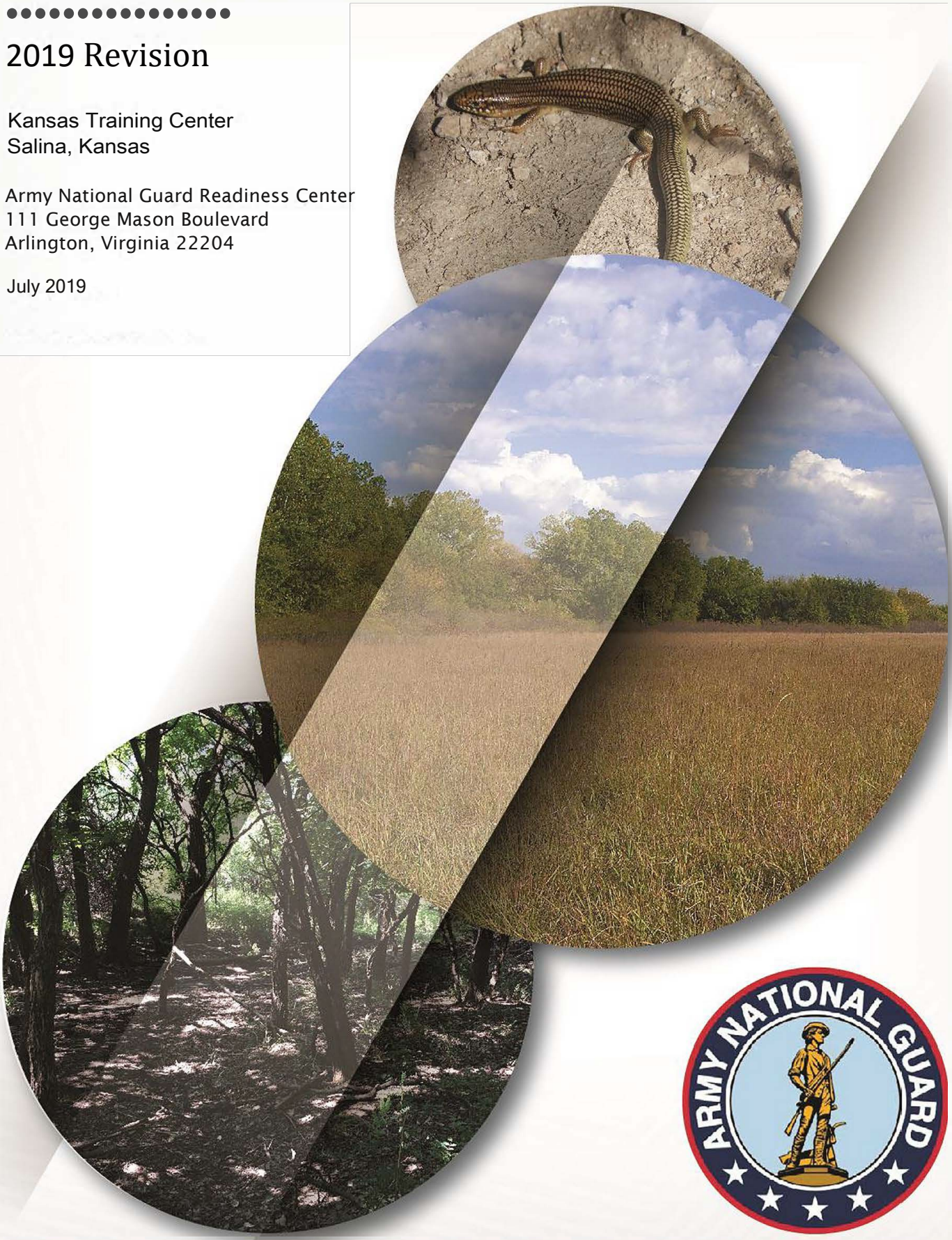
Integrated Natural Resources Management Plan

2019 Revision

Kansas Training Center
Salina, Kansas

Army National Guard Readiness Center
111 George Mason Boulevard
Arlington, Virginia 22204

July 2019



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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

This Integrated Natural Resources Management Plan (INRMP) has been prepared in accordance with regulations, standards, and procedures of the Department of Defense (DoD), and the Sikes Act (16 United States Code [USC] §670a; SAIA 1997). This INRMP provides for management and stewardship of all natural resources present on the Kansas Training Center (KSTC); and addresses land use activities that may affect the natural resources of the Installation.

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN ANNUAL REVIEW AND COORDINATION PAGE

Pursuant to Army Regulation AR 200-1, annual review and coordination, in the form of an annual report, is required. This annual report shall document the INRMP action accomplishments undertaken each effective year of the INRMP, and shall be coordinated with the cooperative offices of Kansas Department of Wildlife, Parks and Tourism (KDWPT) and the US Fish and Wildlife Service (USFWS).

2019 Annual Report Completed

_____ _____

Sam Mryyan, Ph.D. DATE
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2020 Annual Report Completed

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2021 Annual Report Completed

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2022 Annual Report Completed

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2023 Annual Report Completed

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Acronyms and Abbreviations

°F	Degrees Fahrenheit
ACHP	Advisory Council on Historic Preservation
AES	Applied Ecological Services
AG	Agricultural Out-leasing
ANGR	Air National Guard Range
APHIS	Animal and Plant Health Inspection Service
AR	Army Regulation
ARNG	Army National Guard
BCC	Birds of Conservation Concern
CBM	Coordinated Bird Monitoring
CFR	Code of Federal Regulations
CFMO	Construction and Facilities Management Office
CWA	Clean Water Act
DoD	Department of Defense
DODI	Department of Defense Instruction
EA	Environmental Assessment
EMS	Environmental Management Systems
ESA	Endangered Species Act of 1973
EO	Executive Order
FARP	Forward Arming and Refueling Point
GIS	Geographic Information System
INRMP	Integrated Natural Resource Management Plan
IPaC	Information for Planning and Conservation
IPMP	Integrated Pest Management Plan
ISM	Invasive Species Management
ITAM	Integrated Training Area Management
KBS	Kansas Biological Survey
KDWPT	Kansas Department of Wildlife, Parks and Tourism
KGS	Kansas Geological Survey
KSANG	Kansas Air National Guard
KSARNG	Kansas Army National Guard
KSTC	Kansas Training Center
LM	Land Management
LMU	Land Management Unit
MBM	Migratory Bird Management
MLRA	Major Land Resource Areas
MOA	Memorandums of Agreement
MOU	Memorandums of Understanding
NEPA	National Environmental Policy Act
NGB	National Guard Bureau

NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRT	Natural Resource Training
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NWWP	Noxious Weed Work Plan
PAO	Public Affairs Office
PIF	Partners in Flight
PL	Public Law
PO	Public Outreach
ROC	Record of Communication
RTLP	Range and Training Land Program
SAIA	Sikes Act Improvement Act
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment
SINC	Species in Need of Conservation
SHPO	State Historic Preservation Office
SRP	Sustainable Range Program
T&E	Threatened and Endangered
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United State Geological Survey
WOUS	Waters of the United States
WM	Wildlife Management
WP	Watershed Protection
WT	Wetland Management

Reference List of Supporting Documents

Army Regulation 350–19, The Army Sustainable Range Program. Headquarters, Department of the Army, Washington, DC. 30 August 2005

DoD Instruction 4715.03 Natural Resources Conservation Program

DoD Manual 4715.03. Integrated Natural Resources Management Plan Implementation Manual. November 25, 2013.

DoD Directive 4715.21. Climate Change Adaptation and Resilience. Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. Effective: January 14, 2016

Army National Guard, Guidance, Army National Guard Directorate, Environmental Programs Division Guidance for the Creation, Implementation, Review, and Revision and Update of Integrated Natural Resource Management Plans (April 9,2012).

DoD. 2014. Department of Defense 2014 Climate Change Roadmap. June 2014.

National Guard Bureau (NGB). 2011. Integrated Natural Resources Management Plan 2011 Update. Kansas Training Center, Salina, Kansas.

Plant Communities and Restoration Potential at the KSARNG Regional Training Center Near Salina, Kansas (AES, October 2005)

QuickLook Wildlife Survey of the KSARNG Training Center, Salina, Kansas (AES, October 2005).

Wetland Restoration Study at the Kansas Army National Guard Training Center Near Salina, Kansas (AES, October 2007)

Kansas Training Center Watershed Management Study (AES, January 2008)

Preliminary Environmental Assessment Report, Kansas Army National Guard Weapons Training Ranges, Kansas Training Center (Olsson Associates, November 2010)

Undesirable and Noxious Weed Control Plan, Kansas Army National Guard (Olsson Associates, January, 2012)

Limited Faunal Survey of the Kansas Training Center – Reptile and Amphibian Survey, Small Mammal Survey, and Terrestrial Invertebrate Survey (Olsson Associates, July 2012)

Jurisdictional Evaluation and Wetland Delineation (Habitat Architects, March 2012)

Summary of Spring 2013 Prairie Enhancement Plan Activities for the Kansas Training Center (Olsson Associates, June 2013)

Chiroptera Location Survey of the Kansas Training Center (Olsson Associates, July 2013)

Woodland Assessment, Kansas Training Center (Olsson Associates, December 2013)

Prairie Encroachment Assessment, Kansas Training Center (Olsson Associates, June 2014)

Off-Road Navigation Course Natural Resources Management Plan (Olsson Associates, July 2015)

Vegetation Monitoring for the Kansas Training Center (Olsson Associates, July 2015)

Northern Long-Eared Bat Presence/Absence Survey (Stantec, 2016)

Aquatic Macroinvertebrate Survey, Kansas Training Center (Olsson Associates, November 2013)

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1. Executive Summary

This INRMP is a revision of the 2011 INRMP established for the Kansas Army National Guard (KSARNG) KSTC - also referred to as the Installation - in accordance with the Sikes Act Improvement Act, as amended (SAIA 2012), the National Environmental Policy Act (NEPA 1970), and the Environmental Analysis of Army Actions (32 Code of Federal Regulations [CFR] Part 651 2002). This INRMP is a revision that addresses changes in the operations for the military training mission at the KSTC, as presented in this document. Changes in the military training mission at the KSTC include the addition of Forward Arming and Refueling Point (FARP) training, mounted navigation (convoy) training, increased use of firing ranges, and increased training at Crisis City at the Installation.

The revised INRMP is a proposed action that requires review in accordance with the NEPA prior to implementation of its projects, objectives, and goals. The initial implementation of this plan requires preparation of an Environmental Assessment (EA) in compliance with NEPA requirements, with topics related to the effects of the proposed plan on natural and cultural resources.

The SAIA requires the cooperating partners to review of the existing INRMPs at least once every five years for operation and effect. This joint review evaluates the implementation and effectiveness of the INRMP and whether the KSARNG should continue following the INRMP or revise it to reflect changes in mission, goals, or objectives. The Army National Guard (ARNG) Environmental Checklist provides a template for review of actions and documents produced for, and related to, operations of the KSTC (Appendix A).

This INRMP provides KSARNG's natural resource personnel with a baseline description of the KSTC and its surrounding environments. The INRMP also provides management practices that will allow the KSARNG to avoid, minimize, and/or mitigate negative impacts while enhancing the positive impacts of the Installation's mission on regional ecosystems. Natural resources management has been integrated with the military operations of the KSTC to accomplish its mission to the maximum practicable extent. Accordingly, this INRMP revision presents practicable alternatives and management activities that are consistent with KSARNG's training mission and provide for the management and stewardship of natural resources to promote the conservation, enhancement, and sustainability of existing ecosystems on the Installation. In some cases, the implementation of these management activities may sacrifice the improvement of KSTC's natural resources in deference to the safety and efficiency of the military mission.

Management practices identified in this INRMP have been developed to enhance and maintain biological diversity within the Installation's boundary while providing connectivity the Installation's ecosystem. Specifically, management practices strive to do the following:

1. Set forth management that will maintain and enhance natural resources on KSTC that are needed to support the mission of the KSARNG

2. Minimize habitat fragmentation and promote the natural pattern and connectivity of habitats

3. Protect native species and discourage non-native, exotic species

4. Protect rare and ecologically important species

5. Protect unique or sensitive environments

6. Maintain or mimic natural processes

7. Protect genetic diversity

8. Rehabilitate ecosystems, communities, and species

9. Monitor biodiversity impacts

From these specific management practices, and using the INRMP as guidance, management actions in the form of program elements were identified (see Chapter 8.0).

INRMP Content
The content of this INRMP include descriptions of the natural resources, the training mission goals of the KSARNG, and the natural resource conservation goals and strategies for the Installation. The chapters of the INRMP include:

- Chapter 2.0: INRMP's purpose, authority, responsibilities, management philosophy, and implementation conditions

- Chapter 3.0: The Installation's location, area, history, military mission, and regional land use

- Chapter 4.0: The KSTC's physical environment

- Chapter 5.0: The KSTC's existing biological environment

- Chapter 6.0: The recognized mission impacts on natural resources

- Chapter 7.0 The current status of KSTC's natural resources management programs

- Chapter 8.0: KSTC management goals

- Chapter 9.0: KSTC plans for implementation

Based upon the analyses contained in this document, implementation of the natural resources management strategies will result in a balanced and sustainable ecosystem at KSTC. This INRMP establishes explicit responsibilities and long-range goals for managing natural resources at KSTC in compliance with all applicable federal laws, regulations, and National Guard Bureau (NGB) guidelines. The goals included in the INRMP require close interaction between KSTC range control staff and KSARNG staff. Implementation of the INRMP is not anticipated to result in significant environmental effects, but will instead benefit the physical, biotic, and cultural environment.

The KSARNG will use this INRMP to guide and execute the management of natural resources as described by the INRMP itself. Implementation of the program elements of this INRMP will support the KSARNG's continuing requirement to ensure the safety and efficiency of the mission at KSTC, practice sound resource stewardship on the Installation, and comply with environmental policies and regulations.

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2. General Information

2.1 Purpose

The goal of the ARNG's environmental programs and policies is conserving the environment for mission sustainability (Department of Defense [DoD] Memorandum 4715.03 November 25, 2013). This INRMP is intended for use by the NGB, the KSARNG, and the KSTC range control personnel as the primary tool for managing natural resources at the KSTC, in accordance with Code of Federal Regulations, Title 32, Part 651 – Environmental Analysis of Army Actions (32 CFR Part 651, 2002) and the provisions of the SAIA.

The 2012 SAIA requires the USFWS and the KDWPT to jointly review existing INRMPs for operation and effect at least once every five years. This joint review evaluates the implementation and effectiveness of the INRMP and whether KSARNG should continue following the INRMP or whether it should revise the INRMP to reflect changes in mission, goals, or objectives in regard to conservation and rehabilitation of natural resources on KSTC.

This INRMP provides KSARNG and visiting personnel with a description of the Installation (e.g., location, history, and mission), information about the surrounding physical and biotic environment, and an assessment of the impacts to natural resources resulting from mission activities. Furthermore, in compliance with federal, state, and local standards, the INRMP outlines various management practices designed to mitigate negative impacts and to enhance the positive effects of the Installation's mission on local ecosystems.

This INRMP integrates sound natural resources management with the training mission of the KSARNG. This document is intended to be the primary tool for managing the complex association of soil, water, and vegetation as an integral component for the successful accomplishment of the military mission of the KSARNG at the KSTC. One of the primary goals of natural resources management at the KSTC is to ensure no net loss in the capability of military installation lands to support the military mission of the Installation. In addition, the INRMP is a guide for the management and stewardship of all natural resources present at KSTC. This INRMP provides the guidance for achieving the following outcomes:

1. Biodiversity: A key component of natural resource management is conserving biodiversity. Biodiversity is the number of different types of plant and animal species within an environment. The concept of biodiversity can be applied on three basic levels: genetic diversity, ecosystem diversity, and landscape diversity. Genetic diversity refers to the variation of genotypes within a species or even a biological community that influences different characteristics between individuals or populations. Ecosystem diversity refers to the number of different kinds of organisms and species within a given area. Landscape diversity describes multiple landforms, biological communities, and land uses within an area.

Conservation and integration of these three concepts of biodiversity provide human communities with necessary goods and are essential to quality of life and function. Declines in biodiversity and ecological systems are a threat not only to the natural environment, but also to civilized human prosperity.

2. Ecosystem Sustainability: Ecosystem sustainability is the key to both biological diversity and human existence. It is the goal of this INRMP to successfully integrate ecological sustainability with goals and objectives that will sustain human communities and the operational mission of KSTC. By conserving habitats to support their natural biodiversity, this INRMP helps perpetuate viable, sustainable populations of native species and communities.

3. Climate Change: Climate change refers to any significant change in the measures of climate that may last several decades or longer, including major changes in temperature, precipitation, or wind patterns (U.S. Environmental Protection Agency [USEPA] 2017). Managing operations at the KSTC must include consideration of impacts to natural resources that could affect factors of climate change, and the resiliency of natural resources to the effects of climate change in the region.

4. Adaptive Management: The natural resources management program must remain flexible if it is to achieve long-term success. This requires incorporating adaptive management techniques into the program. Adaptive management gathers new information through monitoring data or scientific literature and determines if changes in the management approach are necessary for the continued success of the program. This management approach is conducted through annual reviews with the USFWS and KDWPT. In addition, the natural resources management program may be required to adapt to unforeseen changes in military missions and/or legal requirements.

5. Comprehensive Planning: The comprehensive planning process, which incorporates logistics and operations of the KSTC, should incorporate the concerns presented in this INRMP so that the growth of the Installation can progress in a manner consistent with, and complementary to, the objectives of the NGB in regard to the health and sustainability of natural resources.

The KSARNG proposes to implement this INRMP at the KSTC, thus supporting the management of natural resources as prescribed by the INRMP itself. The purpose of the program elements is to describe the execution of identified resource-specific management measures developed by KSARNG. It is expected that implementation of the INRMP will support the KSARNG's need to provide realistic training for KSARNG personnel while meeting mission requirements and complying with environmental regulations and policies.

The integration of natural resource conservation measures and military activities on mission land in a manner consistent with federal stewardship requirements is based on the key legislation and regulations as described in the following sections.

2.2 Authority

This INRMP revision has been completed in accordance with the following guiding documents:

1. The 2012 SAIA

2. The April 2012 NGB Memorandum: ARNG Directorate, Environmental Programs Division Guidance for the Creation, Implementation, Review, and Revision and Update of Integrated Natural Resource Management Plans.

3. AR 200-1, E*nvironmental Protection and Enhancement*, 13 December 2007.

The Environmental Analysis of Army Actions (32 CFR Part 651 2002) sets forth policy, responsibilities, and procedures for integrating environmental considerations into Army planning and decision-making. In addition to the NGB guidance, Table 1 summarizes key legislation and guidance used to create and implement this INRMP.

Table 1: Annotated Summary of Key Legislation Related to the Design and Implementation of the INRMP

United States Code	
Sikes Act, as amended; 16 USC 670 (a) et seq., 2012	Authorizes military installations to carry out programs for the conservation and rehabilitation of natural resources. Requires preparation and implementation of INRMPs for all military installations in the U.S. except for those lacking significant natural resources.
National Environmental Policy Act of 1969 (NEPA), as amended 97-258 @ 4(b) et seq.	Requires federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts to the environment.
Leases: Non-excess Property of Military Departments, 10 USC 2667, as amended	Authorizes the DoD to lease federal land that is not currently needed for public use to commercial enterprises. Covers agricultural out-leasing programs.

Table 1: Annotated Summary of Key Legislation Related to the Design and Implementation of the INRMP

Clean Air Act, 42 USC 7401-7671q, July 14, 1955, as amended	This act, as amended, is known as the Clean Air Act of 1990. The amendments made in 1990 established the core of the clean air program. The primary objective is to establish federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Federal Water Pollution Control Act (Clean Water Act), 33 USC 1251-1387	The Clean Water Act (CWA) is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement of the CWA rests with the USEPA.
Migratory Bird Treaty Act 16 USC 703-712	The Migratory Bird Treaty Act implements various treaties for the protection of migratory birds. Under the act, taking, killing, or possessing migratory birds is unlawful.
Endangered Species Act of 1973, as amended P.L. 93-205, 16 USC 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, federal agencies are to consult with the USFWS or National Marine Fisheries Service (NMFS) to ensure their actions (funded, authorized, or carried out by them) do not jeopardize the continued existence of an endangered or threatened species. The Endangered Species Act of 1973 (ESA) also requires consultation with the USFWS and the NMFS, and the preparation of a biological assessment/evaluation when a federal agency proposes an action that may affect the listed species.

Table 1: Annotated Summary of Key Legislation Related to the Design and Implementation of the INRMP

National Historic Preservation Act 16 USC 470	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in or is eligible for, inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the National Register), and protection of historical and cultural properties of significance.
Federal Noxious Weed Act of 1974, 7 USC 2801-2814	The Federal Noxious Weed Act of 1974, and as amended in 1990, was superseded by the Plant Protection Act, except for parts 7 USC 2801 and 7 USC 2814. These portions of the Noxious Weed Act provide listings of non-indigenous, noxious weeds that injure, or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health, and provide instructions for management of the undesirable plants on federal lands.
Plant Protection Act, 7 USC 7701	This act supersedes much of the Federal Noxious Weed Act, and authorizes the Secretary of Agriculture to prohibit or restrict the importation, entry, or movement of any plant pest or noxious weed within the United States.
Sale of certain interests in land logs, SC	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Agreements to Limit Encroachments and the Constraints on Military Training, Testing, and Operations, USC 2684a	This act provides an opportunity for the DoD to work in partnership with states and other governments, as well as public or private environmental and conservation groups, to achieve a common goal of sustainability. The act also allows the military to encumber land to protect habitat and training.
Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost Share Program	Amends two acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes a program for the stewardship of biological, geophysical, cultural, and historic resources on DoD lands.
Executive Order (EO) 11988, Floodplain Management	Provides direction regarding actions of federal agencies in floodplains, and requires permits from state and federal review agencies for any construction within a 100-year floodplain.

Table 1: Annotated Summary of Key Legislation Related to the Design and Implementation of the INRMP

EO 11514, Protection and Enhancement of Environmental Quality	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, Protection and Enhancement of the Cultural Environment	All federal agencies are required to locate, identify, and record all cultural and natural resources. Cultural resources include sites of archaeological, historical, or architectural significance. Natural resources include the presence of endangered species, critical habitat, and areas of special biological significance.
EO 11990, Protection of Wetlands	Each agency shall take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial value of wetlands in carrying out the agency's responsibilities.
EO 11987, Exotic Organisms	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters that they administer.
EO 12088, Federal Compliance with Pollution Control Standards	This EO delegates responsibility to the head of each executive agency to ensure that all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the USEPA authority to conduct reviews and inspections that monitor federal facility compliance with pollution control standards.
Executive Order (12898) Environmental Justice	The purpose of E.O. 12898 is to focus federal attention on the environmental and human health effects of federal actions on minority and low-income populations with the goal of achieving environmental protection for all communities.
Executive Office of the President. Climate Action Plan. June 2013	Promote climate change resilience by protecting biodiversity and conserving natural resources on federal lands.
DoD Instruction (DoDI) 4715.03. Natural Resources Conservation Program. Nov. 25, 2013	This instruction implements policy and assigns responsibilities for compliance with applicable federal statutory and regulatory requirements, executive orders, and presidential memorandums for the integrated management of natural resources controlled by the DoD.

Table 1: Annotated Summary of Key Legislation Related to the Design and Implementation of the INRMP

EO 13653, Preparing the United States for the impacts of Climate Change. Nov. 2015	This EO directs the DoD to help complete an inventory and assessment of proposed and completed changes to its land- and water-related policies, programs, and regulations necessary to make the nation's watersheds, natural resources, and ecosystems, and the communities that depend on them, more resilient in the face of changing climate.
DoD 4715.21, Climate Change Adaptation and Resilience. Jan 14, 2016.	This directive establishes policy and assigns responsibilities to assess and manage risks associated with the effects of climate change while ensuring continuity of DoD operations.
H.R. 1080 - To amend the Sikes Act and promote the use of cooperative agreements under such Act for land management related to o readiness activities and to amend title 10, USC, to facilitate interagency cooperation in conservation programs and avoid or reduce adverse impacts on military readiness activities.	Authorizes payment of up to 3 percent of total project administrative costs, fees, and management charges any federal, state, local, or nongovernmental entity for the conservation and rehabilitation of natural resources in an area that is not on a military installation. Permits amounts available to the DoD be used only for payment of such areas.

2.3 Responsibilities

Conservation is an integration or blending of natural resources management and preservation designed to maintain ecosystem integrity. This blending occurs in this INRMP, a dynamic document that will be maintained and adapted as necessary, to reflect updated natural resources information. The development and implementation of this INRMP indicates KSTC's commitment to natural resources as reflected in DoDI 4715.3 (Environmental Conservation Program).

This INRMP uses an interdisciplinary approach and gathers information from a variety of sources, including information and guidance from a variety of federal, state, and local agencies, KSARNG personnel, and KSTC management personnel. The Supervisory Environmental Protection Specialist and his staff are responsible for reviewing the INRMP before formally submitting the plan to the USFWS, the KDWPT, and other state agencies as necessary. The Environmental Directorate is responsible for tracking projects, providing technical assistance, quality assurance, and the execution of funds.

Presented in this INRMP are practicable recommendations that protect and enhance natural resources and conserve existing ecosystems, all while minimizing impacts to the Installation's mission. Consequently, the implementation of some of these recommendations will sacrifice

improvement of KSTC natural resources in deference to the safety and efficiency of the military mission. Specific responsibilities are discussed in the following paragraphs.

2.3.1 Installation Stakeholders

The INRMP program is organized to ensure the implementation of cost-effective management activities and projects that meet the requirements of KSTC, the KSARNG, and the NGB. The KSARNG Environmental Branch and its natural resource management team are required to implement this INRMP. The KSARNG natural resource manager must be a qualified professional natural resource manager, defined in Section 670g of the 2012 SAIA as a professional who has an undergraduate degree in a natural-resources-related science. The KSARNG natural resources manager will be supported by KSARNG personnel and contracted personnel in implementing this INRMP.

Implementation of this INRMP includes support from the following stakeholders:

KSARNG

- The G3, director of operations, provides operational and training guidance and support to the KSARNG. The G3 conducts contingency planning and provides timely and appropriate military support to meet required federal, state, and community missions. The G3 assesses, evaluates, and monitors the readiness of KSARNG units and implements programs and procedures to meet unit mission readiness requirements. These responsibilities support the implementation of this INRMP.

- The Construction and Facilities Maintenance Office (CFMO) in the KSARNG Department of Public Works ensures that KSARNG facilities enhance ARNG's role as a community-based defense force while supporting mission requirements. The CFMO plays a vital role in overseeing the development of the facilities used to support natural resources management at KSTC.

- The KSARNG Natural Resources Manager is responsible for the daily implementation of the actions, goals, and objectives outlined in the INRMP. The KSTC range control staff draws on the direct support of the KSARNG natural resources manager and KSARNG environmental program staff to ensure that operations of the Installation are compliant with this INRMP. The range control staff is under direct supervision of the KSTC commander, who has direct responsibility for activities that occur at the Installation.

- The KSARNG Public Affairs Office (PAO) is responsible for conveying KSARNG roles within the NGB and the community. It also outlines the contributions made by the KSARNG not normally associated with the ARNG. This includes the natural resources management conducted by implementing this INRMP.

- The KSARNG natural resources manager will coordinate regularly with the KSTC range control command to ensure the effective implementation of this INRMP. In addition, the USFWS and the KDWPT will also be consulted as necessary to focus on high-level priority natural resources management issues.

National Guard Bureau

NGB is the higher headquarters for the KSARNG. Two Directorates are involved in the management of natural resources: the Director of Installations & Environment (ARNG I&E), and the Director of Operations, Training, and Readiness (ARNG-TRS). ARNG I&E ensures operational readiness by sustaining environmental quality by tracking projects, providing technical assistance, quality assurance, and execution of funds. ARNG-I&E provides policy guidance and resources to create, sustain, and operate facilities that support the Army National Guard. ARNG-TRS is responsible for training and training site support to include sustainable range management.

2.3.2 External Stakeholders

Other federal agencies have an interest or a role in the management of the natural resources at KSTC. The involvement of these agencies is based on signatory responsibilities, cooperative agreements, regulatory authority, and technical assistance as required by federal laws and regulations. The agencies and their roles and responsibilities are described below.

Federal Agencies

- U.S. Department of the Interior, USFWS: The USFWS assists with the INRMP development and review, ensures the INRMP is being properly implemented, and determines if the goals and objectives of the INRMP are valid. The USFWS may provide technical assistance to the KSTC as well as signatory approval on the INRMP. Specifically, USFWS will alert the KSARNG environmental program manager whenever new species that have the potential for inhabiting the region are added to the Federal Endangered Species lists. The USFWS may support KSTC personnel during scheduled wildlife and vegetation surveys. The USFWS will support the development of operational component plans to be developed in conjunction with the implementation of this INRMP.

- U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS): The APHIS provides assistance with animal damage control problems, if needed.

- Natural Resources and Conservation Service (NRCS): The NRCS provides technical expertise in erosion control and soil productivity, and will do so for KSTC.

- U.S. Army Corps of Engineers (USACE): The USACE provides jurisdictional supporton CWA Section 404 issues including permitting, management, and protection of Installation wetlands.

State Agencies

- KDPWT: The KDPWT assists with the INRMP review to determine if the INRMP is being implemented and if the goals and objectives remain valid. In addition to the technical and signatory role that the KDPWT plays in the INRMP process, other state agencies participate in the technical and philosophical guidance of natural resources at KSTC. The KDPWT also

aids the KSARNG and the KSTC with information regarding changes in the status, distribution, or listing of state-listed threatened or endangered species.

- Kansas Department of Agriculture: The Kansas Department of Agriculture provides technical assistance in conjunction with the Saline County Weed Department in the management of noxious and invasive weed species.

- Other Parties: Kansas State University will be invited to participate as a stakeholder of the KSTC, and is anticipated to conduct or participate in biological inventories and monitoring, and other scientific studies or research at the training site.

Other Organizations

- The Kansas Nature Conservancy and the Smoky Hills Chapter of the Audubon Society may be invited to assist in biological surveys and habitat assessments.

2.4 Management Philosophy

2.4.1 Military Mission Statement

The primary purpose of natural resources management at the KSTC is to support the military training mission and to maintain sustainable natural resources as a critical training asset. Components of this overall goal include the following:

- Ensuring no net loss in the capability of Installation lands to support existing and projected military training and operations at the KSTC

- Maintaining quality training lands through range monitoring and damage minimization, mitigation, and rehabilitation

2.4.2 Ecosystem Management

Ecosystem management is a process that optimizes and conserves major ecological services and restores natural resources while meeting the socioeconomic, political, and cultural needs of current and future generations (Lackey 1998). Ecosystem management is used to support present and future training and testing of military operations while conserving and enhancing ecosystem integrity. This approach maintains and improves sustainability and biological diversity of plants and animals while supporting human use and the environment required for KSTC operations. In short, ecosystem management supports the military training mission of the KSTC through the following:

- Collaboration with existing natural resources management authorities to provide realistic and sustainable training and testing environments.

- Integration of ecosystem management with the KSTC military training mission with limited land base and diminished budgets.

- Coordination of training and testing operations with natural resource managers to reduce impacts and optimize natural resource conditions.

- Confirmation of biodiversity conservation that contributes to ecosystem integrity and sustainability.

- Cooperation with other state and federal agencies and with adjacent land owners to develop partnership-based actions that assist the KSTC to support military operations and training.

The KSARNG will implement ecosystem management using the following actions:

- Maintaining and improving the sustainability and native biodiversity of ecosystems by restoring and enhancing native vegetation at the KSTC, including prairie vegetation, while reducing the presence of invasive species.

- Conducting natural resource studies that examine ecological units within the KSTC in context of similar regional ecological systems, and timeframes that allow examination of the cumulative effects of the KSTC's operations.

- Supporting sustainable human activities, such as hunting and/or agricultural leasing.

- Developing a vision of ecosystem health. This will involve identifying and collaborating with regional and local stakeholders to develop a shared vision of what a desirable future ecosystem will be composed of.

- This INRMP will manage natural resources in context of the training mission of the KSTC, and will achieve the vision and goals of ecosystem health for the Installation. The plan includes:
    - Ecosystem management goals for the KSTC
    - Priorities for ecological units within the KSTC
    - Development and implementation of a natural resources project priorities list that includes natural resources restoration and surveys.

This plan will include adaptive management and have the flexibility to accommodate evolving conditions at the KSTC as well as potential changes in training schedules and pressures.

2.4.3 Sustainable Range Program

The Sustainable Range Program (SRP) is the Army's overall approach for improving the way in which it designs, manages, and uses its ranges to ensure long-term sustainability. The goals and execution of the SRP is provided in Army Regulation 350–19. The goal of the SRP is to maximize the capability, availability, and accessibility of ranges and training lands to support the training mission of the Army, including mobilization, and deployments under normal and surge conditions. The SRP operates under three primary tenets:

1. Information excellence. Information excellence ensures that the Army has the best available data and science to support the operational, environmental, and infrastructure characteristics of its ranges and training land assets. This includes the environmental impacts of live-fire and the doctrinal implications associated with transformation.
2. Integrated management. Integrated management ensures that the major management functions (operations, facilities, and environment) directly affecting ranges and training land assets are integrated to support the training mission.
3. Dedicated outreach program. A dedicated outreach program, which is coordinated with Public Affairs, educates the public on the need for live-fire training and improves the Army's understanding of public concerns related to Army training and range operations.

The SRP is defined by its two core programs, the Range and Training Land Program (RTLP) and the Integrated Training Area Management (ITAM) program, both of which focus on compliance with the Army's training mission. To ensure the accessibility and availability of Army ranges and training land, the SRP core programs are integrated with the facilities management, environmental management, munitions management, and safety program functions supporting this mission.

2.4.3.1 Range and Training Land Program

The RTLP provides for the central management, programming, and policy for modernization of the Army's ranges and their day-to-day operations. This program includes range operations and modernization of live-fire training ranges and maneuver training lands, including the design and construction activities associated with them.

The planning process of the RTLP 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. The RTLP defines the quality assurance and inspection milestones for range development projects, including:

- The standard operating procedure to safely operate military training, recreational, or approved civilian ranges under Army control
- Support for commanders' mission essential task list and Army training strategies

- The procedures and means by which the Army range infrastructure is managed and maintained on a regular basis in support of the training mission

2.4.3.2 Integrated Training Area Management

The ITAM program is a management and decision-making process geared toward integrating Army training and other mission requirements for land use with sound natural resource management (U.S. Department of the Army 1999). The Army's goal in establishing the ITAM program is to achieve optimum sustainable use of training lands by implementing a standardized methodology for inventorying and monitoring land condition, integrating training requirements with land capacity, educating land users to minimize adverse impacts, and providing for land rehabilitation and maintenance (U.S. Department of the Army 1999). The ITAM program is a core program of the SRP and is the Army's formal strategy for focusing on the sustained use of training lands. This strategy is designed to integrate land stewardship practices with training requirements and ensure Army training lands remain viable for training and missions in the future.

The ITAM Program's four areas of responsibility are:

- Repair training land damage
- Configure/reconfigure training lands to meet current and future training needs
- Monitor training land conditions in direct support of current and future training needs
- Educate training land users to reduce unnecessary damage on training lands

The ITAM Program is responsible for the off-road training and land navigation areas of the KSTC.

2.4.4 Climate Change

Climate change is considered an issue of national security; one which can affect the training mission of the KSARNG and the DoD in terms of readiness to respond to both natural and man-made emergencies (U.S. Department of Defense 2014). In response to the potential for climate change, the KSARNG must be able to adapt current and future operations to address the impacts of climate change to maintain an effective and efficient U.S. military. According to DoD Directive 4715.21, military mission planning and execution must include the following:

- Identifying and assessing the effects of climate change on the DoD mission
- Taking those effects into consideration when developing plans and implementing procedures
- Anticipating and managing any risks that develop as a result of climate change to build resilience

According to the USEPA, climate in Kansas is expected to get hotter and drier (USEPA 2016). Precipitation patterns may change, with longer dry periods expected during the summer and more frequent intense storms. With changes in precipitation and temperature, soil is expected to be drier, and plant community composition may change.

Management of natural resources in consideration of potential changes resulting from climate change will include coordination with other state and federal agencies to follow the latest developments in climate monitoring and modeling. This information will be used to understand possible pressures that could affect the KSTC's natural resources as well as natural resources in the surrounding areas, and adapt management accordingly. Activities will include the following:

- Assess historical regional trends in climate shifts, including changes in temperature and precipitation
- Assess potential impacts on natural resources and sensitivities resulting from climate change based upon information developed for training and operations at the KSTC
- Conduct and update vulnerabilities assessments of natural resources and their resiliency to pressures resulting from climate change

2.5 Conditions for Implementation and Revision

To ensure that this INRMP properly addresses all aspects of the natural resources present at the KSTC and that it proposes actions in accordance with NGB goals and objectives, the INRMP and all its components are subject to approval by the KSARNG environmental program manager.

Per Army regulation, this INRMP will be reviewed annually to assess the suggested management practices in terms of their appropriateness for current conditions at the KSTC. The INRMP will be revised whenever there are significant changes to the military mission or natural resources of the Installation. Otherwise, this INRMP will be updated, as necessary, to document minor changes such as those that provide current information on regulations/laws/resources or to adjust timelines or projects that would not result in environmental changes substantively different than those previously agreed to by the INRMP's partners.

2.5.1 Implementation

The KSARNG promotes the principles of responsible environmental stewardship, sustainability, and accountability at the KSTC that go beyond compliance to achieve its mission. Collaborating closely with federal and state agencies, the KSARNG has identified and promotes program elements that enhance natural resources.

Successful implementation of the INRMP will require:

1. Administrative and technical support
2. Agency cooperation and technical assistance
3. Funding
4. The management of priorities and scheduling
5. The production of project scopes and budgets
6. The ability to amend and revise this document as necessary

Where projects identified in the plan are not implemented because of lack of funding or other compelling circumstances, the Installation will review the goals and objectives of this INRMP to determine whether adjustments are necessary. Implementation of this INRMP is described in detail in Chapter 9.0.

2.5.2 Revisions

Major revisions are required when changes to the INRMP are expected to result in a biophysical consequence materially different from those anticipated in the existing INRMP. Such revisions may be caused by a change in the Installation's mission or physical boundaries, a change in laws or regulations affecting the Installation's natural resources, or because of a review for operational and effectiveness reviews. In these cases, a NEPA review may be necessary. Page revisions can be made when necessary. Agency response letters can be found in Appendix B.

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3. Installation Overview

This chapter describes the location and surrounding environmental characteristics of the KSTC, and provides an understanding of the areas near the Installation and the development of the goals of this INRMP.

3.1 Location and Area

The KSTC is located in southwestern Saline County, approximately 12 miles southwest of the city of Salina. The Installation occupies all or parts of Sections 14, 15, 16, 21, 22, 23, 27, 28, and 33, Township 15 South, Range 4 West. Figure 1 illustrates the location of the Installation in Kansas. The KSTC covers approximately 3,560 acres of land in the northeast corner of the Smoky Hill ANGR, which is owned by the Air Force and licensed to the KSARNG for training and support.

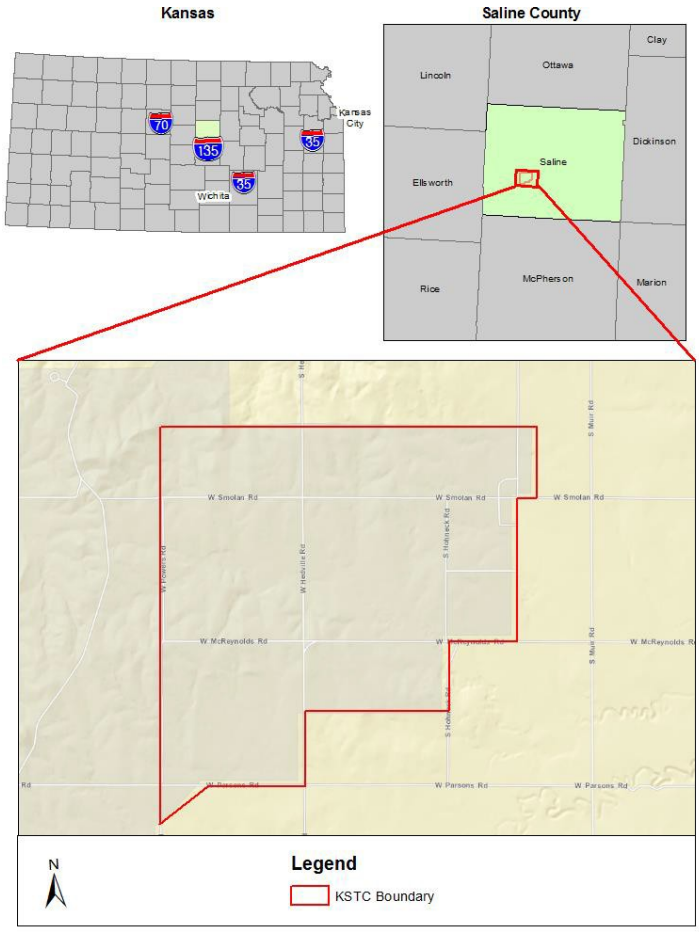

Figure 1: KSTC Location

3.2 Installation History

Prior to the 1800's, the Saline County area was principally inhabited by the Plains Comanche, Kansa, Pawnee, Wichita, and Cheyenne tribes. French fur traders and trappers bartered with Indian tribes in the Saline County area during the 1700's, and in 1806 Captain Zebulon Pike came into the area and met with the chiefs of the Kansa tribe to arrange a peace treaty and establish friendly relations with the Comanche. Captain Pike also gathered information on the natural environment, streams, mineral resources, and the people of the southern portion of the Louisiana Purchase. On the way to a large Pawnee village on the Republican River in Nebraska, Pike's expedition passed only a few miles to the east of the Smoky Hill ANGR (GlobalSecurity.org. 2017).

Settlers began to arrive in the Saline County area in the late 1850s, although the number remained low due to fear of the various Indian tribes in the region. With the arrival of the railroad, however, many more settlers came to Saline County, and the population grew to over 2,000 in a matter of months. The railroads continued to be a major influence in the growth and development of Saline County, and by 1918, Salina had become a major railroad junction for the Union-Pacific, Missouri-Pacific and Salina Northern rail lines.

In the 1860's, Swedish settlers purchased 22 sections of Kansas Pacific railroad land in the Smoky Hills valley. Two small towns located east of the KSTC, Smolan and Falun, were founded by members of the Swedish community. Other immigrants to Saline County in the area of the KSTC included African American families who settled west of Falun. The graves of several members of the families are still contained within the Smoky Hill Range. Descendants of these families remained in the area for over 60 years until the establishment of Camp Phillips in the early l940s.

With the onset of World War II, 107 farm families had to leave their homes and sell their land in 1942 for the construction of Camp Phillips (275th Armored Field Artillery Battalion. 2009). Camp Phillips was one of a number of 35,000-man training camps established around the country following the start of the second world war. Over 42,000 acres (72 square miles) were taken for the base. Camp Phillips housed 45,000 troops and contained 54 miles of roads, a complete water and sewer system, cold storage plants, and large laundries. Among its 3,500 buildings were 11 chapels, 100 recreational buildings, 5 theaters, and 35 warehouses. It is estimated that over 150,000 troops trained at Camp Phillips. The facility also included a separate internment camp where Italian and German prisoners of war were held.

Camp Phillips was deactivated in October 1944, when it was dismantled and the land was either leased or sold back to the original owners by 1946. Following the dismantling, the western part of the camp was used briefly as a gunnery range by Army Air Corps pilots stationed at the Smoky Hill Air Field. After the deactivation of Schilling, operation of the Range was transferred to various commands of the United States Air Force. In 1973, the KSANG assumed all operating and maintenance authority (GlobalSecurity.com, 2017). The 3,550 acres that comprise the KSTC is leased from the KSANG.

3.3 Military Mission

The mission of the KSARNG at the KSTC is to provide skills training to soldiers of the ARNG. Training at the KSTC includes billeting, weapons ranges, vehicle transport and navigation training areas, FARP training, vehicle fueling, maintenance, recovery training, and ground navigation training areas for the DoD, the KSARNG, and other federal, state, and local government agencies.

The training mission of the KSARNG at the KSTC will include increases in use of firing rages that have expanded at the facility in 2016 and 2017; more mounted navigation, or convoy training both on- and off-site; and increased training use at the Crisis City facility. FARP training is new to the KSTC, and will include increased troop training from Fort Riley, Kansas. It is anticipated that current training levels for field navigation and off-road vehicle training will remain the same or may decrease.

3.4 Surrounding Communities

The city of Salina is the closest large community to the KSTC, approximately 6 miles northeast of the Installation. It has a population of approximately 55,691 according to the 2015 census. Salina is located southeast of the intersection of Interstate 70 and Interstate 135. Several small towns are located within 5 miles of the Installation. The towns of Smolan and Falun are located east of the Installation and the towns of Brookville and Bavaria are located to the north of the Installation. In Saline County, the top three employers are Schwan's Global Supply Chain, Salina Regional Health Center, and Unified School District 305. Saline County is in the center of one of the world's largest wheat producing regions. Transportation, especially commercial trucking, is also important to Salina's economy.

3.5 Regional Land Use

The KSTC is part of the Smoky Hill Bombing Range which is owned by the United States Air Force and operated by the KSANG. The Smoky Hill Bombing Range and associated KSTC are located in a rural area of Saline County. Surrounding land to the north, east, and south of the KSTC is dominantly used for agriculture, with most of the land used for pasture and cattle grazing/ production and crop production.

3.6 Local and Regional Natural Areas

There are three natural areas within 60 miles of the KSTC. State lands within 60 miles of the Installation include Kanopolis State Park and Reservoir and McPherson State Lake and Park. Kanopolis State Park and Reservoir encompass more than 15,000 acres of rolling hills, bluffs, and woods. The reservoir at normal pool covers 3,000 acres and is about 33 miles southwest of Salina. This is Kansas's first recreation area and provides hunting, fishing, and trails for recreational purposes. Game animals in the area include quail (*Callipepla californica*), pheasant (*Phasianus colchicus*), greater prairie-chicken (T*ympanuchus cupido*), white-tailed deer (O*docoileus virginianus*), mule deer (O*docoileus hemionus*), turkey (*Meleagris gallopavo*),

eastern grey squirrels (*Sciurus carolinensis*), eastern cottontail rabbits (*Sylvilagus floridanus*), coyotes (*Canis latrans*), and a variety of waterfowl.

McPherson State Lake and Park is located approximately 39 miles south of Salina. The park also includes the Maxwell Wildlife Refuge. McPherson State Lake encompasses approximately 2,560 acres of rolling native prairie. The Wildlife Refuge provides one of the best viewing opportunities for large mammals with the presence of bison (*Bison bison*) and elk (*Cervus canadensis*).
Federal lands within 60 miles of the Installation include the Quivira National Wildlife Refuge (NWR). The NWR encompasses approximately 22,135 acres of land. The NWR was established in 1955 to protect migratory waterfowl. It's 7,000 acres of wetlands attract hundreds of thousands of ducks and geese annually. Its location in the middle of the Central Flyway places it in the primary pathway for many species of migrating shorebirds. Over 340 species of birds have been recorded at Quivira, including threatened and endangered species such as the whooping crane (*Grus americana*) and the interior least tern (*Sternula antillarum*).

4. Physical Environment

The natural resources of the KSTC reflect the physical environment that forms them. Understanding the physical environment of the Installation is essential for developing effective natural resource management strategies as presented in this INRMP.

4.1 Climate

The KSTC is located close to the middle of the state, in a transition between wetter areas to the east, and much drier areas to the west. The climate affecting the KSTC is classified as continental, affected both by warm surges of often moist air from the south, as well as strong cold fronts from the north. The area is typified by cold winters, hot summers, and moderate precipitation. The hottest month is July, with an average maximum temperature of 93 degrees Fahrenheit (°F). The coldest month is January, with an average minimum temperature of 17 °F. Table 2 shows the range of temperatures and precipitation expected through an average year. The average freeze-free period is 215 days from the average last spring freeze around March 31 to the average first freeze on or around November 2. The mean annual precipitation is 26 to 33 inches, most of which falls as rain between April and September. Precipitation is one of driving factors of the types of vegetation present in an area.

Table 2: Climate Summary (Period of Record: 1961 to 1990)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Max. Temp. (°F)	39	46	56	67	76	87	93	91	82	70	54	42	66.9
Avg. Min. Temp. (°F)	19	24	34	43	53	64	69	68	58	46	33	23	44.5
Avg. Total Precip. (in.)	0.79	1.06	2.64	3.07	5.12	4.13	4.33	3.5	2.52	2.56	1.57	0.94	32.23

Source National Oceanic and Atmospheric Administration

Data obtained from the National Oceanic and Atmospheric Agency (NOAA) shows that the average annual temperature from 1900 to 1999 in Central Kansas is 54.3 degrees Fahrenheit (ºF). The average annual temperature from 2000 to 2016 was 55.3 ºF, an increase of an average of 1.0 ºF. The NOAA data also show that the average annual precipitation from 1900 to 1999 was 26.94 inches. The average annual precipitation from 2000 to 2016 is 28.96 inches. Table 3 charts average annual temperatures and precipitation by decade from 1990 through 2016. Figure 2 and Figure 3 show corresponding average annual temperature and precipitation, respectively, from 1990 to 2016.

Table 3: Average Annual Temperature and Precipitation Since 1990

	1900 - 1999	1990 - 2016	1990 - 1999	2000 - 2009	2010 - 2016
Average Annual Temperature (°F)	54.3	55.6	54.85	55.35	55.94
Average Annual Precipitation (inches)	26.94	28.96	30.63	28.67	27.19

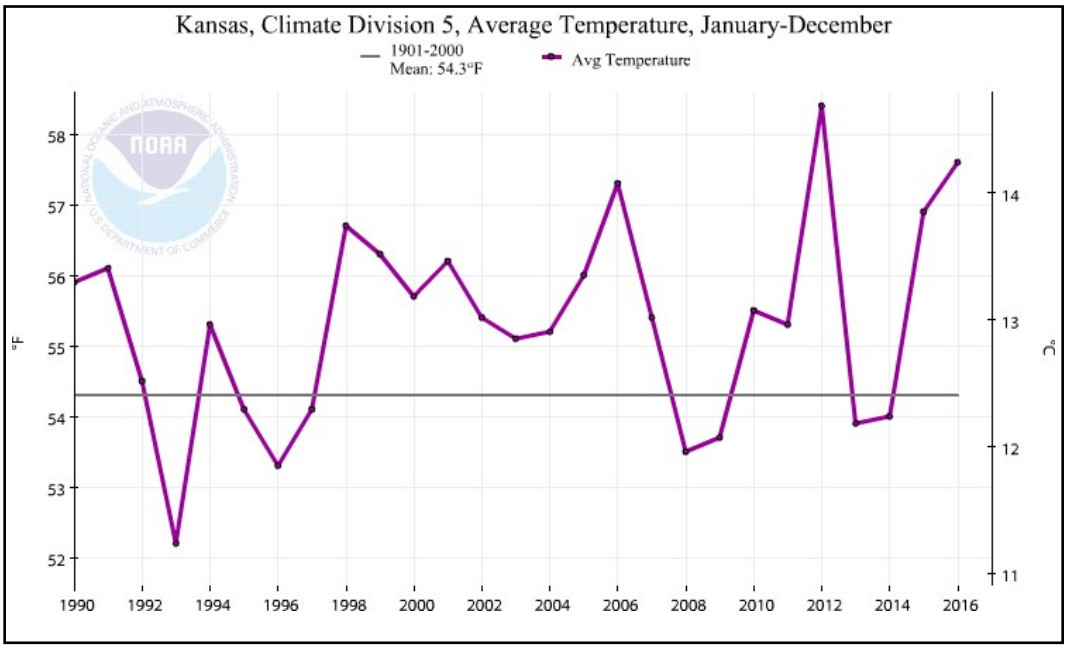

Figure 2: Average Annual Temperature for Central Kansas – 1990-2016

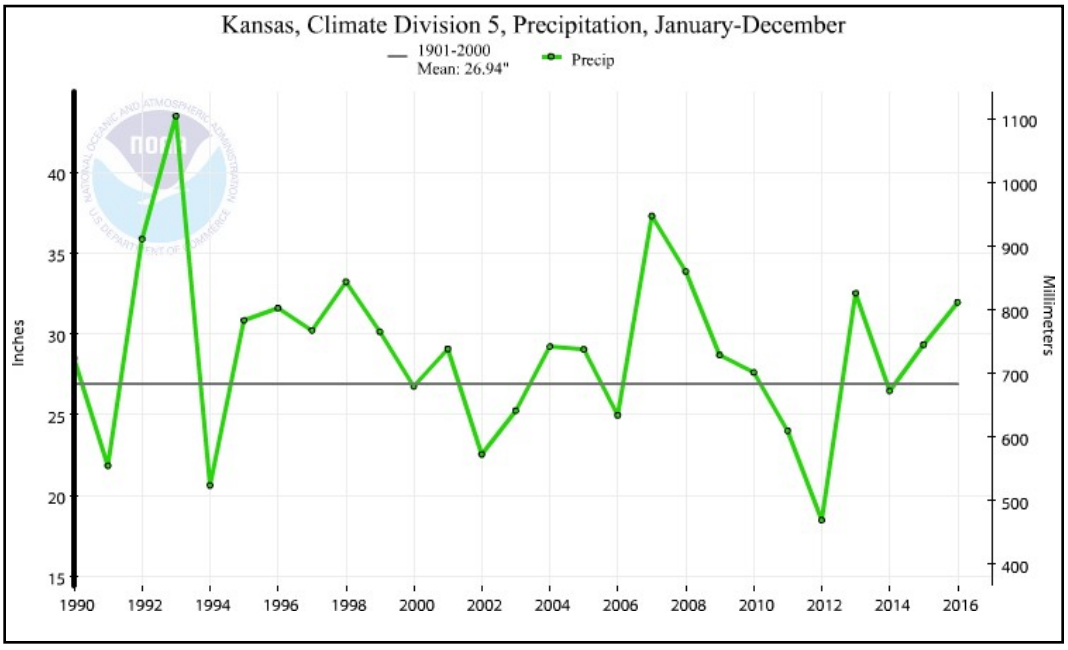

Figure 3: Average Annual Precipitation for Central Kansas – 1990-2016

The data from Table 3, and from Figures 2 and 3 show that average annual temperature in Central Kansas is trending warmer than the 1900 to 1999 average, especially since 2000. The data also show that average annual precipitation, while generally increased over the 1900 to 1999 average annual precipitation, has been slightly decreasing for each decade since 2000 after a wet decade in the 1990's.

