Integrated Natural Resources Management Plan Update

Camp Edwards Training Site
Cape Cod, Massachusetts

Final

December 2020

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Final
Integrated Natural Resources Management Plan Update
Camp Edwards Training Site
Cape Cod, Massachusetts

Prepared for

Massachusetts Army National Guard
Camp Edwards Training Site
Natural Resources Office
3468 Beaman Street
Camp Edwards, Massachusetts 02542

DECEMBER 2020

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SIGNATURE PAGE
CAMP EDWARDS TRAINING SITE
CAPE COD, MASSACHUSETTS

This Integrated Natural Resources Management Plan (INRMP), dated December 2020, was developed for the Camp Edwards Training Site (Camp Edwards) in accordance with the Sikes Act, as amended (16 U.S. Code §670a et seq.); Army Regulation 200-1 – *Environmental Protection and Enhancement*; Department of Defense Instruction 4715.03, *Natural Resources Conservation Program*; and Department of Defense Manual 4715.03, *Integrated Natural Resources Management Plan Implementation Manual* and in cooperation with the U.S. Fish and Wildlife Service and Massachusetts Division of Fisheries and Wildlife. The management of natural resources in this INRMP reflects the mutual agreement of all parties.

Approving Officials:

Major General Gary W. Keefe, Adjutant General
Massachusetts National Guard

1/14/2021
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08 February 2021
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1. EXECUTIVE SUMMARY

The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act, as amended (16 U.S. Code [U.S.C.] §670a et seq.), to develop and implement an Integrated Natural Resources Management Plan (INRMP) for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing natural communities and natural resources to support and be consistent with the military mission while protecting and enhancing those natural communities and resources for multiple use, sustainable yield, and biological integrity.

Camp Edwards is a 14,433-acre MAARNG training site located in southeastern Massachusetts approximately 50 miles southeast of Boston, at the base of Cape Cod (i.e., Barnstable County). The Commonwealth of Massachusetts owns the land comprising Camp Edwards and leases the property to the Department of the Army, who in turn leases the land to MAARNG for soldier training. Most of the land was designated as the Upper Cape Water Supply Reserve through Chapter 47 of the Acts of 2002 (Massachusetts General Law). This designation also transferred care, custody, and control of the land—subject to the existing lease—to the Massachusetts Division of Fisheries and Wildlife (MassWildlife). The land use of Camp Edwards consists of military training activities, including assembly, tactical maneuvering, tactical bivouacking, small arms range firing, engineering, ammunition storage, support, maintenance and aviation facilities, and environmental management, as well as being designated the Upper Cape Water Supply Reserve, a drinking water recharge area. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the land and resources of Camp Edwards must be properly managed to minimize negative impacts from use, to preserve sensitive habitats and rare species, and to promote the sustainment of native natural communities.

This INRMP is a practical guide for the management and stewardship of natural resources present at Camp Edwards, while ensuring the successful accomplishment of the military mission. The INRMP was developed using an interdisciplinary approach in which information was gathered from a variety of organizations, and federal and state agencies that have an interest in Camp Edwards and the management of its resources. Representatives from the U.S. Fish and Wildlife Service (USFWS) and MassWildlife participated in the update of the Camp Edwards INRMP. Participation in meetings and review of the INRMP by USFWS and MassWildlife satisfied the provisions of the Sikes Act (16 U.S.C. §670a et seq.). The Sikes Act requires the preparation of an INRMP in cooperation with USFWS and the appropriate state fish and wildlife agency (i.e., MassWildlife). In addition, it is required that the resulting plan reflect the mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources.

The Camp Edwards INRMP supports and guides the Massachusetts National Guard's (MANG) Final Environmental Impact Report (2001). The Environmental Performance Standards (EPS) listed in the MANG's Area Wide Final Environmental Impact Report and as required by Massachusetts General Law Chapter 47, Acts of 2002, serve as the guide by which MAARNG training and natural resources management is conducted on Camp Edwards. These EPS are continuously incorporated with federal environmental and land management programs specified by military regulation and federal law. The INRMP, to the extent appropriate and applicable, integrates and aids in achieving the standards set forth within the EPS. For a complete description of the EPS, please refer to the MANG's Area Wide Final Environmental Impact

Report (2001). Also, the INRMP integrates current environmental management practices incorporated in the Camp Edwards Regulations 385-63 (Range Safety) and MAARNG's Natural Resources (NR) and Integrated Training Area Management (ITAM) Programs. In addition, the Environmental Readiness Center was formed to help guide and implement the aforementioned documents, laws, regulations, standards, and programs.

