray gnatcatcher	*Polioptila caerulea*
Blue-winged teal	*Anas discors*
Blue-winged warbler	*Vermivora pinus*
Bobolink	*Dolichonyx oryzivorus*
Brewer's blackbird	*Euphagus cyanocephalus*
Broad-winged hawk	*Buteo platypterus*
Brown creeper	*Certhia americana*
Brown thrasher	*Toxostoma rufum*
Brown-headed cowbird	*Molothrus ater*
Bufflehead	*Bucephala albeola*
Canada goose	*Branta canadensis*
Canada warbler	*Wilsonia canadensis*
Canvasback	*Aythya valisineria*
Carolina chickadee	*Parus,carolinensis*
Carolina wren	*Thryothorus ludovicianus*
Caspian tern	*Sterna caspia*
Cattle egret	*Bubulcus ibis*
Cedar waxwing	*Bombycilla cedrorum*
Cerulean warbler	*Dendroica cerulea*
Chestnut-sided warbler	*Dendroica pensylvanica*
Chimney swift	*Chaetura pelagica*
Chipping sparrow	*Spizella passerina*
Chuck-will's-widow	*Caprimulgus carolinensis*
Cliff swallow	*Hirundo pyrrhonota*
Common goldeneye	*Bucephala clangula*
Common grackle	*Quiscalus quiscula*
Common loon	*Gavia immer*
Common merganser	*Mergus merganser*
Common Moorhen	*Gallinula chloropus*
Common nighthawk	*Chordeiles minor*
Common pigeon	*Columba livia*
Common snipe	*Gallinago gallinago*
Common yellowthroat	*Geothlypis trichas*
Connecticut warbler	*Oporornis agilis*
Cooper's hawk	*Accipiter cooperii*
Dark-eyed junco	*Junco hyemalis*
Dickcissel	*Spiza americana*
Double-crested cormorant	*Phalacrocorax auritus*
Downy woodpecker	*Picoides pubescens*
Eastern bluebird	*Sialia sialis*
Eastern kingbird	*Tyrannus tyrannus*
Eastern meadowlark	*Sturnella magna*
Eastern phoebe	*Sayornis phoebe*
Eastern screech-owl	*Otus asio*
Eastern wood-pewee	*Contopus virens*

Common Name	Scientific Name
Eurasian collared dove	*Streptopelia decaocto*
European starling	*Sturnus vulgaris*
Evening grosbeak	*Coccothraustes vespertinus*
Field sparrow	*Spizella pusilla*
Fish crow	*Corvus ossifragus*
Forster's tern	*Sterna forsteri*
Fox sparrow	*Passerella iliaca*
Gadwall	*Anas strepera*
Golden eagle	*Aquila chrysaetos*
Golden-crowned kinglet	*Regulus satrapa*
Golden-winged warbler	*Vermivora chrysoptera*
Grasshopper sparrow	*Ammodramus savannarum*
Gray catbird	*Dumetella carolinensis*
Gray-cheeked thrush	*Catharus minimus*
Great blue heron	*Ardea herodias*
Great crested flycatcher	*Myiarchus crinitus*
Great egret	*Casmerodius albus*
Great horned owl	*Bubo virginianus*
Greater roadrunner	*Geococcyx californianus*
Greater White-fronted Goose	*Anser albifrons*
Greater yellowlegs	*Tringa melanoleuca*
Green heron	*Butorides virescens*
Green-winged teal	*Anas crecca*
Hairy woodpecker	*Picoides villosus*
Henslow's sparrow	*Ammodramous henslowii*
Hermit thrush	*Catharus guttatus*
Herring gull	*Larus argentatus*
Hooded merganser	*Lophodytes cucullatus*
Hooded warbler	*Wilsonia citrina*
Horned grebe	*Podiceps auritus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
House sparrow	*Passera domesticus*
House wren	*Troglodytes aedon*
Indigo bunting	*Passerina cyanea*
Kentucky warbler	*Oporornis formosus*