4.2 Landforms

The USEPA, in conjunction with various state and local agencies, has developed a system to define ecological regions—ecoregions—that are relatively large units of land and water defined by similarities in biotic and abiotic factors (e.g., climate, topography, geology, and vegetation) that regulate the structure and function of the ecosystems within them (USEPA 2013).

The Installation is located within the broad Level I Great Plains, Level II South Central Semi-Arid Prairies ecoregion, Level III Central Great Plains ecoregion, and Level IV Smoky Hills ecoregion. The Smoky Hills ecoregion is a transition zone between the tallgrass prairies to the east and the mixed-grass prairies to the west (USEPA 2013), situated on the eastern border of the Central Great Plains. The Central Great Plains ecoregion was once characterized as a grassland with low scattered trees and shrubs, and now is characterized by croplands forming the eastern boundary of the major wheat growing area of the United States (USEPA 2013). The land cover within the Installation is primarily native rangeland and is consistent with a transitional zone between the tallgrass and mixed-grass prairies. Section 5.2 describes the vegetation at the Installation.

The land cover at the KSTC is dominantly herbaceous, which comprises 89 percent of the KSTC. The remaining land covers include deciduous forest, woody wetlands, open water, developed low-intensity land use, developed open-space land use, and cultivated crops. Figure 4 shows estimated land cover as determined during a 2014 cover type survey completed at the KSTC (Olsson, 2014). The deciduous forest is primarily located along the stream corridors and is considered riparian forest. Open water includes multiple ponds at the Installation. Developed low intensity land use consists of the range office, equipment storage yards and buildings, vehicle parking and staging areas, new barracks and shower houses, and buildings at the firing ranges. In addition, developed low-intensity land includes Crisis City that includes an operations and training center, training areas with staged aircraft, train cars, demolition debris, and parking area. Developed open-space includes firing ranges that have mechanical targets and associated firing stations, roads, and disperse, small areas with cultivated crops are feed plots for wildlife.

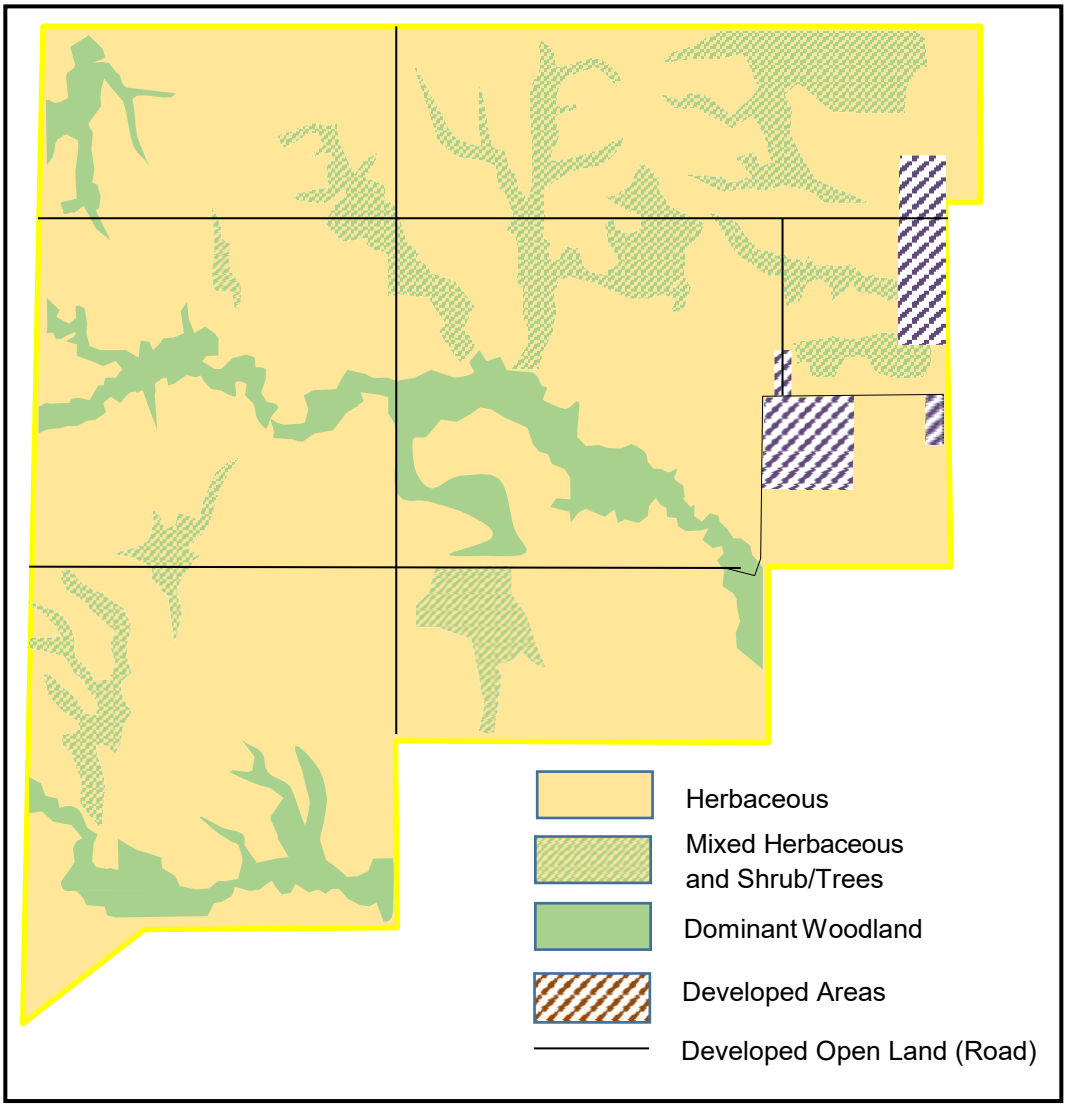

Figure 4: Estimated Land Cover Types at the KSTC

Source: Prairie Encroachment Assessment, Kansas Training Center (Olsson Associates, 2014)

4.3 Geology and Soils

4.3.1 Geology

The KSTC falls in the region known as the Smoky Hills. This region is identified by the outcrops of Cretaceous-aged rocks and gets the name Smoky from the early morning haze that gathers in the valleys. During the Cretaceous Period, Kansas was under water. Three types of rock outcrops define the Smoky Hills: the sandstones of the Dakota Formation, the thick chalks of the Niobrara Chalk, and the limestones of the Greenhorn Limestone. The hills and buttes of the Smoky Hills are capped by the Dakota Formation sandstone and rise sharply above the surrounding plains. The next outcrop is the Greenhorn Limestone, made up of thin chalky limestone beds alternating with thicker beds of grayish shale. The third range is the Niobrara Chalk, where the chalk beds

are known for the pinnacles, spires, and odd-shaped masses formed by chalk remnants (Kansas Geological Survey [KGS] 2005).

4.3.2 Soils

The soils at the KSTC formed on uplands with deep to moderately deep, well-drained to moderately well-drained soils, with clayey or loamy subsoils. The upland soil is drained by intermittent streams and is gently sloping with slopes ranging from 0 to 12 percent. The soils formed from weathered sandstone, weathered sandy shale, or in loess on ridge tops and side-slopes. Figure 5 illustrates the formation of the parent materials for soils at the KSTC.

A Soil Management Plan for the KSTC completed in 2014 (Olsson Associates, 2014) identified soils in eight primary soil series that are present on the KSTC. The soils of the west and central portions of the KSTC, having formed in more rolling topography, are similar in nature, typically consisting of silt loam surface soil underlain by clay loam. These soils are often deep in the valley areas between ridges, and are shallow to moderate in depth along the side slopes and ridge tops. They are typically well drained, although infiltration is relatively slow. Soils in the east portion of the Installation have formed on more gently rolling to nearly flat topography. These are silt loam soils with clayey subsoil that is typically deep and well drained, and has good infiltration but slow percolation. General soil properties are provided in Table 4.

Table 4: Summary of Soil Properties Kansas training Center

Soil Series	Drainage	Slope	Landscape	Permeability	Flooding	Hydric
Crete-Wells complex	Moderately well drained	3-7%	Hillslopes	Slow/moderate	None	No
Crete silt loam	Moderately well drained	0-1%	Interfluves	Slow	None	No
Crete silt loam	Moderately well drained	3-7%	Hillslopes	Slow	None	No
Wells loam	Well drained	3-7%	Hillslopes	Moderate	None	No
Lancaster-Hedville complex	Well drained	3-20%	Hillslopes	Moderate	None	No
Longford silt loam	Well drained	1-7%	Hillslopes	Slow	None	No
Tobin silt loam	Well drained	0-2%	Flood plains	Moderate	Occasionally	No
Edalgo clay loam	Well drained	3-7%	Hillslopes	Very slow	None	No

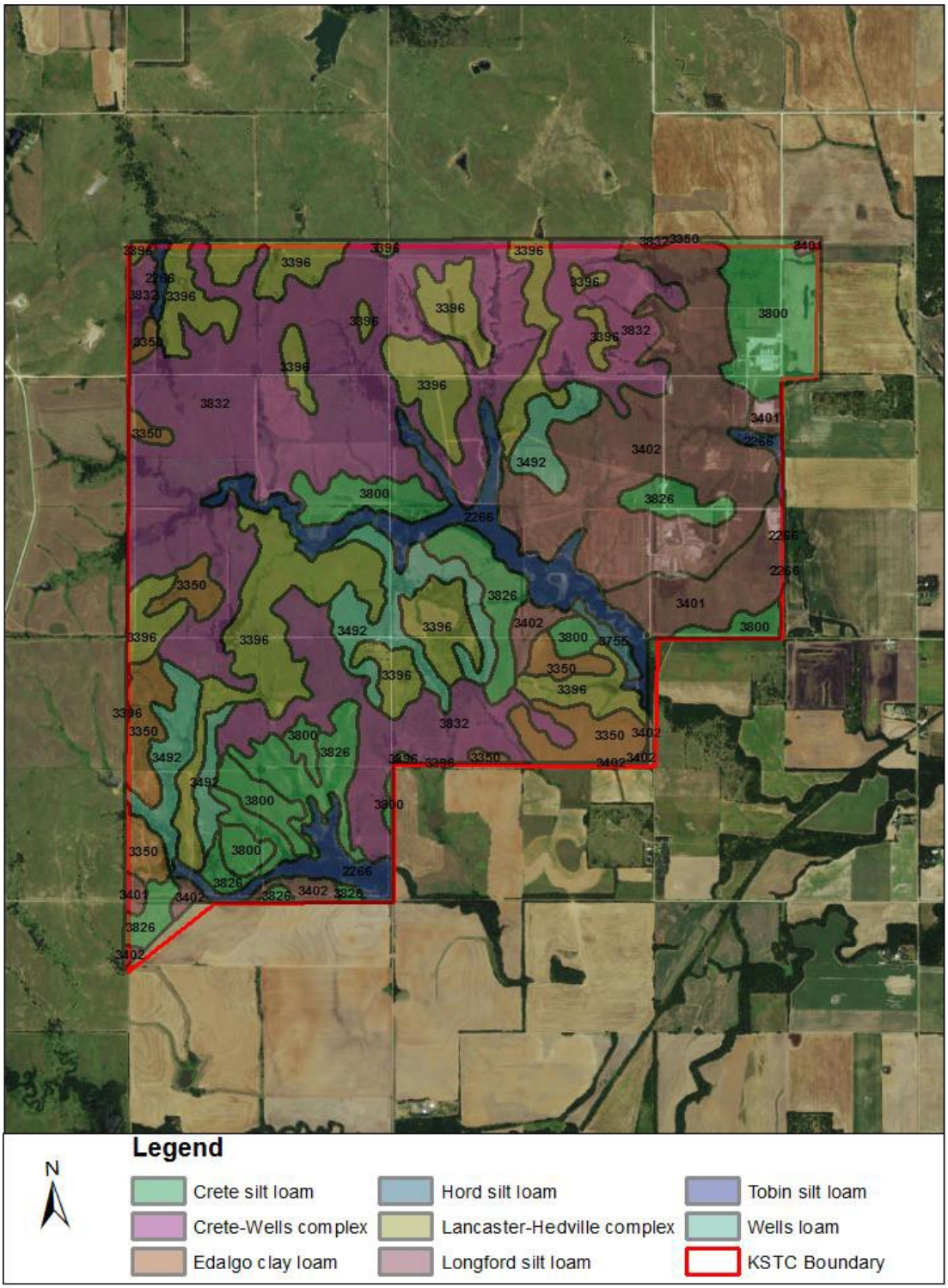

Figure 4: Soil Types at the KSTC

4.4 Hydrology

The hydrologic characteristics of the KSTC are defined by the frequency of significant runoff resulting from storm events. Drainage of the KSTC is generally to the east through a tributary of Dry Creek that flows to the Saline River. This drainage is the dominant landform on the Installation, running from west to east, and southeast toward the east border of the Installation. It is fed by several smaller sub-tributary drainages from the north and south areas of the Installation. Within the tributary stream areas are small wetland areas that are typically wet only during times of precipitation runoff and stream flow. The KSARNG has impounded some drainages to create ponds and wetlands to provide diverse wildlife habitat at the Installation.

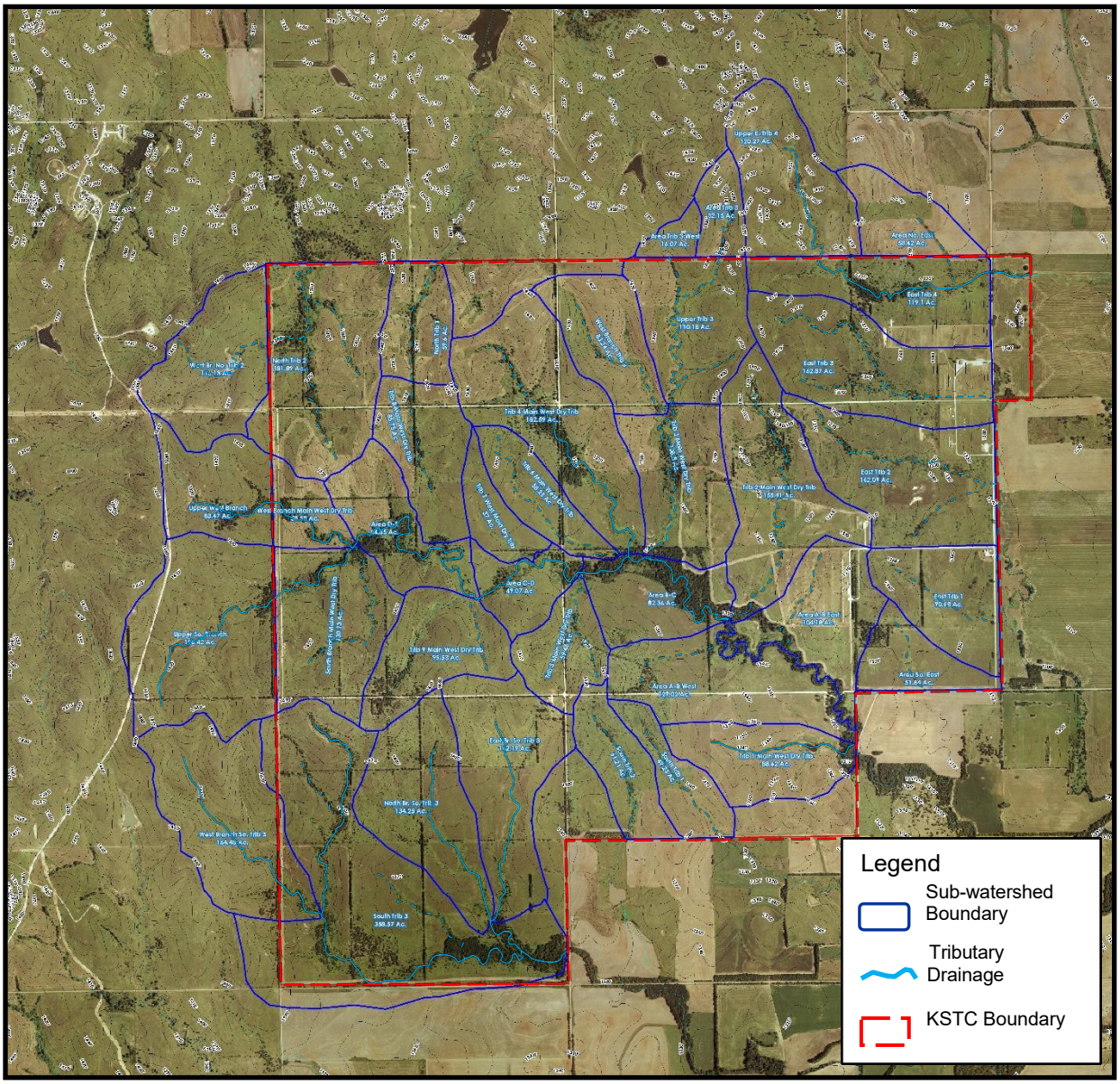

Figure 4.1: KSTC Watershed Map
Source: Kansas Training Center Watershed Study (AES, 2008)

Surface waters are regulated under the Kansas Administrative Regulations, Article 16. This article states that, “For all surface waters of the State, if existing water quality is better than applicable water quality criteria established in these regulations, that existing water quality shall be fully maintained and protected.” A watershed study of the KSTC was completed in 2007 (Applied Ecological Services [AES] 2008) and stated the condition of the watershed is stable. It noted, however, that if and as the military training mission of the KSTC changes, the potential for added erosion could increase, thereby impacting water quality. The watershed study included a vulnerability assessment that concluded there is increased stormwater runoff volumes with construction of new facilities, particularly on the east portion of the Installation.

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5. Ecosystems and Biotic Environment

An ecosystem is a localized community of interdependent organisms—including plants, animals, and microorganisms—which exist together with the environment they inhabit and depend on. Ecosystems vary in size. Everything that lives in an ecosystem is dependent on the other species and elements that are also part of the ecological community. If one part of the ecosystem is disrupted or disappears, all the other members are affected. When an ecosystem is healthy, it is balanced and sustainable.

Since 2005, several natural resource surveys and restoration projects have been completed at the KSTC to examine vegetative and wildlife conditions at the Installation and ways to conserve the native prairie ecosystem present at the KSTC. The surveys have included the following:

- Plant Communities and Restoration Potential at the KSARNG Regional Training Center Near Salina, Kansas (AES 2005)
- QuickLook Wildlife Survey of the KSARNG Training Center, Salina, Kansas (AES 2005).
- Wetland Restoration Study at the KSARNG Training Center Near Salina, Kansas (AES 2007)
- Kansas Training Center Watershed Management Study (AES 2008)
- Preliminary Environmental Assessment Report, KSARNG Weapons Training Ranges, Kansas Training Center (Olsson Associates 2010)
- Undesirable and Noxious Weed Control Plan, Kansas Army National Guard (Olsson Associates 2012)
- Limited Faunal Survey of the Kansas Training Center – Reptile and Amphibian Survey, Small Mammal Survey, and Terrestrial Invertebrate Survey (Olsson Associates 2012)
- Jurisdictional Evaluation and Wetland Delineation (Habitat Architects 2012)
- Summary of Spring 2013 Prairie Enhancement Plan Activities for the Kansas Training Center (Olsson Associates 2013)
- Chiroptera Location Survey of the Kansas Training Center (Olsson Associates 2013)
- Aquatic Macroinvertebrate Survey, Kansas Training Center (Olsson Associates 2013)
- Woodland Assessment, Kansas Training Center (Olsson Associates 2013)

- Prairie Encroachment Assessment, Kansas Training Center (Olsson Associates 2014)
- Off-Road Navigation Course Natural Resources Management Plan (Olsson Associates 2015)
- Vegetation Monitoring for the Kansas Training Center (Olsson Associates 2015)
- Bat Survey at the Kansas Training Center (Stantec 2016)

The surveys have provided the KSARNG Natural Resources Management team an understanding of natural resource conditions of the KSTC, a baseline of natural resource conditions, and the ability to continue effective natural resources and ecosystem management for the Installation. This section describes ecosystem and the biotic environment of the KSTC as found through these surveys.

5.1 Ecosystem Classification

The USDA NRCS maps the Major Land Resource Areas (MLRA) for the United States. MLRAs group areas into land based on climate, physiology, soils, vegetation, land use, geology, and hydrology. The KSTC lies in MLRA 74: Central Kansas Sandstone Hills.

This MLRA is entirely in Kansas. This area is an undulating to hilly, dissected plain. Wide flood plains and terraces are along the larger rivers, and narrow bottom-land is along the small streams. Elevation ranges from 1,310 to 1,640 feet (400 to 500 meters), increasing from east to west. Local relief is typically 65 to 130 feet. The dominant soil order in this MLRA is mollisols. The soils have a mesic soil temperature regime, an ustic soils regime, and mixed or smectitic mineralogy. They are shallow to very deep, moderately well drained to somewhat excessively drained, and loamy or clayey.

5.2 Vegetation

5.2.1 Historic Vegetative Cover

The KSTC lies in the transition zone between the tallgrass prairie and the mixed-grass prairie, although tallgrasses historically dominated the area. No well-developed forests were present; rather relatively small woodland areas were established along the streams or wetland areas. Naturally, the prairie was maintained by fire and grazing buffalo, and later by grazing cattle. The dominant vegetation of the tallgrass prairies included big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*).

5.2.2 Current Vegetative Cover

A vegetation inventory was completed in 2005 at the KSTC, during which four distinct vegetative community types were identified. The vegetative communities were determined by species composition, and included the following:

- Grassland, including dry mesic prairie, mesic prairie, and wet prairie
- Woodland, including riparian woodlands, hackberry woodlands, and osage-orange woodlands
- Wetlands, including emergent/wet prairie wetland complexes, wet and dry ponds, pond/emergent wetland complexes, and scrub-shrub wetlands
- Cultural vegetative communities, including fire breaks, cropland, and developed or disturbed areas (office, barracks, and maintenance areas)

The current grassland vegetative cover consists mainly of a mix of foraging and pasture grass species, with several areas of shrub and woody tree species. The dominant grass species are native grasses, including big bluestem, Indiangrass, big bluestem, prairie dropseed (*Sporobolus heterolepsis*), sideoats grama (*Bouteloua curtipendula*), and grama grass (*Bouteloua* spp.). Smooth and Downy brome (*Bromus inermis* and *Bromus tectorum*, respectively) are also present, but not dominantly. Switchgrass, big bluestem, little bluestem, and Indiangrass are nicknamed “The Big Four” for a healthy tallgrass prairie ecoregion. Forb species present on the site include lead plant (*Amorpha canescens*), western ragweed (*Ambrosia psilostachya*), Heath aster (*Symphyotrichum ericoides*), and Maximillian sunflower (H*elianthus ma imillani*).

Woodlands are dominated by Osage orange (*Maclura pomifera)* and hackberry (*Celtis occidentalis*) in terms of stem counts, canopy cover, and overall importance. Riparian woodlands tend to be more diverse than upland areas, with American elm (U*lmus americana*), hackberry, Osage orange, honey locust (*Gleditsia triacanthos*), and several minor tree species present. Woodlands at the KSTC, then, are of the same general nature of many woodlands throughout the state (Olsson Associates 2014). The diversity of tree species further identifies these woodlands as young ecosystems that provide diverse wildlife habitat.

Wetland communities included scrub-shrub wetlands typically found along narrow, intermittent drainages or along pond edges in the central and western portions of KSTC. They consist of bush wild-indigo (*Amorpha fruticosa*), prairie cordgrass (*Spartina pectinata*), American germander (T*eucrium canadense*), American waterhorehound (L*ycopus americanus*), and Torrey's rush (J*uncus torreyi*) with pond edges composed of black willow (*Sali nigra*) and eastern cottonwood (*Populus deltoides*). Wetlands also include Palustrine emergent wetlands that are associated with drainages, depressions, and ponds and consist of smartweed (*Persicaria* spp.), cattails (T*ypha* spp.), bald spikerush and pale spike-rush (E*leocharis erythropoda* and *leocharis. Macrostachya,* respectively), American water horehound, yellowfruit sedge (*Care annectans*), Torrey's rush,

rough barnyard grass (E*chinochloa muricata*), common cocklebur (X*anthium strumarium*), and broad-leaf arrowhead (*Sagittaria latifolia*) (AES 2007).

5.2.3 Turf and Landscaped Areas

There are no former landscaped areas at the KSTC, rather there are limited areas with fescue turf grass that are maintained as lawns on the east portion of the Installation near the office and maintenance areas, the short-arms firing ranges, and in the training area of Crisis City. In addition, wildfire breaks maintained to have no vegetation are located around the periphery of the KSTC, as well as around the boundaries of weapons ranges. Maintenance on these areas occur periodically throughout the year primarily for operational versus aesthetic reasons.

5.3 Aquatic and Terrestrial Wildlife

This section describes aquatic and terrestrial wildlife populations as determined from faunal surveys conducted at the Installation since 2005. Surveys completed from 2010 to 2015 found that mammal species captured or observed at the KSTC are similar to general mammal populations and diversity in Kansas prairies.

5.3.1 Aquatic Macroinvertebrates

A survey of aquatic macroinvertebrates was conducted in 2013. Four aquatic features, including one deep pond, two shallow ponds and one wetland, were surveyed at the KSTC to assess diversity and relative population numbers of aquatic macroinvertebrate species that provide part of the foundation of the ecosystem of the KSTC. The survey was successful at collecting and identifying a total of 678 aquatic macroinvertebrate specimens consisting of 13 different orders and 22 families. Two of the identified aquatic macroinvertebrates have a low tolerance to organic pollution, making them ideal indicators of water quality. Three of the four aquatic features surveyed revealed good biodiversity. However, the deep pond that was surveyed revealed low numbers and diversity of specimens. This may be attributed to a variety of causes; however, one specimen collected was a low-tolerance specimen, or an insect that is sensitive to degraded water quality or other environmental conditions. This suggests that the cause of the low invertebrate populations and diversity was not necessarily attributable to poor environmental conditions, but other factors that are may be attributable to hydrology, population dynamics, or random distribution of species at the site.

5.3.2 Aquatic Vertebrates

An aquatic vertebrate survey was conducted in 2013. Through a combination of standard electrofishing techniques and fish nets on the front of the boat, fish species were captured and identified. The species that were caught and identified included green sunfish (L*eopomis cyanellus*), golden shiners (N*otemigonus crysoleucas*), fathead minnows *Pimephales promelas*), and bullhead catfish (*Ameriurus* spp.). This survey was conducted on one of the shallow ponds within the Installation. This pond has been previously stocked with largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), channel catfish (I*ctalurus punctatus*), and fathead

minnows. The only stocked fish species to be identified during the survey was the fathead minnow. As the other species were not captured it is likely that the pond went dry since the stocking.

The aquatic vertebrate surveys are important for monitoring ecological health of the waters at the KSTC. The results can help determine future management projects by comparing the biodiversity and species composition of the waters on the KSTC.

5.3.3 Terrestrial Macroinvertebrates

A terrestrial macroinvertebrate survey was conducted in 2013. Through a combination of sweep surveys and direct searches, 404 insect and spider specimens were found that provide a baseline of terrestrial invertebrate populations at the KSTC.

The sweep surveys conducted for the terrestrial invertebrate survey were accomplished on dominantly grassland communities and produced the greatest number of captures (347 of 404 specimens captured). Most of these specimens were members of the Hemiptera and Homoptera orders (131 of 347), insects classified as “true bugs” that typically include leafhoppers, assassin bugs, and cicadas. During the sweep surveys, insects in the order Coleoptera (beetles) were also numerous (86 of 347 specimens captured in the sweep surveys), as well as Orthoptera (62 of 347 specimens captured). These results are indicative of greater diversity in the family and genus types found in the grassland communities. Direct search surveys were conducted in woodlands and riparian areas. Generally, fewer populations of invertebrates (57 specimens of the total 404 captured) were found.

The terrestrial invertebrate surveys are important for monitoring ecological and plant community health at the KSTC. The surveys should be used as a preliminary baseline to which future surveys can be compared to measure biodiversity, species composition, and the effectiveness of resource management projects.

5.3.4 Birds

Avian surveys conducted from 2012 to 2016 detected 64 species of breeding birds at the KSTC and an additional 33 species using the area as a wintering ground. Birds of conservation interest include one Species in Need of Conservation (SINC) (Henslow’s sparrow, [*Ammodramus henslo ii*]), and six Birds of Conservation Concern (BCC) (Olsson Associates, 2017). Species identified during the surveys are listed in Table 4.

Table 4: Avian Species Observed and Recorded at the KSTC 2012 - 2016

Common Name	Scientific Name	Common Name	Scientific Name
American crow	*Corvus brachyrhynchos*	House finch	*Haemorhous me icanus*
American goldfinch	*Spinus tristis*	Indigo bunting	*Passerina cyanea*
American robin	*Turdus migratorius*	Killdeer	*Charadrius vociferus*
American tree sparrow	*Spizella arborea*	Lark sparrow	*Chondestes grammacus*

Table 4: Avian Species Observed and Recorded at the KSTC 2012 - 2016

Common Name	Scientific Name	Common Name	Scientific Name
Baltimore oriole	*Icterus galbula*	Loggerhead shrike	*Lanius ludovicianus*
Barn swallow	*Hirundo rustica*	Mourning dove	*Zenaida macroura*
Barred wwl	*Stri varia*	Northern bobwhite	*Colinus virginianus*
Bell's vireo	*Vireo bellii*	Northern cardinal	*Cardinalis cardinalis*
Black-capped chickadee	*Poecile atricapillus*	Northern flicker	*Colaptes auratus*
Blue grosbeak	*Passerina caerulea*	Northern mockingbird	*Mimus polyglottos*
Blue jay	*Cyanocitta cristata*	Orchard oriole	*Icterus spurius*
Brown thrasher	*Toxostoma rufum*	Red-bellied woodpecker	*Melanerpes carolinus*
Brown-headed cowbird	*Molothrus ater*	Red-eyed vireo	*Vireo olivaceus*
Cliff swallow	*Petrochelidon pyrrhonota*	Red-headed woodpecker	*Melanerpes erythrocephalus*
Common grackle	*Quiscalus uiscula*	Red-tailed hawk	*Buteo amaicensis*
Common nighthawk	*Chordeiles minor*	Red-winged blackbird	*Agelaius phoeniceus*
Common yellowthroat	*Geothlypis trichas*	Ring-necked pheasant	*Phasianus colchicus*
Dickcissel	*Spiza americana*	Rose-breasted grosbeak	*Pheuticus ludovicianus*
Downy woodpecker	*Picoides pubescens*	Ruby-crowned kinglet	*Regulus calendula*
Eastern bluebird	*Sialia sialis*	Savannah sparrow	*Passercula sand ichensis*
Eastern kingbird	*Tyrannus tyrannus*	Scissor-tailed flycatcher	*Tyrannus forficatus*
Eastern meadowlark	*Sturnella magna*	Spotted towhee	*Pipilo maculatus*
Eastern wood-pewee	*Contopus virens*	Summer tanager	*Piranga rubra*
Eurasian collared-dove	*Streptopelia decaocto*	Swainson's hawk	*Buteo s ainsoni*
European starling	*Sturnus vulgaris*	Tufted titmouse	*Baelophus bicolor*
Field sparrow	*Spizella pusilla*	Turkey vulture	*Cathartes aura*
Grasshopper sparrow	*Ammodramus savannarum*	Upland sandpiper	*Bartramia longicauda*
Gray catbird	*Dumatella carolinensis*	Warbling vireo	*Vireo gilvus*
Great crested-flycatcher	*Myiarchus crinitus*	Western kingbird	*Tyrannus verticalis*
Greater Prairie-chicken	*Tympanuchus cupido*	Western meadowlark	*Sturnella neglecta*
Great-tailed grackle	*Quiscalus me icanus*	Wild turkey	*Meleagris gallopavo*
Henslow's sparrow	*Ammodramus henslo ii*	Yellow warbler	*Setophaga petechia*
Horned lark	*Eremophila alpestris*	Yellow-billed cuckoo	*Coccyzus americanus*

Source Olsson

Ten species of interest were detected during the five-year survey period: one SINC species, six BCC species, and three additional species. The species of interest include the following:

5.3.5 Henslow's sparrow: This is the only SINC species detected during the survey period. These sparrows are restricted to tall, dense grasslands with a thick layer of litter. Saline County is at the far western edge of their range in Kansas, and consequently the species would be highly uncommon (Thompson et al. 2011).

5.3.6 Bell's vireo: This vireo is a BCC species found in edge habitat, particularly in thickets and scrub. Within grassland habitat, they prefer isolated clusters of dense vegetation (Thompson et al. 2011). This species was the seventh most commonly detected species across all five years. This indicates a high probability of a large, stable breeding population within the project area.

5.3.7 Swainson's hawk: This diurnal raptor is a BCC species and was only detected during 2013.

5.3.8 Upland sandpiper: This 'shorebird' is a BCC species associated with the high plains. This species is attracted to burned areas and managed grasslands. Upland sandpipers were detected in the project area at one station in 2013.

5.3.9 Red-headed woodpecker: This is a BCC species associated with both open country and woodlands (Thompson et al. 2011). It was only detected in 2012, but it is a common breeder in central Kansas (Thompson et al. 2011).

5.3.10 Scissor-tailed flycatcher: A BCC species associated with open areas populated by widely dispersed trees, though it can be found in almost any setting in Kansas outside of forests (Thompson et al. 2011). There is likely a stable population of this species at the KSTC.

5.3.11 Loggerhead shrike: A BCC species associated with general open country with scattered trees. While it can be locally common, this species is declining across its range (Thompson et al. 2011).

5.3.12 Greater prairie-chickens: This species is a permanent resident of Kansas and requires extensive areas of native prairies and mixed grasslands for successful breeding. The species has been confirmed to breed in Saline County (Thompson et al. 2011). The presence of groups of seven and 11 individuals at different stations in 2013 is a strong indication that they are nesting in or near the Installation.

5.3.13 Brown-headed cowbirds: A native songbird species that breeds throughout the state of Kansas. The species is most commonly associated with fragmented forests and edge habitat (Thompson et al. 2011). Brown-headed cowbirds were the tenth most commonly detected species across all five years.

5.3.14 Grasshopper sparrow: This is a species associated with high-quality grasslands, including the tallgrass prairie of Kansas. Generally, the density of the species increases with habitat quality, and its presence/population size can be used as a proxy of ecological health.

5.3.5 Mammals

Both small and large mammals were surveyed at the KSTC in separate studies in 2012 and 2013. The small mammal survey completed in 2013 yielded a total of 78 specimens, representing four distinct species. These species include: white-footed mouse (*Peromyscus leucopus*), deer mouse (*Peromyscus maniculatus*), eastern woodrat (N*eotoma floridana*), and house mouse (*Mus musculus*). The white-footed mouse was the most dominant species captured, accounting for 61 percent of the specimens. The 2013 survey results are similar to a prairie species diversity study completed in Oklahoma in 1994. This study found that five species dominated (94 percent) the total specimen capture in varying prairie habitat (Olsson Associates 2013).

Based on estimates from mammal surveys at other similar locations, a total of 25 species of small mammals may be expected to occur on the Installation. Included in these species are the eastern mole (*Scalopus a uaticus*) and Elliot's short-tailed shrew (*Blarina hylophaga*). Small mammals are the primary source of prey for raptors, snakes, and larger carnivorous mammals. Fluctuations in their population often result in fluctuations in the populations of their associated predators. The disruption of the KSTC's grassland habitat through cultivation, erosion, or annual burning has the potential to reduce the small mammal population, which will directly affect the populations of those predator species which rely upon them for food (Olsson 2012a).

The community of medium to large mammals have been studied and documented on the KSTC several times. Studies include Terrestrial Mammals of the Smoky Hill ANG Training Facility (Kansas State University 2006), QuickLook™ Wildlife Survey (AES 2005), and A Natural Features Inventory of the Smoky Hill ANG Range, Kansas (Kansas Biological Survey [KBS] 2007). The most recent survey was done in 2014 using the combination of camera surveys, mammal sign searches, spotlight visual counts, and terrestrial visual encounter surveys (Olsson Associates 2014). The 2014 survey identified 10 mammal species present on the KSTC. With all the studies combined there has been a total of 16 large to medium mammal species identified on the Installation. The species identified include the American badger (*a idea ta us*), North American beaver (*Castor canadensis*), black-tailed jack rabbit (L*epus californicus*), black-tailed prairie dog (*Cynomys ludoviciansus*), bobcat (L*ynx rufus*), coyote, eastern cottontail, fox squirrel (*Sciurus niger*), mule deer, plains pocket gopher (*Geomys bursarius*), raccoon (*Procyon lotor hirtus*), red fox (V*ulpes fulva*), striped skunk (*Mephitis mephitis*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), Virginia opossum (D*idephis virginiana*), and white-tailed deer. Of the former, the bobcat and the coyote occupy the top trophic level within the KSTC and help control the populations of the small mammal species, through predation. White-tailed deer and mule deer are both known to occur within and around the KSTC, preferring the cover provided by the riparian corridors running through the Installation.

5.3.6 Bats

An acoustical analyses study conducted in 2016 at the KSTC detected six bat species. The six species included the big brown bat (E*ptesicus fuscus*), eastern red bat (L*aisurus borealis*), silver-haired bat (L*asionycteris noctivagans*), little brown bat (*Myotis lucifugus*), evening bat (N*ycticeius humeralis*), and the tri-colored bat (*Perimyotis subflavus*). The threatened northern long-eared bat (*Myotis septentronalis*) was not detected during the 2016 survey (Stantec 2016). The nearby Konza Prairie has also recorded the hoary bat (L*asiurus cinereus*) (Konza Prairie LTER 1997). A single, eastern red bat was captured during the mist net survey. It is possible that other species occur on the Installation; however, they have not been detected as of the publication of this report.

5.3.7 Reptiles and Amphibians

A limited faunal survey conducted in May 2012 detected four species of snake, two species of turtle, two species of skink, and three species of frog on the KSTC. Most of the detected species are associated with wet or aquatic environments, which was reflected by the habitat in which they were found. These 11 species are likely only a subset of the actual faunal diversity of reptiles and amphibians present on the KSTC (Olsson 2012a).

A faunal survey conducted at the adjacent Smokey Hill ANGR detected 34 species of reptile and amphibian. The majority of these species were those associated with grassland and aquatic habitat. Due to the overall habitat similarity between the ANGR and KSTC and their proximity, it is expected that most, if not all of the species detected in the ANGR survey can be found on the KSTC (KBS 2007). The expected and currently identified species within the KSTC represent a diverse group occupying multiple habitat niches and ecological roles. Turtle species include the predatory snapping turtle (*Chelydra serpentina*), ornate box turtle (T*errepene ornata*), and the fully aquatic red-eared slider (T*rachemys scripta elegans*). Snake species present on the KSTC include two species of garter snake (T*hamnophis* spp.) and the western rat snake (*Scotophis obsoletus*). Other snake species with the potential to occur in the KSTC include the eastern and western hognose snake (H*eterodon nasicus* and *H. platyrhinos*), Graham's crayfish snake (*Regina grahami*), massasagua (*Sistrurus catenatus*), and prairie rattlesnake (*Crotalus viridus*) (KBS 2007; NGB 2011).

5.4 Threatened and Endangered Species

The USFWS's Information for Planning and Conservation (IPaC) database and the KDWPT's database were reviewed for potential threatened and endangered species (T&E) and SINC in Saline County, pursuant to the requirements of Section 7 (c) of the Endangered Species Act (16 USC 1536), and the Non-Game and Endangered Species Conservation Act (Kansas State Statutes Chapter 32, Article 5). T&E and SINC species are detailed in Chapter 7.0.

5.5 Wetlands

The USACE defines wetlands as "those areas that are inundated or saturated with ground or surface water at a frequency and duration sufficient to support, and that under normal

circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328). Wetlands are an important natural system because of the diverse biological and hydrologic functions they perform. These functions may include water quality improvement, groundwater recharge, pollution treatment, nutrient cycling, provision of wildlife habitat and niches for unique flora and fauna, stormwater storage, and erosion protection.

Potential wetland locations during a 2012 field survey using data from National Wetland Inventory (NWI) maps, aerial photographs, US Geological Survey (USGS) topographic maps, and NRCS soil surveys. A total of 22 wetlands were identified at the KSTC during the 2012 field surveys (Habitat Architects 2012). Wetland locations larger than 0.10 acres as determined in 2012 are shown in Figure 7.

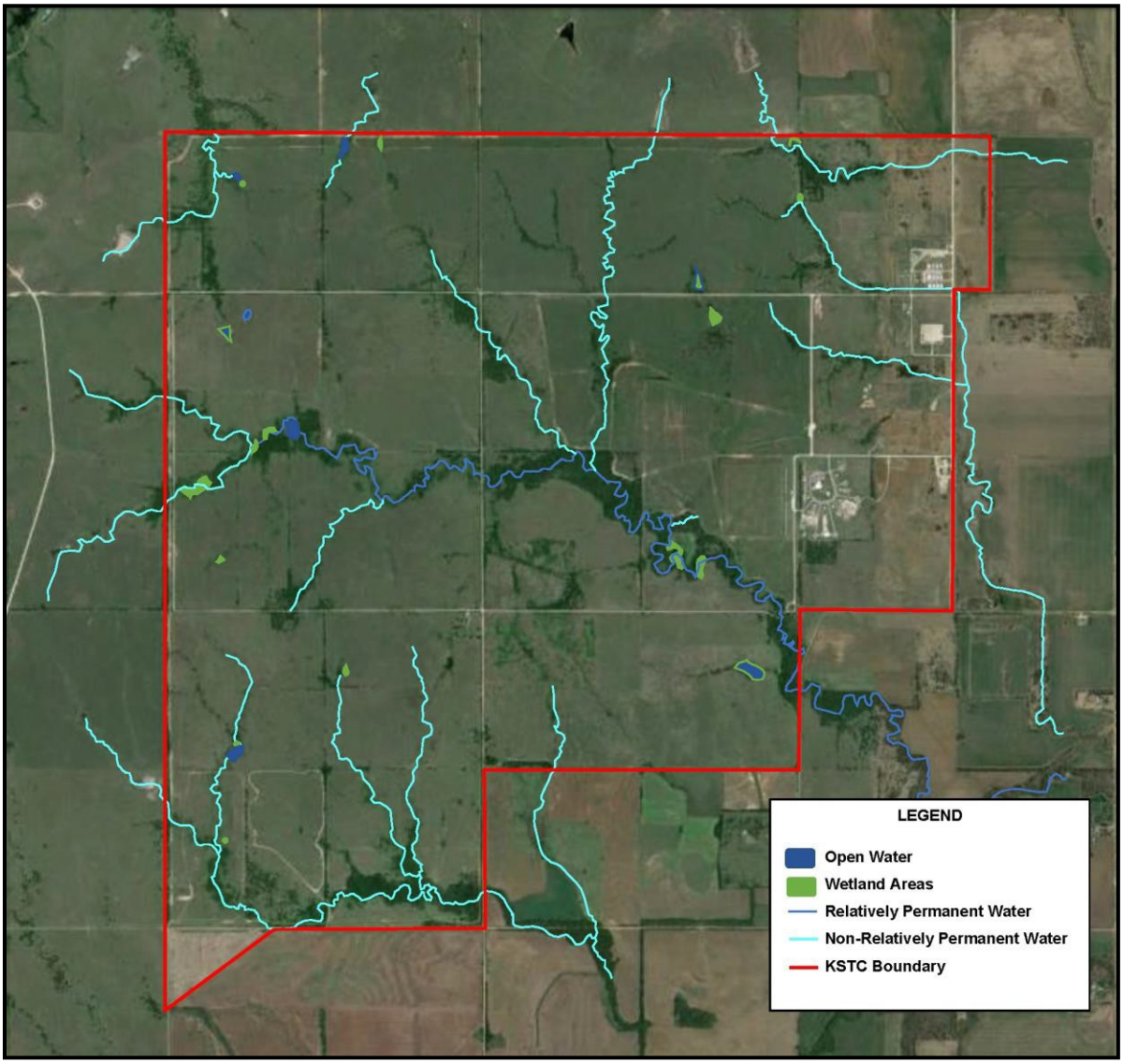

Figure 7: Wetlands, Open Waters, and Streams at the KSTC
Source Habitat Architects

Nineteen of the 22 wetlands were identified as palustrine emergent wetlands. Emergent wetlands are characterized by herbaceous vegetation such as smartweed (*Persicaria* spp.), wild millet (P*chinochloa pungens*), flatsedge (*Cyperus* spp.), sedges (*Care* spp.), flatstem spikerush (E*leocharis compressa*), and narrowleaf cattail (T*ypha angustifolia*). Many of the emergent wetlands were bordered by black willow. However, based on soils and hydrology, most of the black willow did not occur within the delineated boundary of the wetlands. Many of the wetlands are associated with open water features. Open waters are described as unvegetated bodies of water such as ponds and lakes. These features may be jurisdictional if connected to jurisdictional water.

Two scrub-shrub wetlands were identified on the KSTC. Scrub-shrub wetlands are defined by a dominance of buttonbrush (*Cephalanthus occidentalis*) with an understory component dominated by swamp smartweed (*Persicaria hydropiperoides*).

5.6 Surface Waters

The landscape of the KSTC is rolling prairie with wooded riparian zones following intermittent drainages. The native vegetation has been restored from past agricultural use of the land, and provides diverse wildlife habitat and a return to natural hydrologic conditions that existed before settlement of the area. The site is drained by numerous intermittent drainages in broad valleys as well as interspersed steep, deep valleys that flow dominantly to the east toward the Saline River. The streams and creeks that form these drainages maintain a steady flow only during wet years, or wet seasons of the year. Figure 7 shows the locations of these streams and creeks, identified as relatively permanent and non-relatively permanent water. Precipitation falls mostly as rain, sometimes in heavy thunderstorms. Significant runoff occurs during three to five events most years. Because of this pattern, the hydrologic characteristics of the KSTC are defined by the frequency of significant runoff, the time between events, and the time it takes for water to evaporate (AES 2007). Because soil moisture may become depleted between rainfall events, small to moderate rainfall may not result in much, if any, runoff.

There are three ponds that hold water year-round. Water level on the ponds will vary depending on precipitation amounts during wet or dry years. Generally, all surface flow of water at the KSTC drains to the southeast through Dry Creek, the major drainage feature at the facility, with intermittent streams coursing across the site from northwest to the southeast. Smaller sub-tributary drainages feed this main stem tributary from both the northern and southern halves of the facility, and smaller tributaries also channel water mostly to the east. Intermittent drainage features, including streams and small channels, are expected to have continual flow during wet seasons, which may result in temporary ponding of water as well as refreshing of wetlands at the site. All of the tributary drainages discharge to West Dry Creek near the community of Smolan, east of the KSTC.

5.7 Other Natural Resource Information

The KSARNG has completed numerous surveys of the KSTC as reflected in this section of the revised INRMP. Many of the reports completed for natural resource surveys, as well as restoration planning have been supported by information from regional biological studies that are referenced in the reports.

6. Mission Impacts on Natural Resources

6.1 Land Use

Military land use at KSTC is divided into three Land Management Units (LMUs): Mission Operations, Grassland/Agricultural LMU, and Land Navigation LMU.

- The Mission Operations LMU consists of 801 acres (23 percent) that is used for weapons firing ranges, including the M203 Sub Cal Range where simulated rounds of AT4s and hand grenades are used; designated ranges for M249 SAWs, M240Bs, M16s, and M4s, including computerized targets for multiple ranges; and a 9 mm pistol range. It also includes the maintenance shed located at KSTC. There is a C-130 plane fuselage and concrete rubble pile just north of Crisis City, used for training.

- The Grassland/Agricultural LMU encompasses 1,455 acres (41 percent) of land. This LMU is primarily range and woodland that provides areas for light training if needed, but functions mostly for hay production and wildlife habitat. The Grassland/Agricultural LMU also supports two bivouac areas.

- The Land Navigation LMU encompasses 1,278 acres (36 percent) of the land used at KSTC. The Land Navigation LMU is used for overland vehicle training, troop orienteering, and FARP operations training.

- The Crisis City LMU consists of 156-acres, including 44 acres that are fenced and 112 acres that are not fenced. Crisis City includes a primary operations building, a simulation building, and aircraft and train wreckage facilities designed to train Kansas first responders. The Crisis City area also includes wastewater treatment lagoons, rubble pile, and shoot houses.

Figure 8 illustrates major land use areas at the KSTC.

6.2 Current Major Impacts

The major environmental impacts resulting from current military training operations include the following:

- Soil compaction: soil compaction results from excessive pressures for frequent site use by troops or by vehicle use in non-designated areas.

- Loss of native vegetation: Damage to vegetation occurs primarily when vehicles are used away from designated areas. Native vegetation may be damaged from lateral and compressive forces of wheels on heavy vehicles passing through open fields away from designated roadways. Under the resulting stressful conditions, invasive species can

establish and potentially out-compete native species, and become dominant in some areas of the Installation.

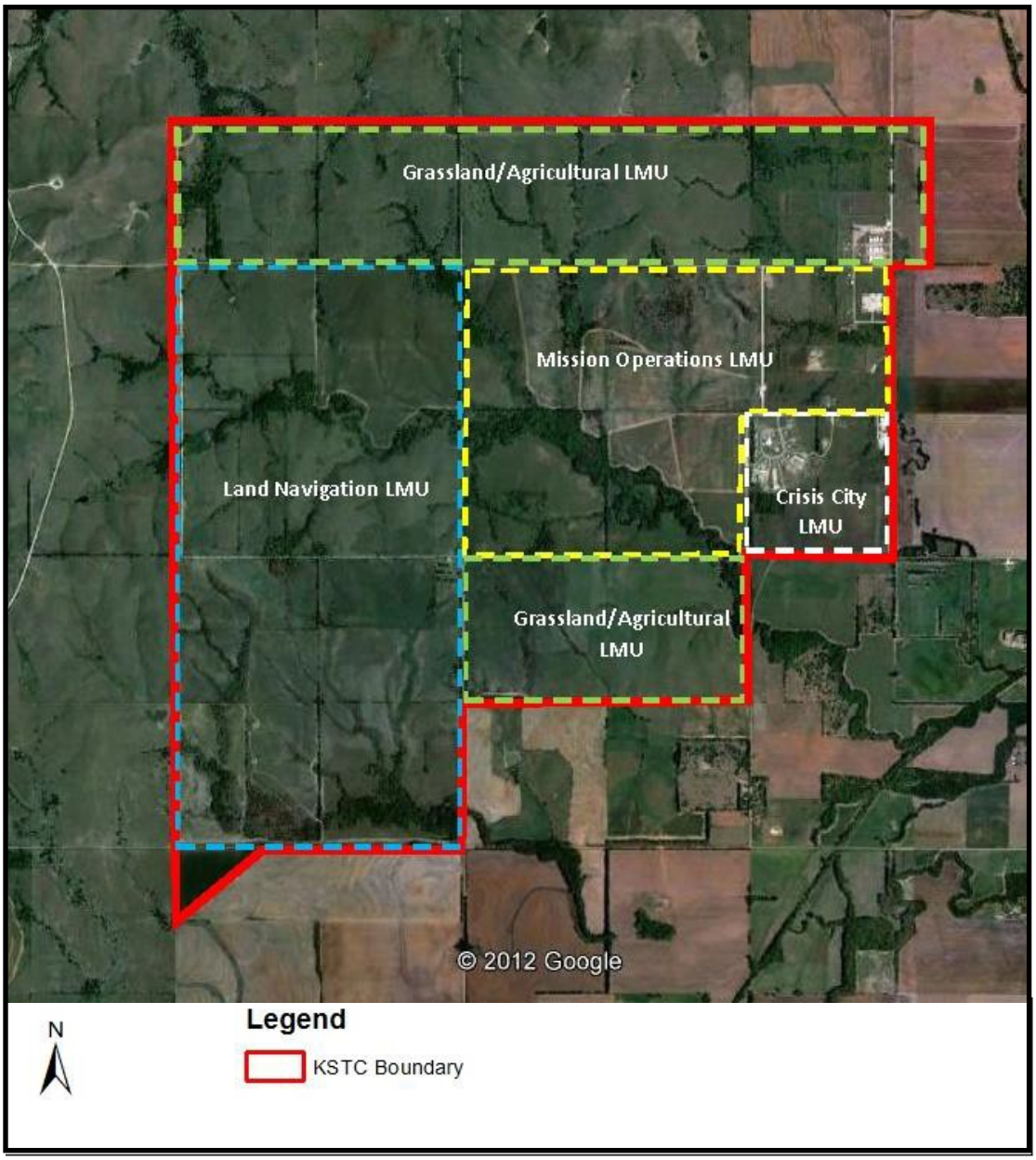

Figure 8: LMU Areas at the KSTC

- Soil erosion: soil erosion occurs when soil becomes unprotected from loss of vegetative cover, and from increases in precipitation runoff resulting in a reduction of water infiltration or a construction of impervious surfaces. Soil erosion also occurs on unprotected slopes when runoff flow is not slowed by vegetation or grade controls that reduce the velocity of the downhill movement of water.