This INRMP provides Camp Edwards with a description of the installation and its surrounding environment, and presents various management practices designed to mitigate negative impacts and enhance the positive effects of the installation's mission on regional ecosystems. Throughout the development of this INRMP, management issues were identified in a number of natural resources subject areas. One of the purposes of this INRMP is to identify goals and objectives for the installation and to obtain workable and useful solutions for each topic of concern.

Chapters 2 and 3 of this INRMP provide general information on authority and purpose of the INRMP, and Appendix C on the Camp Edwards mission and surrounding region. Appendix E provides an overview of the physical resources of Camp Edwards, while Appendix F covers the ecosystems and biotic environment of Camp Edwards. The topics of concern involving natural resource constraints to planning and mission operations are presented in Appendix G. Appendix D provides the projects related to the management goals and objectives developed for natural resource management at Camp Edwards. These goals and objectives are detailed in Appendices H through U. Each of the management strategies described in this INRMP should be monitored so that modifications can be made as conditions change during implementation.

By protecting a variety of habitats that support the greatest variety of life and its processes, this INRMP will help perpetuate the form and function of native communities, thus enhancing the long-term viability of Camp Edwards and ensuring its sustainability for military operations. The INRMP presents practicable alternatives that seek to both promote the mission at Camp Edwards while providing for management and stewardship of natural resources that would conserve and enhance existing ecosystems on the installation.

Based on the guidance provided in the March 2019 *Army National Guard (ARNG) Installations and Environment (I&E) Directorate Policy for Integrated Natural Resource Management Plans (INRMP)*, this INRMP provides the purpose and scope, authority and relevant laws, and information on funding and roles and responsibility in the text. The bulk of the information on INRMP goals and project descriptions, a summary of natural resources at the installations, and additional relevant information is presented in the appendices.

The appendices provide updated and/or expanded information on MAARNG resources that became available since the last INRMP was prepared. Appendix A of this INRMP provides the references for the document, while Appendix B provides a list of acronyms and abbreviations. The following appendices present resource information pertinent to this INRMP:

- Appendix C: Installation Overviews
- Appendix D: Project Implementation Table and Annual Work Plans
- Appendix E: Physical Environment
- Appendix F: Ecosystems and the Biotic Environment

- Appendix G: Mission Impacts on Natural Resources
- Appendix H: Natural Resources Program Management
- Appendix I: Fish and Wildlife Management
- Appendix J: Outdoor Recreation and Public Access to Natural Resources
- Appendix K: Management of Threatened and Endangered Species and Habitats
- Appendix L: Water Resource Protection
- Appendix M: Wetland Protection
- Appendix N: Grounds Maintenance
- Appendix O: Forest Management
- Appendix P: Wildland Fire Management
- Appendix Q: Integrated Pest Management Program
- Appendix R: Cultural Resources Protection
- Appendix S: Public Outreach
- Appendix T: Geographic Information Systems
- Appendix U: Climate Change
- Appendix V: Agency Consultation
- Appendix W: Annual Reviews

The following subject areas are not applicable at Camp Edwards and are not analyzed in this INRMP: Conservation Law Enforcement, Agricultural Outleasing, Coastal and Marine Resource Management, and Bird and Aircraft Strike Hazard. In the cases of Conservation Law Enforcement and Bird and Aircraft Strike Hazard, MAARNG will continue to act in accordance with the agencies regulating these practices. The INRMP presents practicable alternatives and recommendations that seek to both promote the mission at these installations while providing for management and stewardship of natural resources that would conserve and enhance existing ecosystems on the installations.

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2. GENERAL INFORMATION

2.1 PURPOSE AND SCOPE

This INRMP has been developed for use by Camp Edwards Training Site (Camp Edwards) and MAARNG in accordance with Army Regulation (AR) 200-1 – *Environmental Protection and Enhancement*, Department of Defense (DoD) Manual (DoDM) 4715.03 – *Integrated Natural Resources Management Plan Implementation Manual*, and DoD Instruction (DoDI) 4715.03 – *Natural Resources Conservation Program*, and the *Army National Guard (ARNG) Installations and Environment (I&E) Directorate Policy for Integrated Natural Resource Management Plans (INRMP)* and the provisions of the Sikes Act, as amended (16 U.S.C. §670a et seq.). The original INRMP for Camp Edwards was developed in 2001, and the last INRMP Update was completed in 2007, with final signature in 2009.