Common Name	Scientific Name
Killdeer	*Charadrius vociferus*
Lark sparrow	*Chondestes grammacus*
Laughing gull	*Larus atricilla*
Least flycatcher	*Empidonax minimus*
Least sandpiper	*Calidris minutilla*
Lesser scaup	*Aythya affinis*
Lesser yellowlegs	*Tringa flavipes*
Little blue heron	*Egretta caerulea*
Loggerhead shrike	*Lanius ludovicianus*
Long-eared owl	*Asio otus*
Louisiana waterthrush	*Seiurus motacilla*
Magnolia warbler	*Dendroica magnolia*
Mallard	*Anas platyrhynchos*
Marsh Wren	*Cistothorous palustris*
Merlin	*Falco columbarius*
Mourning dove	*Zenaida macroura*
Mourning warbler	*Oporornis philadelphia*
Nashville warbler	*Vermivora ruficapilla*
Northern bobwhite	*Colinus virginianus*
Northern cardinal	*Cardinalis cardinalis*
Northern flicker	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Northern mockingbird	*Mimus polyglottos*
Northern parula	*Parula americana*
Northern pintail	*Anas acuta*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
northern saw-whet owl	*Aegolius acadicus*
Northern shoveler	*Anas clypeata*
Northern waterthrush	*Seiurus noveboracensis*
Orange-crowned warbler	*Vermivora celata*
Orchard oriole	*Icterus spurius*
Osprey	*Pandion haliaetus*
Ovenbird	*Seiurus aurocapillus*
Palm warbler	*Dendroica palmarum*
Philadelphia vireo	*Vireo philadelphicus*
Pied-billed grebe	*Podilymbu podiceps*
Pileated woodpecker	*Dryocopus pileatus*
Pine warbler	*Dendroica pinus*
Prairie warbler	*Dendroica discolor*
Prothonotary warbler	*Protonotaria citrea*

Common Name	Scientific Name
Purple finch	*Carpodacus purpureus*
Purple martin	*Progne subis*
Red-bellied woodpecker	*Melanerpes carolinus*
Red-breasted nuthatch	*Sitta canadensis*
Red-eyed vireo	*Vireo olivaceus*
Redhead	*Aythya americana*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Red-shouldered hawk	*Buteo lineatus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-necked duck	*Aythya collaris*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Ruby-crowned kinglet	*Regulus calendula*
Ruby-throated hummingbird	*Archilochus colubris*
Ruddy duck	*Oxyura jamaicensis*
Ruffed grouse	*Bonasa umbellus*
Rufous-sided towhee	*Pipilo erythrophthalmus*
sandhill crane	*Grus canadensis*
Savannah sparrow	*Passerculus sandwichensis*
Scarlet tanager	*Piranga olivacea*
Scissor-tailed flycatcher	*Tyrannus forficatus*
Semipalmated sandpiper	*Calidris pusilla*
Sharp-shinned hawk	*Accipiter striatus*
Short-eared owl	*Asio flammeus*
Snow goose	*Chen caerulescens*
Snowy egret	*Egretta thula*
Solitary vireo	*Vireo solitarius*
Song sparrow	*Melospiza melodia*
Sora	*Porzana carolina*
Spotted sandpiper	*Actitis macularia*
Summer tanager	*Piranga rubra*
Swainson's thrush	*Catharus ustulatus*
Tennessee warbler	*Vermivora peregrina*
Tree swallow	*Tachycineta bicolor*
Tufted titmouse	*Parus bicolor*
Tundra swan	*Cygnus columbianus*
Turkey vulture	*Cathartes aura*
Veery	*Catharus fuscescens*
Vesper sparrow	*Pooecetes gramineus*
Virginia rail	*Rallus limicola*
Warbling vireo	*Vireo gilvus*
Whip-poor-will	*Caprimulgus vociferous*
White-breasted nuthatch	*Sitta carolinensis*
White-crowned sparrow	*Zonotrichia leucophrys*
White-eyed vireo	*Vireo griseus*
White-throated sparrow	*Zonotrichia albicollis*
Wild turkey	*Meleagris gallopavo*
Willet	*Catoptrophorus semipalmatis*
Willow flycatcher	*Empidonax traillii*
Wilson's phalarope	*Phalaropus tricolor*
Wilson's warbler	*Wilsonia pusilla*
Winter wren	*Troglodytes troglodytes*
Wood duck	*Aix sponsa*
Wood thrush	*Hylocichla mustelina*
Worm-eating warbler	*Helmitheros vermivorus*
Yellow warbler	*Dendroica petechia*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Yellow-billed cuckoo	*Coccyzus americanus*
Yellow-breasted chat	*Icteria virens*
Yellow-crowned night-heron	*Nycticorax violaceus*
Yellow-rumped warbler	*Dendroica coronata*
Yellow-throated vireo	*Vireo flavifrons*