- Invasive vegetation species: invasive species can establish in training areas as a natural result of wind-blown seeds, or from introduction as off-site vehicles and equipment are brought onto the KSTC. Invasive species can quickly become established and outcompete native plants, creating undesirable wildlife habitat, and in some situations, undesirable training environments for troops.

- Stream bank erosion: increased stormwater runoff from compacted surfaces increases the volume and velocity of water moving through drainage swales, creeks, and streams at the KSTC. The increased water volume and velocity erodes stream banks and beds, resulting in incised (vertical cuts) banks, increased stream width, and deeper channels. Damage to the streams can expand into wildlife habitat and military training areas, sometimes creating dangerous conditions for troop and/or vehicle training.

6.3 Potential Future Impacts

Future impacts to the KSTC natural resources will likely encompass the same issues that are listed for current impacts. However, with increased training needs with mounted navigation, FARP operations and at Crisis City, future impacts may also include the following:

1. Mounted navigation training will likely increase periodic dust emissions along unpaved roads of the KSTC. Roadside stress and damage to vegetation and wildlife will likely increase due to increased movement of vehicles and personnel not contained to roads.

2. Several potential natural resource impacts could occur in association with FARP operations training. These impacts will likely include the following:

    - Increased erosion resulting from stormwater runoff from helicopter landing pads. The helicopter landing pads are typically on higher ground and are built with impervious materials, the increased stormwater runoff volume and velocity will likely result in soil erosion. Also associated with the FARP training, roadways constructed or formed with fueling vehicles and other equipment will likely form channels that will concentrate and focus runoff, increasing erosion potential.
    - Fueling vehicles and supply trucks will increase pressure on localized native vegetation in the FARP operations training area, potentially increasing damage to vegetation and enabling invasive species to establish.
    - FARP operations involve re-fueling of aircraft. If spills of fuels, oils, or greases occur, contamination of soil, potential stormwater runoff, and the receiving waters could occur.
    - Soil compaction may result from added vehicle operations in the FARP operations training areas.
    - Disruption of wildlife may occur with increased air traffic in the area of FARP operations training. Helicopter traffic may disrupt terrestrial species in close vicinity

to the training, especially avian species nesting and roosting in the vicinity of FARP operations training.

3. Crisis City occupies a relatively limited portion of the KSTC. Rapid response training at the facility may include the following impacts to natural resources.

    - Increased traffic to/from the facility at the east side of the KSTC may result in increased fugitive dust emissions along dry access roads. Fugitive dust may adversely impact vegetation along roadsides by covering leaves and flowers, and by disrupting plant growth and respiration. Fugitive dust may also impact wildlife that lives near the road by covering food sources and causing temporary respiration problems.

    - Paved and compacted soil areas in and around Crisis City will result in increased stormwater runoff and increase the potential for soil erosion extending away from Crisis City.

    - Noise emanating from Crisis City training operations could disturb roosting bird species.

4. Navigation training for the military mission is not expected to increase in the coming years, however, both off-road vehicle training and troop orienteering training will likely have adverse impacts on natural resources at the KSTC. Future impacts may include the following:

    - Off-road vehicle navigation training will result in compaction and rutting of existing driving courses. Increases in both compaction and rutting will increase stormwater runoff, channeling runoff in concentrated flows that will result in erosion gullies both on the training course as well as away from the training course. The impacts will be greater on slopes. Damage to the driving courses and adjacent areas can create hazards impacting the military training mission as well as disrupting wildlife habitat and native vegetation.

    - During off-road navigation training, it is not uncommon for vehicles to leave the training course and cross prairie and woodland habitat. With increases in navigation training, it is expected that such occurrences will increase. When vehicles leave the training course, soil compaction is expected to occur along with damage to prairie plants. The motion of tires and the weight of vehicles will likely damage vegetation, causing stresses that will result in bare soil prone to erosion, and opportunities for invasive plant species to become established and disrupt wildlife and vegetation habitat. Vehicles that leave the navigation course may also impact wildlife food sources and living areas.

- Increased foot traffic through prairie and woodland areas may damage vegetation during navigation training. If large numbers of personnel repeatedly transverse across common pathways, soil compaction may occur and vegetation may be damaged. If pathways are used repeatedly, soil erosion could occur, causing long-term damage to vegetation, including opportunities for invasive species to become established.

5. Increased frequency of weapons training on firing ranges may result in increased soil compaction and potential erosion in limited areas. Firing ranges have been, and are expected to continue to be, areas of high activity at the KSTC. Compaction of soils could occur when larger numbers of people are continuously present on firing ranges, or if the sites are used when soil is moist to wet. With compaction, it is expected that stormwater runoff volume will increase, and a corresponding potential increase for soil erosion in the range or adjacent areas will result. Soil erosion can affect KSTC native vegetation, wildlife habitat, and create potential hazards for training operations.

6.4 Natural Resources Needed to Support Military Mission

Healthy natural resources are vital to the military training mission. They provide realistic training environments for all aspects of military operations while also sustaining stable site conditions that are safe for personnel on site, with an annual average of more than 10,000 troops utilizing the facility per year, and with as many as 350 to 400 soldiers on site at any given time. The following natural resource needs at the KSTC are required to support the military mission of the Installation.

1. Healthy soils – those that are not compacted nor impacted by erosion – support vegetation while also creating stable surfaces for both vehicle and foot traffic.

2. Native vegetation supports a natural training environment that will provide safer training conditions for military operations. Native vegetation also provides a stable base of operations for troops, by doing the following:

    - A variety of plant populations that supports the diversity of potential training and operations environments that military personnel may be required to work within.

    - Reduction of potential invasive species. Many invasive species create unsuitable training habitats with excessively heavy growth, sometimes producing potentially-damaging human health effects (thorns or exudation of toxic substances).

3. Stable streams and drainages are necessary to sustain healthy training areas. If streams or drainages are damaged or allowed to erode, cut banks can create sharp drops leading to hazardous conditions for training operations. In addition, if streams and drainages are allowed to erode and be damaged, water quality will degrade, creating environmental compliance issues that the KSARNG will be required to address with state agencies.

4. Diverse wildlife habitat supports balanced animal populations. Balanced animal populations include both predators and prey to keep wildlife healthy. If certain species are not kept in balance, the potential for disease vectors, damage to facilities, and destabilization of training surfaces (such as excess burrowing in soils, overgrazing of vegetation, or disease in trees) may occur.

6.5 Natural Resources Constraints to Missions and Mission Planning

The military training mission and mission planning may be constrained by unbalanced natural resources at the KSTC. Such constraints may include the following:

1. Damages to streams and drainages, such as eroded banks or nearby surface areas resulting from eroding streams or drainages, may prevent the execution of training operations at the KSTC until repairs and stabilization of the streams can occur. Damaged streams or drainages may result in the flooding of training or operations areas that will further restrict the training and planning missions of the KSTC.

2. Potential invasive plant species, particularly those that may be harmful to human health, may impede or restrict the military training mission at the KSTC until the species are controlled or removed from the site.

3. Wetlands at the KSTC must be protected in accordance with Section 404 of the CWA. Any operations that will impact wetlands must consider repair of the wetlands, or mitigation of changes or damages to the wetlands.

4. Damaged, eroded soils may impact safe passage of personnel and vehicles in all training areas.

5. While wildlife management is an important component of effective site management of the KSTC, if threatened or endangered species are identified on-site, operations in those areas may become constrained until or unless mitigation of the threatened or endangered species can be accomplished. If the threatened and endangered species is unique and becomes established in the KSTC training area, alternative training areas may need to be established, or procedures for training that will not disrupt but protect the threatened or endangered species will need to be developed.

Currently, the most common potential natural resource constraints to the military mission of the KSTC involve protecting and maintaining streams and drainages, controlling invasive species, and conserving wetlands.

7. Natural Resources Program Management

7.1 Natural Resources Program Management

The KSTC has become an important regional training facility not only for the KSARNG, but also for regional and local law enforcement and emergency response agencies. Consistent with the requirements of DoD Manual 4715.03 (INRMP Implementation Manual), it is important that ecosystem management at the KSTC support present and future training requirements while also conserving and improving the ecosystem characteristics and communities of the Installation. This will, in turn, maintain and improve the sustainable ecosystems and natural resources, support human use, and provide the environment required for realistic military training operations (DoD Instruction 4715.3).

7.2 Geographic Information Systems

The Kansas Adjutant General's Department utilizes Geographic Information System (GIS) as a support and planning tool in the management of natural resources. All KSARNG GIS data is managed through the DoD's server-driven Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) 3.1 personal geodatabase. This proprietary system allows data to be added or modified from multiple users across the world. To allow for more uses and better interaction, online applications have been developed.

The KSARNG incorporates all GIS data pertaining to the KSTC as it is developed. Natural resource data obtained through Installation studies and surveys is digitized and classified based on DoD requirements and integrated into the SDSFIE geodatabase. Natural resource data pertaining to the KSTC includes, but is not limited to the following:

7.2.1 Flora and fauna
7.2.2 Wetlands
7.2.3 Vegetation classification
7.2.4 Water features
7.2.5 Forestry
7.2.6 Fire management areas

7.3 Fish and Wildlife Management

Hunting and fishing activities are permitted on the KSTC and regulated and overseen by the Kansas Air National Guard Smoky Hill Range. Local, state, and federal hunting and fishing regulations are enforced on the KSTC, and generally follow the same seasons. All anglers and hunters must apply for and obtain a Trespassing Permit, and check-in and check-out with Range Control personnel. A copy of the Trespassing Permit, and Trespassing Permit Program details, are presented in Appendix C.

Fish are not native to the water features at the KSTC. Ponds are surveyed for fish populations, and restocked if and as necessary to maintain balanced aquatic ecosystems. Terrestrial wildlife

is surveyed for population and adaptive management of the KSTC's natural resources to enhance wildlife habitat that will support diverse amphibian, reptile, and mammal species at the Installation.

7.4 Management of Threatened and Endangered Species and Habitats

Awareness and management of T&E species is a critical component of natural resources and ecosystem management. T&E species are protected by law as promulgated in PL No. 93-205 (December 28, 1973), otherwise known as the ESA, as well as under the Kansas Nongame and Endangered Species Conservation Act of 1975, as administered through Kansas Statute 32, Article 10, Sections 1010 through 1012. Under these laws, the following definitions of threatened and endangered species apply:

1. An endangered species is defined as any species of wildlife whose continued existence as a viable component of the state's wild fauna is determined to be in jeopardy. That term also includes any species of wildlife determined to be endangered as defined in the ESA, including any amendments of the ESA.

2. A threatened species is defined as any species of wildlife that appears likely to become an endangered species within the foreseeable future. The ESA also defines a threatened species as any species of wildlife that may become endangered.

A species may be designated as threatened or endangered by the KDWPT for any of the following reasons:

1. The present or threatened destruction, modification or curtailment of the species' habitat or range

2. The overutilization of such species for commercial, sporting, scientific, educational or other purposes

3. The results of disease or predation has severely reduced species populations

4. The inadequacy of existing regulatory mechanisms to protect species

5. The presence of other natural or man-made factors affecting the species continued existence within this state (Kansas State Statutes Chapter 32, Article 9, Section 32-960)

In addition to T&E species, the KDWPT oversees SINC. The KDWPT defines a SINC as any nongame species deemed to require conservation measures in an attempt to keep the species from becoming a threatened or endangered species. SINC species do not have the level of statutory protection as those species listed as threatened or endangered in Kansas.

The State of Kansas provides a listing of T&E species, as well as SINCs throughout the state by county. In Saline County, several species have been listed, including those shown in Table 5 and in the following paragraphs. Some of these species could be present at the KSTC.

Table : Federal and State-Listed Threatened and Endangered Species, and Species in Need of Conservation Potentially Occurring at the KSTC

Common Name	Scientific Name	Federal Status	State Status
Mammals			
Eastern spotted skunk	*Spilogale putorius*	-	T
Franklin's ground squirrel	*Poliocitellus fran linii*	-	S
Northern long-eared bat	*Myotis septentrionalis*	T	-
Southern bog lemming	*Synaptomys cooperi*	-	S
Invertebrates			
American burying beetle	*Nicrophorus americanus*	E	E
Wabash pigtoe mussel	*Fusconaia flava*	-	S
Reptiles			
Western hognose snake	*Heterodon nasicus*	-	S
Fish			
Topeka shiner	*Notropis topeka*	E	T
Birds			
Black tern	*Childonias niger*	-	S
Bobolink	*Dolichony oryzivorus*	-	S
Ferruginous hawk	*Buteo regalis*	-	S
Golden eagle	*Aquila chrysaetos*	-	S
Henslow's sparrow	*Ammodramus henslo ii*	-	S
Least tern	*Sternula antillarum*	E	E
Long-billed curlew	*Numenius americanus*	-	S
Piping plover	*Charadrius melodus*	T	T
Short-eared owl	*Asio flammeus*	-	S
Snowy plover	*Charadrius nivosus*	-	T
Whooping crane	*Grus americana*	E	E

E – Endangered

T – Threatened

S – SINC by the State of Kansas

Source: USFWS IPaC 2017; KDWPT 2017

7.4.1 Mammals

The following mammal species were identified as T&E or SINC species in Saline County and could potentially be found at the KSTC.

Eastern Spotted Skunk

The Eastern spotted skunk (*Spilogale putorius*) is listed as threatened in Kansas. This is a medium-sized, slender mammal with a small head, short legs, and a prominent, long-haired tail. The overall color is black with conspicuous white stripes and spots. There is a white spot on the forehead and in front of each ear. Eastern spotted skunks tend to inhabit open prairies, cultivated

land, and brushy area. They require some form of cover such as brushy field borders, fencerow, or heavily vegetated gullies between their den and foraging areas.

Franklin's Ground Squirrel

The Franklin's ground squirrel (*Poliocitellus fran linii*) is listed as a SINC species in Kansas. The Franklin's ground squirrel inhabits areas with tall dense herbaceous cover and does not often utilize edges, right-of-ways, or areas with shorter cover.

Northern Long Eared Bat

The northern long-eared bat is federally listed as threatened species under the ESA. The primary threat to the northern long-eared bats is white-nose syndrome, which is a fungal disease that causes bats to leave their hibernacula during winter. In the summer, northern long-eared bats roost singly or colonies underneath bark, or in cavities or crevices of both live trees and snags. This bat species will spend the winter hibernating in caves and mines.

Southern Bog Lemming

The southern bog lemming (*Synaptomys cooperi*) is listed as a SINC species in Kansas. Southern bog lemmings occur in a wide variety of habitats, mostly in bogs and low moist places, but also grasslands, mixed deciduous/coniferous forests, spruce-fir forests, freshwater wetlands, marshes, and meadows.

7.4.2 Invertebrates

Two invertebrate T&E and SINC species may be present in Saline County, as identified below.

American Burying Beetle

The American burying beetle (N*icrophorus americanus*) is a federally listed endangered species that occupies a varying range of habitat types including tallgrass prairie, woodlands, and forests. They are considered habitat generalists since they readily move between different habitat types; however, they tend to be selective in their breeding habitat. This beetle is shiny and black with the wing covers having two orange-red markings. American burying beetles are protected by the Kansas Nongame and Endangered Species Conservation Act, the Federal Endangered Species Act, and state and federal regulations applicable to those acts.

Wabash Pigtoe Mussel

The Wabash pigtoe mussel (F*usconaia flava*) is a SINC species in Kansas. This mussel is an obligate riverine species that prefers gravel substrates and moderate currents. Fish host for this mussel often include bluegill, black crappie (*Pomo is nigromaculatus*), and white crappie (*Pomo is annularis*). Habitat for this species is not present at the KSTC.

7.4.3 Reptiles

Only one reptile on the Kansas SINC list may be present in Saline County and at the KSTC.

Western Hognose Snake

The western hognose snake (H*eterodon nasicus*) is a SINC species in Kansas. This species exhibits a distinctive upturned snout used for digging that is characteristic of all hognose snakes. This snake species favors habitats with sandy, loose soils into which the snake can easily burrow, such as grasslands and prairies. One possible reason for the decline of this species is attributed to the conversion of prairie habitat for agricultural use. Restoration of prairie habitat may provide opportunity for this species to have increased and stable populations at the KSTC.

7.4.4 Fish

Only one fish species is on the T&E list for Saline County and could potentially be present at the KSTC.

Topeka Shiner

The Topeka shiner (N*otropis topeka*) is a federally endangered and state threatened species. Topeka shiner habitat includes small to midsized streams within the historic range of Iowa, Kansas, Minnesota, Missouri, Nebraska, and South Dakota. Stream qualities that allow for Topeka shiner survival include good water quality, cool to moderate temperatures, and year-round water flow. Dry periods during the summer, or caused by drought, do not restrict potential habitat. Larger streams may support Topeka shiner populations if they are downstream of existing populations. Topeka shiners are protected by the Kansas Nongame and Endangered Species Conservation Act, the Federal Endangered Species Act, and state and federal regulations applicable to those acts. Habitat for this species does not exist at the KSTC.

7.4.5 Birds

Eleven bird species were listed in Saline County and could potentially be found at the KSTC.

Black Tern

The black tern (*Childonias niger*) is a SINC species in Kansas that use wetland marshes and shallow lakes and ponds, that have approximately 50 percent emergent vegetation. There is designated critical habitat for the black tern in every county in Kansas except for Chautauqua, Elk, Ness, and Wilson Counties.

Bobolink

The bobolink (D*olichony oryzivorus*) is a SINC species in Kansas that prefers tall grasslands, uncut pastures, and overgrown fields and meadows. After breeding in the previously described areas, bobolinks move to freshwater marshes and coastal areas to molt before migrating. The bobolink is an irregular transient and summer resident in eastern and central Kansas.

Ferruginous Hawk

The ferruginous hawk (*Buteo regalis*) is a SINC species in Kansas that breeds in grasslands and prefers open country. They often build on nests of other hawks or crows as the bulky sticks of

their nests are not easily woven together for tree nesting. This species occurs year round and breeds locally in the western portion of the state.

Golden Eagle

The golden eagle (*Aquila chrysaetos*) is a SINC species in Kansas that lives in open and semi-open country. This species occurs more regularly in western Kansas, but can winter sporadically eastward. The golden eagle is protected by the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, and state and federal regulations applicable to those acts.

Henslow's Sparrow

The Henslow's sparrow is a SINC species in Kansas that prefers large, flat fields with no woody plants, but with tall, dense grass, a dense litter layer, and standing dead vegetation. This species usually has well-hidden nest on the ground under grass clumps that overhang and cover the nest. This species occurs in the eastern half of Kansas as a local summer resident. Saline County contains designated critical habitat for the Henslow's sparrow.

Least Tern

The least tern is a federally listed endangered species. The least terns are summer residents in Kansas. This species prefers barren areas near water such as saline flats in salt marshes, sand bars in river beds, and shores of large impoundments. Least terns are protected by the Kansas Nongame and Endangered Species Conservation Act, the Federal Endangered Species Act, and state and federal regulations applicable to those acts. Habitat for this species is not present at the KSTC.

Long Billed Curlew

The long-billed curlew (N*umenius americanus*) is a SINC species in Kansas that prefers areas with sparse, short grasses, including shortgrass and mixed-grass prairies, and agricultural fields. In the past, there were breeding birds in Kansas but current records only show breeding birds in Finney, Morton, and Stanton Counties.

Piping Plover

The piping plover (*Charadrius melodus*) is a federally listed threatened species that uses flat, open, sandy beaches with little vegetation. Nesting has been recorded on sand bars along the Kansas River. There has never been a record of observation of piping plovers in Saline County. Piping plovers are protected by the Kansas Nongame and Endangered Species Conservation Act, the Federal Endangered Species Act, and state and federal regulations applicable to those acts. Habitat for this species is not present at the KSTC.

Short Eared Owl

The short-eared owl (*Asio flammeus*) is a SINC species in Kansas that live in large, open areas with low vegetation, including prairie and coastal grasslands, meadows, marshes, dunes, and

agricultural fields. They often nest on the ground, only nesting in trees when snow covers the ground. Most counties in Kansas have designated critical habitat for the short-eared owl.

Snowy Plover

The snowy plover (*Charadrius nivosus*) is a state listed threatened species that prefer sparsely vegetated sand beaches, dry salt flats in lagoons, dredge spoils deposited on beach or dune habitat, levees and flats at salt-evaporation ponds, river bars along alkaline or saline lakes, reservoirs, and ponds. There has never been a recorded observation of snowy plovers in Saline County. Snowy plovers are protected by the Kansas Nongame and Endangered Species Conservation Act, the Federal Endangered Species Act, and state and federal regulations applicable to those acts. Habitat for this species is not present at the KSTC.

Whooping Crane

The whooping crane is a federally listed endangered species. The whooping crane prefers remote locations away from human disturbance (KDWPT 2011). Stopover sites typically include open bottomlands of large rivers and marshes, but whooping cranes have been known to use croplands, playas, and various other aquatic habitats to forage and roost. Areas characterized by wetland mosaics appear to provide the most suitable stopover habitat (USFWS 2009). Whooping cranes are protected by the Kansas Nongame and Endangered Species Conservation Act, the Federal Endangered Species Act, and state and federal regulations applicable to those acts.

Management of T&E species, SINC species, and migratory bird species is an on-going activity for the KSARNG and KSTC natural resources teams. Recent surveys have included aquatic and terrestrial invertebrate (insect) surveys, reptile and amphibian surveys, mammal surveys, bat surveys, and annual avian monitoring to assess wildlife populations and possible threatened and endangered or SINC species. Wildlife surveys will continue at the KSTC to assess the potential presence of T&E and SINC species. In addition, vegetation surveys, prairie restoration and enhancement, and wetlands restoration and enhancement are routine management functions that are conducted to improve habitat for T&E and SINC species. KSTC range control management is routinely provided information regarding wildlife surveys and habitat conditions, including information of areas of possible concern that may affect KSTC operations and military training.

7.5 Water Resources Protection

Water resources at the KSTC include intermittent streams, wetlands, and ponds. Water levels are strongly associated with precipitation and associated infiltration and runoff. During wet years, ponds and wetlands at the KSTC maintain constant pools of water, although streams and their associated tributaries do not maintain constant flow. During dry years, ponds typically see lower water levels, or shallow ponds may dry out, and wetlands and streams remain dry except for short periods during precipitation events. Because of the largely native prairie vegetation, stormwater runoff is only generated during heavier rainfalls such as those that typically fall in the spring. During these times runoff through drainages into streams is often moderate and controlled by stable stream conditions. Sometimes, very heavy rainfalls may produce large runoff events that can erode drainage channels and stream banks.

Water quality of surface waters and groundwater can be impacted by natural resources management practices that affect stormwater runoff. Stormwater runoff is produced when rainfall, during any time of a storm, exceeds infiltration capacity of the soil. Because of the rolling topography of the KSTC, it is not unusual that runoff can occur during particularly heavy rain storms. Effective natural resources management includes maintaining healthy soil vegetative cover that slows surface movement of water and its collection in drainages and streams. In areas where vegetative cover is sparse, including excessively mowed areas, or areas where soil has been compacted, runoff may collect more rapidly into drainages. The increased volume will cause bank erosion as the streams respond to increased flows.

Stormwater runoff can be a significant source of pollutants and sediment in surface waters, especially in areas where groundcover has been disturbed. Water quality also may be negatively impacted by disturbances causing increased sedimentation to wetlands and stream channels. Stormwater runoff from impervious surfaces, such as may exist in FARP operations training areas or in semi-paved or compacted parking areas, has a high potential to carry pollutants into wetlands, surface waters, and groundwater.

The following sections include management recommendations to protect KSTC water resources.

7.5.1 Erosion and Soil Conservation

Soil erosion and conservation are important management concerns to protect water resources. A soil management plan has been developed that provides listings of the soil types at the KSTC, and management to maintain soil quality and prevent erosion.

7.5.2 Revegetation

Vegetation not only protects soil resources from erosion, but it also filters pollutants from stormwater runoff. Revegetation of disturbed areas, or areas where excessive land use has damaged existing vegetation will restore vegetative cover that will slow runoff velocity and filter pollutants before runoff enters drainages and streams. Responsibilities for these tasks will be determined on a case by case basis

7.5.3 Silt Fences and Other Erosion Control Materials

Silt fences or straw wattles will be used during all site construction activities to prevent eroding sediments from moving off of the construction site and into KSTC drainages. The KSARNG has developed a comprehensive erosion and sediment control plan for state-wide facilities that provides instruction on the development of site-specific erosion and sediment control plans.

7.5.4 Guidance for Roadways and Ditches

All roadways at the KSTC are non-paved, compacted soil and gravel. Ditches exist along all roads at the Installation. Roadways that are on slopes greater than two percent are prone to erosion, and therefore monitoring road conditions and regrading is periodically conducted. Ditches that collect stormwater runoff and sediment from the roads will be monitored for sediment

accumulation and other potential occlusions by natural resource manager and/or range maintenance staff and will be periodically cleaned to allow runoff flow into nearby drainages as deemed necessary following large precipitation events.

7.6 Wetland Protection

As shown in Section 5.5, there are 22 wetlands that have been identified at the KSTC. Most of these wetlands are small and associated with drainages and streams throughout the site. Wetlands provide multiple functions at the KSTC, including filtering and storing stormwater runoff helping to reduce flood potential, providing infiltration of water into the soil, and providing valuable wildlife habitats.

Wetland management generally involves activities that can be conducted with, in, and around wetlands, both natural and man-made, to protect, restore, manipulate, or provide for their functions and values (water.ncsu.edu. 2016). Generally, wetlands protection is jointly administered by the USACE and the USEPA under Section 404 of the CWA. Protection of wetlands under Section 404 involves regulation of the discharge of dredged or fill material into "waters of the United States," which includes wetlands. The KSARNG natural resources manager has and will continue to protect wetlands at the KSTC through wetland monitoring and restoration, as well as buffer establishment as necessary. Regular monitoring and management of wetlands will be conducted using the *Regional Supplement to the Corps of ngineers etland elineation Manual Great Plains Region* (USACE 2010). This regional supplement is part of a nationwide effort to address regional wetland characteristics and improve the accuracy and efficiency of wetland delineation procedures. Regional differences in climate, geology, soils, hydrology, plant and animal communities, and other factors are important to the identification and functioning of wetlands and cannot always be addressed with a national perspective.

7.7 Grounds Maintenance

Grounds maintenance at the KSTC is conducted routinely to provide safe conditions for military training and operations. Any ground maintenance is performed in accordance with federal and state laws and regulations as applicable. Grounds maintenance at the KSTC is a function of vegetation management including use of control burns, agricultural out-leasing, and integrated pest management. In addition, grounds maintenance includes grading of roads, clearance of drainage channels (ditches and swales), and tilling and grading fire breaks. Using these maintenance options will promote landscape features conducive to the KSTC training mission.

7.8 Forest Management

Forestry management activities at KSTC are primarily limited to the forested riparian areas and the control of invasive woody encroachment. Invasive woody encroachment is controlled through prescribed burns or mechanical removal. The existing forest types were classified and presented in Chapter 5.0. A woodland assessment completed in 2013 provided forest management recommendations for the KSTC’s woodlands.

7.9 Fire Management

Wildfires are an important component of environmental management at the KSTC, both in the sense of using fire as a tool for vegetation management, and as a threat to the site and surrounding areas if not controlled.

Wildfires have several undesirable aspects including the following:

- They interfere with ongoing training activities
- They make training areas unsuitable for training over the short- and long-term
- They produce smoke that can bring complaints from the surrounding neighbors
- They damage property and threaten life
- They can have direct and indirect impacts on habitats and species
- They may also lead to soil erosion when vegetative cover is sufficiently reduced

Conversely, there are positive aspects to wildfires from an ecological standpoint including benefits to many grassland species of plants and wildlife with the encouragement of new vegetative growth that enhances diversity. In the region around the KSTC, these positive effects normally outweigh the negative ones. Use of fire as an ecological management tool of the grassland at the KSTC is vital to the health and diversity of the ecosystem. Prescribed fires have long been used in Kansas to improve and maintain the native and agricultural resources within the state. In the nearby Flint Hills, a long tradition of fire management by private ranches has been used to improve rangeland productivity and has prevented the encroachment of woody and other undesirable plants into the prairie. Fire is well documented as a key ecological driver in grassland communities as an ecological management tool.

7.10 Agricultural Out-leasing

Lands used to support the military mission may also be out-leased for agricultural and grazing purposes. 10 USC 2667(d)(4) authorizes the use of proceeds from agricultural leases and sales of agricultural products to cover administrative expenses of agricultural leasing and to finance natural resources management activities that implement an approved INRMP, including improvements of lands currently or not currently leased for agricultural and grazing purposes, wildlife habitat improvement, noxious weed control, and erosion control. These are the broadest-use funds available exclusively to natural resource managers. Agricultural funds are treated as normal operations and maintenance funds and must be obligated in the fiscal year that they are issued. The Kansas Air National Guard manages all agricultural out-leases at the KSTC.

7.11 Integrated Pest Management

A pest management program must be provided that maintains and safeguards the health, environmental quality, aesthetic values, and ecological balance of the military community by protecting real estate investments from depreciation by pests, while complying with environmental protection and improvement policies.

The mission of the Integrated Pest Management Plan (IPMP) at the KSTC is to provide effective control of pest species (insects, arthropods, mammals, birds, weeds, and other deleterious invasive species) to ensure that pests do not hinder completion of the KSTC mission or become detrimental to migratory birds, T&E species, SINC species, or any other wildlife. Personnel are responsible for dealing with small vertebrate and invertebrate pests in facilities and open areas, as well as weeds, invasive species, and insect control throughout the KSTC. All pest management at the KSTC will be done in accordance with the KSARNG IPMP, including the listing of pesticides on the KSARNG State Pesticide Use List (SPUL) prior to application, applicator certification, and reporting of pesticide usage.

Noxious weeds are the main pest for the KSTC. Noxious weeds are defined within the Federal Noxious Weed Act of 1974 as "any living stage (including but not limited to, seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health." KSTC has developed a program element for documenting the location of invasive species on the Installation. Table 6 lists common noxious weeds found at the KSTC. In 2011, an undesirable and noxious weed control plan was developed at the KSTC.

Table 11. Noxious and Invasive Species Found at the KSTC

Common Name	Scientific Name	Common Name	Scientific Name
Bull thistle*	*Cirsium vulgare*	Kentucky bluegrass	*Poa pratensis*
Canada thistle	*Cirsium arvense*	Leafy spurge*	*Euphoriba esula*
Caucasion bluestem	*Bothriochloa bladhii*	Pigweed ssp.	*Amaranthus spp.*
Clammy ground cherry	*Physalis heterophylla*	Reed canary grass	*Phalaris arundinacea*
Common mullein	*Verbascum thapsus*	Russian knapweed*	*Centaurea repens*
Common ragweed	*Ambrosia artemisiifolia*	Sericea lespedeza	*Lespedeza cuneata*
Crabgrass	*Digitaria spp.*	Smooth brome	*Bromus inermis*
Field bindweed*	*Convolvulus arvensis*	Western ragweed	*Ambrosia psilostachya*
Flodman's thistle	*Cirsium flodmanii*		*Setaria pumila*
Giant ragweed	*Ambrosia trifida*	Yellow bluestem	*Bothriochloa ischaemum*

Noxious Weeds found on the KSTC
Source Olsson Associates
2012b

The KSARNG Environmental Department and the KSTC staff have successfully utilized multiple methods for control of invasive species in restoration of the Installation from agricultural use to native prairie habitat. These strategies have included the following:

- Controlled burning
- Cutting and harvesting of grasses for forage
- Herbicide applications

Laws and regulations pertaining to invasive and exotic species and pest control include the following (KSARNG, 2017):

Federal Laws

- The Federal Insecticide, Fungicide, and Rodenticide Act (through PL 100-460, 100-464 to 100-526, and 100-532)
- Title 7, CFR, 1996 revision, Section 360, Noxious Weed Regulations
- Title 29, CFR, 1993 revision, Section 1910, Occupational Safety and Health Standards
- Title 40, CFR, 1993 revision, Section 165.10, Recommended Procedures and Criteria for Storage of Pesticides and Pesticide Containers
- Occupational Safety and Health Act of 1970, 29 Dec 70 - PL 91-596
- Endangered Species Act of 1973 – PL 93-205, as amended in 1978 – PL 95-632 (16 USC 1531 et seq.)
- National Environmental Policy Act – PL 91-190, as amended in 1975 (42 USC 4321 et seq.)
- Protection of the Environmental Pesticide Program - 40 CFR Part 162-180, 1984 ed.

Regulations

- DoD Instruction 4150.7, DoD Pest Management Program, 29 May 2008
- AR 11-34, The Army Respiratory Protection Program, 15 February 1990
- AR 40-5, Preventive Medicine, 15 October 1990
- AR 50-6, Chemical Surety, 26 June 2001
- AR 200-1, Environmental Protection and Enhancement, 13 December 2007

- Title 32, CFR, Section 651, Environmental Analysis of Army Actions, 29 March 2002
- AR 385-32, Protective Clothing and Equipment, 31 October 1985
- AR 385-10, Army Safety Program, 27 August 2007
- AR 385-61, Accident Reporting, 1 November 1994
- HSC Pam 40-3, Environmental Health Program, October 1985
- NGR No. 385-10, Army National Guard Safety and Occupational Health Program, 12 September 2008. Available at http://www.ngbpdc.ngb.army.mil/pubs/385/ ngr385_10.pdf
- Memorandum, ARNG-ILE, 04 February 2016, subject: Integrated Pest Management Program Policy

7.12 Outdoor Recreation

People and social uses/needs are an integral part of ecosystem management. The needs of the military mission determine the extent of outdoor recreational activities allowed. After ensuring the military mission is fulfilled, the outdoor recreation program provides quality recreational opportunities while sustaining ecosystem integrity.

Limited outdoor recreational opportunities exist at KSTC due to the dangers associated with the military mission and planned land use. The level of enjoyment derived from outdoor recreation on the KSTC is directly related to the quality of the natural resources present. Maintaining a quality outdoor recreation program is dependent on the proper management of natural resources and the efficient program administration and oversight. Areas of the KSTC are posted with signs to warn the public of the dangers associated with entering the area. The signs also indicate that permission must be granted to enter by the Installation commander, including during the hunting seasons. When hunting is allowed at the KSTC, hunters must check-in and check-out with Range Control. All visitors to the KSTC are required to be briefed on the dangers of using the Installation. During periods of non-use, these areas may be opened for organized hunts. When the military activity in any given area is not compatible with a particular recreational use, that area will be closed until the military activity is completed.

7.13 Cultural Resources Protection

Cultural resources management at the KSTC is provided in accordance with Section 106 and Section 110 of the NHPA (NHPA, 16 USC Section 470, as amended), the Archeological Resource Protection Act (16 USC Section 470aa-47011), the American Indian Religious Freedom Act (42 USC), the Native American Graves Protection and Repatriation Act (25 USC Section 3001 et seq.), and EO 11593 (Protection and Enhancement of Cultural Environment). The implementing

regulations for the Section 106 process (36 CFR Part 800), have been developed by the Advisory Council on Historic Preservation (ACHP). The Secretary of Interior administers the NRHP and sets forth significance criteria (36 CFR Part 60) for inclusion in the register. Cultural resources as defined under the NHPA, are considered “historic properties” to determine if there is a federal undertaking that may impact them.

Cultural resources include sites, buildings, structures, or objects that may have significant archaeological and historic values, or properties that may play a significant traditional role in a communities’ history, beliefs, customs, or practices. From a tribal perspective, natural resources also constitute cultural resources. Therefore, natural resources must be considered in the review of cultural resources.

Historic properties are protected if they fall under one of the following categories:

- Are formally placed in the National Register by the Secretary of Interior
- Meet the criteria and are determined to be eligible for inclusion but have yet to be formally placed on the register
- Are yet undiscovered but may meet eligibility criteria

The KSTC is comprised of federally-owned land. All projects are subject to review by the Kansas State Historic Preservation (SHPO) Officer and concerned tribes to determine the effects and mitigation measures.

7.14 Enforcement

A critical component of the KSTC natural resources management program is conservation law enforcement. The Saline County Sheriff’s Department (primary law enforcement agency) and the KSTC’s Range Control personnel are responsible for enforcing a myriad of federal, state, and local natural and cultural resource laws and regulations or notifying the appropriate federal, state, or local agency when enforcement services are needed. The KSTC is fenced along the perimeter to both delineate the boundaries of the Installation, as well as to restrict trespassing by unauthorized persons. An automatic gate is used at the main entrance of the Installation to restrict entry onto the Installation, after which persons entering the facility must check in with Range Control management.

Without professional natural resources enforcement personnel in the field, natural resources management activities are ineffective. Such features as harvest controls, protection of sensitive areas or species, pollution prevention, hunting and fishing recreation, non-game protection, and others dependent upon effective law enforcement. Game laws must be implemented in accordance with applicable state and federal laws. Whenever hunting or fishing is allowed on military installations, enforcement of natural resource laws and regulations will be in accordance with the INRMP.

7.15 Public Outreach

This INRMP cannot be implemented by the KSTC alone. The KSTC has forged partnerships with various agencies to help manage its natural resources. Major partners in the implementation of this INRMP are the KDWPT, NRCS, USEPA, and the USFWS.

The KSARNG will continue with a strong public affairs campaign. This campaign will include the development of community information and involvement strategies to reinforce the positive effect of the KSTCS's presence in the region. These strategies range from individuals volunteering and providing assistance within the local community to hosting community events at the Installation. KSTC's Range Control personnel have the opportunity to participate in numerous local activities and to provide resources and manpower to support and enhance the community's quality of life.

All persons and organizations having a potential interest in the proposed actions, including minority, low income, disadvantaged, and Native American groups, are also urged to participate in the decision making process.

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8. Management Goals and Objectives

Effective ecosystem management must be based on clearly stated goals and objectives. This INRMP identifies program elements for which goals and objectives and the means to accomplish them were developed. The INRMP is a mechanism through which both ecosystem management and biodiversity conservation will be accomplished on the KSTC in agreement with the successful accomplishment of the Installation's training mission.

The program elements identified for this INRMP include the following:

- Fish and wildlife management
- Threatened, endangered, and SINC management
- Wetlands and deep water habitats management
- Prairie and woodland management
- Migratory bird management
- Invasive species management
- Land management
- Agricultural out-leasing
- Law enforcement of natural resources management
- Public outreach
- Training of natural resource personnel
- Watershed protection

The process of establishing ecosystem and natural resource management goals for the KSTC focused on considering a reasonable range of resource-specific goals, and from those, objectives and associated actions that can be implemented to achieve balanced natural resources and ecosystem management. The development of natural resource management goals for the KSTC is described below.

Through this INRMP, the fundamental goal of the KSARNG is to systematically conserve biological diversity and natural resource balances on lands within the context of KSRNG's mission to train troops.

The KSARNG recognizes that natural ecosystems play a vital role in maintaining a healthy environment, and that natural ecosystems are most effectively managed by protecting the biological diversity of the many organisms - and the ecological processes they perform – as a whole system to the extent that can reasonably be accomplished. Habitat management is key to effective conservation of biological diversity and the protection of listed species. Special consideration is given to soil and vegetation characteristics; surface water; wetlands; archaeological and geological sites; flood plains; and wildlife resources in the development, design, construction, and maintenance of installations and facilities without compromising mission performance.

Objectives
Measurable objectives are established for each of the specific goals developed for each of the program elements of this INRMP. Management objectives have been selected to sustain and enhance natural resources while meeting the operational mission at KSTC. Adaptive ecosystem management provides a means for the KSARNG to both conserve biodiversity and to provide high quality military readiness.

Projects and Tasks
Achievable actions in the form of implementable, measurable projects are identified and listed. Each objective has a framework in which the goals of this INRMP are accomplished, and from which evaluation and analysis of the natural resource program for the KSTC can be conducted. New goals and objectives will be formulated in the continuing management of the Installation.

The following project goals have been developed for the twelve natural resource program elements of this INRMP. Proposed project schedules and estimated budgets are provided in Appendix D.

8.1 Fish and Wildlife Management

The variety of wildlife habitats present at the KSTC, such as wetlands, woodlands, and grasslands, contributes to the diversity of wildlife species found on the Installation. It is important for the KSARNG to maintain and control balanced wildlife populations without limiting the training mission of the Installation. Balanced wildlife populations contribute to the health and sustainability of the KSTC environment through natural control of pests and invasive species and through soil and vegetative productivity. Goals have been developed specifically for wildlife management at the Installation and are listed below (identified as wildlife management (WM) goals).

WM GOAL 1: Fish and Wildlife Planning Level Surveys
Objective: Update fish and wildlife surveys every five years at the KSTC to gather available current scientific data and formulate natural resource management strategies consistent with the KSTC's military mission.

Projects: 1. Review and revise fish and wildlife survey protocol(s) as necessary

2. Update fish and wildlife surveys at the KSTC every five years

3. Implement a program of data review to evaluate and compare survey results to assess wildlife population dynamics and conduct adaptive management where necessary

4. Develop and implement a program to communicate the results of fish and wildlife surveys with KSARNG command and the KSTC Range Management staff, the USFWS, and KDWPT

Monitoring Criteria: Significant trends observed for any wildlife species will be documented, and adaptive management will be implemented as necessary.

WM GOAL 2: Manage Balanced Fish Populations
Objective: Maintain balanced fish populations in the KSTC ponds

Projects: 1. Develop a fish management plan for KSTC ponds, including appropriate fish species diversity and populations, aquatic habitat quality maintenance, and stocking if necessary

2. Monitor fish populations, including species diversity and fish sizes to determine needs for adaptive fish habitat and population management on a two-year basis

3. Implement fish stocking or habitat improvement as necessary to maintain fish populations

Monitoring Criteria: Sustained fish populations and diversity in ponds will be documented and adaptive management strategies will be implemented as necessary.

WM GOAL 3: Manage Balanced Wildlife Populations On-site
Objectives: Achieve no net loss of wildlife habitat to sustain species.

Projects: 1. Develop a wildlife management plan

2. Incorporate a T&E management plan into the wildlife management plan

Monitoring Criteria: Develop and finalize a wildlife management plan, with updates as necessary to maintain or enhance the diversity of wildlife as monitored through WM surveys.

WM GOAL 4: Establish a Wildlife Database
Objective: Update the GIS wildlife database to prioritize wildlife adaptive management techniques by 2022.

Projects: 1. Develop a comprehensive, family-specific, wildlife database to document the results of the baseline surveys

2. Update the wildlife database with the results of the five-year surveys

3. Share results of the five-year surveys with USFWS and KDWPT

Monitoring Criteria: Use the database to organize data from the baseline and subsequent wildlife surveys and compare this to regional trend studies.

8.2 Threatened, Endangered, and Species in Need of Conservation Management

Protection and conservation of T&E and SINC wildlife is an important component of the natural resources at the Installation. Goals have been developed specifically for T&E at the Installation and are listed below (identified as T&E goals). The project goals for T&E species at the KSTC includes comprehensive management actions to conserve and support T&E species and their habitat, if present, on the Installation. These projects include adaptive management strategies, if necessary, that comply with SAIA requirements to conserve and improve site conditions for T&E species while also maintaining the military training missions for the Installation. State-listed and other sensitive species potentially occurring or known to occur on the Installation are listed in Chapter 7.0 of this INRMP, include the Henslow's sparrow, and habitat that would possibly support the short-eared owl, the eastern spotted skunk, and the western hognose snake.

Because the occurrence of T&E species at sites changes, the KSARNG and the Installation must be aware of proper procedures for determining if a Section 7 consultation of the ESA and/or the Kansas Nongame and Endangered Species Conservation Act may be required in the future. Based on the habitat associations of these species listed in Appendix E, KSARNG natural resources management staff can monitor the appropriate ecological association for rare species known to occur in the region. If no T&E species or their respective habitat are found during baseline monitoring, monitoring for T&E species and their associated habitat will be conducted at five-year intervals.

KSARNG natural resource management staff will work to promote ecosystem-based management in the local region. If and as T&E and SINC species are found at the KSTC, specific actions that conserve habitat and protect these species will be implemented at the Installation. In addition, adherence to the goals set for T&E management will ensure that the KSTC remains in compliance with the ESA and applicable state regulations. To achieve these priorities, the following goals have been identified:

T&E GOAL 1: Identify Potential T&E Habitat In and Near KSTC
Objective: Characterize KSTC habitats related to T&E for site management. Recent wildlife surveys have preliminarily established baselines for potential T&E and SINC species.

Projects:
1. Conduct an updated T&E survey and habitat survey on the KSTC to identify the presence of potential T&E habitat that occurs on the Installation on a five- year basis

2. Update the KSARNG GIS database to include T&E habitat, including potential changes to that habitat

3. Develop and implement an education program for the KSTC Range Management personnel about habitat areas critical to T&E and where they are located on the Installation

Monitoring Criteria: T&E/SINC survey reports and routine updates to the GIS database about changes and status of T&E habitat will act has the monitoring activity of this goal.

T&E GOAL 2: Conserve Known T&E Species Habitat

Objectives:
1. If T&E or SINC species exist onsite, identify and characterize the area(s) where the species exist, including habitat quality, vegetation, and aquatic features
2. Determine and develop appropriate habitat management plans for T&E and SINC species
3. Coordinate T&E information with KSARNG training command for consideration in the development of training operations

Projects:
1. Identify, map, and communicate locations or occurrences of T&E/SINC habitats to KSARNG command and staff
2. Develop and produce signage identifying T&E conservation areas
3. Update GIS database to include T&E numbers and locations
4. Create a management plan for existing T&E habitat that would protect the species and habitat from potential impacts

Monitoring Criteria: Numbers and locations of T&E/SINC species identified at the KSTC, and acreage of T&E habitat will be used to track the status of T&E species at the KSTC.

T&E GOAL 3: Protect SINC Species (Henslow's Sparrow) Avian Nesting Areas

Objective: Develop an avoidance plan to avoid disruption of Henslow's sparrows' nests on or near the KSTC.

Projects:
1. Identify and communicate locations or occurrences of Henslow's sparrow or other T&E/SINC avian species nests to KSARNG command and staff
2. Develop and produce signage identifying Henslow's sparrow nest avoidance areas on the KSTC
3. Create a management plan to avoid Henslow's sparrow or other T&E/SINC species nesting areas during any activities conducted at the KSTC

8.3 Wetlands, Streams, and Deep Water Habitats Management

The KSTC only has a small area of jurisdictional wetlands (9.29 acres), mostly associated with the stream system at the KSTC. In addition to the wetland areas, three ponds hold water year-

round, although water levels vary depending on precipitation amounts each year, and a fourth pond that will hold water during wet years. Wetlands and deep water habitats are of importance for providing habitat for many species. To minimize the impacts on wetlands and deep water habitats, KSARNG Environmental program personnel strive to conserve healthy, functional wetlands that can sustain minor KSARNG operational influences or impacts. When possible, it is the goal to enhance wetland and deep water functions that maximize the water quality values that wetlands and ponds add to the ecosystem, and to maximize floral diversity of wetland and pond-edge communities that will improve faunal diversity of the ecosystem. It is the goal of KSTC to have no net loss to the function and value of wetlands and deep water habitats existing at KSTC. The goals for wetland, streams, and deep water habitats management (WSW) include the following:

WSW-1: Wetland Inventory Update
Objective: Wetland and non-wetland Waters of the United States (WOUS) are to be inventoried and mapped for updates to KSARNG command and the KSTC Range Management staff.

Project: Update the wetland and WOUS delineation at the KSTC. Document wetland and non-wetland WOUS results and representative site photographs in the form of a Preliminary Jurisdictional Report.

Monitoring Criteria: Wetlands and tributaries are not static systems. Because of this, and to ensure adherence to current regulations and guidance, wetland and non-wetland WOUS should be identified and monitored at least every five years.

WSW-2: Wetland Monitoring and Maintenance
Objective: Wetlands will be monitored for function, with necessary maintenance and adaptive management implemented as necessary.

Projects:
1. Eradicate invasive and noxious species
2. Plant emergent vegetation and seed graded upland areas with specified species

Monitoring Criteria: Wetlands should be inspected semi-annually for evidence of disturbance and invasive/noxious species. If any wetlands are found to be disturbed, adaptive management techniques should be employed to restore wetland function, as planned.

WSW-3: Pond Monitoring and Maintenance
Objective: The existing ponds at the KSTC should be monitored for water depth, quality, for maintenance of aquatic habitat, and for support of wildlife species. If and as ponds are found to be too shallow or not holding sufficient water, appropriate maintenance and management is to be completed to restore aquatic function.

Projects: 1. Develop and implement a pond/aquatic habitat management plan

2. Update the KSTC Watershed Master Plan to assess water flow and storage in ponds and wetlands

3. Dredge ponds that become too shallow

4. Eradicate invasive and noxious species in and around ponds

5. Plant emergent vegetation and seed graded upland areas with native species

6. Stock pond with native fish

Monitoring Criteria: Ponds should be inspected semi-annually for evidence of disturbance and invasive/noxious species. Should any of the ponds be found to be disturbed, adaptive management techniques should be employed to restore pond function, as planned.

WSW-4: Update Watershed Management Plan

Objective: Assess the current physical and biological health of streams at the KSTC.

Projects: 1. Develop and implement the stream survey protocol

2. Conduct stream surveys at the KSTC to update the 2008 KSTC Watershed Management Plan

3. Share results of surveys with the USFWS, the KDWPT, and the KBS, Kansas Water Office, and the KDHE

4. Use data to evaluate WP and the watershed management study (KSARNG 2008) goals and objectives and modify when necessary

Monitoring Criteria: Significant trends observed in physical and biological health of the streams will be documented and adaptive management techniques will be employed.

8.4 Prairie and Woodland Management

It is the goal of the KSARNG to maintain native prairie and woodland habitat. Prairie and Woodland (PW) management activities at the KSTC are conducted to maintain native habitat that promotes wildlife as well as supports the military training mission. The adaptive ecosystem approach manages these areas primarily through habitat modifications discussed through other program elements of this INRMP. The following program element addresses KSTC's PW goals:

PW GOAL 1: Vegetation Planning Level Survey
Objective: Identify and delineate vegetation cover boundaries and evaluate areas that contain native prairie vegetation, woodland vegetation, and non-native vegetation communities.

Projects: 1. Conduct a prairie vegetation planning level survey

Monitoring Criteria: The completion of the prairie vegetation planning level survey will be documented and include recommendations for adaptive ecosystem management.

PW GOAL 2: Conserve Prairie Habitat
Objective: Enhance and manage prairie habitats.

Projects:
1. Develop a prairie management plan that will conserve and enhance the quality of native prairie vegetative habitat types at the KSTC
2. Develop and implement a training program for KSTC Range Management personnel regarding management and the locations of prairie habitat at the Installation
3. Flag important prairie areas prior to training exercises near those prairie areas
4. Update the Off-road Vehicle Navigation management plan, and implement any improvements to conserve identified critical native prairie habitats in navigation training areas
5. Create and keep current a vegetative cover inventory and GIS database

Monitoring Criteria: Routine review of the prairie vegetative cover inventory will be used to monitor this goal.

PW GOAL 3: Mixed-grass Prairie Restoration
Objective: Identify, restore, and maintain prairie ecosystem areas at the KSTC and reseed to native mixed-grass prairies within 5 years.

Project: Restore or reseed 250 acres of native prairie ecosystem within 5 years

Monitoring Criteria: Monitoring criteria will be based on the increased acreage of restored prairie.

PW-4: Location, Density, and Succession of Riparian and Upland Trees
Objective: Maintain healthy forest ecosystems at KSTC.

Projects: 1. Update the Woodland Survey on a five-year basis (by 2018)

2. Update the Prairie Encroachment Survey on a five-year basis

Monitoring Criteria: Woodland and prairie encroachment surveys will be documented and data placed into the KSARNG GIS database. Significant vegetative trends observed for riparian and upland tree populations will be assessed and adaptive management techniques will be employed.

8.5 Migratory Bird Management

Wherever possible, KSTC strives to implement cooperative projects and programs on the Installation to benefit the health and well-being of migratory birds and their habitats. KSTC recognizes that migratory bird management (MBM) aids the military mission and also enhances the natural environment. The KSARNG has been conducting avian surveys at the KSTC since 2012 and has developed a preliminary database of bird populations at the Installation. In continual evaluation of bird population trends at the KSTC, the KSARNG will continue avian surveys while also using existing available information and resources available through the DoD Partners in Flight (PIF) program to conduct long-term coordinated bird monitoring (CBM).