This INRMP Update provides Camp Edwards 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 on natural resources as a result of mission activities. Furthermore, the INRMP outlines various management practice alternatives in compliance with federal, state, and local standards designed to mitigate negative impacts and enhance the positive effects of the installation's mission on local ecosystems.

This INRMP integrates all aspects of natural resource management with the rest of the installation's mission and, therefore, becomes the primary tool for managing the installation's ecosystems while ensuring the successful accomplishments of the military mission at the highest possible levels of efficiency. The INRMP is a guide for the management and stewardship of natural resources present on the installation and enhancement of biodiversity. A multiple-use approach will be implemented to allow for the presence of mission-oriented activities, as well as environmental quality through informed management of natural resources.

Specific management practices identified in this INRMP have been developed to enhance and maintain biological diversity within the installation. Specifically, management practices should:

- Minimize habitat fragmentation and promote the natural pattern and connectivity of habitats
- Protect native species and discourage non-native, invasive species
- Protect and promote rare and ecologically important habitats
- Protect unique sensitive environments
- Maintain or mimic natural processes, including fire
- Protect genetic diversity
- Restore species, communities, and ecosystems

- Monitor impacts on biodiversity.

The Camp Edwards natural resources staff plan to monitor each of the management strategies described in the plan so that modifications can be made during implementation if conditions change. In addition, these management strategies will be addressed during the annual INRMP reviews with internal stakeholders and attending signatory agencies to ensure that management practices are addressing current needs and providing appropriate conservation of natural resources.

Appendix A of this INRMP provides the references for the document, while Appendix B provides a list of acronyms and abbreviations.

2.2 MANAGEMENT PHILOSOPHY

Conservation is an integration or blending of natural resources management and preservation designed to maintain ecosystem integrity. This INRMP provides conservation measures and is a dynamic document that will be maintained and adapted, as necessary, to reflect updated natural resources information. The development and implementation of this INRMP indicate Camp Edwards's commitment to natural resources. The goal of ecosystem management on military training lands is to ensure that military lands support present and future training requirements while, as much as possible, preserving, improving, and enhancing an ecosystem's characteristics and communities of which it is comprised. Over the long term, that approach will maintain and improve the sustainability and biological function of ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations (DoDI 4715.03). The INRMP presents practicable alternatives to allow for the protection and enhancement of natural resources and conservation of existing ecosystems, while minimizing impacts and allowing for an enhanced training environment as part of the installation's mission.

This INRMP was developed using an interdisciplinary approach and with information gathered from a variety of organizations. Information and guidance were also solicited from a variety of federal and state agencies. Involvement with stakeholders and signatory natural resource agencies (USFWS and MassWildlife) ensured that information concerning the natural resources on or in the vicinity of the installation was accurate and presented local and regional management strategies. As a result, the probable effects of installation operations on the surrounding natural and cultural resources will be projected. This approach also allowed for insight into possible operational alternatives, which could result in reduced impacts on natural resources on the installation and in surrounding areas. Participation in the INRMP Update process by representatives from USFWS and MassWildlife satisfies the provisions of the Sikes Act (16 U.S.C. §670a et seq.). The Sikes Act requires the preparation of an INRMP in cooperation with USFWS and the appropriate state fish and wildlife agency (MassWildlife). In addition, it is required that the resulting plan reflects the mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources. Appendix C includes consultation with USFWS and MassWildlife and the meeting notes from stakeholder meetings.

2.3 AUTHORITY

This INRMP is developed under, and proposes actions in accordance with, the applicable DoD and Army National Guard (ARNG) and National Guard Bureau (NGB) policies, directives, and instructions. AR 200-1 – *Environmental Protection and Enhancement* and *Army National Guard (ARNG) Installations and Environment (I&E) Directorate Policy for Integrated Natural Resource Management Plans (INRMP)* provide the necessary direction for preparing an INRMP. Issues are addressed in this plan using guidance provided under legislation, Executive Orders (EOs), Directives, and Instructions that include DoDM 4715.03 – *Integrated Natural Resources Management Plan Implementation Manual*, and DoDI 4715.03– *Natural Resources Conservation Program*, and the provisions of the Sikes Act, as amended (16 U.S.C. §670a et seq.). DoDI 4715.03 provides direction for DoD installations in establishing procedures for an integrated program for multiple-use management of natural resources (including biological and earth resources) on property and lands managed or controlled by DoD. DoDM 4715.03 provides the procedures to prepare, review, update, and implement INRMPs in compliance with the Sikes Act.