DoD PIF Programs

The DoD PIF program sustains and enhances the military mission by maintaining healthy landscapes and training lands through proactive, habitat-based conservation and management strategies. The key components of DoD PIF's work are its partnerships at state, regional, national, and international levels.

Coordinated Bird Monitoring

The Installation lies within Bird Conservation Region # 19. The CBM plan ensures that the DoD meets its legal requirements for monitoring birds in the most cost effective manner possible. Monitoring includes short-term assessments, effectiveness monitoring and long-term status monitoring programs. CBM is an effort to increase the efficiency and utility of bird monitoring through improved coordination.

The MBM program element is described as follows:

MBM GOAL 1: Facilitate Migratory Bird Habitat to Meet the Mission of the KSARNG

Objective: Manage military training with minimal impact to migratory birds.

Projects:
1. Develop an MBM plan based on the migratory bird surveys, habitat surveys, and researched data about migratory birds that may be present at the Installation

2. The MBM plan will identify the species of migratory birds that may nest at the KSTC, their preferred habitat, and their preferred time of nesting (generally April 1 through September 1)

3. Develop a program to identify changes nesting sites and habitat

4. Specify any type of activity and the timing of such activities that could impact migratory birds and insert this data into the MBM plan. Clearly state the necessary surveys and steps to complete a permit in the MBM plan

5. Develop and implement a program to communicate results of the avian surveys with USFWS, KDWPT, and the KSARNG training command

6. Implement a management system to avoid haying during nesting times

Monitoring Criteria: Develop and adhere to an MBM plan that includes survey techniques and strategies, survey data evaluation protocols, and reporting requirements.

MBM-2: Long-term Coordinated Bird Monitoring

Objective: Conduct avian surveys at the KSTC every five years to assess sustaining populations of birds there. With the aforementioned resources, conduct long-term avian surveys on the KSTC to formulate avian conservation strategies.

Projects:

1. Review and revise the avian survey protocol for the KSTC

2. Conduct avian surveys on an annual basis using 2012 avian survey protocol

3. Develop and implement a program to review data and re-evaluate MBM goals and objectives, and conduct adaptive management where necessary

Monitoring Criteria: Evaluate the use of nesting sites annually to observe increased nesting habitat utilization. Significant trends observed for avian populations – especially T&E or SINC species - will be documented and adaptive management techniques will be employed.

8.6 Invasive Species Management

Land management of the properties surrounding the KSTC has the potential to directly affect Installation plans, programs, and activities by inadvertently contributing to the encroachment of invasive, non-native vegetation, and non-native animal species. Invasive species can easily upset the balance of the natural environment of the KSTC, creating inhospitable environments for training, disrupting natural resource management, and potentially allowing vectors of disease to enter onto the Installation property.

EO 13112, Invasive Species, requires all federal agencies to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause.

The KSARNG will control invasive species at the KSTC using an ecosystem-based approach that conserves biodiversity while preserving the military mission from associate infringement. To

accomplish effective invasive species management, the following invasive species management (ISM) goals have been identified:

ISM GOAL 1: Locate and Identify Invasive Species at the KSTC

Objectives: Conduct a survey to document the distribution and density of invasive vegetative species at the KSTC.

Projects: 1. Develop an invasive species survey protocol, conduct an invasive species survey at the KSTC and the communicate results of surveys with USFWS, KDWPT, and NRCS

2. Review, revise, and implement the KSTC Noxious Weed Work Plan (NWWP, Appendix F), followed by control of invasive vegetation by means of chemical pesticides, fire, and/or native plant seeding if necessary to enhance vegetation competition and reduce invasive species

3. Develop and implement a program to review data for the evaluation of invasive species distribution and density and develop management prescriptions

Monitoring Criteria: Significant trends observed for any invasive species will be documented and management prescriptions will be employed.

8.7 Land Management

It is the commitment of the KSARNG to manage the lands of the KSTC in a manner that is consistent with the requirements of the SAIA and to complete actions that enhance and balance the physical (soil and water) and biological (plant and animal) communities at the Installation. This is a commitment to protecting Installation resources and natural ecological processes. Although ecological knowledge and theories have evolved relatively quickly, the scope and process of land management have had difficulty keeping pace. Ecological processes, including fire and other disturbances, and changing landscape conditions are often not integrated into land management planning and decisions. The following goals address land management (LM) at the KSTC:

LM-1: Static Rotation of Controlled Burns

Objectives: Continue to apply prescription fire on grasslands on the systematic 3-year cycle to promote a mosaic of diverse native vegetation and help reduce invasive species and woody plants.

Projects: 1. Create and implement a controlled prescription fire plan that will establish a mosaic of burned and un-burned areas. Areas will not be left un-burned for greater than five years due to the succession of woody plants

2. Conduct prescribed burns later in the year (late April) to help reduce infestations of invasive weeds and maintain invasive trees and shrubs (i.e.

eastern red cedar, Osage orange, and smooth sumac). Foliage is dryer in late April and the ignition of larger trees is more likely

Monitoring Criteria: Evaluate the effectiveness of the prescription fire schedule for the reduction of invasive species.

LM-2: Tallgrass Prairie Restoration

Objectives: Continue restoration of the prairie ecosystem to a mixed seral stage succession. Restore the ecosystem to a higher quality and functioning native prairie habitat.

Projects:
1. Conduct invasive species removal and installation of native plant plugs
2. Continue to restore wetlands that are located on the land navigation course
3. Implement the use of nesting boxes to provide additional avian habitat
4. Implement the fire prescriptions outlined in LM-1

Monitoring Criteria: The above action involves the monitoring seral stages and adapting land uses based on the results.

8.8 Agricultural Out-leasing

The KSARNG is committed to maintaining agricultural leases at the KSTC through producing and harvesting forage grasses and controlling invasive species to optimize forage production in identified lease areas. Agricultural out-leasing (AG) to regional producers not only provides the public with access to the Installation for production, but is necessary as a maintenance tool in this ecosystem. Cattle grazing and hay production are used in some local areas to mimic the graze/fire dependent prairie ecosystem. However, due to the potential environmental damage that can result from these activities, management goals have been developed to ensure that these activities remain productive and sustainable while providing beneficial ecosystem results. Leases must be managed to ensure that noxious weeds are controlled, the public is protected from Installation operations, sustainable levels of harvest are conducted, land and facilities are maintained, and that no significant alteration of the ecosystem occurs.

To accomplish effective AG, the following goals are established:

AG-1: Continue to Manage Invasive Woody Vegetation in t e Grasslands and Agricultural Leases

Objective: Control the spread of woody vegetation o the Installation and eliminate small dense patches.

Projects:
1. Continue to use prescribed burns and additional mechanical removal of woody vegetation
2. Should infestations be observed, implement biological, physical, or chemical controls under the guidance of the Saline County foresters
3. In support of the land navigation training mission, allow small controlled patches of woody vegetation to bisect sightlines on the course to create a more realistic training mission
4. Monitor changes in invasive species annually through visual observation and GPS

Monitoring Criteria: The above action involves controlled management of woody vegetation that will control significant woody encroachment, but will also improve the training mission at the KSTC. Evaluate the effectiveness of the areas where sightlines have grown in.

8.9 Public Outreach

Public outreach (PO) is allowed by instruction (16 U.S.C. 670 Sikes Act), subject to safety requirements and military security. Access has been provided to quality recreational opportunities for military personnel, their families, employees, and the general public. However, if recreational or management activities conflict with military activities, the military mission comes first.

The primary concern related to public access for outdoor recreation is safety. Those unfamiliar with the area and/or military operations and regulations may wander into off limits areas or other restricted areas perhaps putting themselves in danger or causing disruptions to military activities.

Military personnel, their dependents, and their accompanied guests are allowed access to most outdoor recreational activities such as fishing and hunting. The KSTC personnel rely on the responsible public to adhere to Installation policies designed to promote physical security, minimize safety hazards, and protect natural and cultural resources. All visitors to the KSTC are required to be briefed on the dangers of using the Installation. Signs are posted to warn the public of the dangers associated with entering the area.

PO-1: Public Outreach Potential

Objective: Promote the involvement of the KSTC community groups and other agencies to assist with regional conservation efforts, research opportunities, and public outreach programs.

Projects:
1. Involve high schools, universities, and conservation groups in assisting with subsequent (not baseline) biological surveys at the KSTC

2. The Public Affairs Office (PAO) to develop associated public outreach programs

3. Provide access to the KSTC for research purposes that will benefit regional conservation efforts

4. Analyze the success of associated public outreach programs and adjust order to foster continued good relations with the public

Monitoring Criteria: Analyze the success of associated public outreach programs and adjust public outreach efforts as appropriate.

8.10 Training of Natural Resource Personnel

A guiding philosophy of this INRMP is to take an ecosystems approach to managing the natural resources present on the KSTC. The interdisciplinary approach taken by this INRMP follows an ecosystems model, in which all appropriate components are integrated by their function. This section addresses the KSTC's goal of being a leader in Installation and natural resource management within the KSARNG and the Army. Ecosystem management is emphasized because it is recognized that the mission of the KSARNG is inextricably linked to local, regional, and global ecological integrity. Sustaining ecosystem integrity is also the best way to protect biodiversity, ensure sustainable use, and minimize the effort and cost of management. Native and natural communities, and the processes that sustain them, are unique expressions of the evolutionary and geological histories that are essential to sustaining current system function and resilience. While habitat that has the potential to dramatically alter ecosystem form and function is limited at the KSTC, it is still a priority at the KSTC to manage according to this paradigm. The following natural resource training (NRT) goals have been developed for the KSTC:

NRT-1: Expanding the Knowledge of the KSARNG Natural Resource Staff
Objective: Continue to provide training opportunities for KSARNG environmental program staff.

Projects: 1. Attend NGB natural resource training and natural resource conferences and workshops specific to rangeland management when available

Monitoring Criteria: This concern will be monitored through type and frequency of attended technical workshops and conferences.

9. Implementation

This INRMP has been developed for the KSARNG to use as a primary tool for planning and integrating natural resources management activities into the military mission. Currently, the KSARNG environmental office and KSTC personnel are responsible for natural resource management responsibilities at the KSTC that will be necessary to implement this INRMP. Additional sources of temporary labor (hired with term limitations), could be utilized to augment current staff, such as seasonal employees (e.g., grounds maintenance summer hires). Outside agency reimbursable hires and Guardsman, Reservists, or Active Duty Army personnel assigned to the KSTC on temporary duty are another source of supplemental labor.

Implementation of a number of projects discussed in this INRMP will require active outside assistance. The outside assistance may come from state and federal agencies, private consortiums and organizations, universities, and/or contractors. Using these resources is the most efficient and cost-effective method for acquiring expertise on a temporary basis. Some parties will be reimbursed for their assistance, as agreed based on Memorandums of Understandings (MOUs), Memorandums of Agreements (MOAs), and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements. The KSARNG and the KSTC Range Control Staff should assess the level of additional resources necessary to fully implement this INRMP during the annual review process and determine the extent to which outside assistance will be required. An implementation table has been developed to assist the INRMP Working Group in the carrying out of the goals outlined in Chapter 8. The table displays potential staffing needs and potential subcontractor costs for each goal. The table can be found in Appendix G.

9.1 Work Plans

Work plans and projects are integral to the successful implementation of this INRMP. Work plans may change with time as work requirements change and projects are completed on time, ahead of schedule, or behind schedule, or work plans are significantly changed due to mission changes. All work plans and subsequent projects will revolve around the best management practices to support the mission and ensure ecosystem management.

9.2 Natural Resource Management Staffing

Currently, the KSARNG Environmental Branch office and KSTC personnel are responsible for natural resource management responsibilities at the KSTC that will be necessary to implement this INRMP. Additional staff, including temporary labor, could be utilized to augment current staff, such as seasonal employees (e.g., grounds maintenance summer hires). Outside agency reimbursable hires and Guardsman, Reservists, or Active Duty Army personnel assigned to the KSTC on temporary duty are another source of supplemental labor.

Implementation of a number of projects discussed in this INRMP will require active outside assistance. The outside assistance may come from state and federal agencies, private consortiums and organizations, universities, and contractors. Using these resources is the most

efficient and cost-effective method for acquiring expertise on a temporary basis. Some parties will be reimbursed for their assistance, as agreed based on MOUs, MOAs, and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements. The INRMP Working Group should assess the level of additional resources necessary to fully implement this INRMP during the annual review process and determine the extent to which outside assistance will be required.

9.3 Annual Coordination Requirements

The DoD Supplemental Guidance states that each INRMP "must be reviewed as to operation and effect by the parties thereto on a regular basis, but not less than every five years" according to SAIA. This revised INRMP was developed using an interdisciplinary approach; information has been gathered from the KSARNG and the KSTC Range personnel, as well as other federal, state and local agencies and special interest groups with an interest in the management of natural resources at the KSTC.

Per DoD policy, the KSARNG reviews the INRMP annually in cooperation with KDWPT and the USFWS. The KSARNG will coordinate with the agencies annually to determine if changes or issues indicate the need for a meeting. If warranted, a meeting will be held at the KSTC with KDWPT and the USFWS and will be documented with meeting minutes. If a meeting is not necessary, any conversations will be documented via email correspondence or Record of Communication (ROC). Annual reviews shall verify that:

- Current information of all conservations and decisions is available
- All "must fund" projects and activities have been budgeted for and implementation is on schedule
- All required trained natural resources positions are filled or are in the process of being filled. Projects and activities for the upcoming year have been identified and included in the INRMP. An updated project list does not necessitate revising the INRMP
- All required coordination has occurred
- All significant changes to the Installation's mission requirements or its natural resources have been identified

Appendix H of this revised INRMP has been reserved for documents that have been generated during Annual Coordination.

9.4 Monitoring INRMP Implementation

Monitoring and evaluation are the heart of adaptive management and act as a check for implementation of the INRMP. Although the INRMP establishes direction for 2017-2021, it may

take longer to adequately address some goals and desired future conditions. Monitoring determines whether:

- Projects are implemented in compliance with INRMP, ARNG, and DoD requirements
- Standards and guidelines are followed
- Standards and guidelines are effective
- Goals and objectives are met
- Assumptions, relationships, and decisions are valid, considering new information or changing conditions

Implementation monitoring is pertinent to this INRMP. Implementation monitoring, the most basic monitoring level, determines whether or not projects and activities are designed and conducted in compliance with the INRMP and other directions. Implementation work plans and environmental assessment documents will track whether projects comply with the INRMP and have been completed.

Because of the dynamic nature of natural resources and the mission, there are expected variations in need during the course of a normal year. Some projects may be moved to a higher priority status than originally planned and some may have to be dropped totally as systems change or work priorities change. This INRMP implementation and monitoring effort will include these and other changes, ensure they are reviewed and documented, and alter INRMP planning, if necessary, to fit the current ecosystem and military mission needs.

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Appendix A
ARNG Environmental Checklist

ARNG ENVIRONMENTAL CHECKLIST

Enter information in the yellow shaded areas.

PART A - BACKGROUND INFORMATION

1. PRO ECT NAME:

KSARNG Kansas Training Center Integrated Natural Resources Management Plan

2. PRO ECT NUMBER:	**3. DATE:**
0	1-May-17

4. DESCRIPTION AND LOCATION OF THE PROPOSED ACTION:

5. START DATE (dd-mmm-yy):	25-May-17	6. END DATE (dd-mmm-yy):	1-Jun-22
7. STATE/ORGANIZATION:	KS/DOF-E JFHQKS	8. SERVICE COMPONENT:	ARNG
9. ADDRESS:	2800 SW Topeka Blvd. Topeka, KS 66611		
10. PROPONENT/UNIT NAME:	KSARNG	11. POC:	
12. PROPONENT/UNIT ADDRESS:	2800 SW Topeka Blvd. Topeka, KS 66611		
13. COMM VOICE: 785-274-1154	14. COMM FAX:	15. DSN VOICE:	
16. DSN FAX:	17. EMAIL:		

18. Was the project adequately addressed in a separate environmental review? **Do not include Environmental Baseline Surveys (EBSs).** ☐ YES ☐ NO

If YES, fill out and attach copy of the decision document:	Document Title:	Integrated Natural Resources Management Plan and Environmental Assmt
	Reviewing Agency:	National Guard Bureau Environmental Programs Div.
	Date of Review: (dd-mmm-yy):	

PART B - HISTORICAL INFORMATION

1. Is the agency undergoing, or has it undergone, legal action for NEPA issues? ☐ YES ☑ NO

2. Has there been previous ARNG training, construction, or similar proposals on the site? ☑ YES ☐ NO

3. Are there any known contentious environmental issues currently associated with the site? ☐ YES ☑ NO

Explain any **YES** answers.

4. Has the proposed type of equipment (tracked or wheeled) been operated on the site before? ☑ YES ☐ NO

If NO, what NEPA document covers this action? Provide copy of REC, FNSI, or ROD. **This does not include EBSs.**	Document Title:	
	Preparing Agency:	
	Date (dd-mmm-yy):	

5. Describe the environmental setting, including past and present use of the site.

Location is a training site owned by the U.S. Air Force, licensed to the KSARNG for training. The location is predominantly mid-grass prairie and rural. This location has been used for military training since 1943.

PART C - DESCRIPTION OF PROPOSED PRO ECT ACTION

Include a map with the site clearly marked

1. The proposed action will involve (check all that apply):
☐ Training Activities/Areas ☐ Construction ☐ Reorganization/Restationing
☐ Maintenance/Repair/Rehabilitation ☐ Lease or License ☑ Environmental Plans/Surveys
☐ EBS Preparation
☐ Other (Explain):

2. Has any related real estate action been addressed in a separate environmental document within the last 5 years? ☐ YES ☑ NO
If YES Document Title: Date (dd-mmm-yy):

3. Number of acres to be disturbed: NA

4. How is the site currently zoned?
☐ Residential ☐ Commercial ☐ Industrial ☐ Park
☑ Other (Explain): Rural/Agricultural

5. Briefly describe the surrounding area land uses (e.g., undeveloped, recreation, residential, etc):
Area is surrounded by training areas and ranges to the south and west, agriculture to the north, far south, and east.

6. Provide distances to **ALL** environmentally sensitive areas:

TYPE	Distance	Unit	TYPE	Distance	Unit
a. Prime/Unique Farmland	on site		e. Wild/Scenic River	na	
b. Wilderness Area/National Park	na		f. Coastal Zones	na	
c. Sole-Source Aquifer	na		g. Floodplain	1.0	km
d. Wetlands	on site				

PART D - ENVIRONMENTAL IMPACT ANALYSIS

1. AIR

a. Is the proposed action in a non-attainment/maintenance area? ☐ YES ☑ NO
Attach a General Conformity Determination or Record of Non-Applicability (RONA) for Military Construction activities in non-attainment maintenance areas.

b. Will the proposed action require an air emissions permit, registration, license, etc?
During proposed action ☐ YES ☑ NO
During normal operations after proposed action is completed ☐ YES ☑ NO

c. Will the proposed action release objectionable odors, smoke, dust, suspended particles, or noxious gases into the air?
During proposed action ☐ YES ☑ NO
During normal operations after proposed action is completed ☐ YES ☑ NO

d. Will the proposed action expose sensitive receptors (threatened or endangered plants or animals, or children) to pollutants?
During proposed action ☐ YES ☑ NO
During normal operations after proposed action is completed ☐ YES ☑ NO

Explain any **YES** answers and/or planned mitigation here.

2. TRAFFIC

a. Will the proposed action result in generation of or increase in aircraft activity/traffic? ☐ YES ☑ NO

b. Will the proposed action result in the generation of or increase in vehicular traffic? ☐ YES ☑ NO

c. Will the proposed action use and/or construct unimproved roads?	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☑ NO

Explain any **YES** answers and/or planned mitigation here. Include aircraft types, number of sorties, and flight schedules (if applicable).

3. NOISE

a. Will the proposed action result in an increase in noise levels?	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☑ NO

b. Is the proposed action close to any civilian activity where noise might affect the population (add any not listed in the spaces provided)? Include distances for all types: ☐ YES ☑ NO

TYPE	Distance	Unit	TYPE	Distance	Unit
(1) Residence/Home	1.0	km	(5) Library	>5	km
(2) Church	>5	km	(6) Wilderness Area	na	
(3) School	>5	km			
(4) Hospital	>5	km			

c. Will the proposed action involve aircraft?		☐ YES	☑ NO
d. Will the proposed action involve night (10 pm to 7 am) operations?	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☑ NO

Explain any **YES** answers.

4. EARTH

a. Will the proposed action result in long-term disruptions, displacements, compaction, or overcovering of soil, a permanent change in topography, or ground surface relief features?	☐ YES	☑ NO
b. Will the proposed action result in a long-term increase in wind or water soil erosion, on or off the site, after the proposed action is completed?	☐ YES	☑ NO

Explain any **YES** answers.

5. NATURAL RESOURCES

NOTE- A **subject matter expert** from the State/Territory ARNG Environmental Office must confirm the answers to these questions by signing the signature page.

a. Will the proposed action change the diversity or numbers of any species including mammals, birds, reptiles, amphibians, fish, trees, shrubs, grasses, crops, microflora, or aquatic plants?	☐ YES	☑ NO
b. Will the proposed action introduce any non-native species into the area?	☐ YES	☑ NO
c. Will the proposed action impact any plants or animals that are listed or candidates for threatened, unique, rare, or endangered status?	☐ YES	☑ NO
d. Will the proposed action create barriers to prevent the migration or movement of animals?	☐ YES	☑ NO

e. Will the proposed action deteriorate, alter, or destroy existing fish or wildlife habitat?	☐ YES	☑ NO
f. Will the proposed action deplete any non-renewable natural resources?	☐ YES	☑ NO
g. Will the proposed action alter, destroy, or significantly impact environmentally sensitive areas (wetlands, coastal zones, etc.)?	☐ YES	☑ NO

Explain any **YES** answers.

6. LAND USE

a. Will the proposed action alter the present land use of the site?	☐ YES	☑ NO
b. Who owns the property? ☑ Federal/DOD ☐ State ☐ City/Town/County ☐ Private ☐ Other (Explain):		
c. Does the proposed action involve a real estate action (e.g., purchase, lease, permit, or license)?	☐ YES	☑ NO
Answer the following if you answered **YES** above: (1) Has an EBS been completed? **If YES,** attach the EBS.	☐ YES	☐ NO
(2) Require an increase of acreage/amendment to an existing lease or license?	☐ YES	☐ NO
(3) Require new purchase of additional acres using federal, state, or other funds?	☐ YES	☐ NO
(4) Require a new lease, license, and/or land use permit?	☐ YES	☐ NO
(5) Replace or dispose of existing facilities?	☐ YES	☐ NO

Explain any **YES** answers.

7. SOLID WASTE

a. Will the proposed action generate solid wastes that must be disposed of on or off site?	☐ YES	☑ NO

Explain a **YES** answer.

8. HAZARDOUS WASTE

a. Will the proposed action generate hazardous waste?		☐ YES	☑ NO
b. Will the proposed action store and/or prepare for the disposal of hazardous waste or materials?	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☑ NO
c. Does the proposed action require a permit to accumulate hazardous waste or materials at the site?	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☑ NO
d. Does the proposed action have an increased risk for explosion, spill, or the release of hazardous waste or materials (including but not limited to pesticides, chemicals, or radiation)?	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☑ NO
e. Will the proposed action require the presence of trained personnel to handle and dispose of hazardous and/or toxic waste/materials?	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☑ NO

f. Will the proposed action involve the opportunity for hazardous material minimization and recycling?	During proposed action During normal operations after proposed action is completed	☐ YES ☐ YES	☑ NO ☑ NO
Explain any **YES** answers.			
g. Do you have a plan describing procedures for the proper handling, storage, use, disposal, and cleanup of hazardous and/or toxic materials?	During proposed action During normal operations after proposed action is completed	☑ YES ☑ YES	☐ NO ☐ NO
Explain any **NO** answers.			

9. WATER

a. Will the proposed action change currents, course, or direction of water movements in marine or fresh waters?		☐ YES	☑ NO
b. Will the proposed action discharge sediments, liquids, or solid wastes into surface waters, or alter the surface water quality?	During proposed action During normal operations after proposed action is completed	☐ YES ☐ YES	☑ NO ☑ NO
c. Will the proposed action change the quality and/or quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations?		☐ YES	☑ NO
d. Does the proposed action have the potential to accidentally spill hazardous or toxic materials in or near a body of water?	During proposed action During normal operations after proposed action is completed	☐ YES ☐ YES	☑ NO ☑ NO
e. Does the proposed action have the need for a Spill Control and Countermeasure Plan, and/or Installation Spill Contingency Plan (SPCC and/or ISCP)?	During proposed action During normal operations after proposed action is completed	☐ YES ☐ YES	☑ NO ☑ NO
f. Will the proposed action construct facilities or implement actions within floodplains and/or wetlands?	During proposed action During normal operations after proposed action is completed	☐ YES ☐ YES	☑ NO ☑ NO
g. Does the proposed action require an NPDES stormwater or wastewater discharge permit?		☐ YES	☑ NO
h. Does the proposed action involve the construction of a water or wastewater treatment system (oil water separators, grease traps, etc)?		☐ YES	☑ NO
Explain any **YES** answers.			

10. CULTURAL RESOURCES

a. Does the proposed action involve an undertaking (Reference: 36 CFR 800.161[y]) to a building/structure 50 years or older?	☐ YES	☑ NO
If YES to Question a, has an architectural inventory/evaluation been completed to determine eligibility for the National Register of Historic Places?	☐ YES	☐ NO
b. Does the proposed action involve ground disturbance? (Reference: 36 CFR 800.161[y])	☐ YES	☑ NO
If YES to Question b, has an archaeological inventory been completed to determine if there are any archaeological sites present?	☐ YES	☐ NO
If YES to Question b, did the state contact any Federally-recognized Tribes to comment on the proposed action?	☐ YES	☐ NO
c. Does the proposed action fall under any Federal or Nationwide Programmatic Agreement or Programmatic Comment? **If YES**, reference it below.	☐ YES	☑ NO
If NO to Question c, has the state contacted the SHPO for comments?	☐ YES	☐ NO
d. Does the proposed action have the potential to affect any traditional cultural properties or sacred sites? **If YES,** attach coordination with Federally-recognized Tribes.	☐ YES	☑ NO

Explain any **YES** answers.

11. POPULATION

a. Will the proposed action alter the location, distribution, density, or growth rate of the human population of an area?		☐ YES	☑ NO
b. Will the proposed action affect children? Reference: Executive Order 13045	During proposed action	☐ YES	☑ NO
	During normal operations after proposed action is completed	☐ YES	☐ NO
c. Are there any Environmental Justice issues associated with the proposed action? Reference: Executive Order 12898.		☐ YES	☑ NO

Explain any **YES** answers.

12. INFRASTRUCTURE

a. Will the proposed action result in the need for new systems or substantial alterations to the following utilities:

(1) Electrical power, fossil fuel or other (specify):	☐ YES	☑ NO
(2) Drinking water?	☐ YES	☑ NO
(3) Wastewater treatment?	☐ YES	☑ NO
(4) Sewer collection system?	☐ YES	☑ NO
(5) Wash racks?	☐ YES	☑ NO
(6) Solid waste disposal?	☐ YES	☑ NO

Explain any **YES** answers.

PART E - INNOVATIVE READINESS TRAINING (IRT)

Skip this portion if this is not an IRT Project

1. REQUESTER INFORMATION

a. REQUESTER NAME:		b. TITLE:			
c. AGENCY NAME:					
d. AGENCY ADDRESS:					
e. COMM VOICE:		f. COMM FAX:		g. DSN VOICE:	
h. DSN FAX:		i. EMAIL:			

j. TYPE: ☐ FEDERAL ☐ STATE ☐ LOCAL/MUNICIPAL ☐ YOUTH/CHARITABLE

k. SUPPORT TYPE REQUESTED:

☐ ENGINEER ☐ TRANSPORTATION ☐ TECH ASSISTANCE ☐ LOGISTICAL

☐ COMMUNICATION ☐ ADMINISTRATIVE ☐ CEREMONIAL ☐ PARADE

☐ OTHER (SPECIFY):

2. ASSIGNED UNIT INFORMATION (Filled out by assigned National Guard unit)

a. UNIT ASSIGNED PROJECT:		b. SERVICE COMPONENT:	
c. UNIT ADDRESS:			
d. PROJECT OFFICER	RANK:	NAME:	
e. SITE VISIT DATE (dd-mmm-yy			

f. PROJECT ASSESSMENT (Give detailed assessment of project requirements. Review project requirements against the screening criteria in Section 651.29 of 32 CFR Part 651. If the project qualifies for a Categorical Exclusion, indicate the Categorical Exclusion code).

g. ESTIMATED NUMBER OF HOURS REQUIRED TO COMPLETE PROJECT:		h. PERSONNEL REQUIRED:	OFFICER / ENLISTED

PART F - DETERMINATION

a. Does the proposed action have the potential to degrade the quality of the environment, or curtail the diversity of the environment? ☐ YES ☑ NO

b. Does the proposed action have the potential for cumulative impacts on environmental quality when the effects are combined with those of other Federal/State actions, or when the action is of lengthy duration? ☐ YES ☑ NO

c. Does the proposed action have environmental effects that will cause substantial adverse effects on the human or natural environment, either directly or indirectly? ☐ YES ☑ NO

On the basis of t is initial evaluation, t e following is appropriate (check one):

- ☐ An **Environmental Baseline Survey (EBS)** and a **new check list** once the EBS is completed.
- ☐ IAW 32 CFR 651 Appendix B, the proposed action qualifies for a **Categorical Exclusion (CX)** that does not require a Record of Environmental Consideration.
- ☐ A **Record of Environmental Consideration (REC).**
- ☐ An **Environmental Assessment (EA).**
- ☐ A **Notice of Intent (NOI)** to prepare an **Environmental Impact Statement (EIS).**

Signature of Proponent (Requester)

Printed Name of Proponent (Requester)

Date Signed

Concurrence:

Environmental Program Manager

Printed Name of Env. Program Manager

Date Signed

Concurrence (as needed):

Signature of Landowner

Printed Name of Landowner

Date Signed

Signature of Commander

Printed Name of Commander

Date Signed

Signature of Facilities Officer

Printed Name of Facilities Officer

Date Signed

Signature of Plans & Operations Officer

Printed Name of Plans & Operations Officer

Date Signed

ARNG RECORD OF ENVIRONMENTAL CONSIDERATION

1. PRO ECT NAME:

KSARNG Kansas Training Center Integrated Natural Resources Management Plan

2. PRO ECT NUMBER:	**3. DATE:**
0	1-May-17
4. PRO ECT START DATE (dd-mmm-yy):	25-May-17
. PRO ECT END DATE (dd-mmm-yy):	1-Jun-22

. DESCRIPTION AND LOCATION OF THE PROPOSED ACTION:

Revision of trhe Kansas Army National Guard's Integrated Natural Resources Management Plan (INRMP)

7. CHOOSE **ONE** OF THE FOLLOWING:

- ☐ An existing **Environmental Assessment** adequately covers the scope of this project.
  EA Date (dd-mmm-yy) Conducted By:
- ☐ An existing **Environmental Impact Statement** adequately covers the scope of this project.
  EIS Date (dd-mmm-yy Conducted By:
- ☐ After reviewing the screening criteria and completing the ARNG Environmental Checklist, this project qualifies for a **Categorical Exclusion** (select one below)**.**
  Categorical Exclusion Code:
  See 32 CFR 1 App. B
- ☐ This project is exempt from NEPA requirements under the provisions of:
  Cite superseding law:

8. REMARKS:

Concurrence:

Signature of Proponent (Requester)	Environmental Program Manager
Printed Name of Proponent (Requester)	Printed Name of Env. Program Manager
Date Signed	Date Signed

Appendix B
Agency Response Letters

Appendix C
Trespassing Program Permit

BY ORDER OF DET 1, 184TH IW OPERATING INSTRUCTION 34-101
THE DET 1, 184TH IW COMMANDER

01 March 2010
Services

TRESPASSING PERMIT PROGRAM

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

NOTICE: This operating instruction is available electronically on the ANG Ranges – Smoky Hill COP. https://www.my.af.mil/afknprod/community/views/home.aspx?Filter=AN-SC-00-17

OPR: Det 1, 184 IW/CEV (TSgt. Benoit)
Supersedes Det 1, 184 IW OI 34-101, 01 March 2008

Certified by: Lt Col. Maddex
Pages: 8
Distribution: F

This Operating Instruction (OI) establishes procedures for hunting, fishing, trapping, camping, or any other recreational activity at Det 1, 184 IW. This OI is applicable to all personnel while on Smoky Hill Range.

1. RESPONSIBILITIES: All trespass permit holders are responsible for ensuring compliance with provisions of this OI, all subjects briefed during Trespass Permit training, and all Kansas Department of Wildlife and Parks (KDW&P) regulations. In addition, all other State and Federal laws are applicable on Smoky Hill Range, including open containers, driving while intoxicated, transporting of firearms, etc.

1.1. Strict compliance with the KDW&P regulations and this OI is mandatory while pursuing any activity on Smoky Hill Range. Violation of any rules, regulations, or laws may result in loss of trespass privileges. Violations by guests may also result in the loss of privileges for the escort.

1.2. The consumption of alcohol, in conjunction with bearing firearms or operating motor vehicles, will not be tolerated. All Smoky Hill Range personnel have the authority to act in the range commander's behalf concerning any activity conducted on Smoky Hill Range. They may check trespass permits and ask anyone abusing this OI to leave the installation.

2. OBTAINING PERMITS: Trespass permits will be issued by range personnel during the trespass training sessions. The dates for these sessions will be posted by 31 January of each year and may be obtained from Det 1, 184 IW or found on the Smoky Hill COP. Only active duty, guard, reserve, and retired military I.D. card holders are eligible. (Guest permits are discussed in paragraph 2.2. below). Proper identification must be presented to obtain a permit and must be carried at all times while on Range. Applicant's liability release and permit will be

processed from the application submitted. All requested information must be included on the form.

2.1. Trespass permit holders are allowed to bring up to three guests on range at one time (except during archery deer and turkey season. See 8.4.4.). No more than 10 guest permits will be allowed under the primary permit holder at any given time. Guests must obtain and carry a guest permit and be accompanied by their sponsor at all times while on the Range. Guest permits may be obtained at the Smoky Hill Range Headquarters, Bldg 6001, or at the 184 IW Security Police (SP) office. To obtain a permit, all guests must be escorted to one of the above locations, by their sponsor, to view a safety video. Trespass permit holders are responsible for the conduct of their guests.

2.2. Spouses must obtain a guest permit and must be accompanied by their sponsor. Minor dependants do not require a trespass permit but must be accompanied by their sponsor. The spouse and minor dependants of the permit holder do not count towards the three guest rule. Minor children of guests do not count towards the three guest rule, but creel and bag limits will be restricted to the number of adults in the party. There must be one adult monitor for each minor carrying a firearm or bow. Adult guests do count towards the three guest limit.

2.3. There is a limit of 200 Primary Permit holders at any given time. Once this number is met, individuals will be placed on a waiting list to obtain a Primary Trespass Permit. This waiting list will be first on, first to receive a permit. When the number of Primary Trespass Permits falls below 200, the first person on the list will be called and they will have six months to attend a Trespass Training Class and receive their permit. If they do not obtain a permit within six months, their name will be dropped to the bottom of the list and the next person will be called. Individuals on the waiting list may attend a Trespass Training Class ahead of time, but they will not receive a Primary Trespass Permit before their name is at the top of the list and there is a vacancy for receiving such permit.

2.4. Primary Trespass Permit holders who have not accessed Smoky Hill Range for recreational activities at least two times throughout the lifespan of their permit will be dropped from the system. Once dropped, they will have to put their name on the waiting list, if existing, and go through the process of obtaining a permit.

2.5. If your name has been dropped from the system as in the cases of not renewing your permit on time or not accessing the Range throughout the lifetime of your permit, you will be required to re-attend a Trespass Training Class.

3. ACCESS: Access for permit holders and their guests is limited to the main gate at the Headquarters entrance and the south gate, located at the extreme south end of Smoky Hill Range, as well as the main Army gate. Combinations for these locks are normally changed monthly, but will be changed more frequently on occasion. The combination may be obtained by calling the Range at DSN 743-7600, (316) 759-7600 or (785) 827-9611, Option 6 then extensions 100, 110, 141 or 179, (Monday through Friday) or via email at galen.wiens.civ@ang.af.mil or edward.benoit@ang.af.mil. For access to the Army side call (785) 822-3297. You must provide your permit number. Permit numbers will be checked against and entered into our database prior

to the combination being issued. This allows the installation to track usage and to know who had access to Smoky Hill Range during any given period.

3.1. Do not give the combination to friends or co-workers, even if you know they have a valid permit. Permit holders found on Smoky Hill Range that have not been logged into the database as having the combination issued to them for the period in question may be subject to permit revocation. Permit holders must sign-in and sign-out at the main gate, the south gate, or the Army gate when entering the range. Anyone found on the range without having signed-in may be subject to a six month revocation of permit or being charged with illegal trespass.

3.2. Anyone accessing the Range for recreational activities must fill out a vehicle marker and have it visible in the dash of your vehicle. Vehicle markers will be available at all sign-in locations.

3.3. Permit holders must ensure that no flying activities are scheduled prior to entering the restricted access area. Unauthorized presence in the restricted access area may result in the revocation of trespass permit. If your unauthorized presence results in the loss of training for aircrews, your loss of privileges may be permanent. Permit holders may access a recording that outlines flying schedule information by calling extension 156.

3.4. **On days when flying activity is scheduled, recreational users will not be allowed in the restricted access area from 0600 hours through the end of the activity.**

3.5. All gates found closed must remain closed except when necessary for passage. Much of Smoky Hill Range is leased out for grazing and gates left open causes major inconvenience to leaseholders and Smoky Hill Range personnel.

4. CAMPING: Camping will be limited to HQ Pond area and the old homestead garage on the "south end", unless otherwise permitted by the Commander. Camping during firearms deer season will be limited to HQ Pond area and the old homestead garage area on the "south end". Campsites must be cleaned up after use. When camping, denote that fact on the sign-in sheet. No open campfires during times of high fire danger (Please check with Land Management Staff).

5. GROUPS: Groups/Organizations desiring activity on Smoky Hill Range are required to contact Operations (Opt 6 ext 147) with their request. The Range Commander, or his representative, is the approval authority for all recreational activity on range.

6. SAFETY: An Unexploded Ordnance (UXO) safety briefing is required and is presented during the trespass permit training session. Do not handle or disturb any object that may be an UXO. Do not take any ordnance found on range even if it appears spent or inert.

6.1. Safety is of prime importance during all activities while on range. Any person who jeopardizes safety by failing to comply with established rules, regulations and laws, or who fails to follow the instructions of range personnel, or who fails to exercise good judgment while on range, may be required to forfeit their trespass privileges. Permit holders are responsible for ensuring that they are familiar with bombing range access procedures.

6.2. Our hours of operation are Monday through Friday 0745-1645. Our hours of operation for flight scheduling are 0600-1700 Monday, Friday, and Saturday and 0600-2300 Tuesday, Wednesday, and Thursday. In addition, we are occasionally active on Sundays and at other times, as mission requires. A red flashing beacon (or red flag) at the main gate indicates the range is active. No recreation is allowed in the restricted access area while the range is active. All recreational users must make every effort to ensure that no activities are scheduled prior to entering the restricted access area. No access is allowed from 0600 until the end of all flights on any day when flying is scheduled. Access to the south end is allowed without prior approval.

6.3. All check-phones are usable for off-range emergency calls. Instructions are posted inside the phone boxes. Limit all calls to emergencies only.

6.4. Smoky Hill Range reserves the right to restrict hunting, fishing, camping, or any other activities at any time. The military mission, safety, and proper stewardship of the natural resources must remain our primary goals.

7. **VEHICLE OPERATIONS:** Only personnel approved by the Range Commander, or his representative, may drive their vehicle on Smoky Hill Range. All persons applying for a trespass permit must register the make, model, year, color, and tag number of the vehicle(s) they will use on or around Smoky Hill Range. Only properly licensed individuals may operate a vehicle on the range.

7.1. Vehicles will be kept on roads, firebreaks, or established pathways. Most firebreaks and some roads will be closed to vehicular traffic during firearms deer season. All secondary (non-graveled) roads will be closed to vehicular traffic when muddy to reduce damage to the roadway.

7.2. Operators of motorcycles or three or four wheel ATV's must carry proof of completion of an applicable safety course while operating these vehicles on government property. All safety gear including helmet, goggles, gloves, long shirt and pants and sturdy boots are required. Racing or operating these vehicles in a manner that is destructive to the environment is prohibited.

7.3. Government owned vehicles will not be used to assist privately owned vehicles that are stuck or broken down except when the stuck vehicle affects the mission and then only by the direction of the Range Commander.

7.4. In order to ensure the safety of everyone utilizing Smoky Hill Range, the following guidelines must be adhered to: Keep right on hills and other areas of limited visibility; slow down around buildings, stopped vehicles, and pedestrians; wear seatbelts; do not drink and drive; slow down when meeting oncoming traffic; slow down when road or weather conditions are poor.

8. HUNTING:

8.1. **TRANSPORTATION OF FIREARMS**: All firearms will be unloaded and cased while being transported in a vehicle on range. Firearms and ammunition should be stored separately and out of reach of the driver and all passengers until reaching the desired location.

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8.2. Minors and firearms/archery equipment: Keep in mind that for each minor carrying a firearm/bow, there must be an adult to monitor that minor (i.e. 3 adults and 5 minors in the party- then only 3 minors may carry firearms at any given time.)

8.3. Upland Game: Upland game hunters are required to wear a blaze orange hat while hunting. All hunters are encouraged to wear a blaze orange vest. While quail hunting, group size is limited to four hunters. Large groups in quail cover jeopardize personal safety and tend to over-harvest coveys of quail. Quail need a minimum of 8-10 birds to remain a viable covey.

8.3.1. We encourage all upland hunters to quit hunting at 1500 hours on days of extreme cold, in order to allow the game to find feed and shelter before nightfall.

8.4. Waterfowl: Waterfowl blinds, if constructed, must be registered with the land management section and must be removed at the end of the season, along with all associated litter (i.e. hulls, construction materials, etc.). Blinds constructed completely of natural materials found at the site need not be registered. Persons found occupying unregistered waterfowl blinds may be asked to surrender their trespass permit. If you use decoys, remove them after each day's hunt.

8.5. Deer: Due to the complexities of deer herd management as conducted by the KDW&P, consult Smoky Hill Range Land Management personnel for the current season's deer policies. Firearms deer hunting is open only to military trespass permit holders, their spouse, and/or minor dependants. **Guests are not allowed to hunt deer on Range (except as provided in paragraph 8.5.4 of this ROI). There must be an adult monitor for each minor carrying a firearm or bow.**

8.5.1. The use of another hunter's tree stand or ground blind without their permission is illegal. Illegal usage of tree stands or ground blinds will result in a one year suspension of trespass privileges.

8.5.2. During any firearms deer season, firearms will not be discharged within 100 meters of your vehicle.

8.5.3. No other hunting will be allowed during firearms deer season, with the exceptions of the harvesting of coyotes or furbearers (with proper license) by deer permit holders and waterfowl hunting. A blaze orange hat and vest must be worn by all individuals during the firearms deer season.

8.5.4 . Only one guest permit holder will be allowed to hunt with each military permit holder during the archery deer and turkey seasons. This means that if you bring guest X out for the first part of the archery or turkey season that is the only guest that is allowed for that archery or turkey season. However, you may bring guest "X" for turkey and then guest "Y" for archery deer, or guest "X" can be your guest for both seasons. Dependants do not count as the one guest, but no more than two individuals may accompany the primary permit holder during archery deer and turkey seasons (one guest and one dependant or two dependants). Keep in mind that each minor carrying a firearm or bow must have an adult monitor.

9. **TRAPPING:** No trapping is allowed on Smoky Hill Range.

10. **FISHING:** All KDW&P length and creel limits apply at all ponds on Smoky Hill Range unless otherwise posted. When keeping fish, only one creel limit per adult in the party will be allowed. For example, if you bring 2 adult guests and 6 kids, you may only keep 3 creel limits (1 per adult in party).Newly stocked ponds or special management ponds will be catch and release only for the first three years and will be posted as "catch and release only". Other ponds may be marked with harvest limits or other information necessary for proper management of the fishery. Harvesting of minnows, crayfish or other baitfish will only be allowed when the harvested baitfish will be used in the pond from which they were removed. This is necessary to avoid over harvesting of the forage base. Transferring fish from pond to pond is destructive to the ecosystem and prohibited. The ponds are stocked and managed in accordance with fish biologists' expertise.

11. **HARVEST REPORTING:** Smoky Hill Range monitors the quantity and species harvested each season to ensure wildlife populations are maintained at an appropriate level. To accomplish this we need your help. Therefore, after each hunting or fishing trip all permit holders are required to fill out a harvest report. These reports are available in the sign-in/sign-out boxes. All information should be completed, even if you did not harvest any game or fish. Please be very specific when annotating the areas hunted or fished. Look these forms over closely, prior to beginning your fishing or hunting, to see what information is requested. The more information that we receive the better decisions we can make.

JEFFREY L. MADDEX, LT COL, KSANG
Commander

Attachment 1

SMOKY HILL ANG RANGE
SAFETY, ETHICS, AND HUNTER EDUCATION BRIEF

SAFETY

Do not pick up, handle or disturb any ordnance (i.e. bombs, bullets, etc.) or any thing that looks like it could have been ordnance. Under no circumstances will any ordnance, target, target pieces, or other Government property be taken off Smoky Hill Range. We find live ordnance from the 1940's and 1950's out here every year. These old UXO's (unexploded ordnance) are very dangerous.

Targets will be left alone. There will be no climbing or sitting on targets and no shooting of targets. Do not go inside of targets. The targets may contain bombs, broken glass, wasp and bee nests, snakes, rats and any number of hazards.

All buildings and equipment are off limits and will be left alone.

Stay on main roads or established pathways. Keep to the right on hills.

The speed limit on range is 45 mph except where posted otherwise. Slow down when conditions warrant. Seat belts must be worn.

Be extremely careful with hot vehicle parts, smoking materials, and any other ignition sources to avoid starting grass fires.

ETHICS AND EDUCATION

Be considerate of the other users of Smoky Hill Range. If someone gets to your hunting or fishing spot before you do, have an alternate location to go.

Be on the lookout for other hunters to avoid spoiling their hunt by walking through the area that they are using. Consider finding a different pond to fish if someone is at the one you planned on fishing, they might want to be left alone.

Slow down around parked vehicles. Sometimes hunting dogs don't look both ways before crossing the road. People are out in the country and don't look for traffic prior to opening truck doors or stepping out into the roadway.

Do not keep more fish than you can use. Do not shoot all the quail in a covey; quail need 8-10 birds to survive cold weather and predation. This may help to ensure that we have sufficient breeding stock for next year. Don't leave piles of fish and or game carcasses lying around. Clean your animals at home or dispose of the waste properly.

Consider ending your hunt early to allow birds to find feed and shelter before nightfall. Don't hunt the same area day after day. Give the game some time to go about the business of living.

Individuals or groups displaying a willful disregard for these rules and regulations may be asked to leave the Range and/or surrender their permit.

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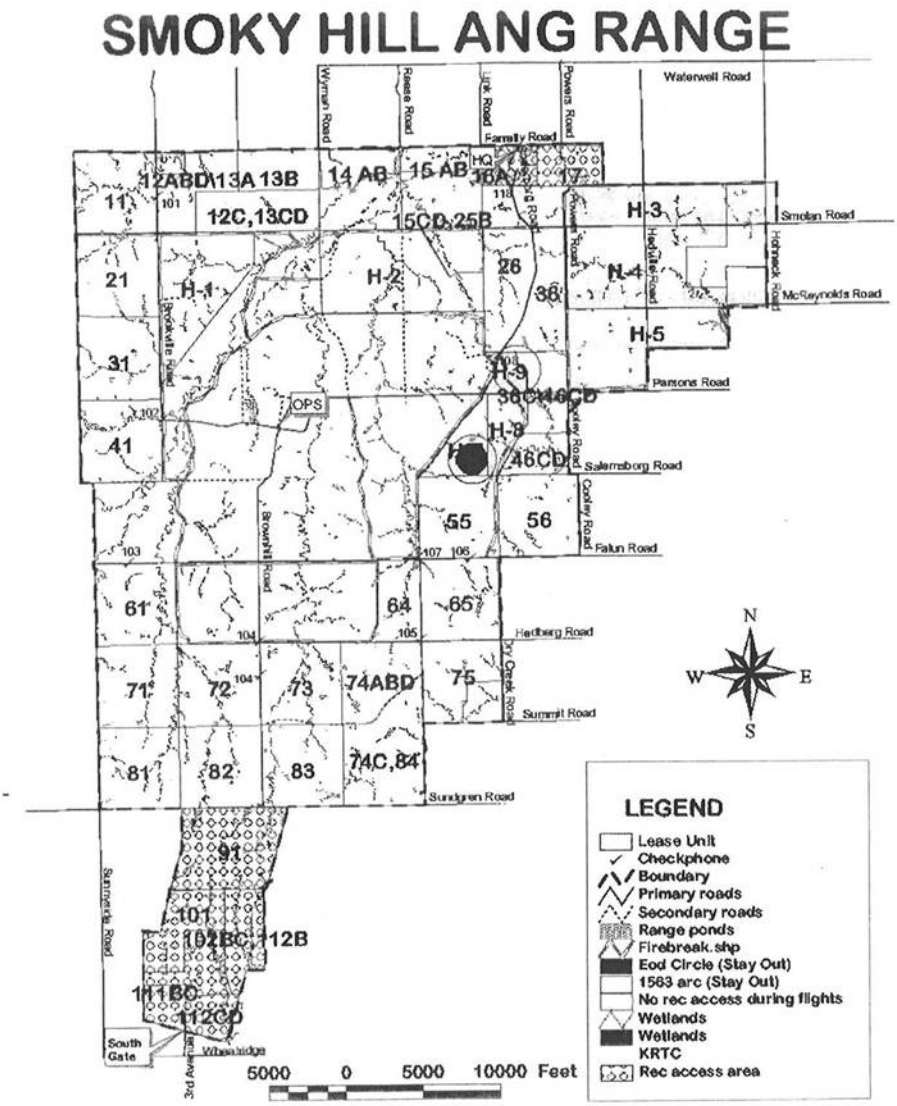
Attachment 2



Appendix D
Proposed Project Schedules and Budgets

INRMP Implementation Table 2017-2021 DRAFT

Program Element Number	Program Element	Project Period																		Total Funding					Project Total	Date Completed
		FY17				FY18				FY1				FY20				FY21				FY17	FY18	FY1	FY20	FY21		
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4							
WM	**Wildlife Management**																											
WM-1	Fish and Wildlife Planning Level Surveys																					$ 14,500	$ 4,000	$ 17,500		$ 17,500		$ 53,500	
	Review and Revise fish and Wildlife survey protocols																												
	Update fish and wildlife surveys																												
	Data review/management program																												
WM-2	Manage Balanced Fish Populations																						$ 6,500	$ 15,500	$ 6,500	$ 4,500		$ 33,000	
	Develop Fish Management Plan																												
	Monitor Fish Populations																												
	Fish Stocking and Habitat Improvement																												
WM-3	Manage Balanced Wildlife Populations on Site																						$ 16,675					$ 16,675	
	Develop a Wildlife Management Plan																												
	Incorporate a T&E Management Plan into the Wildlife Mgmt Plan																												
WM-4	Establish a Wildlife Database																						$ 11,000	$ 3,500	$ 2,000	$ 3,500		$ 20,000	
	Develop Wildlife Database																												
	Update Wildlife Database																												
	Wildlife Data Communications to USFWS and KDWPT																												
T E	**T reatened and Endangered and Species of Concern**																												
T&E-1	Identify Potential T&E Habitat In and Near KSTC																					$ 2,000	$ 11,000	$ 16,500	$ 2,000	$ 8,500		$ 40,000	
	T&E species Survey and Habitat Evaluation																												
	GIS update with T&E species data																												
	T&E species Education Program																												
T&E-2	Conserve Known T&E Species Habitat																					$ 2,000	$ 10,000	$ 2,500	$ 9,500	$ 2,500		$ 26,500	
	Identify/Map T&E Species Locations																												
	T&E Species Habitat Signage																												
	Update GIS Database with T&E Species Information																												
	T&E Management Plan																												
T&E-3	Protect SINC Species (Henslow's Sparrow) Nesting Areas																							$ 8,500				$ 8,500	
WSW	**Wetlands, Streams, Deep Water Habitat**																												
WSW-1	Wetland Inventory Update																							$ 15,000				$ 15,000	
WSW-2	Wetland Monitoring and Maintenance																					$ 9,200			$ 7,500			$ 16,700	
WSW-3	Pond Monitoring and Maintenance																									$ 17,500		$ 17,500	
WSW-4	Update Watershed Management Plan																						$ 15,000					$ 15,000	
PW	**Prairie and Woodland Management**																												
PW-1	Vegetation Planning Level Survey																					$ 13,750						$ 13,750	
PW-2	Conserve Prairie Habitat																						$ 4,500	$ 4,500	$ 6,500	$ 2,500		$ 18,000	
PW-3	Mixed-grass Prairie Restoration																								$ 22,500			$ 22,500	
PW-4	Location, Density, and Succession of Riparian and Upland Trees																							$ 6,000				$ 6,000	
MBM	**Migratory Bird Management**																												
MBM-1	Manage Migratory Bird Habitat to Meet Mission of KSARNG																											$ -	
MBM-2	Long-Term Coordinated Bird Monitoring																					$ 15,000						$ 15,000	
ISM	**Invasive Species Management**																												
ISM-1	Locate and Identify Invasive Species at the KSTC																						$ 4,500					$ 4,500	
LM	**Land Management**																												
LM-1	Static Rotation of Controlled Burns																											$ -	
LM-2	Tallgrass Prairie Restoration																									$ 7,500		$ 7,500	
AG	**Agricultural Out-leasing**																												
AG-1	Manage Invasive Woody Vegetation																						3000			3000		$ 6,000	
PO	**Public Outreac**																												
PO-1	Public Outreach Potential																						500	500	500	500		$ 2,000	
NRT-1	**Training of Natural Resource Personnel**																												
NRT-1	Expanding the Knowledge of the KSARNG Natural Resource Staff																					3000	3000	3000	3000	3000		$ 15,000	
	Total																					$ 59,450	$ 89,675	$ 93,000	$ 60,000	$ 70,500		$ 372,625	

Appendix E
Threatened, Endangered, and SINC Species

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kansas Ecological Services Field Office
2609 ANDERSON AVENUE
MANHATTAN, KS 66502
PHONE: (785)539-3474 FAX: (785)539-8567

Consultation Code: 06E21000-2017-SLI-0257 February 28, 2017
Event Code: 06E21000-2017-E-00519
Project Name: KSTC

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having

similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: KSTC

Official Species List

Provided by:

Kansas Ecological Services Field Office
2609 ANDERSON AVENUE
MANHATTAN, KS 66502
(785) 539-3474

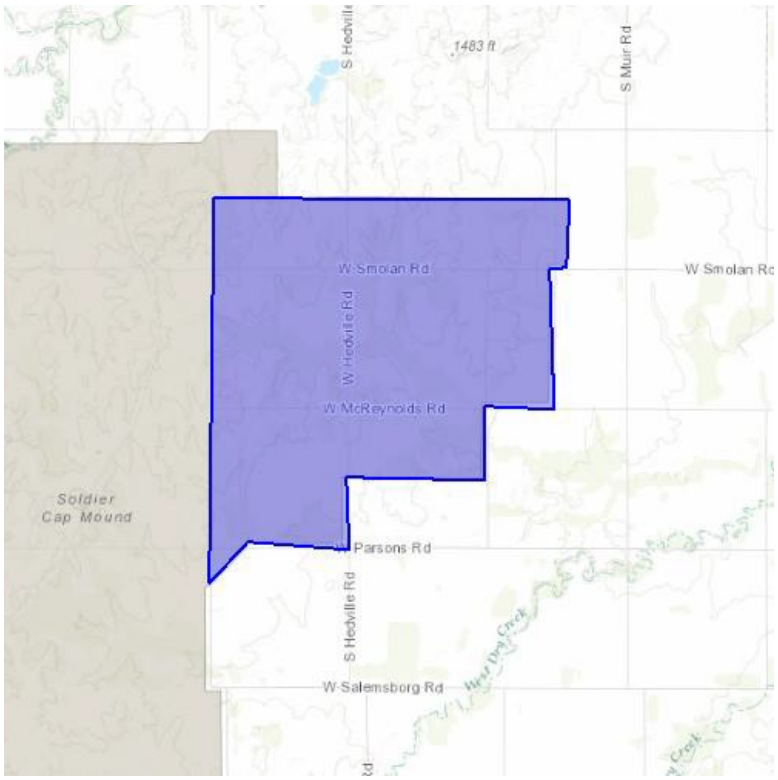
Consultation Code: 06E21000-2017-SLI-0257
Event Code: 06E21000-2017-E-00519

Project Type: MILITARY OPERATIONS / MANEUVERS

Project Name: KSTC
Project Description: Updating the INRMP

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-97.78046607971193 38.707548854407854, -97.77977943420412 38.74765730401543, -97.73231506347658 38.74752342345252, -97.73265838623048 38.74036044733935, -97.73497581481934 38.74029350024827, -97.73428916931154 38.7256975363094, -97.74364471435547 38.72589841843698, -97.743558883667 38.71826450056022, -97.7621841430664 38.7185323711329, -97.76158332824708 38.711098590112485, -97.77523040771486 38.711768331801494, -97.78046607971193 38.707548854407854)))

Project Counties: Saline, KS

United States Department of Interior
Fish and Wildlife Service

Project name: KSTC

Endangered Species Act Species List

There are a total of 2 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	**Status**	**Has Critical Habitat**	**Condition(s)**
Whooping crane *(Grus americana)* Population: Wherever found, except where listed as an experimental population	Endangered	Final designated	
Mammals			
Northern long-eared Bat *(Myotis septentrionalis)* Population: Wherever found	Threatened		

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Kahsas
Department of Wildlife, Parks and Tourism

Saline County

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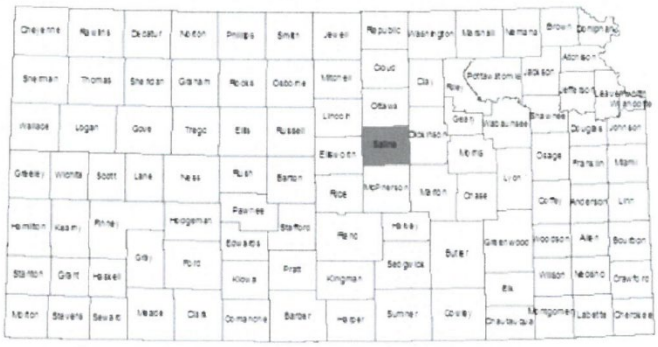

Threatened and Endangered (T&E) Species

Critical

There are no T&E **species with critical habitat** in **Saline county**

Non-Critical

TOPEKA SHINER *Notropis topeka*
State: Threatened **Federal:** Endangered **Critical Habitat:** No

WHOOPING CRANE *Grus americana*
State: Endangered **Federal:** Endangered **Critical Habitat:** No

LEAST TERN *Stema antillarum*
State: Endangered **Federal:** Endangered **Critical Habitat:** No

PIPING PLOVER *Charadrius melodus*
State: Threatened **Federal:** Threatened **Critical Habitat:** No

SNOWY PLOVER *Charadrius alexandrinus*
State: Threatened **Federal:** N/A **Critical Habitat:** No

EASTERN SPOTTED SKUNK *Spilogale putorius*
State: Threatened **Federal:** N/A **Critical Habitat:** No

AMERICAN BURYING BEETLE *Nicrophon;s americanus*
State: Endangered **Federal:** Endangered **Critical Habitat:** No

Species In Need of r 1 (SINC)

Critical

Non-Critical

Southern Bog Lemming *Synaptomys cooperi*

There are no SINC species with critical habitat in Saline county

State: SINC Federal: NIA Critical Habitat: No

Western Hognose Snake *Heterodon nasicus*
State: SINC **Federal:** N/A **Critical Habitat:** No

Black Tern *Chlidonias niger*
State: SINC **Federal:** N/A **Critical Habitat:** No

Short-eared Owl *Asio flammeus*
State: SINC **Federal:** N/A **Critical Habitat:** No

Ferruginous Hawk *Buteo regalis*
State: SINC **Federal:** N/A **Critical Habitat:** No

Golden Eagle *Aquila chrysaetos*
State: SINC **Federal:** N/A **Critical Habitat:** No

Wabash Pigtoe Mussel *Fusconaia f/ava*
State: SINC **Federal:** N/A **Critical Habitat:** No

Bobolink *Dolichonyx oryzivorus*
State: SINC **Federal:** N/A **Critical Habitat:** No

Henslow's Sparrow *Ammodramus henslowii*
State: SINC **Federal:** N/A **Critical Habitat:** No

Long-billed Curlew *Numenius americanus*
State: SINC **Federal:** N/A **Critical Habitat:** No

Franklin's Ground Squirrel *Po/iocitel/us franklinii*
State: SINC **Federal:** N/A **Critical Habitat:** No

Appendix F
Noxious Weeds Work Plan

2018 Invasive and Noxious Plant Species Report

Kansas Army National Guard
Kansas Training Center
Salina, Saline County, Kansas

Prepared for:

The Kansas Army National Guard
Environmental Branch
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Olsson Project No. 017-3053

August 2018

OLSSON ASSOCIATES

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Kansas Army National Guard
Kansas Training Center
Salina, Saline County, Kansas

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EXECUTIVE SUMMARY

This report documents the findings of an invasive and noxious plant species survey conducted July 25 through 27, 2018, at the Kanas Army National Guard (KSARNG) Kansas Training Center (KSTC) Site, located in Saline County, Kansas. The objectives of this invasive and noxious plant species survey were to 1) identify invasive and noxious plant species at KSTC; 2) estimate density and abundance of the invasive and noxious plant species; and 3) map the locations of large patches of the invasive and noxious plant species.

The KSTC area was divided into 21 quarter sections for this survey. Wandering pedestrian surveys were performed in each quarter section and all observed noxious and invasive species were documented and assessed for density. Large patches or stands of noxious and invasive species were mapped to document precise locations for management.

A total of seven invasive and noxious plant species were detected during the wandering surveys within the Study Area. The identified species included: Canada thistle (*Cirsium arvense*), field bindweed (*Convolulus arvensis*), sericea lespedeza (L*espedeza cuneata*), cheatgrass (*Bromus tectorum*), Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), and yellow bluestem (*Bothriochloa ischaemum*). Sericea lespedeza and yellow bluestem were determined to be the two most problematic species in need of active management. Five problem priority areas with high densities of these two species were identified during the survey. Management of these problem areas will require a combination of prescribed burning, herbicide application, and mowing.

1. Introduction

Olsson Associates (Olsson) conducted an invasive and noxious plants survey at the Kansas Army National Guard (KSARNG) Kansas Training Center (KSTC) Site, in Saline County, Kansas. The Army National Guard's environmental mission is to "excel in environmental stewardship to ensure the welfare of all citizens and communities while sustaining military readiness." The purpose of this study, in conjunction with the Undesirable and Noxious Weed Control Plan for KSTC (hereafter Weed Control Plan; Olsson 2012), is to collect baseline data to initiate a long-term monitoring program to assist in the continued plant health at the KSTC over time.

For the purposes of this study, the Natural Resources Conservation Service (NRCS) definitions of the terms "noxious plant" and "invasive plant" were used. The NRCS (2007) defines noxious plants as those which can cause damage to crops, livestock, public health, or the environment. Noxious plants may be subject to regulations. The NRCS defines invasive plants as those that are non-native and able to establish in many areas, grow and spread quickly, and disrupt native plant communities.

2. Objectives

The objectives of this invasive and noxious plant species survey were to:

1) Identify invasive and noxious plant species at KSTC;
2) Estimate the density and abundance of the invasive and noxious plant species; and
3) Map the locations of large patches of the invasive and noxious plant species

3. Study Area

KSTC property (hereafter Project area) is located approximately 12 miles southwest of Salina, in Saline County, Kansas (Figure 1). The Project area boundary encompasses approximately 3,560 acres of land. It is located within the Great Plains ecoregion as defined by the U.S. Environmental Protection Agency (Chapman et al. 2001). More specifically, the Project area is located within the Smoky Hills ecoregion, a transition zone between the tallgrass prairies to the east and the mixed-grass prairies to the west (USEPA 2013), situated on the eastern border of the Central Great Plains.

Portions of the Project area were developed for military training use and contain a mix of wooded and grassland areas. Grasslands in the Project area are predominately used for hay production and military training activities. Other habitat types in the Project area include woodlands and riparian areas associated with tributaries that flow to the Smoky Hill River to the east and northeast to the Saline River. Much of the Project area was burned in March - April 2018 during prescribed spring burns (Figure 2).

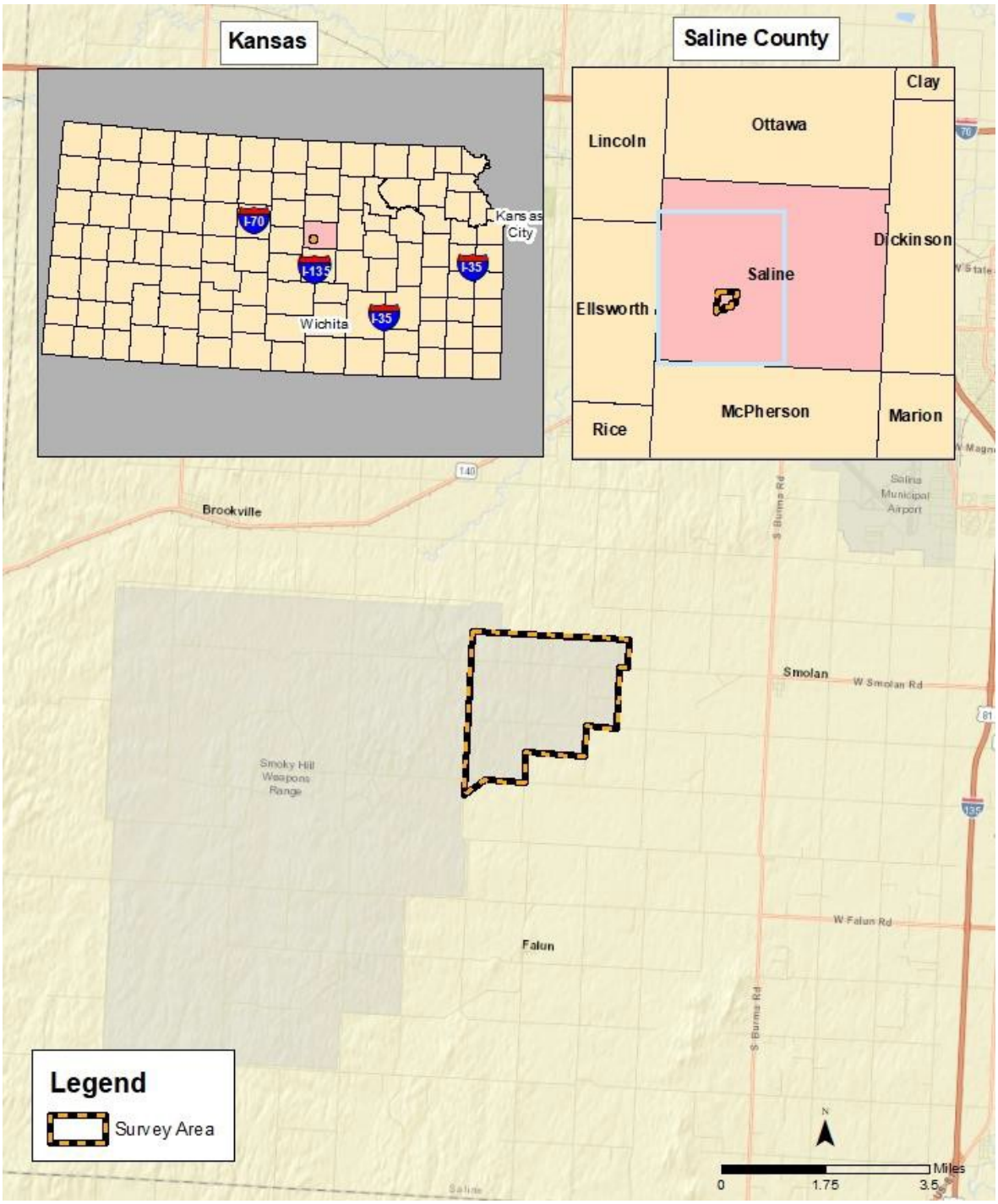


Figure 1. KSTC Location Map

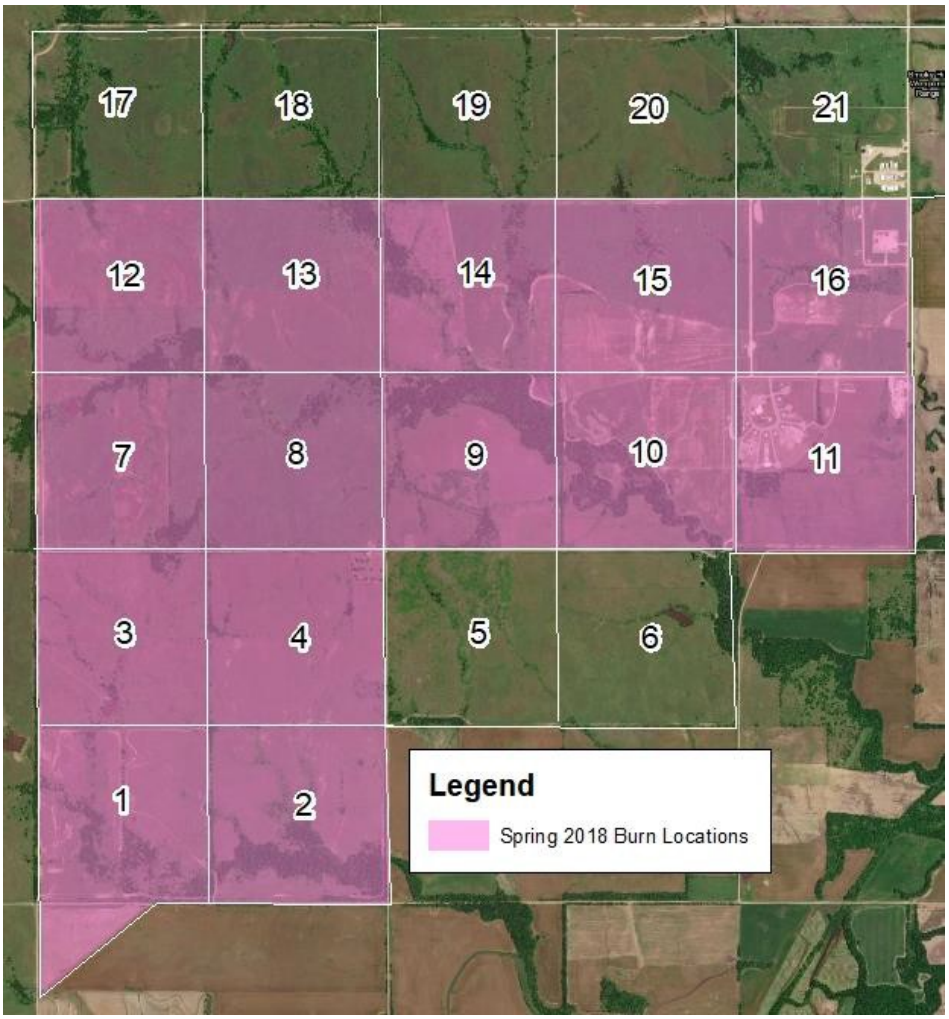


Figure 2. Spring 2018 Survey and Prescribed Burn Locations

4. Methods

4.1 Survey Locations and Timing

The Study Area was divided into 21 quarter sections, each consisting of 160 acres, for wandering pedestrian surveys. Wandering pedestrian surveys were conducted for approximately one hour per quarter section by two Olsson biologists to allow for coverage of the KSTC in a reasonable amount of time. Only open grassland areas in each quarter section were included in the wandering survey; mowed training areas, forested areas, and hay leases were omitted (Figure 3). The invasive and noxious plant survey was conducted July 25 through 27, 2018. This period coincides with the growing season of the plants for the Great Plains ecoregion.

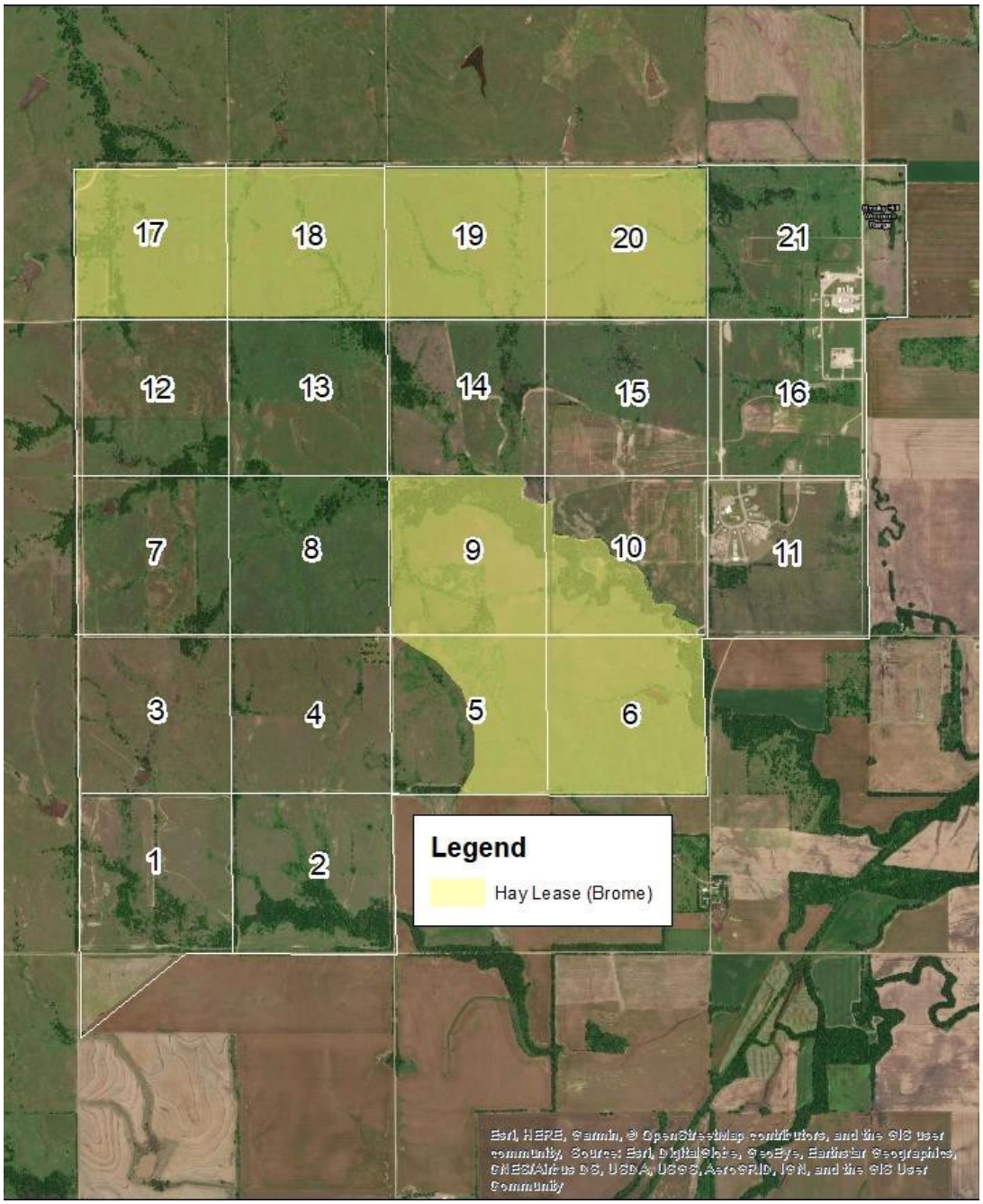


Figure 3. Hay Lease Locations

4.2 Data Collection

Two Olsson biologists conducted wandering pedestrian surveys in each of the quarter sections, with the exception of the hay leases, mowed training areas, and the forested areas. In each quarter section, biologists traversed open grassland areas and remained spaced approximately 100 meters apart from one another to ensure full coverage of each of the quarter sections in the Project area. The Kansas Department of Agriculture (KDA) Noxious Weed list (Table 1) was used

during the survey as well as a list of common invasive plant species (Table 2) found in Kansas. All noxious and invasive plant species encountered by the biologists were recorded on a field datasheet. Large patches or stands of the noxious or invasive plant species were mapped using a Trimble Geo7x Handheld System. At the conclusion of each one-hour survey, biologists shared species lists and quantified the densities of each observed species. Densities were categorized based on NRCS National Rangeland Inventory (NRI) Rangeland Resource Assessments, with adaptations to fit the management goals of the KSTC, where density was recorded as a measure of the percentage of acres occupied by a given species in a known area. Density classes used were as follows:

- Less than five percent
- Greater than five percent

Table 1. KDA Noxious Weed List

Common Name	Scientific Name
Bur ragweed	*Ambrosia grayii*
Canada thistle	*Cirsium arvense*
Field bindweed	*Convolvulus arvensis*
Hoary cress	*Cardaria draba*
Johnson grass	*Sorghum halpense*
Kudzu	*Peuraria lobate*
Leafy spurge	*Eurphorbia esula*
Musk thistle	*Carduus nutans*
Pignut	*Hoffmannseggia densiflora*
Quackgrass	*Agropyron repens*
Russian knapweed	*Centaurea repens*
Sericea lespedeza	*Lespedeza cuneata*
Multiflora rose	*Rosa multiflora*
Bull thistle	*Cirsium vulgare*

Table 2. List of Common Invasive Plant Species Found in Kansas

Common Name	Scientific Name
Caucasian bluestem	*Bothriochloa bladhii*
Cheatgrass	*Bromus tectorum*
Cut-leaf teasel	*Dipsacus lacinatus*
Common reed	*Phragmites australis*
Japanese brome	*Bromus aponicus*
Kentucky bluegrass	*Poa pratensis*
Reed canary grass	*Phalaris arundinacea*
Smooth brome	*Bromus inermis*
Tall fescue	*Schedonorus arundinaceus*
Yellow bluestem	*Bothriochloa ischaemum*

In addition to identifying noxious and invasive species, biologists also documented the four most dominant native grassland species found in each quarter section to help indicate the overall health of the surveyed plant communities within the Project area.

4.3 Data Analysis

Upon completion of all wandering surveys, data were compiled into tables and maps to identify most abundant noxious and invasive species found within the Project area, as well as problem areas that should be high priority for active management.

5. Results

During the survey, seven invasive and noxious plant species were found within the Project area. Three noxious plant species were observed and included Canada thistle (*Cirsium arvense*), field bindweed (*Convolulus arvensis*), and sericea lespedeza (L*espedeza cuneata*). Four invasive plant species including cheatgrass (*Bromus tectorum*), Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), and yellow bluestem (*Bothriochloa ischaemum*) were documented. General species descriptions and control information for each of the seven species are discussed later in this section. Representative photos of observed plant patches can be found in the photolog located in Appendix B.

Noxious Species

Canada thistle

Canada thistle was found in all 13 of the surveyed quarter sections within the KSTC. However, species density estimates were less than five percent in each quarter section. No large patches of this species were observed or mapped. In general, only three to five individual plants were observed in each quarter section.

Field bindweed

Field bindweed was found in three quarter sections. Density measurements for this species were less than five percent in each of the quarter sections it was observed in. This species was not encountered as dense stands or mapped as patches. Field bindweed was primarily observed only along fireguards and two-track roads.

Sericea lespedeza

Sericea lespedeza was observed in three quarter sections in the Project area. The overall density for each of the three quarter sections was less than five percent; however, the species was generally found in thick patches that were mapped when observed. Three patches of sericea lespedeza were mapped in the Project areas and totaled of 1.18 acres (Figures 3 and 4, Appendix A). One quarter section (quarter section 9) contained sericea lespedeza but was not mapped because only three stems were documented, and no thick patches were present.

Invasive Species

Cheatgrass

Cheatgrass was identified in 11 quarter sections. The overall density of cheatgrass in each of the quarter sections was less than 5 percent. No dense stands were observed or mapped. Cheatgrass was usually observed along the edges of the quarter sections next to the disturbed roadside ditches.

Kentucky bluegrass

Kentucky bluegrass was observed in 10 quarter sections in the Project area. Kentucky bluegrass was observed as less than five percent density in each of the 10 quarter sections. One patch of this species was mapped and totaled 0.05 acre (Figure 5, Appendix A). The patch was not a thick solid mat of Kentucky bluegrass that can become an issue with Kentucky bluegrass establishment.

Smooth brome

Smooth brome was observed in all 13 surveyed quarter sections in the Project area. While the species was present in each surveyed area, density measurements were below five percent in each quarter section. Four patches of smooth brome were mapped and totaled 2.16 acres (Figures 6 and 7, Appendix A). Smooth brome was typically found bordering wooded areas, along roadsides, and in disturbed areas.

Yellow bluestem

Yellow bluestem was observed in 11 of the surveyed quarter sections. Dense patches were observed and mapped in all 11 quarter sections and totaled 23.73 acres within the Project area (Figures 3 – 11, Appendix A). Densities of yellow bluestem were less than five percent in seven quarter sections, and greater than five percent in four quarter sections. Yellow bluestem was present in both burned and unburned quarter sections, though it was found in greater densities in burned quarter sections.

Dominant Plant Species

During the wandering pedestrian surveys of each quarter section, dominant native plant species, both grasses and forbs/shrubs, were documented to characterize the overall health of the plant communities. Dominant native species found in each surveyed quarter section are listed in Table 3. The documented dominant grasses observed during the surveys included big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), yellow bluestem, sideoats grama (*Bouteloua curtipendula*), switchgrass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), Kentucky bluegrass, tall dropseed (*Sporobolus compositus*), and June grass (K*oeleria macrantha*). The dominant forbs and shrubs were documented as white sagebrush (*Artemisia ludoviciana*), Missouri goldenrod (*Solidago missourensis*), leadplant (*Amorpha canescens*), western ragweed (*Ambrosia psilostachya*), Illinois bundleflower (D*esmanthus illinoensis*), and smooth sumac (*Rhus glabra*). Overall, all quarter section plant communities were dominated by native mixed-grass prairie plant species with the exception of section 5 which had Kentucky bluegrass as a dominant species.

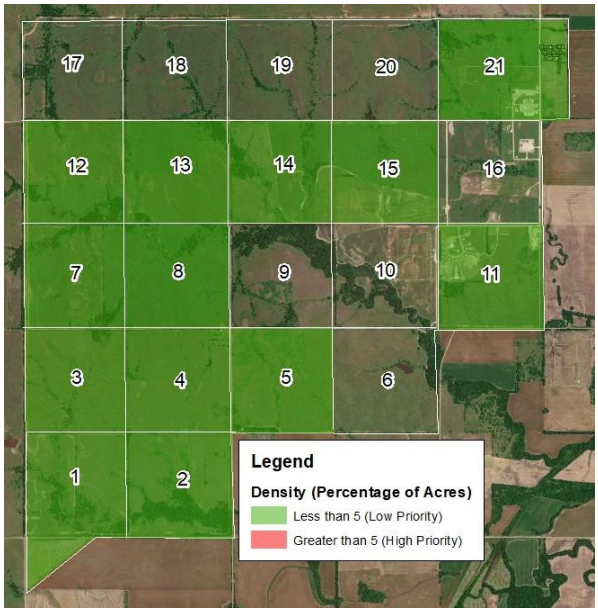
Table 3. Dominant Native Vegetation

Quarter Section	Dominant Grasses	Dominant Forb/Shrub
1	Big bluestem, Little bluestem, Sideoats grama	White sagebrush
2	Yellow bluestem, Little bluestem, Sideoats grama	Missouri goldenrod
3	Big bluestem, Little bluestem, June grass	White sagebrush
4	Big bluestem, Little bluestem, Sideoats grama	Leadplant
5	Big bluestem, Switchgrass, Kentucky bluegrass	Smooth sumac
7	Big bluestem, Little bluestem, Sideoats grama	Western ragweed
8	Big bluestem, Little bluestem, Switchgrass, Sideoats grama	White sagebrush
11	Big bluestem, Little bluestem, Indian grass	Western ragweed
12	Big bluestem, Little bluestem, Indian grass, Switchgrass, Tall dropseed	Illinois bundleflower
13	Big bluestem, Little bluestem, Sideoats grama	Purple prairie clover
14	Big bluestem, Little bluestem, June grass	Western ragweed
15	Big bluestem, Little bluestem, Sideoats grama	Western ragweed
21	Big bluestem, Little bluestem, Switchgrass	Smooth sumac

Canada Thistle (*Cirsium arvense*)

From Kansas Department of Agriculture (KDA) 2016.

Areas on the KSTC where species was identified



Description

Canada thistle is an aggressive, creeping perennial weed that infests crops, pastures, rangeland, roadsides and non-crop areas. Generally, infestations start on disturbed ground, including ditch banks, overgrazed pastures, tilled fields or abandoned sites. One plant can colonize an area 3 to 6 feet in diameter in one or two years. Canada thistle grows in a variety of soils and can tolerate up to 2 percent salt content. It is most competitive in deep, well-aerated, productive, cool soils. Canada thistle begins to flower in late spring to early summer in response to 14- to 16-hour days. Plants are male or female (dioecious) and grow in circular patches that often are one clone and sex. Canada thistle allocates most of its reproductive energy into vegetative propagation. New shoots and roots can form almost anywhere along the root system of established plants.

Spread Prevention

Canada thistle control shall mean preventing the production of viable seeds and destroying the plant's ability to reproduce by vegetative means.

General Control Practices

First plants to appear should be destroyed by pulling or hoeing before the plants become securely rooted. Canada thistles usually appear above ground in early spring. The decline in total food reserves in underground parts proceeds rapidly, then is slower until early summer when the plants bloom and are in their weakest stage. Cultivation during early summer is usually most effective. Persistent cultivation, which destroys roots and rootstocks and exhausts the food reserves, can be successful in eradication.

Chemical Control Practices

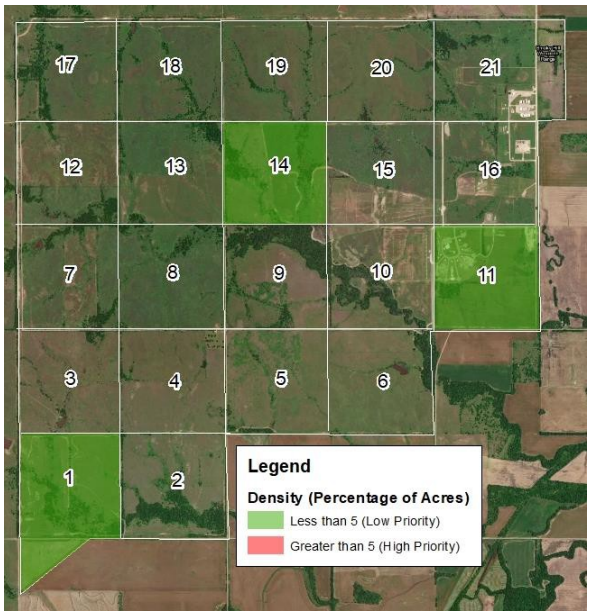
The following herbicides may be used for cost-share with landowners. Other products labeled and registered for use on this noxious weed in Kansas may be used in accordance with label directions but are not available for cost-share. Be sure to follow all label directions and precautions. For additional information consult the current K-State University publication of "Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland".

- 2,4-D (Low Volatile Ester or Amine). Apply in the spring at early bud stage and in the fall when plants are actively growing. Follow labels directions and precautions.
- Picloram (Tordon). Restricted use herbicide. Do not apply to croplands. Follow label directions and precautions.
- Dicamba (Banvel, Clarity, Vanquish). Apply at early bud stage in the spring and at the rosette stage in the fall. Follow label directions and precautions.
- Glyphosate (Roundup). Apply at the pre-bud stage in the spring and when the plants are actively growing in the fall. Follow label directions and precautions.
- Chlorsulfuron (Telar). Follow label directions and precautions.
- Clopyralid (Stinger). Apply from rosette to pre-bud. For most effective control of Canada thistle, apply as a broadcast treatment to the entire infested area. Follow label directions and precautions.
- Triclopyr + Clopyralid (Confront). For control of this thistle in turf. Follow label directions and precautions.
- Clopyralid + 2,4-D (Curtail). Follow label directions and precautions.
- Aminopyralid (Milestone). Apply in either spring to plants in pre-bud growth stage or in the fall to plant regrowth. Follow label directions and precautions.
- Glyphosate + Diquat (QuikPro). Apply in pre-bud growth stage. Follow label directions and precautions.
- Diflufenzopyr + Dicamba + Picloram (Overdrive + Tordon 22k). Restricted use herbicide. Do not apply to croplands. Follow label directions and precautions.

Field Bindweed (*Convolulus arvensis*)

From KDA 2016.

Areas on the KSTC where species was identified



Description

Field bindweed is a perennial broad-leaved plant that spreads over the soil and other structures, and often form mats. Leaves alternate along the stem. Leaf size and shape vary, but typically leaves are up to two inches long and egg-shaped. Flowers are typically white, but often they are light pink and have two leaf-like structures half-way between the main stem and the base of the flower. Seed pods are egg-shaped, 1/4" in diameter, and contain two to four seeds. Though small, these seeds can lay dormant for as long as 30 years. The root system of field bindweed is extensive and may extend as far as 30 feet deep.

Spread Prevention

Field bindweed is spread by both seed and roots. New field bindweed infestations result from planting crop seed that has been contaminated with field bindweed seed or from portions of field bindweed roots that have been transported by tillage machinery. Harvesting equipment, manure from livestock fed contaminated feed, and grazing animals moved from infested to clean areas can also cause new field bindweed infestations. Seeds can be carried by birds, on the feet of animals, or on wheels of machinery; and seeds or plants can be spread by road machinery.

General Control Practices

Control of field bindweed involves preventing the production of viable seed and destroying the plant's ability to reproduce by vegetative means.

Field bindweed seed is viable after remaining dormant in the soil for many years. Seeds brought near the soil surface by tillage, rodents, or other means will germinate under favorable conditions, resulting in new field bindweed infestations.

Effective field bindweed control can be achieved by applying appropriate control practices. In developing a field bindweed control program, one should consider the various alternative control practices and use one or more appropriate control practices for a particular cropland or non-cropland area.

For Cropland: Practices approved for controlling field bindweed on croplands are: 1) plant competitive crops, 2) appropriate and timely cultivation, and 3) application of herbicides registered for use in infested crops or on crop land with no growing crop. Often a combination of control practices results in more effective program than does a single practice.

Competitive cropping: close-drilled sorghum or sudan grass seeded about July 1, after a period of intensive cultivation, provides effective competition for field bindweed. Narrow row grain sorghum may also be used. The effectiveness of all competitive crops depends on intensive cultivation during the field bindweed growing season when land is not in crop.

Appropriate and timely cultivation: intensive cultivation, if properly used, is effective in killing established field bindweed. Intensive cultivation alone, however, is not usually practical because no crops can be grown during the cultivation period. Cultivation used with competitive crops can control field bindweed. With small grains, the most favorable times for beginning cultivation are in the spring after field bindweed growth has started, or in the fall after the grain has been harvested. The depth of cultivation in medium to heavy soil is 4 inches. Field bindweed cannot be controlled satisfactory if cultivation is delayed as long as 20 or 28 days after field bindweed emergence.

For Non-Cropland: Practices approved for controlling field bindweed on noncropland are: 1) hoeing and 2) application of appropriate herbicides. Hoeing in non-cropland areas thoroughly every 10 days to 2 weeks during the growing season can control field bindweed effectively. It is essential to cut off all plants at each hoeing. Field bindweed plants missed in hoeing can replenish their reserves, which delays killing time. Results will not be satisfactory inf field bindweed plants are left outside the hoed area because those plants will supply food to the roots for a distance of about 10 feet, preventing the killing of established field bindweed in the hoed area.

Chemical Control Practices

The following herbicides may be used for cost-share with landowners. Other products labeled and registered for use on this noxious weed in Kansas may be used in accordance with label directions but are not available for cost-share. Be sure to follow all label directions and precautions. For additional information consult the current K-State University publication of “Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland”.

- 2,4-D (Hi-Dep, Weedar 64, Weed RHAP, Amine 4, Aqua-Kleen). Apply during the active growth in spring when plant is in bud stage or in fall after 12 inches of new growth.

- Dicamba (Banvel, Clarity, Vanquish). After crop harvest, apply as spot treatment to stubble, fallow, or other cropland. Apply during field bindweed growth but before killing frost. Follow label directions and precautions.

- Dicamba + 2,4-D (Banvel + Roundup). Follow label directions and precautions.

- Glyphosate (Roundup). Follow label directions and precautions.

- Dicamba + Glyphosate (Roundup + 2,4-D). For suppression of field bindweed, apply when the weed is actively growing, and vines are 6 to 18 inches long. Allow at least 7 days after treatment before tillage. Addition of 0.5 – 1% ammonium sulfate by weight may increase performance. Follow label directions and precautions.

- Picloram (Tordon 22k) A restricted use herbicide. Follow label directions and precautions.

- Picloram + 2,4-D (Tordon 22k + 2,4-D). A restricted use herbicide. Follow label directions and precautions.

- Imazapyr (Arsenal, Chopper). Follow label directions and precautions.

- Imazapic (Plateau). Follow label directions and precautions.

- Quinclorac (Paramount, Drive). Follow label directions and precautions.

- Diflufenzopyr + Dicamba (Overdrive). Follow label directions and precautions.

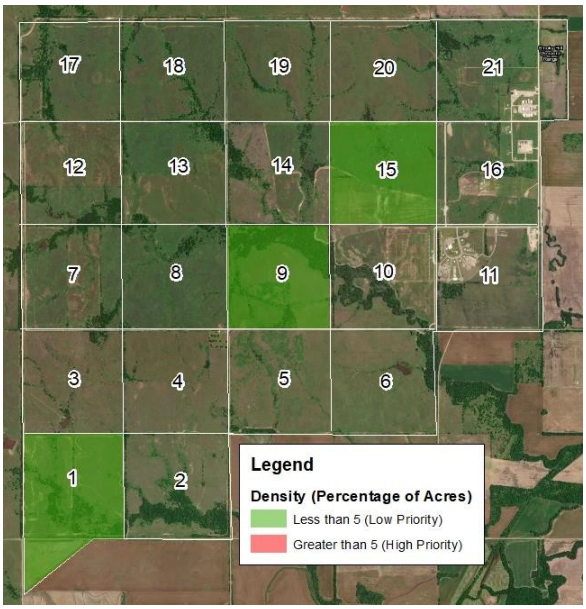
- Glyphosate + Diquat (QuikPro). Follow label directions and precautions.

- Imazapic + Glyphosate (Journey). Apply actively growing plants in non-cropland areas. Follow label directions and precautions.

Sericea Lespedeza (L*espedeza cuneata*)

From KDA 2016.

Areas on the KSTC where species was identified



Description

Sericea lespedeza is a warm-season, perennial legume with erect, herbaceous to somewhat woody stems, with many erect, leafy branches. Blooms July-October. Flowers are 1/4 to 3/8-inch-long and in clusters of mostly 2-3 in upper leaf axils. The petals are cream colored with purple or pink markings. The compound leaves (3 leaflets) are green to ashy green with densely flattened hairs. Its seeds are borne in small oval pods that are up to 1/8 inch wide. Sericea was planted in the past to control soil erosion, provide forage for livestock, and provide cover and food for wildlife. From these plantings, it has spread by animals and movement of hay contaminated with sericea seed to native prairies, shrublands, forests, and introduced pastures.

Spread Prevention

Sericea lespedeza spreads primarily by seeds. The method of seed dispersal is probably by animals. Persons planting mixtures of seeds for erosion control and for wildlife habitat should ensure sericea lespedeza is not included in the mix.

General Control Practices

Control of sericea lespedeza shall mean preventing production of viable seed.

Rangeland – prescribed burning at the proper time (late spring) followed by intensive-early stocking (double stock until July 15 and then remove cattle) may reduce the occurrence of sericea lespedeza. Mature cattle grazing early in the season are more apt to utilize sericea lespedeza.

Tame pastures – proper fertilization and grazing during April and May may reduce the occurrence. Late grazing or no grazing will increase sericea lespedeza.

Grazing infested areas with sheep and goats will provide effective control of sericea lespedeza.

Mowing in the late bud stage for 2 to 3 consecutive years from mid-July to late summer should reduce the vigor of the stand.

Chemical Control Practices

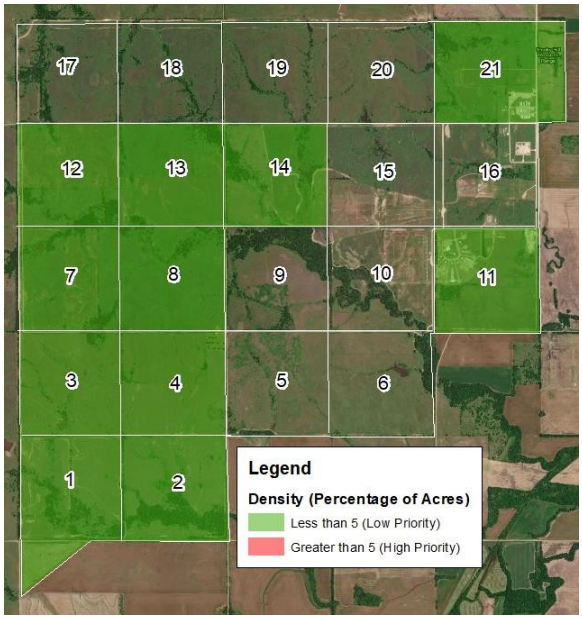
The following herbicides may be used for cost-share with landowners. Other products labeled and registered for use on this noxious weed in Kansas may be used in accordance with label directions but are not available for cost-share. Be sure to follow all label directions and precautions. For additional information consult the current K-State University publication of “Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland”.

- Metsulfuron methyl (Escort XP, Ally, Cimarron). Follow label directions and precautions.
- Triclopyr (Remedy, Garlon). Follow label directions and precautions.
- Triclopyr + Fluroxypyr (Pasturegard). Follow label directions and precautions.

Cheatgrass (B*romus tectorum*)

From Young et al. 1969.

Areas on the KSTC where species was identified



Description

Cheatgrass is an annual or winter annual grass that can range in height from 4 to 30 inches tall. Seedlings are bright green with conspicuously hairy leaves. Stems are erect, slender, and glabrous or slightly hairy. Foliage and seedheads of mature plants often change color from green to purple to brown or tans as the plant dries. A single cheatgrass plant can be comprised of 1 or 2 tillers or as many as 20 tillers. Inflorescence is dense, slender, usually drooping, 1-sided, and 2 to 6 inches in length. Spikelets are nodding, slender, and 3/8 to ¾ of an inch long. Inflorescence of the plant has 5 to 8 florets per spikelet. Long straight awns are attached to the florets that are 3/8 to 5/8-inch-long and are usually purple at maturity.

Spread Prevention

Sericea lespedeza spreads primarily by seeds. The method of seed dispersal is probably by animals. Persons planting mixtures of seeds for erosion control and for wildlife habitat should ensure sericea lespedeza is not included in the mix.

General Control Practices

Control of sericea lespedeza shall mean early detection and local eradication of new infestations. Management of cheatgrass is a difficult proposition because control practices that will damage the plant ay also be detrimental to native species that occupy the same area.

Mechanical – hand pulling small infestations before seeds are produced may eliminate current seed production. However, the infestation may not be eliminated and hand pulling would have to be repeated for several consecutive years to exhaust the seed bank reserves. Disking is often ineffective, unless tilled 4 to 6 inches deep in order to bury

seeds and prevent germination. Disking or tillage may not be appropriate on wildlands or rangelands and would have to be repeated because equipment does not consistently cut deep enough to bury the majority of the seeds. Mowing may reduce plant production, but seeds may already be viable, and plants may regenerate new culms if conducted during the early growth stage. Seeds of cheatgrass can be viable before any purple coloration appears, therefore only a short period time after inflorescences are produced is available when plants can be mowed without dispersing viable seeds. There is no single growth stage when cheatgrass can be mowed that will completely kill or prevent seed production. Mowing should be repeated for several consecutive years to be effective. Prescribed burns conducted in the late spring or early summer before seeds mature, may effectively control cheatgrass infestations.

Chemical Control Practices

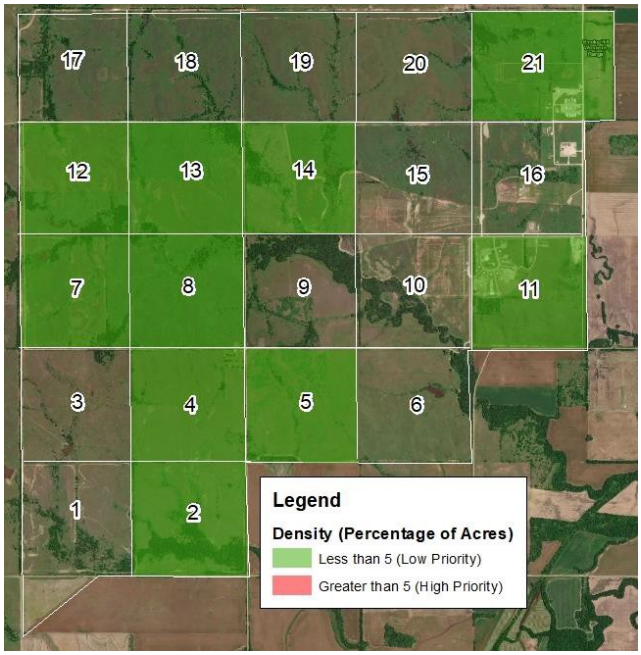
The following herbicides may be used for cost-share with landowners. Other products labeled and registered for use on this noxious weed in Kansas may be used in accordance with label directions but are not available for cost-share. Be sure to follow all label directions and precautions. For additional information consult the current K-State University publication of “Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland”.

- Quizalofop (Assure II). Spring application. Follow label directions and precautions.
- Fluazifop-p-butyl (Tornado, Fusilade 2000, Fusilade Five, Fusilade Super). Spring application. Follow label directions and precautions.
- Sethoxydim (Poast). Spring application. Follow label directions and precautions.
- Glyphosate (Roundup). Spring application. Follow label directions and precautions.

Kentucky Bluegrass (P*oa pratensis*)

From Butterfield et al. 1996.

Areas on the KSTC where species was identified



Description

Kentucky bluegrass is a cool season, mat-forming perennial grass that can reach heights of up to 4 feet. Culms of the plant are erect to decumbent at the base, slender and wiry, and nearly circular to slightly flattened. Leaf blades can be flat to folded, ½ to 6 inches long, 1/32 to 1/8 of an inch wide, glabrous with a double mid-riband curved or boat-shaped (keeled) leaf tip. Sheaths are rounded to slightly keeled, partially closed, and glabrous. Ligules are truncate. The inflorescence of the plant is an open to somewhat contracted panicle that is 1 to 5 inches long and 1/32 to 1/16 of an inch wide with a pyramidal shape when open. Panicle branches are flexuous and lower branches occur in a whorl. Spikelets have three to six flowers and are laterally compressed. Glumes are unequal, acute, with rough keels. Lemmas are sharply keeled and acute or obtuse. Lemmas have soft hairs that are found on the keel, marginal nerves, and are copiously webbed at the base. Anthers are 1/32 to 1/16 of an inch in length.

Spread Prevention

Reducing vigor and spread of the plant is how to control Kentucky bluegrass.

General Control Practices

Kentucky bluegrass seeds can remain viable in the soil for two years and the plant can continue to spread by tillers and rhizomes.

Mechanical- Mowing is not a recommended control method for Kentucky bluegrass and may actually stimulate tillering and rhizome elongation. Burning Kentucky bluegrass can have variable results. Plant response may be dependent on the timing of the prescribed

burn. One factor that needs to be considered when conducting a prescribed burn ofr Kentucky bluegrass control is the initial species composition in a particular area. The objective of the prescribe burn should be to replace Kentucky bluegrass dominance with native warm and cool season species.

Chemical Control Practices

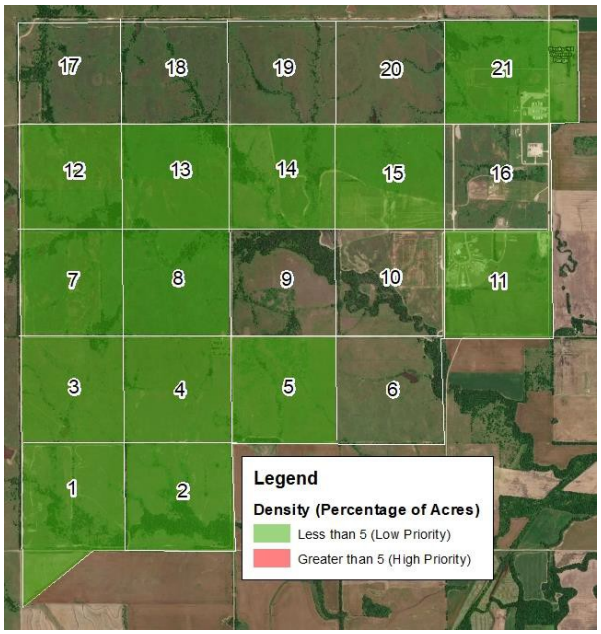
The following herbicides may be used for cost-share with landowners. Other products labeled and registered for use on this noxious weed in Kansas may be used in accordance with label directions but are not available for cost-share. Be sure to follow all label directions and precautions. For additional information consult the current K-State University publication of “Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland”.

- Glyphosate (Roundup). Follow label directions and precautions.
- Imazapyr (Arsenal). Follow label directions and precautions.
- Sulfometuron methyl (Oust). Follow label directions and precautions.

Smoot Brome (B*romus inermis*)

From Illinois Nature Preserves Commission 2017.

Areas on the KSTC where species was identified



Description

Smooth brome is a leafy, sod-forming, perennial, cool season grass that spreads by rhizomes. This species is both native and introduced. The stems vary in height from 2 to 4 feet. The plant produces numerous basal and stem leaves that vary in length from 4 to 10 inches. Frequently the leaves are marked by a transverse wrinkle resembling a “W” a short distance below the tip. The flower head develops a characteristic rich purplish-brown color when mature. The seed is produced in semi-compact 5-inch-long panicles with ascending branches. The flat compressed seed is usually awnless, about 1/3 inch long, and smooth. Smooth brome is the most widely used of the cultivated bromegrasses and has been cultivated in the U.S. since the early 1880s. This is a widely used hay species.

Spread Prevention

Control this grass to prevent sod-forming tendencies is best plan for management.

General Control Practices

Mechanical- Mowing is not a recommended control method for smooth brome and may actually stimulate tillering and rhizome elongation. Burning smooth brome can have variable results. Plant response may be dependent on the timing of the prescribed burn. One factor that needs to be considered when conducting a prescribed burn for smooth brome control is the initial species composition in a particular area. The objective of the prescribe burn should be to replace smooth brome dominance with native warm and cool season species.

Chemical Control Practices

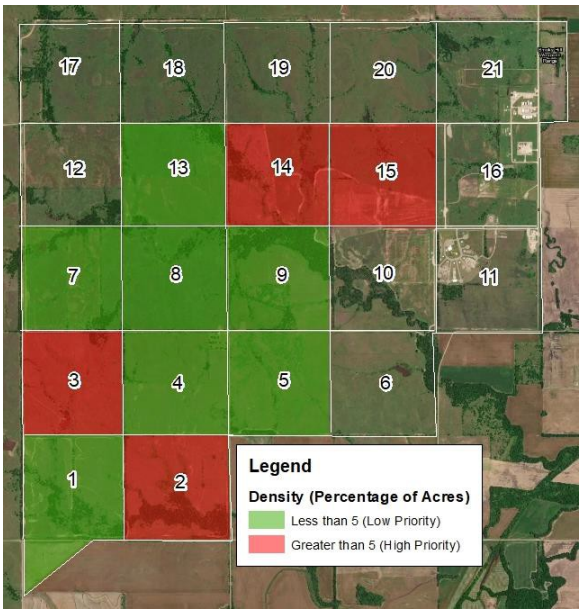
The following herbicides may be used for cost-share with landowners. Other products labeled and registered for use on this noxious weed in Kansas may be used in accordance with label directions but are not available for cost-share. Be sure to follow all label directions and precautions. For additional information consult the current K-State University publication of “Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland”.

- Glyphosate (Roundup). Spray in the fall after killing freeze to prevent detrimental effects on native warm season grasses. Follow label directions and precautions.

Yellow Bluestem (B*othriochloa ischaemum*)

From Illinois Wildflowers 2017.

Areas on the KSTC where species was identified



Description

Yellow bluestem is a perennial grass that consists of a tuft of leafy culms up to 3 feet tall. The culms are light green to pale yellow, terete, and glabrous; they are often decumbent at their bases and either unbranched or branched (especially below). The interior of each culm consists of a white pith. Alternate leaves occur along the entire length of each culm, although they are more abundant below. The leaf blades are ascending to widely spreading and rather floppy; they are up to 12 inches long and 1/32 inch across, becoming gradually smaller in size as they ascend the culm. The upper blade surface is dull medium green or grayish blue, while the lower surface is dull pale green. The leaf blades are mostly hairless, except toward their bases, where scattered white hairs may occur along their upper surfaces and margins. The ligules are short-membranous, although rings of white hair may be located nearby. The nodes of this grass are brownish purple and either across, forming a V-shape. The lateral racemes diverge from the central axis of the inflorescence along the lowest ½ inch of its length. Individual racemes are typically 1-3 inches long and spike-like; their rachises are straight and covered with ascending white hairs. Along each rachis, there are pairs of spikelets. The first spikelet of a pair is perfect and sessile, while the second spikelet of a pair is either sterile or staminate and it is on a short pedicel that is covered with ascending white hairs. Both spikelets are light green to purple while immature, becoming nearly white with age. The sessile spikelet is ½ inch or so long, ellipsoid in shape, and slightly flattened; there is a tuft of white hairs at its base. The lower glume of this spikelet is covered with appressed white hairs along the lower half of its length and margins, otherwise it is either glabrous or minutely pubescent. The lemma of this spikelet has an awn about 1/32 inch long that is straight or curved. The spikelet with a pedicel is similar to the sessile spikelet, except its lower glume is glabrous to minutely pubescent and its lemma is awnless. A perfect floret has a pair of feathery stigmata that are dark red or purple, and 3 anthers that are white to pale yellow, becoming brown

with age. When it is present, a staminate floret has 3 anthers that are similar to those of the perfect floret.

Spread Prevention

Early detection and eradication of yellow bluestem is important to prevent collateral damage to native vegetation.

General Control Practices

Mechanical- Mowing and burning alone tend to stimulate yellow bluestem and are not recommended control methods for this species. Mowing and burning combined with herbicide treatment will be necessary to control yellow bluestem.

Chemical Control Practices

The following herbicides may be used for cost-share with landowners. Other products labeled and registered for use on this noxious weed in Kansas may be used in accordance with label directions but are not available for cost-share. Be sure to follow all label directions and precautions. For additional information consult the current K-State University publication of “Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland”.

- Glyphosate (Roundup). Broadcast applications during the 4 – 5 leaf stage. Follow label directions and precautions.

- Imazapyr (Arsenal). Broadcast applications during the 4 – 5 leaf stage. Follow label directions and precautions.

6. Conclusions and Recommendations

Problem Areas

While seven noxious and invasive plant species were found within the Project area, only sericea lespedeza and yellow bluestem are of an immediate management concern due to the already high densities and potential to spread prolifically. The invasive and noxious species plant survey revealed five quarter sections in need of immediate management within the Project area (Figure 12). Areas in need of immediate management include quarter sections 1, 2, 3, 14, and 15. Sections 1 and 15 contain both sericea lespedeza and yellow bluestem. Sections 2, 3, and 14 do not contain sericea lespedeza, but contain high densities of yellow bluestem.

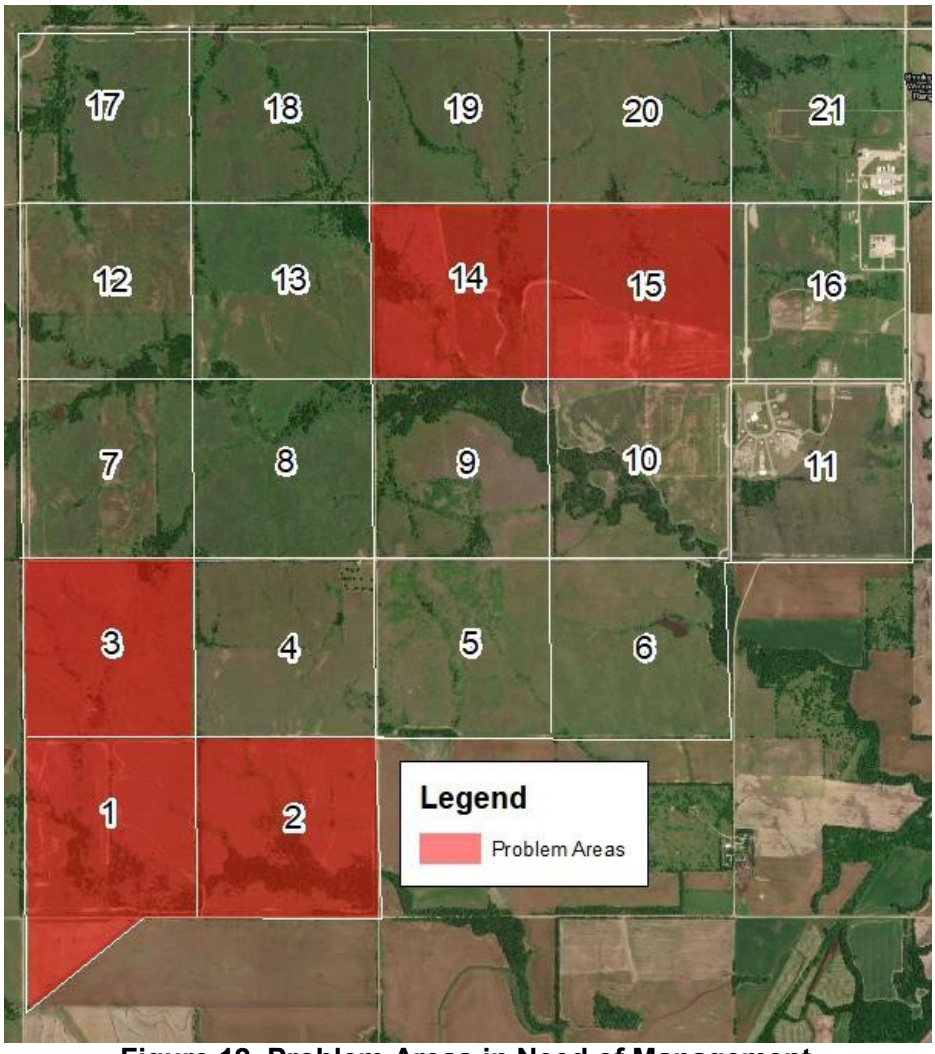


Figure 12. Problem Areas in Need of Management

Sericea lespedeza Management Recommendations

Three stands of sericea lespedeza were observed and mapped in the Project area (Figures 3 and 4 in Appendix A); two stands were identified in quarter section 1 and one stand was identified in quarter section 15. All stands of sericea lespedeza in the Project area occurred in low densities; however, these areas were characterized as a high priority for management because current patch sizes are small enough that effective management may reduce the spread of the species to unoccupied quarter sections. The management of sericea lespedeza will not be adequately controlled by a single management practice, thus a combination of prescribed burning and herbicide application will be necessary.

Sericea lespedeza may be partly controlled using prescribed burns that occur during the fall months, preferably September. While native prairies are traditionally burned at the start of the growing season, typically March – May, spring burns may stimulate seed germination in sericea lespedeza (Cummings et al. 2007). Alternately, fall burns may greatly reduce seed production in sericea lespedeza. The combination of fall burns and summer herbicide application is recommended. Because stands are small and low in density, spot treatment using PastureGard (1 ounce/gallon water) during the growing season, in June or July, is suggested (K-State Research and Extension 2018). Herbicide treatments will likely need to be repeated following initial application. If stands of sericea lespedeza continue to spread, a more aggressive herbicide approach will be needed.

Sericea lespedeza stands within the Project area may benefit from a mid-summer herbicide application spot-treatment followed by a fall burn. Caution is advised with high-frequency burns, as yellow bluestem (discussed below) responds positively to fire. Areas with documented sericea lespedeza occurrences should be monitored yearly to determine if additional management practices are needed.

Yellow bluestem Management Recommendations

Yellow bluestem was the most prevalent of all noxious and invasive species surveyed for within the Project area. Yellow bluestem was observed and mapped in 11 quarter sections in the Project area. A total of 23.73 acres of yellow bluestem were documented in 46 separate patches (Figures 3 through 11 in Appendix A). The highest densities of yellow bluestem were documented in quarter sections 2, 3, 14, and 15, where it represented greater than five percent of the total acreage of each respective quarter section. Quarter sections with high densities of yellow bluestem were characterized as a high priority for immediate management due to the prevalence and degree of difficulty associated with control.

Like sericea lespedeza, yellow bluestem is not effectively controlled using a single management practice; thus, yellow bluestem will be best managed by an integrative approach of herbicide spot-treatment, prescribed spring burns, and mowing. Prior to herbicide spot-treatment, yellow bluestem patches should be either burned or mowed at the beginning of the growing season to increase the efficacy of the herbicide; herbicide alone is not an effective management strategy. Spot treatment of yellow bluestem with glyphosate (Roundup) may occur once or twice per

growing season. If glyphosate is applied only once per season, application should occur four or five weeks after burning or mowing during the growing season (approximately mid-May) at the rate of 1.9 pounds (lbs)/acre (ac). Alternately, glyphosate may be applied twice during the growing season to treat different growth stages of yellow bluestem at a rate of 1.0 lb/ac per treatment. The first application should take place 4 – 5 weeks after patches are burned or mowed (approximately mid-May) and the second application should take place approximately eight weeks after the initial application of herbicide, in late August. Studies suggest that two applications of glyphosate combined with burning or mowing is more effective than a single application following burning or mowing, or herbicide treatment alone (Robertson et al. 2013). Herbicide treatments should take place once or twice per year (preceded by burning or mowing) for at least five years. During that time, known patches of yellow bluestem should be monitored to determine if additional management is necessary.

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Appendix A

Patch Maps

0 0.0375 0.075 0.15 Miles

Project Number: 017-3053

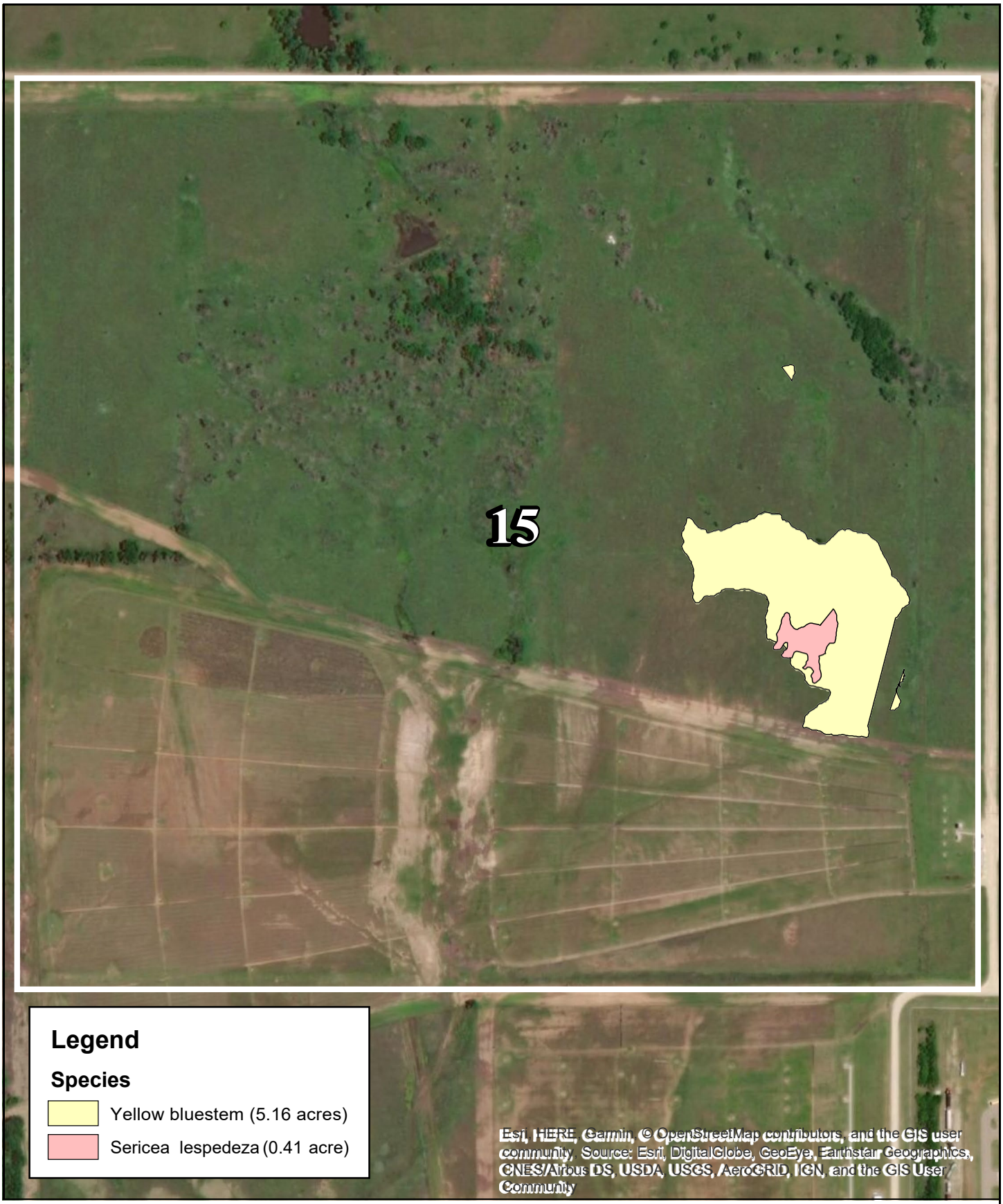
Drawn By: KK

Revision Date: 8/2/2018

Section 1 Map
KSARNG Invasive Species Survey

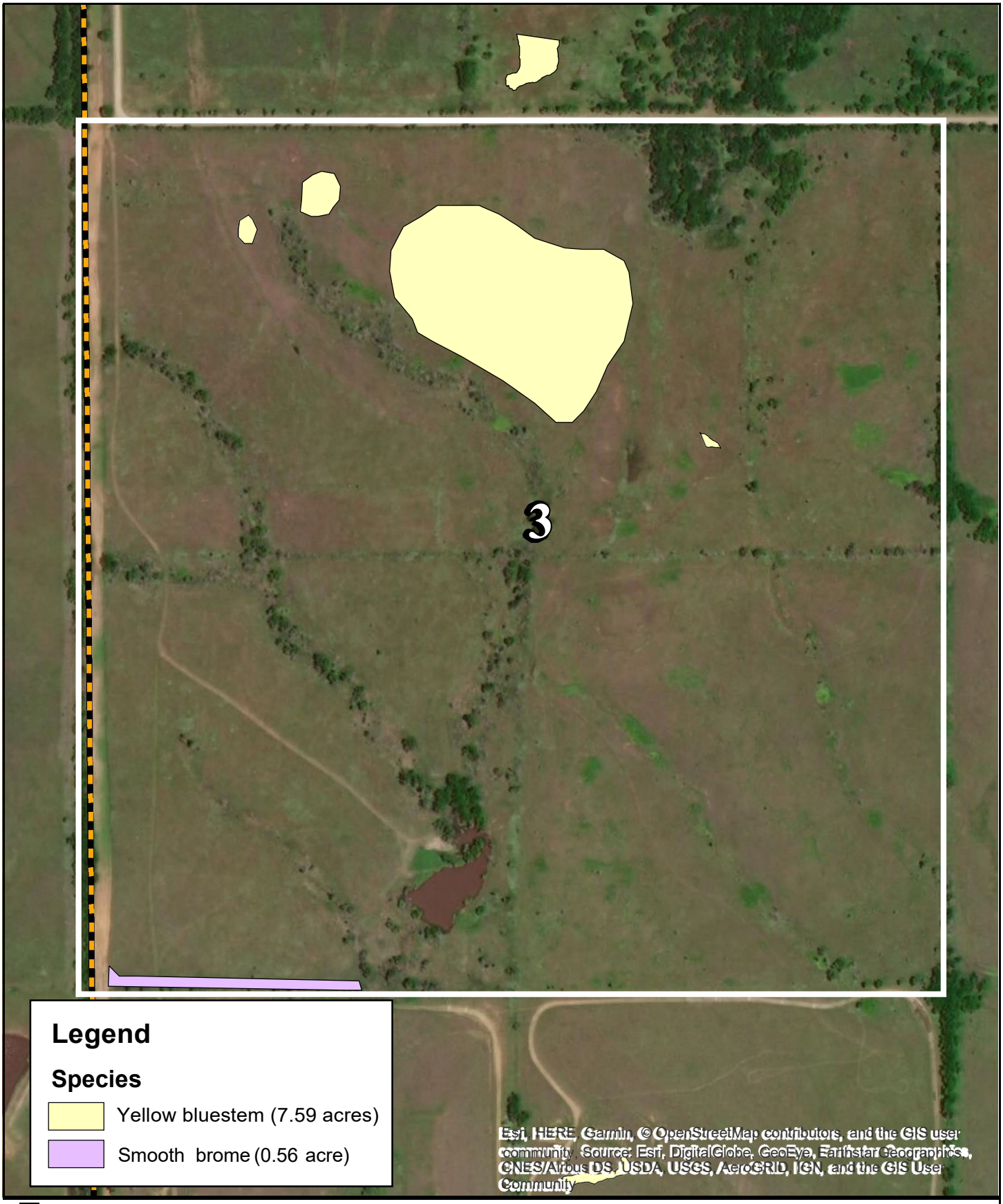
OLSSON ASSOCIATES
7301 West 133rd Street
Suite 200
Overland Park, Kansas 66213
P: 913.381.1170
F: 913.381.1174

Figure



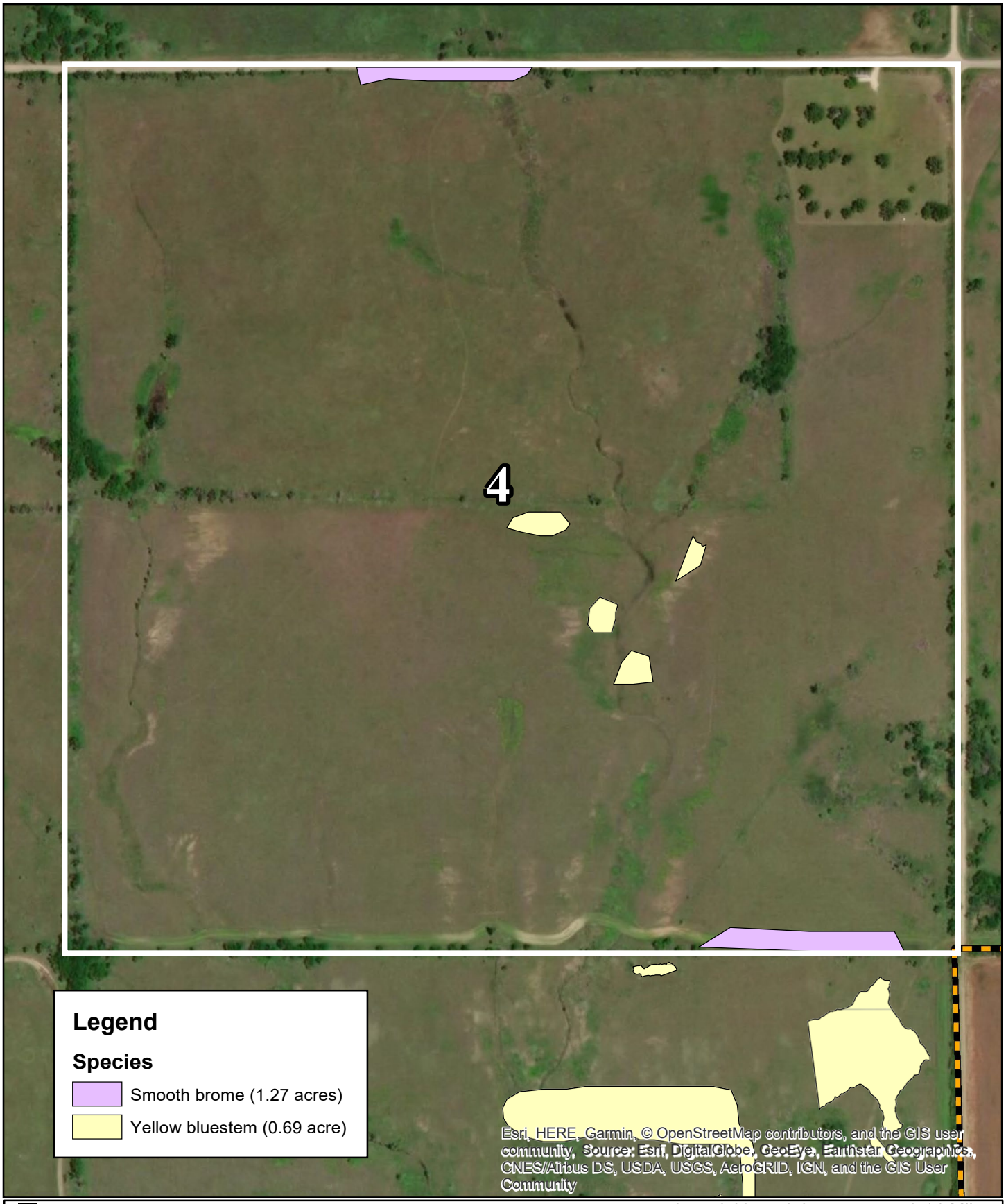
Project Number: 017-3053	**Section 15 Map** KSARNG Invasive Species Survey	DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.	OLSSON ASSOCIATES 7301 West 133rd Street Suite 200 Overland Park, Kansas 66213 P: 913.381.1170 F: 913.381.1174	Figure
Drawn By: KK				
Revision Date: 8/2/2018				**4**

Project Number: 017-3053 *Drawn By: KK* *Revision Date: 8/2/2018*	**Section 2 Map** KSARNG Invasive Species Survey	DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.	OLSSON ASSOCIATES 7301 West 133rd Street Suite 200 Overland Park, Kansas 66213 P: 913.381.1170 F: 913.381.1174	Figure **5**



0 0.0325 0.065 0.13 Miles

Project Number: 017-3053 *Drawn By: KK* *Revision Date: 8/2/2018*	**Section 3 Map** KSARNG Invasive Species Survey	DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.	OLSSON ASSOCIATES 7301 West 133rd Street Suite 200 Overland Park, Kansas 66213 P: 913.381.1170 F: 913.381.1174	Figure **6**



Project Number: 017-3053 *Drawn By: KK* *Revision Date: 8/2/2018*	**Section 4 Map** KSARNG Invasive Species Survey	DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.	OLSSON ASSOCIATES 7301 West 133rd Street Suite 200 Overland Park, Kansas 66213 P: 913.381.1170 F: 913.381.1174	Figure **7**

0 0.03 0.06 0.12 Miles

Project Number: 017-3053

Drawn By: KK

Revision Date: 8/2/2018

Section 7 Map
KSARNG Invasive Species Survey

DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.

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Suite 200
Overland Park, Kansas 66213
P: 913.381.1170
F: 913.381.1174

Figure

0 0.0325 0.065 0.13 Miles

Project Number: 017-3053

Revision Date: 8/2/2018

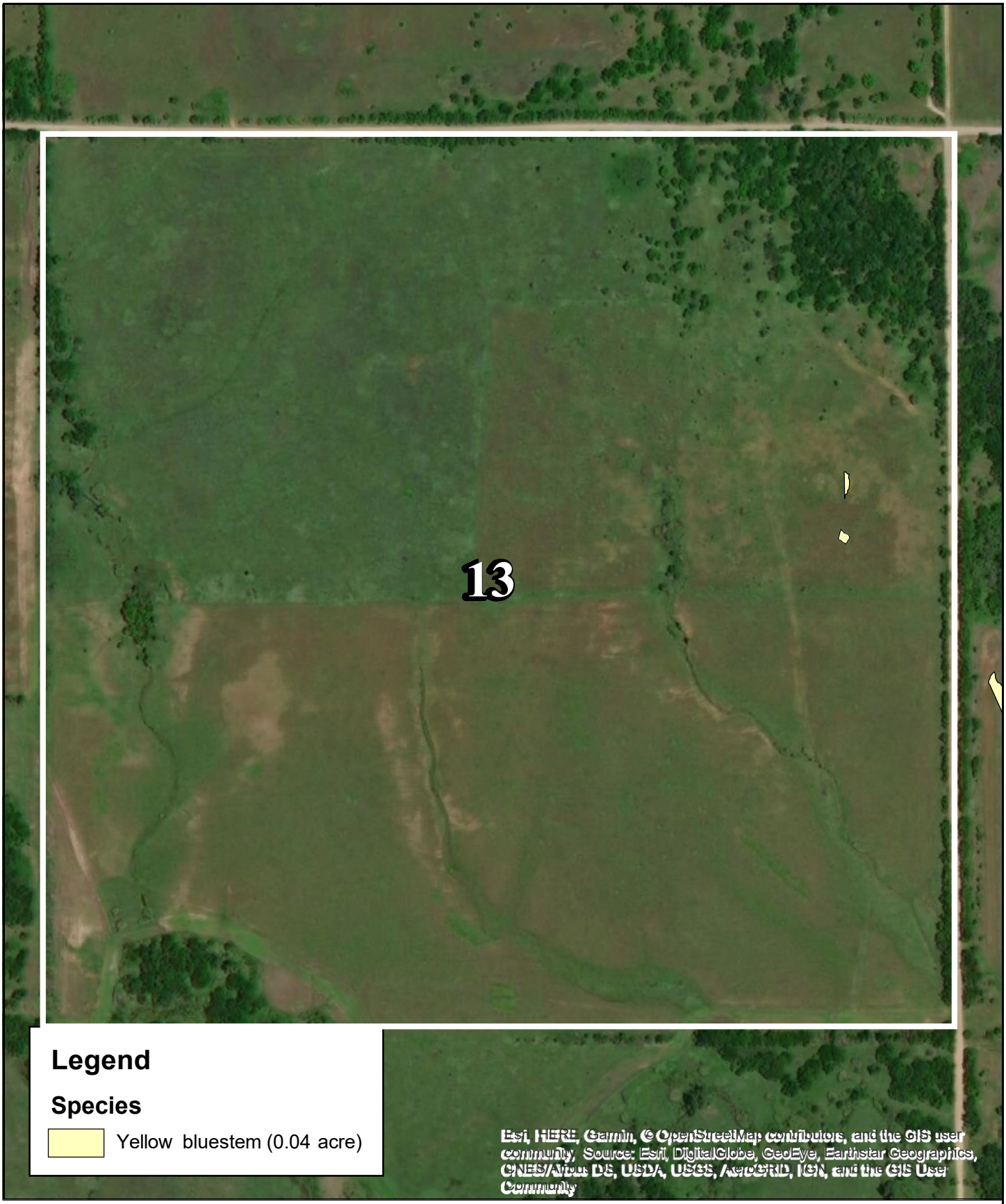
Section 8 Map
KSARNG Invasive Species Survey

DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.

OLSSON ASSOCIATES
7301 West 133rd Street
Suite 200
Overland Park, Kansas 66213
P: 913.381.1170
F: 913.381.1174

Figure

Drawn By: KK



Project Number: 017-3053	**Section 13 Map** KSARNG Invasive Species Survey	DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.	OLSSON ASSOCIATES 7301 West 133rd Street Suite 200 Overland Park, Kansas 66213 P: 913.381.1170 F: 913.381.1174	Figure
Drawn By: KK				
Revision Date: 8/2/2018				**10**

0 0.0325 0.065 0.13 Miles

Project Number: 017-3053 *Drawn By: KK* *Revision Date: 8/2/2018*	**Section 14 Map** KSARNG Invasive Species Survey	DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.	OLSSON ASSOCIATES 7301 West 133rd Street Suite 200 Overland Park, Kansas 66213 P: 913.381.1170 F: 913.381.1174	Figure **11**

Appendix B

Photolog

Photograph 1: Photo of yellow bluestem (*Bothriochloa ischaemum*) patch found in section 1.

Photograph 2: Yellow bluestem patch located in section xx.

Photograph 3: Kentucky bluegrass (*Poa pratensis*) patch, trying to indicate it is not sod-forming in this patch.

Photograph 4: Serciea lespedeza (*Lespedeza cuneata*) patch located in section 1.

Photograph 5: This photo shows one of the hay leases, mostly consisting of smooth brome (*Bromus inermis*).

Photograph 6: Another view of one of the hay leases.

Appendix G
Soil Management Plan

SOIL MANAGEMENT PLAN

For

KANSAS ARMY NATIONAL GUARD
KANSAS TRAINING CENTER

IN

SALINE COUNTY, KANSAS

PREPARED FOR:
KANSAS ARMY NATIONAL GUARD

BY:
OLSSON ASSOCIATES

OCTOBER 2014

Olsson Project No. 014-1181

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EXECUTIVE SUMMARY

The Kansas Army National Guard's (KSARNG) Kansas Training Center (KSTC) has abundant natural resources that are managed by the KSARNG Environmental Management Branch. The foundation of these natural resources is the rich prairie soil of the central Kansas plains that not only sustain vegetation and wildlife at the facility, but also provide a platform on which the primary mission of the KSTC is accomplished: training of military and civilian personnel for response to emergencies of many scales. The purpose of this Soil Management Plan is to provide guidance to KSARNG personnel in effective management of the facility's soil resources to accomplish natural resource management and training mission goals.

The soil resources at the KSARNG are rich, comprised primarily of silt loam that is well drained with very good water- and nutrient-holding capacity for vegetative growth. Primary management concerns for soil management at the KSTC are related to erosion control and potential compaction from heavy use of the soils. Management concerns include the following:

- Slowly permeable soils can result in increased runoff after burning or when tilled.
- Water may potentially pond in nearly level areas.
- Increased stormwater runoff on steeper slopes may create erosion problems.
- Erosion may be an issue on areas where vegetation has been mowed, burned, or otherwise removed.
- Shallow soils at the KSTC may be more fragile and prone to damage from equipment that crosses these areas.
- Compaction of soils may result from heavy land use by vehicles and personnel.
- Heavy metals from weapons training may contaminate soils, and storing and operating equipment may cause petroleum contamination of soils.
- Vegetation is more difficult to maintain on compacted or eroded soils.

With effective management of the KSTC soils, there is high potential for very good vegetative growth, ecological habitat maintenance, and support of training operations.

This Soil Management Plan is presented in the following four sections:

1. Soils at the Kansas Training Center describes the environment in which KSTC soils formed and exist.
2. Soil Suitabilities and Limitations, describing potential issues as well opportunities in regard to soils and site management of the KSTC.
3. Management of Soils at the KSTC provides information for mitigation of soil damage and potential issues, and strategies for optimizing soil conditions.
4. Soil Descriptions describes the various soil types found at the KSTC.

1.0 SOILS AT THE KANSAS TRAINING CENTER

The Kansas Army National Guard (KSARNG) Kansas Training Center (KSTC) consists of approximately 3,360 acres in the southwest corner of Saline County, approximately five miles southwest of Salina, Kansas. Part of the Smoky Hill Air National Guard Range, the landscape of the KSTC is managed for its primary mission, the training of National Guard troops, as well as regional law enforcement and public service personnel. Within this context, land management focuses on maximizing natural resources and native vegetation, as well as agricultural hay production through seeding, weed control, and brush management. In addition to grasslands (prairie and pastures), KSTC land features include woodlands, wetlands, and riparian areas, and improved areas that include office, maintenance, and training buildings; roads; weapons firing ranges; and Crisis City, a training facility for emergency response personnel (KSTC Integrated Natural Resources Management Plan, 2011).

The natural environment of the KSTC supports military training missions that involve weapons qualifications, land navigation, and off-road driving. Management of the soils and natural resources are critical to ensuring long-term continuous training capabilities. Natural resources required for training operations include a mixture of open and forested land areas that are maintained to support their natural, long-term, ecological function. Training activities that include non-mechanized units, wheeled vehicles, and foot soldiers occur year-round at the KSTC and provide year-round disturbances to the natural resources. Disturbances also include off-road drivers training four to five times per year. Maintaining stable vegetation communities requires understanding of the soils' physical, chemical, and biological processes that support a stable plant community (KSTC Integrated Natural Resources Plan, 2011).

1.1 PLAN CONTENT

The focus of this Soil Management Plan is to provide information and guidance essential for soil management in support of the KSARNG's environmental program. The KSARNG recognizes that soil resources are integral for successful natural resources management and long-term sustainability. The Plan is comprised of the following sections:

- Section 1: Background information about the KSTC, including the environment that contributes to the management of soils at the facility, and fundamental soil science information.
- Section 2: Soil capabilities and limitations in regard to the mission of the KSARNG at the KSTC.
- Section 3: Management and mitigation approaches for optimizing soil conditions and achieving KSARNG natural resource management and training mission goals.
- Section 4: Identification of soil series and complexes at the KSTC, providing details of soils at the facility that support understanding of natural resource management.

1.2 KSTC LOCATION

The KSTC is situated in the transition between the Smoky Hills and the Arkansas River Lowlands physiographic regions of Kansas. The project area is located in Sections 14, 15, 22, 23, and 27 of Township 15 South, and Range 4 West, southwest of the city of Salina in Saline County, Kansas (Figure 1-1). The site is located between the north/south Englund and Hedville roads at the intersection of the east/west Smolan Road.

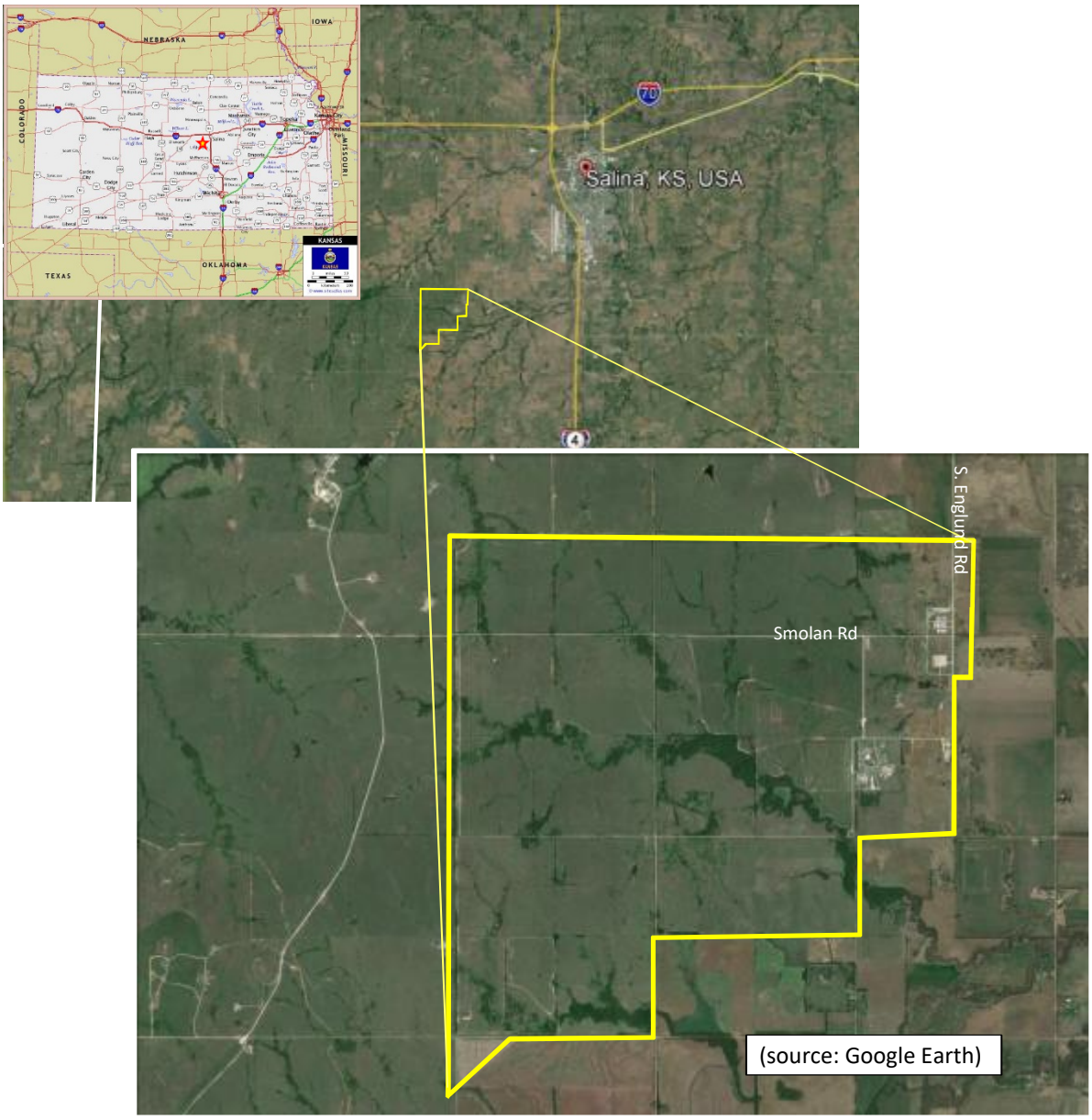

Figure 1-1: Location of the KSTC

1.3 CONSISTENCY WITH MILITARY MISSION

The contents of this document are consistent with the Army National Guard's commitment to environmental excellence as monitored through the Environmental Performance Assessment System (EPAS). The EPAS was developed for the U.S. military for continual environmental improvement by minimizing impacts while allowing soldiers to focus on their mission.

1.4 SITE SETTING

The KSTC is located in the north-central portion of Kansas. Historically, this area was in the transition zone of tallgrass and mixed-grass prairie. The region is described as nearly level to strongly sloping with a majority of the county drained by the Smoky Hill River and its tributaries. The soils are deep or moderately deep and have a silty, clayey, or loamy subsoil (USDA NRCS, 1992).

Those features that are described in site settings—such as topography, soil, vegetation, hydrology, and climate—are all features that contribute to how soils can be used for specific outcomes. At the KSTC, this is the training and preparation of troops for the mission of the Army National Guard. Understanding the interactions of these features provides the basis for managing soils and associated natural resources at this facility.

1.4.1 PHYSIOGRAPHIC SETTING

On a very broad scale, the KSTC is within a physiographic region described by the Natural Resources Conservation Service (NRCS) as a Major Land Resource Association (MRLA). The MLRA program uses soil, climate, vegetation, and farming to group areas of land that share similar properties and function. KSTC is located within MLRA 74 – Central Kansas Sandstone Hills, as described below:

Figure 1-2: The topography at the KSTC is gently rolling.

MLRA 74 – Central Kansas Sandstone Hills: This MLRA is described as undulating to hilly, dissected plain. Wide floodplains and terraces are along the larger rivers, and narrow bottom land is along the small streams. Elevation is generally 1,310 to 1,640 feet (400 to 500 meters), increasing from east to west. Local relief is typically 65 to 130 feet (20 to 40 meters). The area is underlain by Cretaceous sandstone with bedrock exposed in areas. Loess deposits mantle the uplands, and deposits of unconsolidated sand and some gravel occur in the major stream and river valleys (USDA Agriculture Handbook 296, 2006).

The major soil resource concerns are water erosion, maintenance of the content of organic matter and tilth of the soils, surface compaction, and soil moisture management. The resource concerns on pasture and rangeland are the productivity, health, and vigor of plants and the spread of noxious and invasive species. Conservation practices on rangeland generally include prescribed grazing, brush management, management of upland wildlife habitat, proper distribution of watering facilities, and control of noxious and invasive plant species.

1.4.2 CLIMATE

Climate is one of the major soil-forming (and thus soil management) factors to consider in natural resource planning. Climate affects wetting and drying in the soil, how and where plants will grow, soil erosion, surface and subsurface hydrology, and operations for military training on those soils. Central Kansas is categorized as a continental climate, typified by cold winters and hot summers. The average annual precipitation in most of this area is approximately 29 inches, of which about 72 percent falls between April and September, often as high-intensity, convective thunderstorms. The precipitation in winter occurs mainly as snow, with snow falling on a regular basis but not remaining on the ground continually through the winter. The average annual temperature is 56 degrees F, with typical daily low temperatures near 20 degrees in the winter, and daily high temperatures of 90 degrees in the summer. The average freeze-free period is 215 days from the average last spring freeze on March 31 to the average first freeze on November 2.

Recognizing the impact climate has on soil conditions is important in troop training, determining what types of field training can occur, and where. For example, during the spring, high-intensity rain may cause flooding. It will also create potentially unsuitable conditions for cross-country use of vehicles or even foot traffic. The spring and fall moisture also affect groundwater tables and the ability to excavate for new structures, as well as potential training operations.

1.4.3 VEGETATION

Vegetation is important in understanding and managing soil conditions. North-central Kansas is typified by tallgrass and mixed-grass prairie with wooded bottomlands along streams and rivers. The deep-rooted prairie vegetation helps to stabilize soils and moderates the movement or erosion of soils at a natural pace, slowly forming the hills and valleys common in the central Kansas landscape. Trees along the streams and rivers trap sediments, which migrate with the rivers and create new landforms or shift existing landforms along the river. The prairie vegetation also is a primary contributor to the formation of soils, extending roots deep into the ground, opening pores, and allowing water to percolate deep. Prairie vegetation forms the rich organic complex of prairie soils that contribute to their inherent fertility and friable soil structure.

The KSTC is primarily comprised of upland plant community. The vegetation in most areas consists of native and non-native herbaceous plants and grasses with woody tree and shrub species common along creeks and drainages. Grasses and open fields dominate the upland

areas across nearly all of the KSTC, with the most common species being smooth brome (*Bromus inermis*), little bluestem (*Schizachyrium scoparium*), composite dropseed (*Sporobolus compositus*), and Indian grass (*Sorghastrum nutans*). Smooth brome is a strongly rhizomatous perennial species that is native to Eurasia that was introduced for cover in pastures and for hay production. Its rhizomatous root structure is adequate at stabilizing soils. Little bluestem, composite dropseed, and big bluestem are native warm-season grass species that provide good soil stability. Other grass species observed at the KSTC were big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), and side oats grama (*Bouteloua curtipendula*). These species are native to Kansas and have dense, deep root structures and are very adequate at soil stabilization.

Figure 1-3: Representative vegetation at the KSTC.

Woody species at the KSTC include trees and shrubs that are generally along fencelines and in the lower drainage areas. Tree species include hackberry (*Celtis occidentalis*), Osage orange (*Maclura pomifera),* and honey locust (*Gleditsia triacanthos).* Woody shrub species occur in low-lying or drainage areas and in transitional areas between woodlands and upland grasslands. Shrub species include roughleaf dogwood (*Cornus drummondii*), smooth sumac (*Rhus glabra*), and American plum (*Prunus americana*).

1.4.4 GROUNDWATER AND SURFACE WATER

The groundwater in Saline County is hard and in some places contains high concentrations of iron and chloride. Saline County is within the Smoky Hill – Saline water basin and is outside of the High Plains Aquifer that supplies water to much of western and south-central Kansas. The western portion of the KSTC is within the Kiowa geologic unit, which has limited, but high-quality water supplies within the sandstones that have been shown to be adequate for limited public

water supplies (James McCauley KSGS). Groundwater contamination has not been documented at the KSTC.

A pond in the southeast portion of the property near Hohneck Road is the only surface water feature that holds water year-round. Generally, all surface flow of water at the KSTC drains to the southeast through Dry Creek, the major drainage feature at the facility, with intermittent streams coursing across the site from northwest to the southeast. Smaller sub-tributary drainages feed this mainstem tributary from both the northern and southern halves of the facility, and smaller tributaries also channel water mostly to the east. Intermittent drainage features, including streams and small channels, are expected to have continual flow during wet seasons, which may result in temporary ponding of water as well as refreshing of wetlands at the site. All of the tributary drainages discharge to West Dry Creek near the community of Smolan, east of the KSTC.

1.5 SOILS

The soils at the KSTC formed on uplands with deep to moderately deep, well-drained to moderately well-drained soils, with clayey or loamy subsoils. The upland soil is drained by intermittent streams and is gently sloping with slopes ranging from 0 to 12 percent. The soils formed from weathered sandstone, weathered sandy shale, or in loess on ridge tops and side slopes. Figure 1-4, below, illustrates the formation of the parent materials for soils at the KSTC.

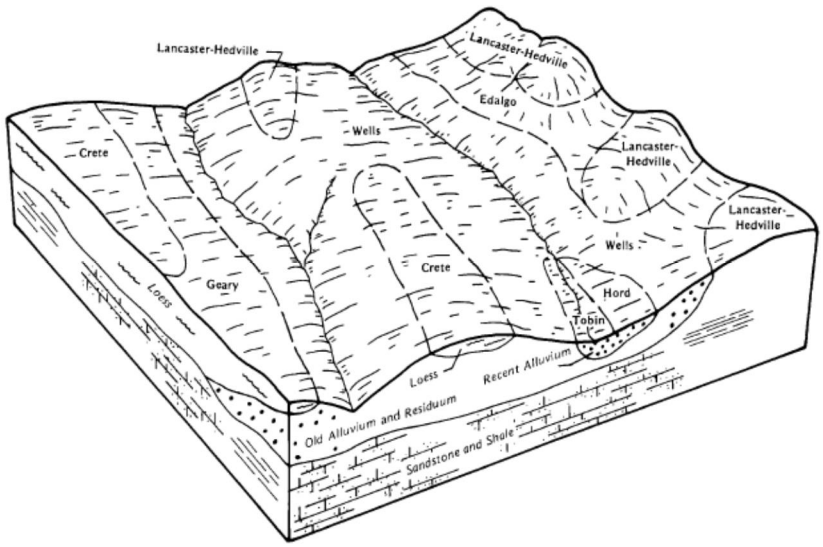

Figure 1-4: Representation of soil parent material at the KSTC.
(source: NRCS Saline County Soil Survey)

According to the U.S. Department of Agriculture (USDA) Soil Survey for Saline County, seven primary soil series or types describe the soils at the KSTC. The seven soil series are Tobin silt loam, Edalgo clay loam, Lancaster-Hedville complex, Longford silt loam, Wells loam, Crete silt loam, and Crete-Wells complex. The Crete-Wells complex is most common, covering

approximately 32 percent of the KSTC area. Figure 1-5 illustrates the locations of these soil series at the KSTC, and they are described in Section 4.

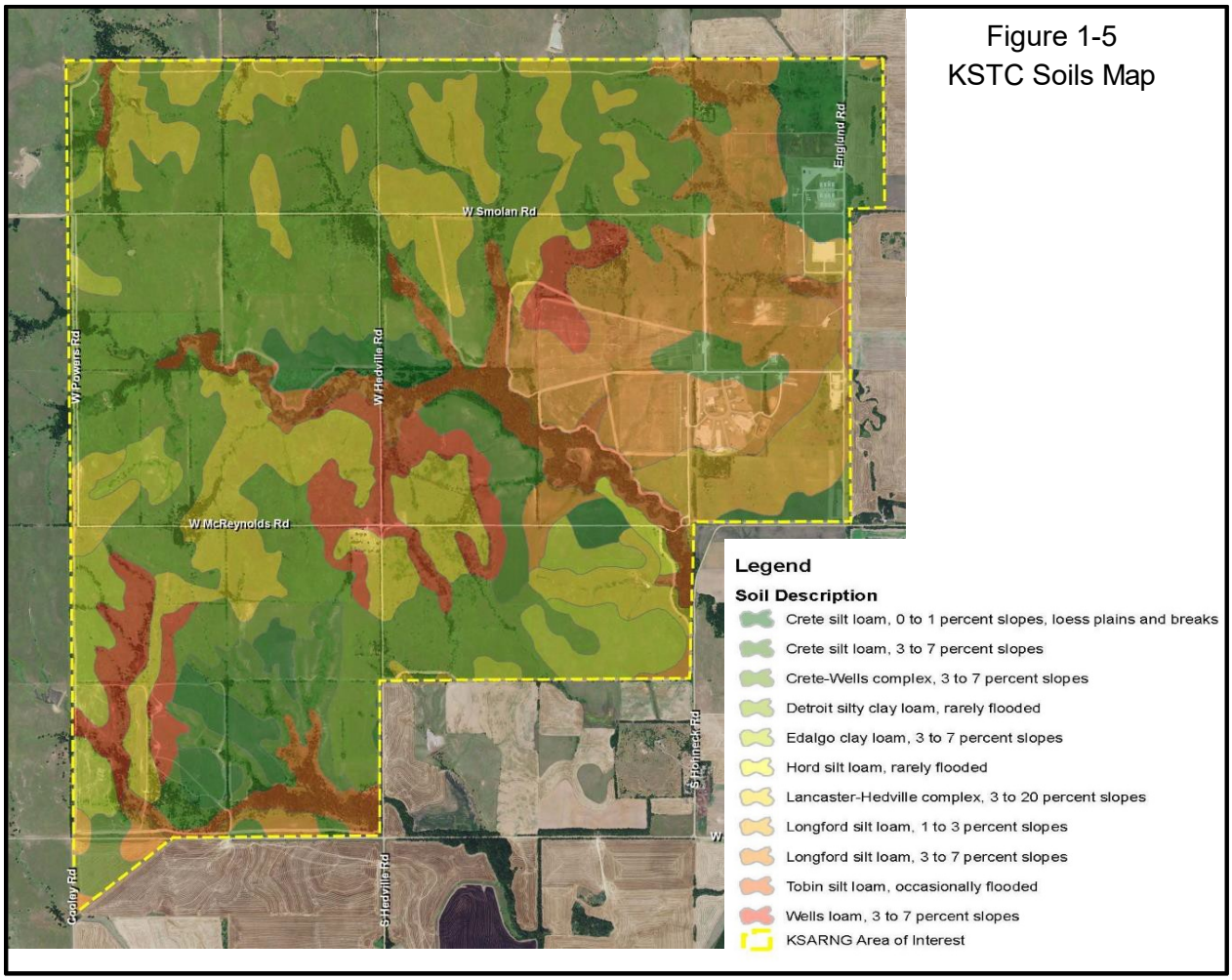

Figure 1-5
KSTC Soils Map

The soils of the west and central portions of the KSTC, having formed in more rolling topography, are similar in nature, typically consisting of silt loam surface soil underlain by clay loam. These soils are often deep in the valley areas between ridges, and shallow to moderate in depth along the sideslopes and ridge tops. They are typically well drained, although infiltration is relatively slow. Soils in the east portion of the facility have formed on more gently rolling to nearly flat topography. These are silt loam soils with clayey subsoil that are typically deep and well drained, and having good infiltration but slow percolation.

Because the soils at the KSTC are relatively similar, their management to meet the needs of the KSARNG for training of troops, optimizing vegetative production and habitat value, and reducing the potential for environmental damage largely depends on their place in the KSTC topography and the land use associated with those locations. While the soils are similar in many ways, there are characteristics that are sufficiently different – such features as depth of soil, slope, vegetative cover, and more – that attention to their nature is required to sustain soils for healthy and successful site management. The following sections present basic concepts of the nature

of soils, and identify suitability of soils for KSTC uses (Section 2) and mitigation and management for maintaining optimal soil condition and environmental health (Section 3).

1.6 SOIL CHARACTERISTICS

Knowledge of soil characteristics provides a resource manager an understanding of how soil supports other natural resources and how soils are an important component of natural resources management and site use. Many characteristics make up the body of the soil, and the following information is provided to understand primary characteristics of soils that contribute to their management.

1.6.1 SOIL SERIES

Soils are mapped into groupings of soils based on their location, parent material, and distinct differences in texture, structure, and layers. The seven soil series identified at the KSTC provide natural resource managers with information that describes differences between soils at the facility and how those different characteristics will affect water and watershed management, vegetation, and land use.

1.6.2 SOIL HORIZONS

Nearly all soil is divided into naturally occurring layers or horizons that form as a soil matures. The horizons have different characteristics—sometimes subtle and sometimes very distinct—that affect soil function such as drainage, fertility, root growth, etc. Typically, the soil horizons are classified as A, B, and C, with several subhorizon groupings to describe characteristics of each layer of the soil. The ‘A’ horizon is the uppermost horizon, usually exhibiting the characteristics of topsoil, or that which best supports plant growth. The ‘B’ horizon is logically below the A horizon and will often have higher clay content, less organic matter, and is often less supportive of optimal plant growth. The ‘C’ horizon is the lower (and often the lowest) distinct soil horizon, reflecting the parent material, or geologic material from which the soil evolved.

1.6.3 SOIL TEXTURE

Texture is the most basic defining characteristic of soil. All soils are comprised of sand, silt, and/or clay in varying amounts. The amount of each in a soil determines the base structure and many of the other characteristics of the soil. Sand particles are the largest soil material, and when dominant, create a loose, porous soil. Silt particles are very small and provide more surface area and cohesiveness to the soil. Clay has extremely small particles that are the most reactive and give the soil much of its source for vegetation-supporting nutrients. Twelve different textural classes are recognized, and the soil textural class can be determined when the percentage of these three soil constituents are plotted on the USDA soil textural triangle (Figure 1-6).

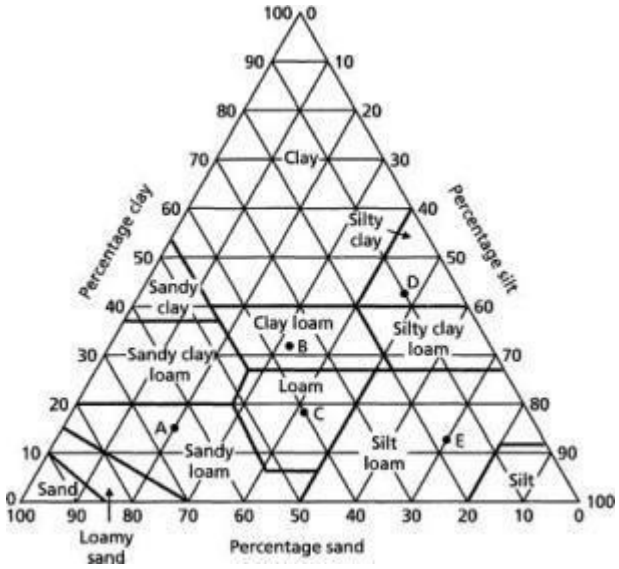

Figure 1-6: USDA Soil Textural Triangle

1.6.4 SOIL STRUCTURE

Soil structure is often confused for soil texture, but soil structure describes the aggregation of soil particles, whereas soil texture describes the particle size content and distribution. How soil particles are aggregated regulates much of how a soil functions—permitting water infiltration and percolation, root growth, and aeration within the soil—all of which are critical factors for water and vegetation management. Soil structure is often described by the following terms.

Granular: Granular structure has small "peds," which are aggregated soil particles that resemble cookie crumbs. These are usually bound together by organic compounds, and reflect excellent soil quality, including pore spaces that allow water infiltration and holding capacity. Figure 1-7 illustrates good granular structure.

Figure 1-7: Typical soil at the KSTC has strong granular structure, with approximately 2 to 5 percent organic matter.

Angular and Subangular: Angular structure usually occurs with clays and silts in small clumps that are held together by the cohesiveness of the clay and silt particles themselves. The edges of the clumps are often sharp, distinct angles. Subangular clumps are more rounded on the edges, but the soil clumps still resemble angular, often box-like structures of varying sizes. The terms angular and subangular are often used with the term “blocky” to reflect medium- to larger-sized clumps.

Platy: Platy structure reflects flat, plate-like soil aggregates that settle on top of each other to form a layered structure. Platy structure is often common near or on the banks of rivers and streams, as well in fields that are subjected to compaction. Platy structure restricts water infiltration and root growth and is difficult to manage.

Single-Grained: Single-grained structure describes soil structure that is made up of individual soil particles. Such structure is often best used to describe sandy soils.

Massive: Massive structure describes seemingly structureless soil that often binds together in large to very large blocks. When wet, it has no recognizable aggregation of soil particles other than a single, often large, block. Massive soils are typically bound together by the cohesiveness of clays and silts. They are very hard when dry, and very sticky when wet.

Prismatic and Columnar: Prismatic structure describes aggregation of soil particles into long, angular blocks that are usually found in a vertical position. Columnar structure is similar, but less angular than prismatic. This type of structure is normally related to soils high in clay content, and usually below the surface horizons of the soil.

1.6.5 SOIL ORGANIC MATTER

Soil organic matter is an essential component of soils, often the “glue” that holds soil particles together as aggregates, improving soil structure and increasing porosity. Soil organic matter provides food for soil microbes, which are essential for successful plant growth, and also increases water-holding capacity and nutrient-supplying capacity. Soil organic matter gives the soil its rich color in the Midwestern U.S., from medium to dark browns and black soils. At the KSTC, soil organic matter in most of the soils ranges from approximately 2 percent to 5 percent.

1.6.6 HYDRIC SOIL

Hydric soils form when the soil at or near the surface is saturated with water for an extended period of time, at times creating conditions of mottling where the iron in soil reflects changing soil conditions between adequate aeration (forming reddish oxidated hues) and anaerobic conditions due to saturation (forming gray or greenish reduced hues). Hydric soils give an indication of the hydrology of a site, and if a soil is suitable for training or other activities. Hydric soils are one of the indicators of wetlands, and impacts to wetlands are regulated by the U.S. Army Corps of Engineers.

2.0 SOIL SUITABILITIES AND LIMITATIONS

The soils at the KSTC are broadly similar in nature: typically loam or silt loam overlying clay loam subsoils. Despite their similarities, soils at the KSTC have varying suitabilities for the many land uses at the facility, from environmental management to the military mission for training. This section presents the suitability of soils at the facility for common land uses of the KSARNG, and limitations that need to be considered during KSTC operations.

2.1 TRAINING SUITABILITIES AND LIMITATIONS

The training mission at the KSTC includes off-road navigation for vehicles as well as troop training, weapons training on firing ranges, bivouacs, and drills. Training exercises at the KSTC can have significantly adverse effects on soil quality. The soils at the KSTC have a silt content that can result in some limitations related to the training mission, as well as other factors such as building construction, waste management, and internal drainage. For purposes of training, the high silt and clay content of the soil can present challenges related to maneuvering equipment or personnel, but can also present potential training opportunities for adverse conditions. In either event, management and restoration of the soil following training events is very important for maintaining site vegetation and condition suitable for future training events.

The following information presents limitations of soils for various training exercises.

2.1.1 VEHICLE TRAINING

Currently, the KSARNG maintains an off-road driving course in the southwestern portion of the KSTC. Both off-road and on-road vehicle use is common in most other locations of the facility. The soils at the KSTC are rated fair to good for vehicle use and training in most locations, including light vehicles such as all-terrain vehicles (ATVs), heavy tracked equipment, large trucks, and passenger vehicles. Limitations of soils for vehicle training include slippery soils, stickiness of the soils, low strength for supporting vehicles, and slopes near drainages. The erosion potential for soils both on-road and off-road at the KSTC is considered to be light (USDA NRCS, 2014); however, erosion has been observed in bare areas, particularly on the off-road navigation course. These characteristics primarily reflect suitability of the soils for allowing traffic, however, and do not include potential soil damage that would include erosion, rutting, and compaction, as well as potential damage to vegetation. Figure 2-1 shows areas at the site that are suitable for vehicle training and use.

Soil management in preparation of training as well as after training must include measures to minimize rutting, compaction, and erosion, and repairs to damages that may occur after training has been completed. In addition, during training, the water table could be high in some locations, causing unstable soil conditions and limiting excavation of soils as they may either fill

with water or have unstable sides unless properly supported. Driving on wet soil will likely cause soil rutting and the high potential for some vehicles to sink into mud.

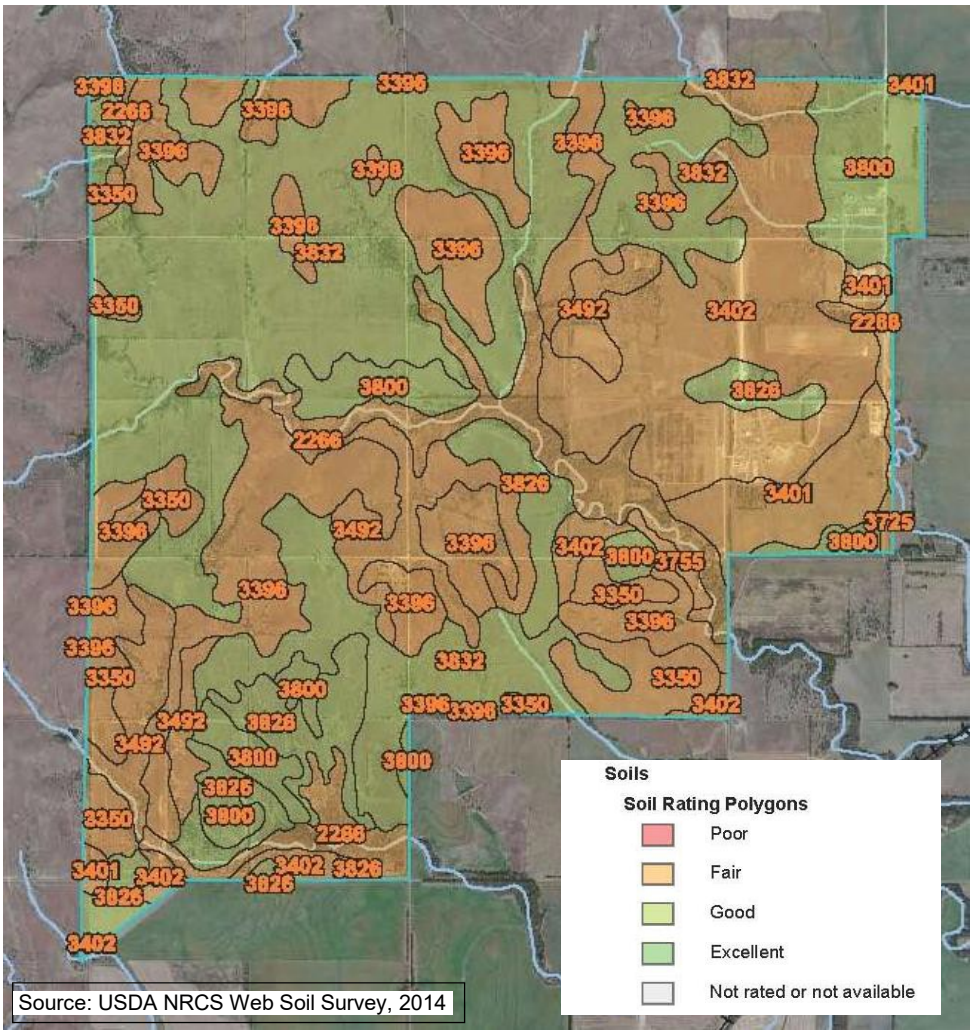

Figure 2-1: Suitability of KSTC soils for vehicle use.

2.1.2 TROOP NAVIGATION TRAINING

There are few limitations regarding soil suitabilities for navigation training of troops, with all areas of the KSTC rated as “somewhat limited,” indicating that all of the soils are suited fair for foot traffic, particularly on trails. Special planning for areas of heavy foot traffic and trails is appropriate, and some maintenance would be required. In general, however, most navigation training at the KSTC is off trail and typically in heavy vegetation, particularly grasslands. The heavy vegetation provides strong resistance to compaction that could result from foot traffic.

2.1.3 WEAPONS TRAINING – FIRING RANGES

The consideration of soil suitabilities and limitations at firing ranges is primarily focused on heavy foot traffic in the firing positions and staging areas, and in regard to attenuation of metals—particularly lead—contamination in soil.

Soil suitability for the firing ranges is good based on the clay percentage of the soil in most areas of the KSTC, particularly where the existing firing ranges are located and in regard to saturated hydraulic conductivity, which is very slow. Figure 2-2 illustrates the expected clay content of soils at the KSTC and saturated hydraulic conductivity. High clay content will tend to adsorb heavy metals resulting from firing of weapons, slowing their movement into the soil, and the slow movement of water restricts the movement of metals into the soil and/or to environmental receptors. In the absence of vegetation, however, these soils can be dusty, and there is a strong possibility that metals-contaminated soil can impact potential human and ecological receptors through wind-blown particulates. Therefore, appropriate management of soils for firing ranges should include strong vegetative cover and/or soil stabilization.

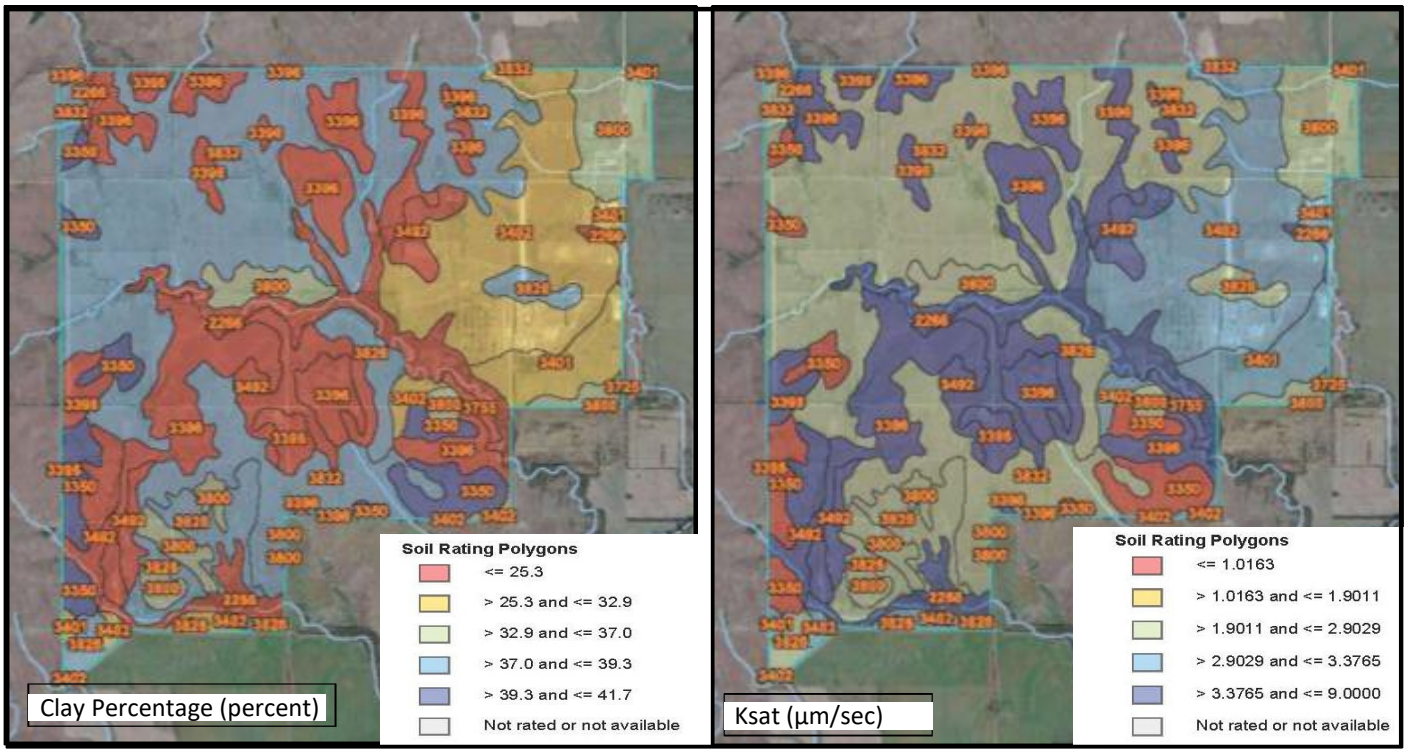

Figure 2-2: Suitability of Soils for Firing Ranges: Clay Content and Permeability
Note: Soil Ratings are Percent Clay and Saturated Hydraulic Conductivity (Ksat) in Micrometers per Second

Source: USDA NRCS Web Soil Survey, 2014

2.1.4 BIVOUAC

A permanent bivouac station has been maintained at the KSTC at the southwestern corner of South Hedville Road and McReynolds Road. This area has maintained stable environmental

and soil conditions for the past several years. If other areas would be considered for bivouac sites, some locations may be limited in some areas of the KSTC primarily due to potentially wet conditions and the drainage of water. Figure 2-3 illustrates soil suitability for bivouac sites at the KSTC. Limitations for bivouac sites include the period of time that soils may stay wet during stormy weather, the slick conditions that may be present because of the high silt soils, and the slow drainage of water into the soils.

During most times of the year, however, bivouacs located on uplands on well-drained soils should be acceptable. Soils may have to be modified to divert stormwater runoff away from bivouac structures. After bivouacs have been dismantled, it may be necessary to recondition the soil to return it to its original quality for supporting plant growth and ecological function.

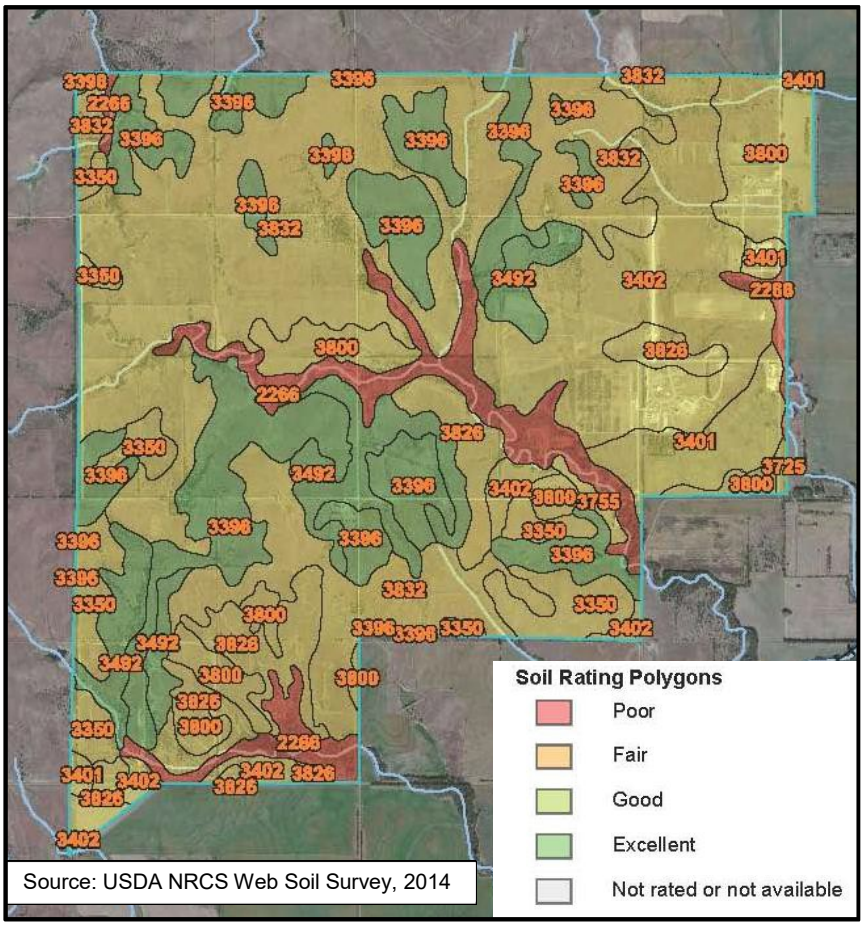

Figure 2-3: Soil Suitability for Bivouac Areas

2.1.5 COMBAT TRAINING

Generally, combat training will not be substantially limited by soil conditions at the KSTC. These limitations may include wet and saturated soils, including shallow depth to groundwater, ponding of water, and clayey soils. A particular challenge during combat training may include excavations for weapons crew or individual fighting locations. The high silt content can be very

difficult to excavate with manual tools when it is dry, as silty soils may be very hard. Similarly, when wet conditions are prevalent, the silty clay soils are very heavy and difficult to manually excavate, and sides of the excavations may not be stable. Combat training operations that include substantial foot traffic may result in very wet, plastic, and slick soils during wet conditions that will require restoration after completion of training.

2.2 CONSTRUCTION

Silt loam soils that are prevalent at the KSTC are common in Kansas, and construction methods for suitable structures built on these types of soils are well developed and used. The NRCS states that the soil series similar to those at the KSTC may have seasonally high water tables and high shrink-swell potential. Inspection of soils at the KSTC by soil scientist Ted Hartsig has not shown indications of high water tables except in major drainage areas. Likewise, while the clay content of the soil is sufficiently high to result in some shrink-swell of the soil, the silt loam surface texture reduces the impact of this condition.

Most structures constructed at the KSTC appear to be built on concrete slabs. Figure 2-4 shows that soils across most of the KSTC are poorly suited for buildings without basements, primarily due to the shrink-swell condition. The soils at the KSTC have better suitability for buildings built with basements, with more area classified as somewhat limited, and the limitation again primarily being the shrink-swell potential of the soil.

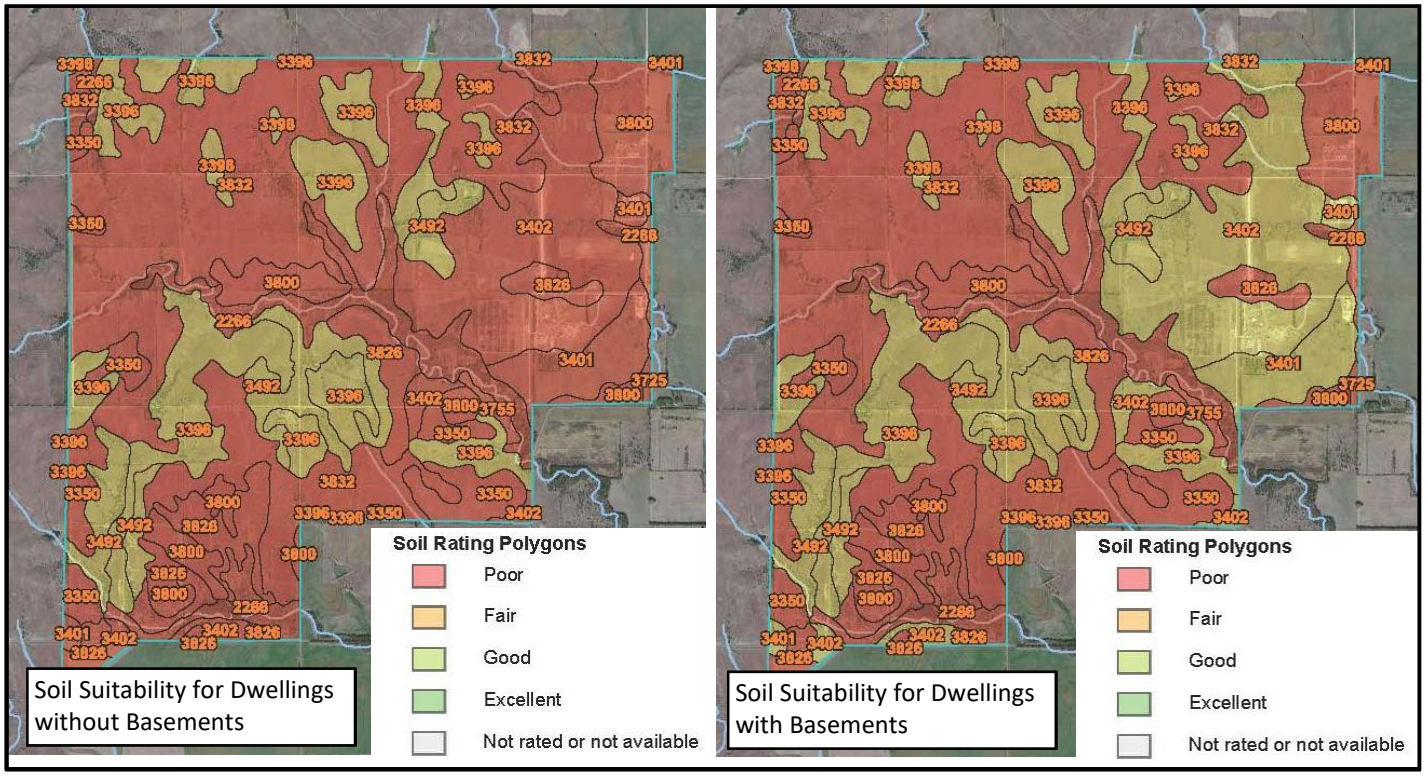

Figure 2-4: Soil Suitability for Dwellings

Soils throughout most of the KSTC are generally poorly suited for construction of non-paved roads (Figure 2-5). Factors contributing to the poor suitability for unpaved roads include shrink-swell potential, slope, and weak bearing strength. Methods for stabilizing the soils for roads have been used at the KSTC—including strengthening the road surface with gravel and grading the road to shed water—should always be considered with the construction of new roads.

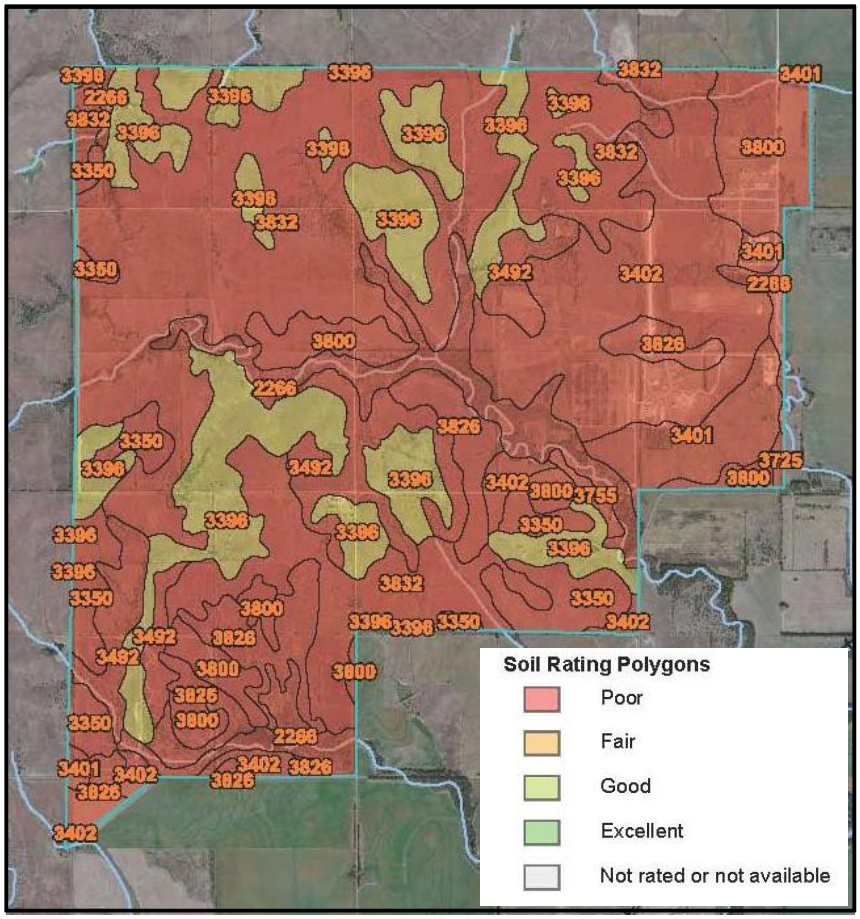

Figure 2-5: Soil Suitability for Unpaved Road Construction
Source: USDA NRCS Web Soil Survey, 2014

2.3 WASTEWATER TREATMENT

The use of septic or leach field wastewater treatment is limited at nearly all locations at the KSTC due to slow percolation of water and the potential for ponding. Wastewater treatments, including septic systems, sewage lagoons, or infiltration galleries, are not recommended for the facility.

2.4 POTENTIAL CONTAMINANTS

Under current operations, the potential for releases of pollutants from spills of oils and greases, solvents, or other materials can occur that require immediate attention. Soils at the KSTC have generally slow infiltration and percolation rates, ranging from 0.5 to 1.0 inches per hour, and liquid spills can be limited in impact if attended to immediately. It must be noted, however, that even a relatively slow infiltration and percolation rate of 0.5 inches per hour, which is common over most of the KSTC facility, will allow a liquid spill to infiltrate into the ground more than 12 inches in a 24-hour period, and often the rate of infiltration can increase if the soil contains cracks or macropores from roots or soil animals. Therefore, expect that spills of liquid contaminants may move faster into the soil than expected.

Soil chemistry also affects contaminant conditions at the KSTC. The typical soils have moderate clay and organic matter content and therefore have good ability to attenuate contaminant compounds, especially metals. Generally, the cation exchange capacity (CEC) of the soils at the KSTC ranges from 20 to 28 milliequivalents/100 grams of soils. This value does not reflect the potential CEC offered by organic matter, which tends to be higher.

The soils at the KSTC present a complex environment within which potential contaminants only slowly move into the soil, and they can and most often will be attenuated and adsorbed to the soil colloids and organic matter. There are limitations on the amount of adsorption of contaminants by soils at the KSTC, and liquid spills have a good potential to migrate to groundwater if they are not attended to immediately. ***Regardless of the soil's ability to attenuate contaminants, all spills of hazardous compounds should be cleaned up immediately, or as soon as possible.***

2.5 VEGETATION

Soils at the KSTC are very productive and supportive of vegetation production, whether for cultivated crops or for restoration of native vegetation conditions. Because of the very similar soil conditions found throughout the KSTC, it can be expected that the production/growth of range grasses will be very good across the site, typically ranging from 3,000 to 5,000 pounds of grass per year. Figure 2-6 illustrates the relative ranges of expected range grass production per year in pounds per acre.

If native plants are selected for the site, soil management will require attention only for those areas disturbed by training and that require restoration of vegetation. Soils in these areas will need to be examined for their potential to support native vegetation if it doesn't already exist there, and strategies for successful establishment of native vegetation will need to be employed (see Section 3.2.2).

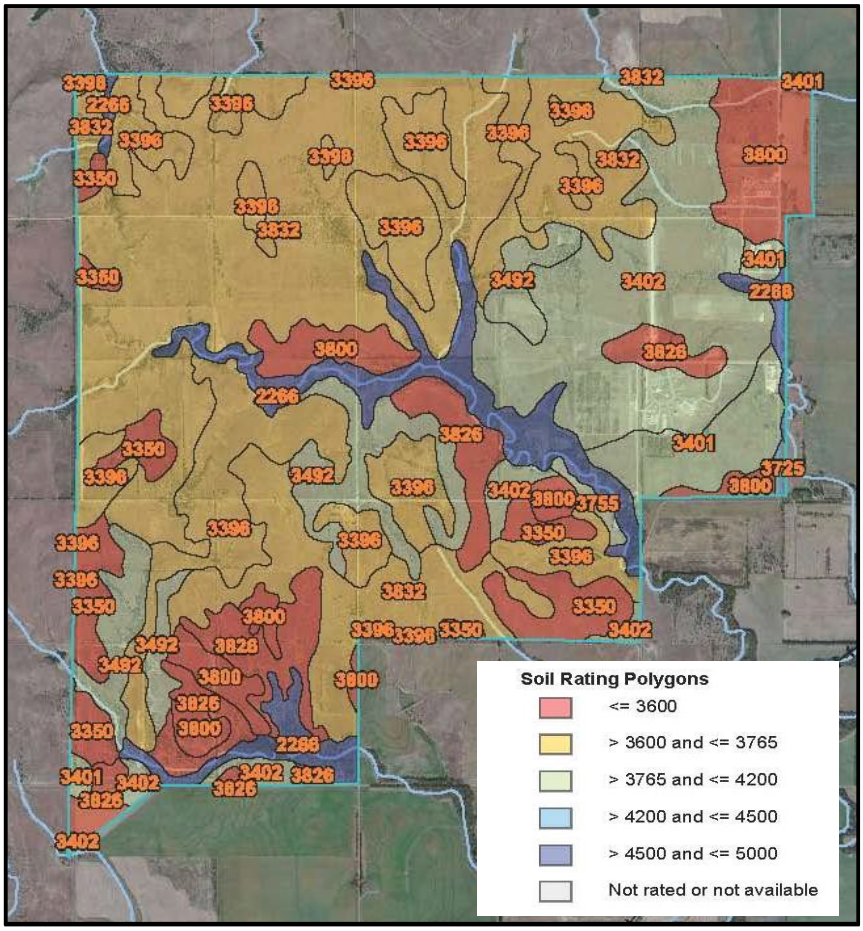

Figure 2-6: Expected Range Grass Production in Pounds per Acre per Year at the KSTC

Source: USDA NRCS Web Soil Survey, 2014

If conventional landscapes or crops are selected for areas of the KSTC, there are few limitations that would limit use of most plants. Drainage is a key factor of the soils at the facility that could limit the establishment of crops or many landscaping plants.

2.6 DRAINAGE

Drainage at most locations of the KSTC is generally good due to rolling topography and good drainage pathways. Excess stormwater is shed as runoff to the main drainages at the site, and while percolation of water through the soil profile is typically slow, few areas experience excessively poor drainage or ponding of water. This is attributable to the growth and function of deep-rooted prairie grasses (both native and adapted) that are prevalent at the site and that facilitate drainage of water into the soil. Many areas that are well drained, however, do retain some hydric soil potential due to their potential for holding and storing water in their pores for an extended period. In addition, some soil types at the facility are poorly drained and retain year-round wetland conditions. Figure 2-7 illustrates the dominant drainage condition of soils—a reflection of site drainage—at the KSTC facility.

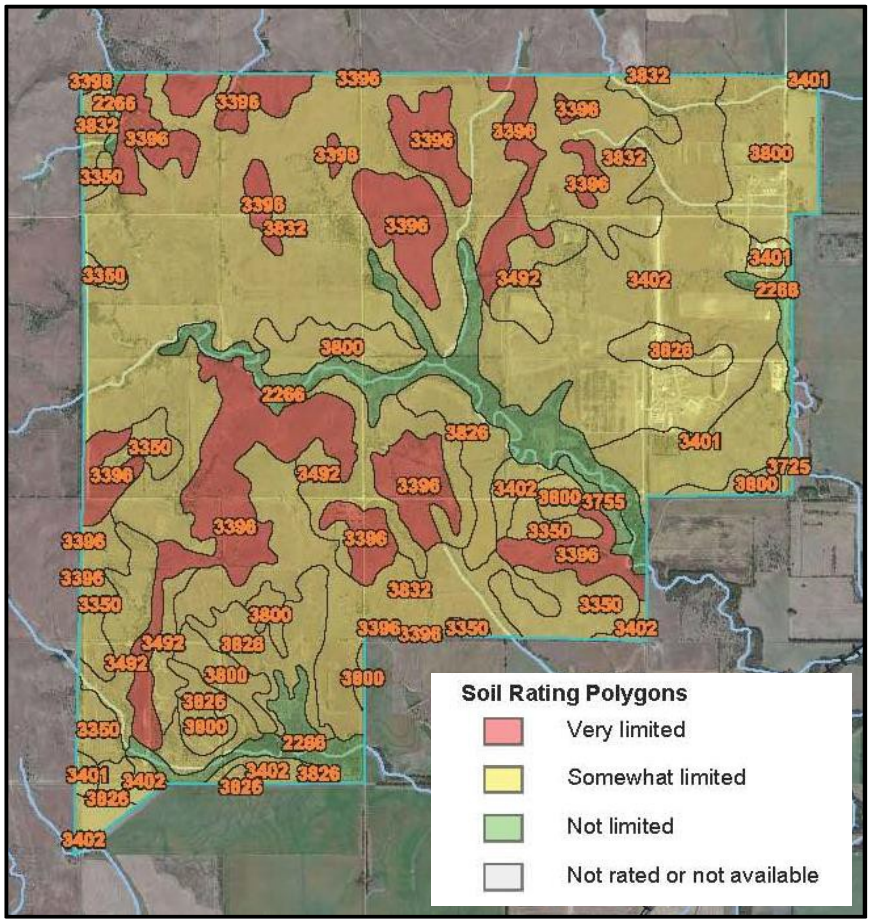

Figure 2-7: Surface Water Drainage Capability at the KSTC
Source: USDA NRCS Web Soil Survey, 2014

2.7 EROSION

The topography at the KSTC is gently to moderately rolling, with nearly flat aspects in the eastern portion of the facility, to more moderately and even severely sloped hills on the western portion of the facility. The NRCS Web Soil Survey shows that all areas of the KSTC have only limited erosion potential under normal climatic conditions. Areas with slopes that exceed 5 percent, however, if left unprotected, combined with the silt loam texture of many of the soils, make the potential for erosion a significant limitation. The potential for erosion is greatest on the western portion of the facility where topographic relief is greatest and where stormwater runoff has been particularly heavy, resulting in significant erosion of existing drainages and near roadsides. Generally, with the exception of steep slopes that occur in and near drainages, healthy vegetative cover should suffice to protect the slopes from erosion.

During all training and operations of the KSTC facility, erosion control contingencies should be in place, including training of troops and facility personnel onsite, preparation of an erosion control and mitigation plan that is present onsite at all times, and monitoring for occurrences of erosion. Section 3.1.1 addresses erosion management at the KSTC.

3.0 MANAGEMENT OF SOILS AT THE KSTC

The KSTC has a relatively stable environment that reflects seasonal changes in land use. Soil management, then, is more a practice of monitoring site conditions and managing changes due to operations and training, vegetation management, and mitigating soil damage that may occur with excess compaction, erosion, or other disturbances. The following sections provide soil management strategies to maintain optimal soil conditions for achieving KSARNG environmental management goals at the KSTC.

The most notable soil management issues at the KSTC include potential erosion on the western side of the facility where drainage patterns have resulted in more rolling topography, including stream banks that could be affected by high runoff flow during extreme rainfall events. Throughout the site, where hay leases are in place, the use of heavy equipment can result in soil compaction that affects plant growth and water infiltration.

3.1 EROSION AND SEDIMENT CONTROL

The potential for erosion is a significant issue at most sites where large areas of land are managed for various uses, and when land is disturbed. The gently rolling topography and training operations that are the primary mission of the KSARNG at the KSTC increase occurrences in which soil erosion may occur.

3.1.1 PREVENTATIVE EROSION CONTROL MEASURES

There are three basic strategies to control soil erosion: 1) Cover management, 2) Run-on management, and 3) Velocity control. Preventive management using these strategies at the KSTC includes:

1. **Cover Management:** Cover management is appropriate for both water and wind erosion control by minimizing bare soils and maximizing vegetative cover of soils. With both wind and water erosion, scouring of the upper portions of the soil will occur, often enlarging the bare soil area and damaging surrounding vegetation and structures. Cover management strategies include:

    a. Vegetative cover: Grasses provide the best vegetative cover for soils, with native grasses preferred due to their deep and fibrous root systems that hold soil in place. Vegetative cover can be accomplished by direct seeding into the soil, preferably with mulch or a fabric cover until the plants are established, or it can be accomplished by spraying a mulch/seed mix onto the soil. The mulch/seed mix often has a tackifier that holds the material in place until the plants are established, while also holding moisture to enhance seed germination and early growth. Vegetation should cover at least 80 percent of the soil surface.

b. Rock or wood mulch: If vegetative cover is not practical or possible, wood mulch or rock can be used to cover the soil to reduce the potential for erosion. This approach is often expensive and requires regular maintenance to restore the wood mulch or to clean weeds from the rock cover. This is an effective approach with immediate results.
c. Compost amendments: Compost mixes with the soil to promote and provide a more complex matrix structure that resists erosion. Compost also facilitates microbial activities that help stabilize the soil particles and improve their resistance to erosion. Compost also enhances vegetation establishment.

2. **Run-on Management:** Run-on management reduces the length of the direct-flow path of stormwater runoff. Strategies include:

    a. Incorporating blocks or islands in parking lots or other impervious surfaces to redirect or slow the flow of water onto non-paved surfaces. In addition to redirecting flow, the volume or flow of water can be dispersed, reducing the energy that creates erosive force.
    b. Constructing or creating diversion channels to change the path of concentrated water flow, particularly away from sensitive areas, steep slopes, or commonly used areas that need to remain protected from damage. Diversion channels should be constructed to slow the velocity of water and/or disperse the volume of flow. Often, a “level spreader” can be incorporated. This structure is similar to a rock-filled channel built perpendicular to a slope that redistributes the flow of water over a wider area.
    c. Constructing terraces on slopes (even gradual slopes) to reduce the grade or slope, or the length of slope, that water can flow and erode areas. Depending on the slope, terraces can be created to appear natural within the local topography.

3. **Velocity Management:** The objective of velocity management is to reduce the speed of water across the soil. On silt loam or silty clay loam soil, the maximum acceptable runoff velocity is less than 5.0 feet per second if the soil has a sod-grass cover (tall fescue or similar). Velocity control may be accomplished by

    a. Reducing the steepness of slopes through use of grade controls or check dams. This strategy is often used in channels where the length and/or steepness of flow must be reduced, thereby slowing the flow and energy of water that creates erosion. Depending on the slope or the amount of water flowing through an area, grade controls and check dams can be constructed of compacted soil (normally for less concentrated and slower flows) or rock (typically for more concentrated and higher-velocity flows).
    b. Increasing the “roughness” of the surface. Establishing roughness of the soil surface includes placement of vegetation (preferably dense, deep-rooted vegetation within the flow path) or rock to reduce velocity. Soil roughness can also be increased by tilling the soil until vegetation can be established. This

process will also increase infiltration that will reduce volume and velocity of water flowing across the surface.

If and where possible, integrating all three of these strategies where erosion might occur will help reduce the occurrence of damaging erosion at the KSTC.

3.1.2 REPAIR OF EROSION DAMAGE

Inevitably, erosion damages will likely occur at the KSTC. Most often, this may occur on relatively shallow sloping areas, and limited in extent. The following steps should be followed to repair soil damaged by erosion:

1. Complete a full assessment of the cause of erosion and extent of soil damages. It may be necessary to mitigate the cause of erosion—such as extensive impervious areas, run-on conditions, or steep grade—in conjunction with repairing damages. Determine if erosion damages threaten existing structures, such as buildings, levees, or berms. If structures are damaged or threatened, it may be necessary to contact engineering support to repair damages to the structure.

2. If erosion is limited to small gullies (less than 2 to 3 inches deep) or rills, fill the eroded areas with a similar soil from a nearby borrow source and blend into the existing landscape.
    a. Incorporate compost with the soil, if possible.
    b. Using a shovel or other hand implement, pack the soil into the rills/gullies firmly, but not to full compaction.
    c. Rake the fill soil smooth and seed with an approved grass seed mix consistent with the surrounding landscape use (native grass if possible).
    d. Install a biodegradable erosion control mat to stabilize the site until the grass cover is established.

3. If erosion is moderate with gullies approximately 3 to 9 inches deep and up to 12 inches wide, fill the eroded areas with similar soil from a nearby borrow source.
    a. Depending on the length and degree of slope, it may be appropriate to mix small rock (less than 1 inch in diameter) into the soil material along with compost to provide increased soil stability.
    b. Depending on the length and degree of slope, incorporate soil grade controls or terraces along the eroded area to slow runoff velocity and disperse volume over a larger area. Grade controls and/or terraces can be blended into the surrounding landscape to appear as part of the natural topography.
    c. Compact the soil material firmly, but not to full compaction. Rake the eroded area smooth and cover with an approved seed mix consistent with the surrounding landscape.

d. Install a biodegradable erosion control mat to stabilize the site until the grass cover is established.

4. If erosion damage is severe (gullies deeper than 12 inches deep and 12 inches wide, and usually more than 20 to 30 feet in length), more extensive repair measures may be required, including:
    a. Backfilling the gully with a soil/compost/rock mix. The soil mix should be blended into the sides and base of the gully by breaking or scarifying the edges of the gully and creating a transition from the surrounding soil to the filled area. This is accomplished by:
        i. Mixing a small amount of the soil/compost/rock backfill mix with the base of the gully, and along the sides of the gully. This can be done by hand tools or with small mechanical equipment (e.g., Bobcat tractor).
        ii. Backfilling the remainder of the gully with the soil/compost/rock mix and packing the mix firmly into the gully (again, not to full compaction).
        iii. Grading the site, if necessary, to include small terraces that will slow and distribute runoff. Terraces should be placed approximately every 15 to 20 feet apart, perpendicular to the direction of flow.
        iv. Placing a soil/compost mix overtop of the gully (approximately 1 to 2 inches) and raking smooth with the surrounding landscape.
        v. Covering with an approved grass seed mix consistent with the surrounding landscape use.
        vi. Covering with a biodegradable erosion control mat until the grass has established.

    b. If erosion damages are more severe, it may be necessary to consult with a geotechnical engineer.

3.2 LANDSCAPES AND VEGETATION MANAGEMENT

More regular soil management for landscapes at the KSTC will likely be limited to administrative or operations buildings at the eastern portion of the KSTC, including Crisis City. Soil management in this area is dependent on the landscape and vegetation types. Conventional landscapes tend to be more structured and manicured, usually with non-native or adapted grasses such as Kentucky blue grass, varieties of fescue grass, and non-native or adapted shrubs and annual forbs (flowering species). Native landscapes can have structured or manicured appearances, but are dominated by native perennial plant species. Native landscapes also include the natural, unaltered landscapes that are found in bottomland wooded areas, open prairies or pastures, or other natural biomes.

3.2.1 CONVENTIONAL LANDSCAPES

Conventional landscapes that include ornamental vegetation such as gardens and shrubbery are not common at the KSTC, other than mowed grass. If such landscape features are to be implemented at the facility, soil management of conventional landscapes typically requires seasonal attention to soil quality, including soil compaction, nutrient status, and possible soil-borne vectors that can cause plant disease or stress. In addition, conventional landscapes usually require regular attention to moisture conditions and possible pests (weeds, insects) that may require treatment. Common soil management actions for conventional landscapes include:

- Fertilizer applications
- Lime applications
- Irrigation
- Core aeration or verticutting to break compaction or tight soils
- Pesticide applications (herbicide, insecticides)

Conventional landscapes are typically found near administrative or operations buildings at the KSTC, and at the close-range firing ranges. Generally, the conventional landscapes at the KSTC require very low maintenance other than regular mowing. The following soil management tasks are recommended for those areas that will be conventionally landscaped:

1. **Soil Testing:** Soil testing should be conducted every other year. Soils may be sampled for nutrient analysis once every two or three years, but only in those areas where vegetation is maintained for formal landscapes, such as turf lawns or gardens. Soil sampling for hay production may be conducted once every four or five years, depending on productivity of the range. In areas where native vegetation is left with no harvesting, soil sampling is necessary only if poor vegetative performance is observed.

   Soil samples can be collected from the 0- to 6-inch depth using a core sampler (recommended) or shovel. One sample should be collected per acre in most turf grass areas, or one per every 5 acres in the large training grounds on firing ranges. Samples should be collected one per garden where special plantings (floral or shrub species) may be planted. Soils should be submitted for analysis at a qualified laboratory that provides nutrient analyses and recommendations (Kansas State University provides this service). Samples should be submitted for analyses of nitrogen (N), phosphorus (P), potassium (K), pH, and organic matter.

   Soil test results will include recommendations for N, P, and K fertilizer applications, and lime (calcium carbonate) to adjust soil pH, if necessary. In addition to routine soil sampling and analyses, soil samples should be collected every five years for micronutrient testing.

2. **Fertilizer Applications:** Fertilizer applications vary by the type of plant or vegetation being grown, the time of year applied, the growth and maintenance expectations or

goals for the vegetation, and the amount of fertilizer nutrients needed. Under most circumstances, fertilizer is applied once or twice a year. If fertilizer is applied once per year, the best time of application is spring, in April or early May. If fertilizer is applied twice during the year, the second application should be in the fall in early to mid-September. Depending on the type of vegetation and/or area being fertilized, timing and amounts of fertilizer may vary from year to year, depending on the amount of rainfall or condition of the vegetation.

3. **Lime Applications:** Calcium carbonate or lime is applied to raise soil pH (reduce acidity) to favor biological growth and nutrient availability. Ideally, soil pH should be between 6.5 and 7.5 standard units. If pH is lower than 6.5, a soil test will provide recommendations for the amount of lime to apply to the soil to raise the pH to 7.0. If soil pH is higher than 8.0, then acidifying compounds such as ammonium sulfate fertilizer may be used to lower pH. Acidifying compounds should be used with recommendations from a turf specialist or soil scientist.

   Lime should be added to soils in broadcast applications. If high lime recommendations are made, it may be appropriate to split the recommended amount and apply smaller amounts of lime during two separate periods, although it may not be necessary that these applications be separated by more than a few weeks.

4. **Irrigation:** If irrigation is used for conventional landscapes at the KSTC, it should be installed to water only those plants that are not drought hardy. At most locations of the KSTC, even in operational areas, native or adapted plants have been used for conventional landscaping to reduce the need for irrigation. If irrigation is needed, it should be timed to apply no more than approximately 0.5 inch of water per week to those areas needing the irrigation, and up to 1.0 inch per week in July and August. The silt loam of the site has excellent water-holding capacity, and therefore, irrigation should be managed to minimize runoff but also to keep soils moist as needed.

   If turf grass is desired for areas at the KSTC facility, then deep-rooted fescue is recommended. Fescue grass is typically drought tolerant, and it will go dormant during very dry times, greening again when moisture is added to the soil through rain or irrigation.

5. **Pesticide Applications:** Many pests—whether insect or disease—are soil-borne and therefore are often treated with pesticide applications to the soil. Care must be taken when applying pesticides, both for the safety of the applicator, as well as for the protection of soil and groundwater resources. The applicator must follow label directions closely, and the too-often thought that “a little is good, so more would be better” must be avoided. Before pesticides are applied, the extent of a pest problem should be well examined, and only those areas that are affected should be treated. If broad areas should be treated, consult with or contract with a certified pesticide applicator.

3.2.2 NATIVE LANDSCAPES

Native landscapes—whether part of a structured landscape or naturally occurring—build beneficial soil properties that stabilize the soil without the addition of fertilizers or other soil amendments. Typically, most native plants used in landscaping are perennials, with deep roots that are often drought tolerant as well as often disease tolerant. With their hardiness, however, native vegetation in landscaped areas near buildings still require care and soil management to be sustained, including:

- Irrigation during very dry periods to prevent desiccation of roots and plant death
- Periodic monitoring for soil-borne diseases that can be observed in plant leaves
- Periodic mowing or burning to remove excess litter buildup after seasons of growth

Native vegetation across most of the KSTC facility will not require attention unless it has been disturbed by operations or training activities, site maintenance, or natural occurrences such as fire or erosion. Native vegetation is recommended for as many landscape applications as possible for protecting soil and groundwater resources while also reducing water demands, fertilizer and pesticide requirements, and overall maintenance.

3.3 STRUCTURAL SOILS

Where soils are or will be used for construction of earthen structures, the following management is recommended:

- In general, 3(H):1(V) side slopes are typically stable for use in berm or embankment construction.
- Soils with high organic matter, as most surface soils at the site have, should not be used for structural soils.
- Any soil used for structural purposes should be well graded, capable of being well compacted, be within a proper range of moisture to optimize compaction, and be free of unsuitable or deleterious materials such as tree roots, branches, stumps, sludge, metal, or trash.
- Most specifications for embankment or berm construction require the compacted soil to have an in-place density typically greater than 95 percent at a moisture content within a certain percentage (usually 3 percent or less) of optimum compaction (which is considered prior to construction of earthen structures).
- Soils used for road grades, foundations, embankments, or berms should be compacted to at least 100 percent to maximize structural stability.
- A detailed geotechnical analysis should be completed for all berm embankment construction.

Excavations intended to remain open for extended periods should not exceed 6 feet in depth without proper shoring or grading to prevent sloughing.

3.4 SOIL RESTORATION OR MODIFICATION, AND MAINTENANCE

Soil disturbance upsets a natural equilibrium that supports desired vegetation and/or land use. Soil restoration for structural uses is dependent on design specifics and load bearings. Soil restoration for sustainable natural resources requires restoring the balance of the soil physically (texture and structure), chemically (nutrients and cation exchange), and biologically (organic matter, microbiology, and plant communities) to reestablish site function and environment.

Prior to soil restoration or modification, determine land use objectives for the area to be restored or modified. Typical land use goals and/or objectives may often include:

1. Restoration or conservation of natural resources
2. Remediation of contaminated soils
3. KSARNG training missions
4. Mitigation of disturbed soil resources

Soil restoration or modification approaches for each of these goals are described below.

3.4.1 RESTORATION OR CONSERVATION OF NATURAL RESOURCES

The restoration or conservation of natural resources is typically most successful with rehabilitation of native soil conditions to the extent possible. This can be accomplished through the following process:

1. Define the restoration goal; for example, restoration of meadow, wetlands, or woodland.

2. If soils will be disturbed by excavation for a specific purpose and then replaced, stockpile removed soils in the order in which they are removed, separating by horizon, if possible. At the KSTC, it is difficult to differentiate between horizons at most locations. In these cases, segregate soils by depth (e.g., top 12 inches) and then by two-foot increments after that.

3. Locate a nearby reference soil in a similar vegetative community to develop a soil restoration template.
    a. Excavate a soil pit to observe and record soil horizon characteristics such as horizon depth, hydric indicators, and vegetative species present.
    b. Collect soil samples and analyze for soil texture, organic matter content, nutrient balance, acid/ alkaline reaction (pH), and cation balance.

4. If restoration objectives are not for previously disturbed areas, condition the surface soil of the restoration area with amendments that will modify the soil to reference topsoil conditions. This may include:
    a. Addition and incorporation of compost up to 12 inches below the surface. Use fully digested, stable compost, and mix thoroughly with the surface soil to the

desired depth. The amount of compost used is dependent on the organic matter content of the reference soil. For each one percent of organic matter increase in the soil restoration, add approximately one-half cubic yard per 4 cubic yards of soil (Note: this will likely be the top 12 to 15 inches of soil restoration).

b. If pH of the soil is to be modified, adjust using lime to raise the pH, or ammonium sulfate fertilizer to lower the pH. Organic matter will also likely lower the pH. Mix the amendments into the soil. Avoid excess fertilizer if possible. Fertilizer applications of nitrogen and phosphorous-containing materials are not necessary unless the soils are devoid of these compounds. Typically, native soils will have approximately 20 to 50 parts per million (ppm) of naturally occurring nitrogen, and approximately 3 to 10 ppm of naturally occurring phosphorus.
c. If possible, obtain as much of the reference topsoil as possible without drastically altering the reference site, and blend into the topsoil. The purpose of this is to inoculate the restored soil with appropriate microbiological species to restore the new area and help achieve restoration goals.
d. Install/plant or seed vegetative species into the restored soils. If and where possible, starting new vegetative communities with young plants is desired. Seeding of grasses includes preparing a firm seedbed, broadcasting seed, and firmly covering the seed with approximately one-half inch of topsoil. It is advisable to use a roller to assure adequate placement and firm compaction of the soil (don't let the soil remain "fluffy"). Cover seeded soil with straw mulch (weed free, if possible).
e. First-year maintenance is essential. These tasks include early watering if the restoration is conducted during the dry season, and identifying and removing invasive or weeding species to enhance growth and development of the desired species.

5. If restoration will be accomplished following disturbance of soil resources, the following procedure is recommended:
    a. Prior to restoring soil within an excavated or disturbed area, prepare the area to be restored by scarifying or roughening the existing soil at the base and along the sides of the disturbed area. If possible, minimize compaction of these areas by limiting use of equipment or personnel to areas that will be scarified or roughened as equipment and/or personnel leave the area. At the KSTC, the potential for compaction is high due to the silty nature of the soil materials.
    b. Assuming soil was segregated by horizon or depth, replace soil in reverse order from which it was removed (i.e., replace the soils that were removed last from the deepest portions of the disturbed area first). Replace the soils in six- to twelve-inch lifts and hand tools and tamp the soil to remove voids. Avoid creating smooth surfaces between lifts. Watering the soil between placement of each lift helps settle the soil to a natural state of compaction.
    c. Before replacing the top 12 to 18 inches of soil, mix in amendments including compost as necessary. Even if the original soil or the reference soil had nominal organic matter content, it is recommended to add at least one-half cubic yard of

compost to every four cubic yards of soil to be replaced. This can be accomplished by:

i. Mixing compost and other amendments as necessary with the top layers of soil before they are placed. This will require “bucket” mixing the soil and components thoroughly to a good homogenous state before placing in the restoration area.
ii. Placing at least 3 inches of compost and other amendments on the surface of the replaced soil and mixing with a rototiller or equivalent mechanism to a depth of approximately 12 inches. When using a rototiller, vary the tilling depth to avoid creating compacted layers at the bottom of the tilled soil layers.

d. If possible, obtain as much of the reference topsoil as possible without drastically altering the reference site, and then blend into the topsoil. The purpose of this is to inoculate the restored soil with appropriate microbiological species to restore the new area and help achieve restoration goals.
e. Install/plant or seed vegetative species into the restored soils. If and where possible, starting new vegetative communities with young plants is. Seeding of grasses includes preparing a firm seedbed, broadcasting seed, and firmly covering the seed with approximately one-half inch of topsoil. It is advisable to use a roller to assure adequate placement and firm compaction of the soil (don’t let the soil remain “fluffy”). Cover seeded soil with straw mulch (weed free, if possible).
f. First-year maintenance is essential. These tasks include early watering if the restoration is conducted during the dry season, and identifying and removing invasive or weeding species to enhance growth and development of the desired species.

3.4.2 REMEDIATION OF CONTAMINATED SOILS

Hazardous substances can contaminate soils in numerous different ways and with varying degrees of severity. The soils at the KSTC have generally slow infiltration and therefore low migration potential for contaminants due to their silty loam and silty clay loam texture. Typically, however, liquid compounds spilled onto the soil will rapidly soak into the first few inches of soil before they slow enough to puddle on the surface. Viscous compounds, such as oils and greases, will only slowly move into soils that have higher clay content. Regardless of how slowly or quickly spilled compounds may move into the soil, immediate attention is appropriate to mitigate releases of hazardous compounds, even if the releases are considered minor in scope. Only personnel trained in response to emergency releases of hazardous materials should address possible releases or spills of hazardous compounds.

In all cases of a hazardous-material release, the KSARNG Environmental Program Manager must be contacted regarding the nature and extent of the spill. The KSARNG Environmental Program Manager will contact regulatory agencies, if necessary (some spills of fuels, oils, or greases may fall below reportable quantities). Emergency mitigation of spilled substances

includes the following recommended procedure. All emergency mitigation must be conducted by trained personnel using appropriate personal protection equipment.

1. If spilled hazardous liquids are on the soil surface, immediately place sorbent socks around the spill, or at least on the down-gradient sides of the spilled liquids. In the absence of sorbent materials, construct a small berm around the spill.

2. Remove and isolate contaminated soils if and as possible or appropriate. Contaminated soils must be handled with care. If removal of the soils could expose nearby facilities or people to vapors or migration of contaminant compounds, delay removal of the soils. If contaminated soils are removed, place them onto plastic sheeting raised at the edges to prevent movement of the liquid contaminant off the plastic sheeting or to prevent movement of water from surrounding areas onto the sheeting.

3. Collect soil samples from the excavated areas for analyses of target contaminant compounds. Also collect samples from the soil removed from the impacted areas for analyses of target contaminant compounds.

4. Depending on weather conditions, it may be possible to leave the excavation open to allow volatilization of minor amounts of organic compounds. If wet weather is anticipated, or if the contaminant compounds are particularly toxic, cover the excavated area with plastic. Cover the removed soils with plastic also.

5. Further site remediation will require a specific plan to be developed and implemented by the KSARNG Environmental Program Manager.

Soils at the KSTC can be effectively remediated depending on the nature and extent of the substance released. Releases/spills of fuel, oil, grease, and some solvents can be accomplished by venting the removed soil and/or by implementing bioremediation. Bioremediation of organic compounds can be accomplished in piles in a secured location, and stabilized contamination that remains in the ground (not prone to further migration) can be bioremediated in situ. Similarly, many solvents can be remediated using soil-venting techniques or bioremediation strategies.

Metal contaminants will tend to adsorb to clays and/or organic matter in the soil. The soils at the KSTC facility tend to have relatively high levels of organic matter and clay; therefore, the sorption capacity is good, and so the potential for migration of metals contaminants is low. In situ stabilization of metals is possible (through modifying pH, adding stabilizing compounds, and/or creating soil curtains), but depending on the concentrations of specific metal compounds, removal and disposal may be the most appropriate strategies.

Specific soil remediation plans will be developed by the KSARNG Environmental Program Manager.

3.4.3 SOIL MANAGEMENT FOR KSARNG TRAINING MISSIONS

Troop training at the KSTC has the potential to impact soil structure and consistency, and therefore drainage, vegetation growth, and land use if soil damage is substantial. Typical field training may include drills, firing at ranges, orientation courses involving foot traffic, and heavy truck and equipment operations. In consideration of land use and training at the KSTC, the following actions are recommended.

Soil Maintenance: Typical land use at the site will often include heavy foot traffic, light and heavy vehicle traffic along unpaved roads, and maintenance of mowed drilling/training areas. Routine or proactive soil management and maintenance actions follow:

1. Promote and maintain healthy vegetative cover on all non-road areas. This will include:
    a. Establishing and maintaining healthy grass cover on all open fields used for drills, training, or recreation. Grass cover should be greater than 90 percent. If grass is mowed, a mulching mower should be used and clippings be allowed to fall to the ground. Monitor grass vigor for color and potential wilting. During dry periods, grass will go dormant to a golden or light brown color. If the grass is otherwise stressed by disease, nutrient deficiencies, waterlogging, or poor soil structure (compaction or tight pores), these common indicators can be observed:
        i. Spots on grass leaves are usually a sign of fungal infection or disease.
        ii. Burning at the leaf tips is usually a sign of nutrient imbalances, particularly nitrogen or potassium.
        iii. Purple color along grass leaf tips and edges is an indication of phosphorus deficiency.
        iv. Medium brown to black coloration indicates necrotic (dead) tissue. This may be caused by soil-borne diseases, waterlogged soils, excess salts in the soil, or soil contamination.
        v. Weak, slow, or sparse growth (less than 90 percent cover) may be a sign of soil compaction, nutrient deficiency, or excessive dryness.

    Establishment of native fescues is recommended for drill areas or office/building areas. If possible, the establishment of native grasses such as blue grama grass or buffalo grass is highly recommended. Species (either existing or planned) need to be deep rooted (roots at least 12 inches deep) and form a thick cover.
    b. Avoiding use of pesticides (particularly insecticides) if and when possible. Pesticides kill or reduce beneficial soil organisms, including highly beneficial earthworms, nematodes, and beneficial microbial populations. It is recognized that sometimes the use of pesticides is necessary to control large infestations of insects or weeds. Use pesticides sparingly in these cases, if possible.
    c. Checking soil nutrient balance and acidity every two years in areas with turf grass. For most fields where grass is maintained, nitrogen levels should range from 15 to 40 ppm (lower end if possible), phosphorus should range from 4 to 10 ppm (up to 20 ppm is okay), and pH should be between 6.0 and 7.0.
    d. Checking soil structure and density every two to three years. Sampling can be accomplished using a soil probe to extract a 1-inch-diameter soil core from the

surface to 6 to 15 inches below the surface. Sampling should be accomplished on a grid basis with collection points on 100-foot to 150-foot centers.

2. Avoid foot traffic and vehicle traffic on non-vegetated areas, if possible. The soils at the KSTC are prone to compaction, and excessive traffic will result in deep soil compaction, limiting the ability of the soil to support vegetation and therefore reducing infiltration of water, impeding drainage, and increasing the potential for erosion.

3. Monitor vegetation and soil conditions in high-use areas (recreation areas) for compaction, plant stress, erosion, or other issues. If persistent problems are observed or noted, develop management plans that may include:
    a. Establishing soil stabilization using different vegetation, walking/playing areas, or structural approaches such as gravel cover, decks, or other.
    b. Implementing a “rest” period for recovery of soils and vegetation.
    c. Changing land use. Development of special vegetation or gardens rehabilitates and changes the orientation of high-use areas.

3.4.4 MITIGATION OF DAMAGED SOIL RESOURCES

Soil resources can become damaged as a result of excessive use and/or traffic from construction, accidents, or unintended consequences of facility maintenance such as road salt applications or spillage or errant disposal of waste materials. It is important that mitigation for damage include both soil form and soil function for drainage, nutrient capacity, and supporting vegetation. The following mitigation strategies are recommended for damaged soil resources.

1. Compaction: As addressed in this survey, the soils at the KSTC are at risk of significant compaction. Compaction can be extensive through several inches of soil, or limited to a thin, but highly compacted layer called a “pan.” Compaction in soils at the site will often likely extend to as deep as 12 to 15 inches below the surface. Where compaction occurs, soils can be restored in the following manner:

    a. Determine the depth and extent of compaction. This can be difficult when only using hand tools.
    b. If compaction is near the surface and widespread, break the compacted areas using a tillage implement such as a disc or harrow behind a tractor. If a tillage implement is not available, use a backhoe to break through compacted soils.
    c. If compaction is deep, use a backhoe to excavate to and through the depth of compacted soils, turning them over in place.
    d. If soil has been excavated, restore soil horizons in the same order in which they were excavated.
    e. If surface areas have been decompacted, mix compost into the top 12 inches of soil at a rate of one cubic yard per 100 square feet of area (approximately a 3-inch layer of compost mixed into the top 12 inches).

f. Replant the area with native or deep-rooted perennial plants, depending on land use of the area. If a recreation area, plant with a deep-rooted grass such as fescue or buffalo grass.

2. Post-Construction Soil Damage: Soils are often damaged during construction activities such as site grading for new buildings or structures, or excavating for foundations. The recommended mitigation approach for post-construction soil damage includes the following:
    a. Identify surrounding soil characteristics. It will be important to restore the soil to surrounding conditions to maintain consistent water- and nutrient-holding functions that will support uniform vegetation in the restored area.
    b. If soil has been segregated (stockpiled by depth) during excavation, attempt to replace soil in the same order in which it was removed from the ground. Replace soil in 6- to 12-inch lifts, taking care not to over compact soils on replacement. The weight of soils replaced alone will tend to bring them to their natural compaction state, but voids may be present. It may be appropriate to stir soil to collapse voids.
    c. Between lifts of soil replaced, make sure the surface of the previous lift has been scarified or is rough. This will prevent formation of smooth boundaries and potential water infiltration barriers.
    d. Replace the topsoil last. If possible, blend into surrounding soils to create a uniform transition from the disturbed area to the previous non-disturbed areas.
    e. If topsoil had not been segregated, blend compost into the top 12 inches of the restored soil profile at a rate of at least one cubic yard per 100 square feet.
    f. In graded areas, break any compaction using a tillage implement, if possible.
    g. Mix compost into the topsoil area, if possible, at a rate of one cubic yard per 100 square feet. If possible, more compost (two cubic yards per 100 square feet) is preferred.
    h. Replant all restored areas with deep-rooted, native plants, if possible, or vegetation consistent with surrounding landscapes.

3. Salt-Affected Soils: Salt-affected soils most often result from using sodium chloride de-icing salts, but they also can result from using saline or alkaline irrigation water, water discharged from waste sites, or excessive use of manure for fertilizing soils. Excess salts, especially sodium, can affect plant growth and soil structure. Soils with excessive salts are called saline soils, and typically have electrical conductivity of greater than 4 mmhos/cm (deciseimens per meter). The soil pH will typically be less than 8.5, and the soil will often appear white from salts accumulating at the surface. If excess sodium is present in the soil, the soil will often have a darker, often black color, soil pH may be greater than 8.5, and infiltration of water into the soil will be substantially reduced.

    If salt-affected soils are identified, it will most often be associated with sodium. Mitigation of salt-affected soils will normally include:

a. Determine the areal extent of the salt-affected soils. Collect soil samples for analysis to determine what salts are present, and in what concentrations. Samples should be collected from the 0- to 6-inch depth.
b. Mix gypsum (calcium sulfate) into the salt-affected soil. It may be necessary to consult with a soil scientist (e.g., Kansas State University Agricultural Extension office in Salina) to determine how much gypsum is necessary.
c. Apply large amounts of water to the affected areas to leach the salts deep into the soil. The sodium and calcium that leach deep into the soil will not adversely affect groundwater. It will likely take several heavy applications of water to sufficiently leach sodium deeper into the soil.
d. Restore vegetation as necessary and appropriate.
e. If possible, reduce the use of de-icing compounds.

4. Waste-Impacted Soils: Soils are often impacted by spilled or carelessly discharged wastes that are non-hazardous or non-toxic, but may have a negative effect on soil condition. Such wastes may include latex paints, cooking oils and greases, solid human wastes, and general debris. Mitigation of waste-impacted soils includes the following:

    a. For soils affected by non-hazardous liquids, the only appropriate strategy will be removal and disposal of the affected soils, and replacement with a suitable fill soil.
    b. Soils affected by disposed oils or greases may be mitigated by:
        i. Removing the affected soils and composting the soil with other organic sources in a localized compost bin or area.
        ii. Mixing compost or high-organic soil in the affected area and allowing time for degradation of the oils or greases to occur naturally.
        iii. Removing the affected soil, disposing of it, and replacing it with suitable fill soil.
    c. Soil affected by disposed human wastes must be handled and treated carefully due to the possible presence of pathogens.
        i. Depending on the amount or volume of wastes disposed, any free human waste should be removed as soon as possible.
        ii. If wastes are on or near the surface of the soil, a soil berm should be constructed around the waste until it can be removed.
        iii. If waste has been buried in the soil, remove the affected soil and waste and dispose at a suitable waste site or treatment center.
        iv. If waste has been mixed with the soil, monitor soil conditions. If possible, add vegetative organic matter as well as lime to control vectors. If possible, establish vegetation over the area to facilitate microbial populations that will decompose the waste materials.

    For soils affected by the disposal of general debris, after larger debris has been removed, it may be necessary to remove soil and sift it through a screen (½-inch or ¾-inch screen openings) to remove unwanted small debris that is left over. It is

important to remove waste debris from unauthorized areas because wildlife can be harmed from the debris, potential damage can occur to field equipment used at the site, or persons using the training facility could be injured.

4.0 SOIL DESCRIPTIONS

Soil profile descriptions provide information about characteristics such as texture, depth, permeability, and insight to such features as density and chemistry that are important to understanding how the soil can be managed. Typical of many of the soils in central Kansas, the soils at the KSTC were formed in deep loess, weathered sandstone, and weathered sandy shale. The topography of the KSTC is variable with gently rolling upland areas and nearly level lowland areas. The soils characterized by the different soil series at the facility are very similar in description and nature. As a result, management of the soils will tend to be somewhat similar across the entire site with exceptions being in drainages where slope may be greater, or in low-lying areas that may tend to be wetter.

The soil descriptions below are from the USDA Natural Resources Conservation Service (NRCS), and provide a general description of soils expected at the KSTC. The NRCS soil descriptions, however, are from sites not at the KSTC. The descriptions presented in this plan are the NRCS soil profile descriptions for each respective series, but modified for conditions at the KSTC, and soil conditions observed onsite in 2014 by Ted Hartsig, a professional soil scientist. The major soil types identified at the KSTC are described in the following pages.

4.1 CRETE-WELLS COMPLEX, 1 TO 3 AND 3 TO 7 PERCENT SLOPES

Soils of the Crete-Wells complex are found on approximately 1,104 acres of the KSTC, or approximately 33 percent of the site (Figure 4-1). This combined soil series is the most common soil type at the KSTC. These soils are typically deep and moderately sloping on ridge tops with slow permeability and high available water capacity. In these areas, the Crete and Wells soil series are impractical to separate due to the scale of the map and multiple, small patches or areas of the two soils within a mapping unit. The Crete-Wells complex is comprised of approximately 45 percent Crete silt loam and 40 percent Wells loam. Individual soil properties for the Crete and Wells series are maintained in the complex and are described individually on the following pages under Crete silt loam, 3 to 7 percent slopes; and Wells loam, 3 to 7 percent slopes.

Generally, the typical land use at the KSTC for Crete-Wells complex is pasture, with most of the area being well drained because of slopes. Good grass growth and other forbaceous and woody species are common in soils mapped in this complex, and as a result, good soil properties are formed. Management considerations of the soils in the Crete-Wells complex include:

1. Slowly permeable soils that can result in increased runoff after burning or when tilled and vegetative cover is removed
2. High potential for erosion if soils are bare
3. Opportunities for very good vegetative growth if soil quality is maintained

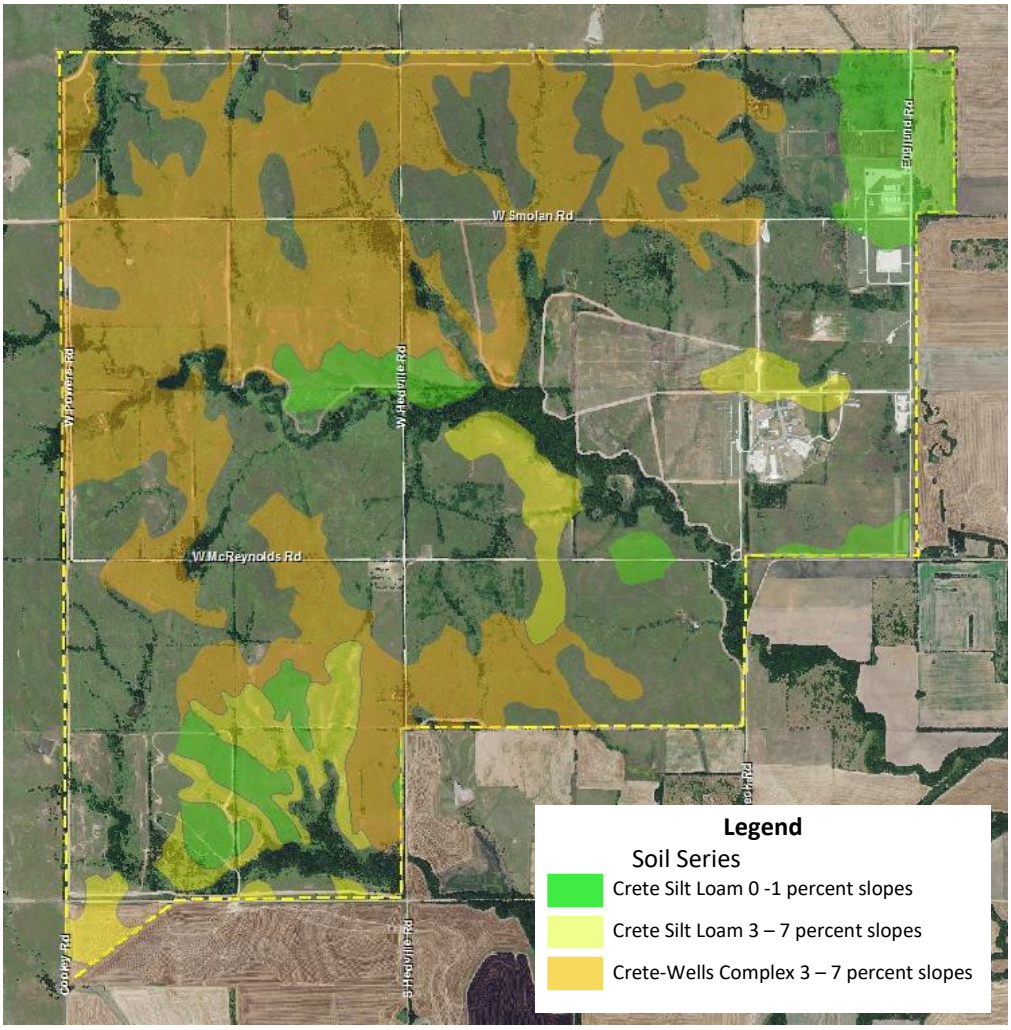

Figure 4-1: Crete-Wells Complex and Crete Silt Loam Series

CRETE SILT LOAM, 3 TO 7 PERCENT SLOPES

The Crete silt loam on 3 to 7 percent slopes, where it is mapped separate from the Crete-Wells complex, is found on 218 acres at the KSTC, or approximately 6 percent of the site. These soils are deep, very gently sloping, moderately well-drained soils formed in loess. With good growth of native and introduced (bromes) grasses, initial infiltration should be good; however, permeability is slow in the subsoil and moderate or moderately slow in the substratum. The depth to free carbonates (high calcium content from limestone parent materials) ranges from 25 to 40 inches.

A Horizon – 0 to 10 inches: Grayish brown silt loam with medium granular structure that is friable with many fine roots. This horizon is medium acidic.

BA Horizon – 10 to 16 inches: Grayish brown silty clay loam with weak medium subangular blocky structure that is hard, yet friable, and has a few fine roots. This horizon is slightly acidic.

Bt1 Horizon – 16 to 32 inches: Brown silty clay with moderate medium prismatic structure grading to moderate medium blocky structure that is very hard. A distinct clay film is common on faces of peds and in root channels. This horizon is mildly alkaline.

Bt2 Horizon – 32 to 44 inches: Pale brown silty clay with moderate medium prismatic structure that is very hard. A distinct clay film is common on faces of peds and in root channels. This horizon is mildly alkaline.

BC Horizon – 44 to 50 inches: Pale brown silty clay loam with weak medium prismatic structure grading to weak medium subangular blocky structure that is hard and slightly effervescent. This horizon is moderately alkaline.

C Horizon – 50 to 60 inches: Light yellowish brown silt loam with massive structure that is friable. This horizon has slight effervescence and is moderately alkaline.

The typical land use in areas covered with Crete silt loam at the KSTC is pasture and native vegetation, with some sparse woodland. Like soils of the Crete-Wells complex, management considerations of the soils in the Crete Silt Loam series include:

1. Slowly permeable soils that can result in increased runoff after burning or when tilled
2. High potential for erosion on soils devoid of vegetation
3. Opportunities for very good vegetative growth if soil quality is maintained

Summary of Properties
Crete Silt Loam, 3 to 7 percent slopes

Drainage	Slope	Landscape	Parent	Permeability	Flooding	Hydric
Moderately well drained	3-7%	Hillslopes	Loess	Slow	None	No

CRETE SILT LOAM, 0 TO 1 PERCENT SLOPES

Crete silt loam on 0 to 1 percent slopes is found on approximately 258 acres of the KSTC, or approximately 8 percent of the site, as shown in Figure 4-1. The soil of this series is deep on nearly level to gently undulating landforms that is moderately well drained. Crete silt loam formed in loess. Typically, where native and pasture vegetation is maintained, initial infiltration of rainwater is rapid, but permeability is slow in the subsoil and moderate or moderately slow in the substratum. Where vegetation has been converted to turf grass or similar, infiltration is slower and the chance for increased runoff is higher. The depth to free carbonates ranges from 25 to 40 inches. A description of the Crete silt loam at the KSTC follows:

A Horizon – 0 to 10 inches: Grayish brown silt loam with strong medium granular structure that is hard and friable with many fine roots. This horizon is medium acidic.

BA Horizon – 10 to 16 inches: Grayish brown silty clay loam with medium subangular blocky structure that is friable and has a few fine roots. This horizon is slightly acidic.

Bt1 Horizon – 16 to 32 inches: Brown silty clay with moderate medium prismatic structure grading to moderate medium blocky structure that is very hard. A distinct clay film is common on faces of peds and in root channels. This horizon is mildly alkaline. The term "Bt" is an indication that the color of this horizon is lighter than the A horizon.

Bt2 Horizon – 32 to 44 inches: Pale brown silty clay with moderate medium prismatic structure that is very hard. A distinct clay film is common on faces of peds and in root channels. This horizon is mildly alkaline.

BC Horizon – 44 to 50 inches: Pale brown silty clay loam with weak medium prismatic structure grading to weak medium subangular blocky structure that is hard and slightly effervescent. This horizon is moderately alkaline.

C Horizon – 50 to 60 inches: Light yellowish brown silt loam with massive structure that is friable. This horizon has slight effervescence and is moderately alkaline.

The typical land use at the KSTC for Crete silt loam is pasture, and also includes the training facilities in the northeastern corner of the site. Management considerations of the soils in the Crete silt loam include:

1. Slowly permeable soils that can result in increased runoff after burning or when tilled
2. Potential ponding of water in nearly level areas
3. Opportunities for very good vegetative growth if soil quality is maintained

Summary of Properties
Crete Silt Loam, 0 to 1 percent slopes

Drainage	Slope	Landscape	Parent Material	Permeability	Flooding	Hydric
Moderately well drained	0-1%	Interfluves	Loess	Slow	None	No

4.2 WELLS LOAM, 3 TO 7 PERCENT SLOPES

The Wells loam occupies approximately 222 acres of the KSTC, or approximately 7 percent of the site. This is a deep, well-drained soil formed in material weathered from sandstone in colluvium and in old alluvium. It has a loam surface layer and is moderately permeable. Figure 4-2 shows the locations of Wells loam at the KSTC.

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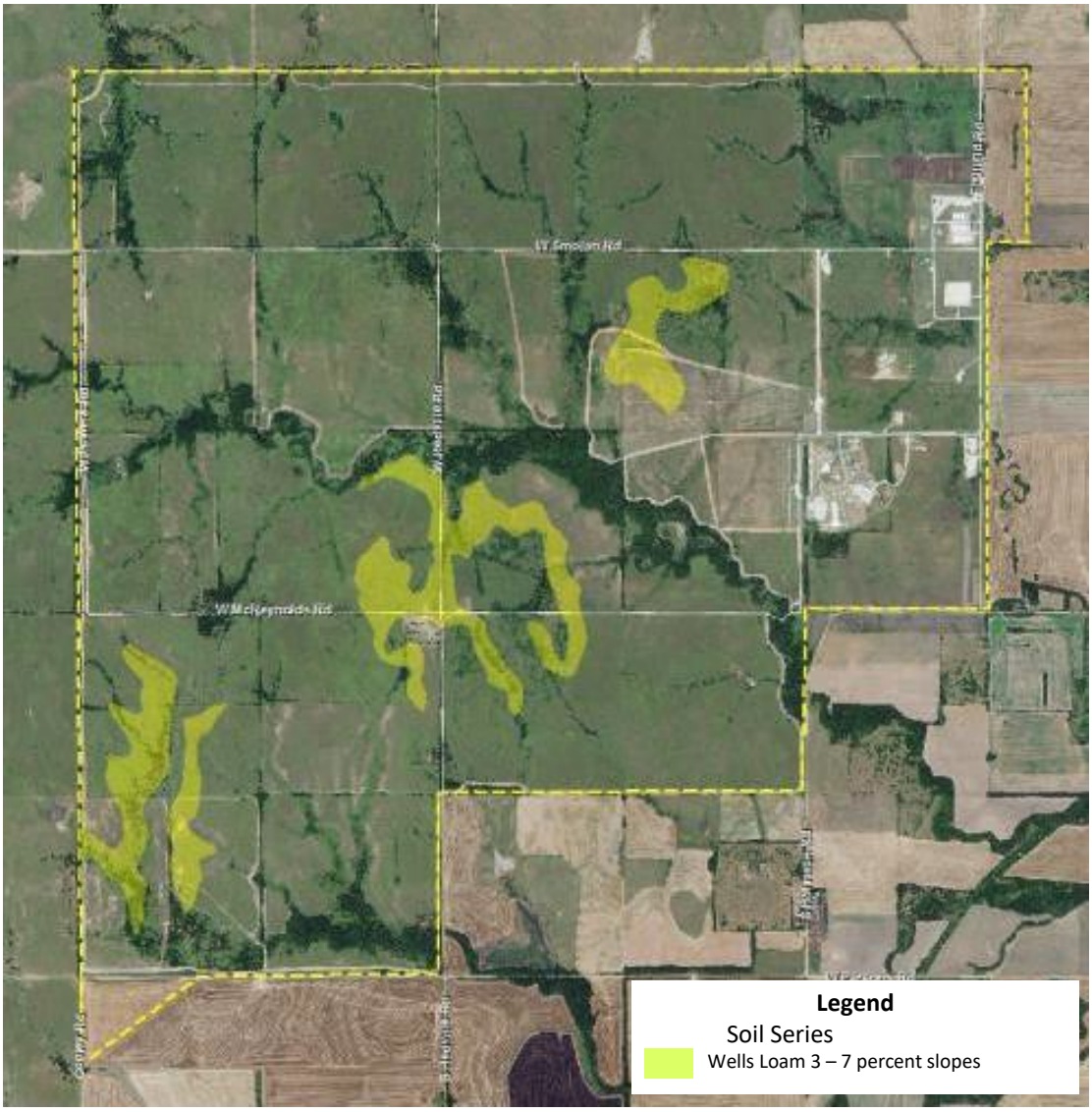

Figure 4-2: Wells Loam 3 – 7 Percent Slopes Series

The typical land use at the KSTC for areas covered with Wells loam is pasture or prairie and includes drainage areas such as streams and tributaries and part of the 50-caliber firing range. A common profile for the Wells loam is:

A Horizon – 0 to 8 inches: Dark grayish brown loam with moderate fine granular structure that is slightly hard and friable. This horizon is medium acidic and has many fine roots.

BA Horizon – 8 to 13 inches: Brown loam with moderate fine subangular blocky structure that is slightly hard, yet friable. This horizon is medium acidic with fine roots.

Bt1 Horizon – 13 to 20 inches: Yellowish red clay loam with moderate fine subangular blocky structure that is hard. The faces of the peds commonly have faint clay films. This horizon is slightly acidic with fine roots.

Bt2 Horizon – 20 to 38 inches: Reddish yellow clay loam with moderate fine and medium blocky structure that is hard. A few of the vertical ped faces have a faint clay film. This horizon is slightly acidic with a few fine roots.

BC Horizon – 38 to 48 inches: Reddish yellow clay loam with moderate fine blocky structure that is hard and friable. This horizon is slightly acidic.

C Horizon – 48 to 60 inches: Reddish yellow loam that has massive structure and is slightly hard and very friable. This horizon is neutral for acidity.

Management considerations of the soils in the Wells loam include:

1. Opportunities for very good vegetative growth if soil quality is maintained
2. High potential for both wind and water erosion if vegetation is removed or soil is bare

Summary of Properties
Wells Loam, 3 to 7 percent slopes

Drainage	Slope	Landscape	Parent	Permeability	Flooding	Hydric
Well drained	3-7%	Hillslopes	Fine loamy residuum	Moderate	None	No

4.3 LANCASTER-HEDVILLE COMPLEX, 3 TO 20 PERCENT SLOPES

Lancaster-Hedville complex is found on approximately 593 acres of the KSTC, or about 18 percent of the site (Figure 4-3). In most locations where this soil complex is found, the soils are moderately steep on side slopes and narrow ridge tops in uplands. The soils typically have slow permeability, low to moderate shrink-swell potential, and high available water capacity. The complex is an area in which separation of the Lancaster and Hedville soil series is impractical due to multiple, small patches or positioning of the two soils within an area.

The soil profiles of these two series are distinctly different, with the Lancaster loam typically exhibiting a moderately deep profile, and the Hedville loam often having a very shallow to shallow profile. Hedville soils may be most likely found and observed at or near the rocky outcrops at the shoulders of slopes. Regionally, this complex of soils is comprised of approximately 45 percent Lancaster loam and 30 percent Hedville loam; however, the distribution of these two soil types is likely very different at the KSTC.

Individual soil properties for Lancaster and Hedville soils series are described in the following paragraphs.

Figure 4-3: Lancaster-Hedville Complex 3 – 7 Percent Slopes

HEDVILLE

The Saline County soil survey describes the Hedville series as a shallow, somewhat excessively drained, and moderately permeable soil on upland locations. The soil is formed in material weathered from noncalcareous sandstone with slopes ranging from 3 to 20 percent. The depth to sandstone ranges from 4 to 20 inches and reaction ranges from medium acidity to neutral through the profile.

A Horizon – 0 to 8 inches: Grayish brown loam that is very dark grayish brown when moist and has a moderate fine granular structure. This horizon is friable with many fine roots and is medium acidic.

Bw Horizon – 8 to 17 inches: Reddish brown gravelly loam with a weak fine subangular blocky structure. Many fine roots exist in this horizon with 30 percent angular sandstone fragments. Also medium acidic.

R Horizon – 17 inches: Brown sandstone.

LANCASTER

The Lancaster soil series is a moderately deep and well-drained soil that is moderately permeable on uplands. Lancaster soils are formed in material weathered from noncalcareous sandstone and sandy shale. Depth to bedrock ranges from 20 to 40 inches, and it is not uncommon to have fragments of sandstone in one or more horizons.

A Horizon – 0 to 9 inches: Dark grayish brown loam with weak medium granular structure that is hard and friable. This horizon is medium acidic and has many fine roots.

BA Horizon – 9 to 16 inches: Brown clay loam with moderate fine subangular blocky structure that is hard and friable. Less than 5 percent of the horizon consists of hard sandstone fragments. This horizon is medium acidic and has a few fine roots.

Bt Horizon – 16 to 24 inches: Brown clay loam with moderate medium subangular blocky structure that is very hard. The faces of the peds and root channels have a slightly darker clay film. The horizon is slightly acidic.

BC Horizon – 24 to 30 inches: Reddish yellow sandy clay loam that is streaked and splotched with colors that are more yellow and grayer than the soil mass and has a few distinct reddish spots. The structure is a weak medium blocky structure that is very hard. The faces of the peds and root channels have a slightly darker clay film. The horizon is slightly acidic and has a few fine roots.

Cr – Horizon 30 inches: Partially weathered sandy shale.

The typical land use of soils in the Lancaster-Hedville complex at the KSTC is native prairie and pasture, with many areas having succeeded to sparse woodland in low-lying areas. Because these soils are typically found on sideslopes and the tops of ridges, and because they tend to be shallow to somewhat shallow, there are several management concerns, including:

1. The shallower Hedville soils may be more fragile and prone to damage from equipment that crosses these areas. Damage may include dislocation and movement of soils and the vegetation supported by them, and some compaction.
2. Native vegetation is best in these areas, in which grasses that can grow on shallow soils and sustain long, dry periods may outperform other species.
3. Erosion may be an issue on areas in which vegetation has been mowed, burned, or otherwise removed.
4. Increased stormwater runoff on steeper slopes may create erosion problems.

Summary of Properties
Lancaster-Hedville Complex, 3 to 20 percent slopes

Drainage	Slope	Landscape	Parent Material	Permeability	Flooding	Hydric
Well drained	3-20%	Hillslopes	Residuum	Moderate	None	No

4.4 LONGFORD SILT LOAM

Longford silt loam is found on approximately 595 acres and located mostly in the eastern portion of the KSTC, or about 18 percent of the site (Figure 4-4). The soil consists of deep, well-drained and permeable soils located on upland landforms. This soil series does not typically flood, and water doesn't normally pond because of its permeability. The Longford series formed in loess and loamy alluvium.

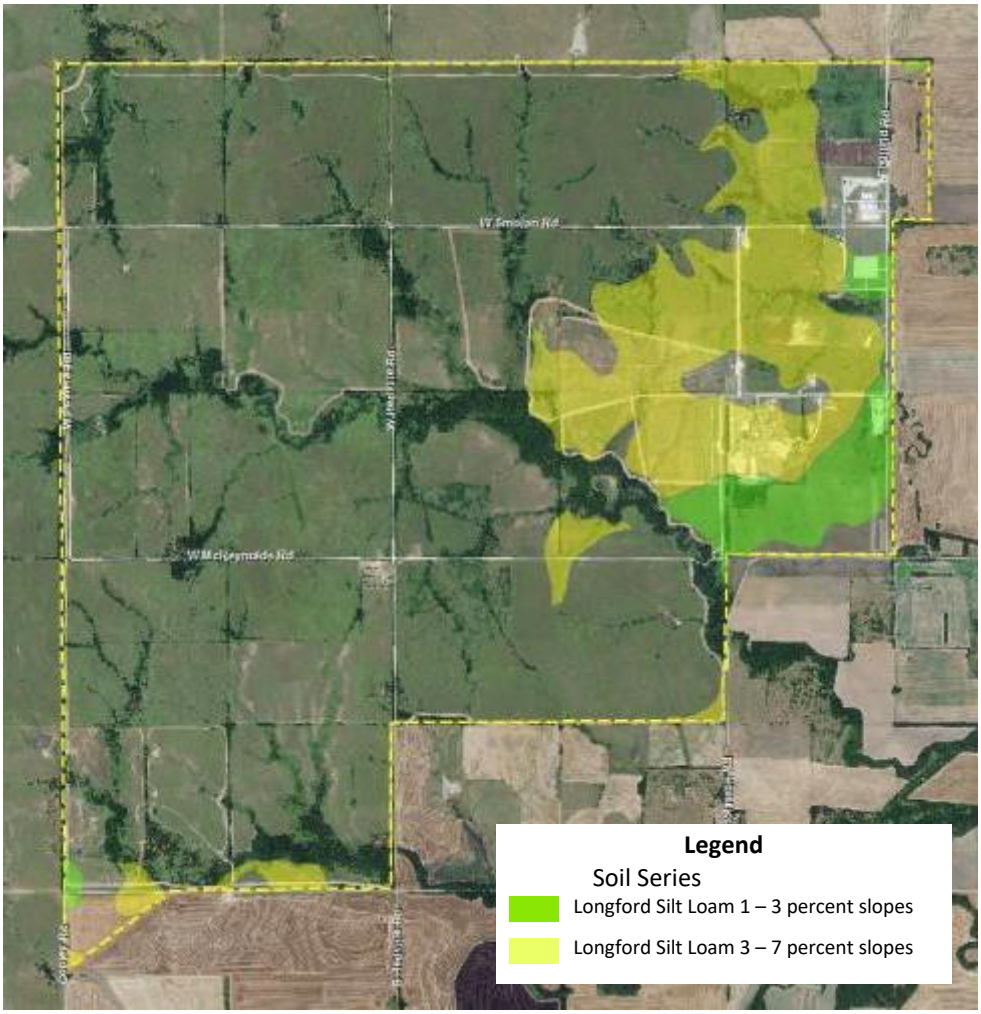

Figure 4-4: Longford Silt Loam Series

A typical soil profile description for the Longford silt loam series is:

A Horizon – 0 to 11 inches: Dark grayish brown silt loam with fine granular structure that is friable, and slightly acidic.

BA Horizon – 11 to 17 inches: Dark silty clay loam with strong fine subangular blocky structure that is hard and slightly acidic.

Bt1 Horizon – 17 to 25 inches: Reddish brown silty clay with strong fine subangular blocky structure grading that is hard. Distinct clay films are present on the faces of peds. This horizon is slightly acidic.

Bt2 Horizon – 25 to 38 inches: Yellowish red silty clay with strong fine and medium subangular blocky structure that is very hard. The horizon has distinct clay films on the faces of peds, a few fine and medium black concretions, and a few fine sandstone pebbles. This horizon is slightly acidic.

BC Horizon – 38 to 45 inches: Reddish yellow silty clay loam with moderate medium subangular blocky structure that is hard and friable. A few faint clay films are present on the faces of the peds, and the horizon is neutral in acidity.

2C Horizon – 45 to 60 inches: Light reddish brown clay loam that is massive, slightly hard, and friable. The horizon is neutral in acidity.

The areas of the KSTC that consist of Longford silt loam are the most intensively used areas of the facility, including land use for firing ranges and weapons training, equipment storage, and administrative and personnel training. Much of the vegetation in these areas is mowed, and many areas are maintained bare for parking of vehicles and for roads. Management concerns on the Longford silt loam include:

1. Potential compaction resulting from heavy land use by vehicles and from personnel
2. Potential heavy metals contamination of soils, resulting from weapons training, and petroleum contamination resulting from storage and operation of equipment
3. Erosion on slopes greater than 2 percent where devoid of vegetation
4. Maintenance of vegetation on compacted or eroded soils

Summary of Properties
Longford Silt Loam

Drainage	Slope	Landscape	Parent Material	Permeability	Flooding	Hydric
Well drained	3-7%	Hillslopes	Loess over residuum	Slow	None	No

4.5 TOBIN SILT LOAM, OCCASIONALLY FLOODED

Tobin silt loam occupies approximately 226 acres of the KSTC, or approximately 7 percent of the site. This is a deep, well-drained soil formed in stratified, silty alluvium. It is a moderately permeable soil on narrow flood plains and along upland drainageways and has a silt loam surface layer. The depth to free carbonates ranges from 15 to 40 inches. Figure 4-5 illustrates the locations of Tobin silt loam at the KSTC.

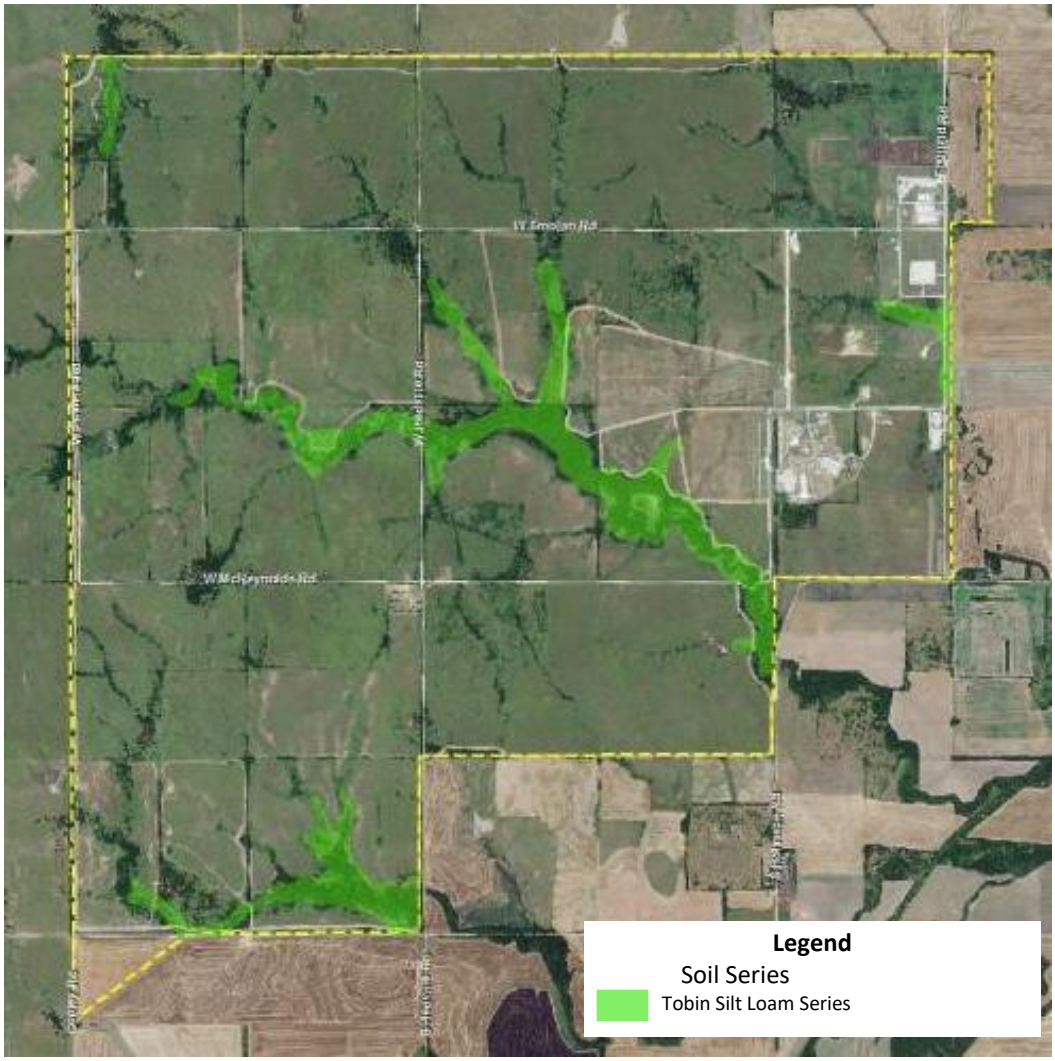

Figure 4-5: Tobin Silt Loam Series

A typical soil profile description for the Tobin silt loam is:

A1 Horizon – 0 to 20 inches: Dark grayish brown silt loam with moderate fine granular structure that is slightly hard and friable. This horizon is slightly acidic and fine roots are common.

A2 Horizon – 20 to 38 inches: Grayish brown silt loam with moderate medium granular structure that is slightly hard and friable. This horizon is slightly acidic and fine roots are common.

C1 Horizon – 38 to 56 inches: Brown silt loam with massive, slightly hard, friable structure and a few fine roots. A few thin strata of darker material are present and the horizon is very slightly effervescent. This horizon is mildly alkaline.

C2 Horizon – 56 to 60 inches: Pale brown silt loam with massive structure that is slightly hard and friable. This horizon has a few thin strata of darker material and a few fine accumulations of lime. The horizon is slightly effervescent and mildly alkaline.

The typical land use on Tobin silt loam is riparian habitat along intermittent drainages, as seen in Figure 2-9. Typically, the drainages in which these soils are situated are well vegetated with woodland and some grasses, although there may be substantial bare soil where the woodland canopy shades the ground. Management considerations for the Tobin silt loam include:

1. High potential for erosion where areas have been cleared of vegetation
2. High potential for compaction, erosion, and vegetation damage if crossed by equipment or personnel when wet

Summary of Properties
Tobin Silt Loam, occasionally flooded

Drainage	Slope	Landscape	Parent Material	Permeability	Flooding	Hydric
Well drained	0-2%	Flood plains	Silty alluvium	Moderate	Occasionally flooded	No

4.6 EDALGO CLAY LOAM, 3 TO 7 PERCENT SLOPES

The Edalgo clay loam is found on 182 acres at the KSTC, or approximately 5 percent of the site, primarily in the southeastern portion of the facility, and along the western boundary. This soil is moderately deep and well drained and is very slowly permeable. The soil was formed in material weathered from noncalcareous shale. The depth to shale bedrock is 20 to 40 inches. Locations of where Edalgo clay loam is found are shown in Figure 4-6. A typical profile description of the Edalgo clay loam is:

A Horizon – 0 to 9 inches: Dark grayish brown clay loam with moderate fine granular structure that is hard and friable. This horizon is medium acidic with fine roots.

Bt1 Horizon – 9 to 13 inches: Brown clay loam with moderate fine subangular blocky structure that is very hard and very firm. Distinct clay films on the faces of the peds are common. There are a few fine sandstone fragments, and the horizon is slightly acidic.

2Bt2 Horizon – 13 to 21 inches: Light brown silty clay with moderate medium subangular blocky structure that is very hard and very firm. Distinct clay films on the faces of the peds are common, and there are a few fine accumulations of carbonate. The horizon is neutral for acidity and there are a few fine roots.

2C Horizon – 21 to 28 inches: Brownish yellow and light gray silty clay with massive structure that is very hard and very firm. There are a few fine accumulations of carbonate and a few fine roots. This horizon is neutral for acidity.

2Cr Horizon – 28 inches: Light gray shale.

Figure 4-6: Edalgo Clay Loam Series

Typical land use where the Edalgo clay loam is found is pasture or native grassland, as well as fire breaks along the western boundary of the property. Because of its clayey nature and slow infiltration, it is expected that stormwater runoff will be high on these soils where vegetation is not present or is sparse, such as in fire breaks. Management concerns on the Edalgo clay loam include:

1. Increased potential for erosion, particularly in firebreaks, or where vegetation has been removed.
2. Clay loam is highly compactable; therefore, compaction is a potential problem where heavy equipment has been used and vegetation is sparse.

Summary of Properties - Edalgo Clay Loam, 3 to 7 percent slopes

Drainage	Slope	Landscape	Parent Material	Permeability	Flooding	Hydric
Well drained	3-7%	Hillslopes	Residuum	Very slow	None	No

4.7 SUMMARY OF SOIL TYPES

The major soil types at the KSTC are closely associated in proximity to each other. Differences lie in the depths of the soils, textural differences related to clay content, and structure. These basic properties of are summarized in Table 4-1.

TABLE 4-1: SUMMARY OF SOIL PROPERTIES
KANSAS TRAINING CENTER

Soil Series	Drainage	Slope	Landscape	Parent	Permeability	Flooding	Hydric
Crete-Wells complex	Moderately well drained	3-7%	Hillslopes	Loess	Slow/moderate	None	No
Crete silt loam	Moderately well drained	0-1%	Interfluves	Loess	Slow	None	No
Crete silt loam	Moderately well drained	3-7%	Hillslopes	Loess	Slow	None	No
Wells loam	Well drained	3-7%	Hillslopes	Fine-loamy residuum	Moderate	None	No
Lancaster-Hedville complex	Well drained	3-20%	Hillslopes	Residuum	Moderate	None	No
Longford silt loam	Well drained	1-3%, 3-7%	Hillslopes	Loess over residuum	Slow	None	No
Tobin silt loam	Well drained	0-2%	Flood plains	Silty alluvium	Moderate	Occasionally flooded	No
Edalgo clay loam	Well drained	3-7%	Hillslopes	Residuum	Very slow	None	No

4.8 DEVIATIONS FROM USDA SOIL DESCRIPTION

The USDA NRCS soil surveys are excellent sources of information about soil series and associations in each county. The information by necessity is general and mapped on a large scale, and can be either confirmed or updated with site-specific information regarding soil characteristics for a particular location within the KSTC. Olsson Associates conducted a site survey to assess soil conditions at the KSTC, including observations of land forms, surface soil characteristics, and land use changes from which to provide as accurate information as possible.

The nature of land use at the KSTC has in most instances resulted in different soil conditions or horizon descriptions than those that are provided in the USDA soil survey information, those being more mature, well developed horizons. Many of the USDA descriptions are for soils that have been cultivated for many years, whereas those at the KSTC have been in grassland for an extended period.

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Appendix H
Annual Review Reports