2.4 INTEGRATION WITH OTHER PLANS

This INRMP is intended to be compatible with other Camp Edwards Training Site planning documents. In preparing this document, other plans consulted are listed below. These documents can be found either as appendices to this INRMP or as Component Plans that are standalone documents that can be provided upon request. All Component Plans listed below are either undergoing update/revision or are past due for such and are scheduled for update within the next 1 to 2 years.

- ***Integrated Fire Management Plan***—This plan provides a summary of the wildland fire program, including fire management strategies, program components, training, techniques, public affairs and agency cooperation, and responsibilities of MAARNG in fire management at Camp Edwards (Component Plan A).

- ***Integrated Pest Management (IPM) Plan***—This plan describes how Camp Edwards will comply with the requirements of DoDI 4150.07, *DoD Pest Management Program*, and provides guidance for operating and maintaining an effective IPM program at Camp Edwards. The plan also identifies and implements strategies for managing specific pests at the installation and implements the use of both chemical and non-chemical control techniques (Component Plan B).

- ***Integrated Cultural Resources Management Plan (ICRMP)***—This plan identifies compliance actions to be followed by MAARNG in accordance with all applicable federal laws and regulations pertaining to cultural resource management. In addition, the plan provides a reference for the Natural Resources Program and other personnel concerning cultural resource management issues that may arise (Component Plan C).

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3. INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN IMPLEMENTATION

3.1 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN IMPLEMENTATION

3.1.1 Implementation

The INRMP Program has been organized to ensure the implementation of year-round, cost-effective management activities and projects that meet the requirements of the installation. The various organizations on the installation that are responsible for implementation of the INRMP are described below.

Installation Stakeholders—The development and implementation of the INRMP requires the cooperation and participation of the MAARNG Training Site Commander; the Construction and Facilities Management Officer; the Plans, Operations, and Training Officer; and Camp Edwards Range Control. The Construction and Facilities Management Officer provides a full range of financial, engineering, and environmental services for all facilities, including Camp Edwards, under the jurisdiction of the state Military Division. Specific responsibilities include: (1) procurement and contracting, (2) warehousing, (3) master planning, (4) construction, and (5) environmental funding. In addition, all Commanders, trainers, and soldiers must abide by the management guidelines detailed in this document for successful implementation of the INRMP.

The Camp Edwards Operations and Training Office is primarily responsible for the scheduling of military training and for the safety of all personnel while training exercises are conducted. In addition, personnel are in charge of maintaining an adequate training environment, which is accomplished through monitoring usage and enforcement of natural resource and land management regulations. The Camp Edwards Natural Resource Office is responsible for coordinating activities that affect the installation's natural resources. This involves, but is not limited to, preparing plans, developing projects, conducting field studies, securing permits, providing geographic information system (GIS) support and analysis, preparing reports, and facilitating cooperation between military operations and other natural resource agencies at the local, state, and federal levels. The responsibility of the Facility Engineers Office on Camp Edwards is to develop and maintain training site land and facilities. This office supports the Camp Edwards Natural Resource Office by providing equipment and personnel to aid in conducting natural resource and remediation projects.

Implementing the Camp Edwards INRMP is ultimately the responsibility of the Adjutant General of the MAARNG, and the day-to-day coordination and implementation of the management proposed in the INRMP will be the responsibility of the Camp Edwards Natural Resource Office. The NGB is responsible for providing Army funds for natural resources management as programmed and budgeted by MAARNG and submitted to the NGB for funding by the MAARNG.

External Stakeholders—Implementation of the INRMP also requires coordination with external stakeholders, including the signatory agencies USFWS and MassWildlife. An annual meeting to review the INRMP with these partners is required annually under the Sikes Act. Other federal

agencies that might have an interest in the management of natural resources on Camp Edwards include agencies located on Joint Base Cape Cod (JBCC), such as the U.S. Coast Guard, U.S. Air Force, MAARNG, and the Department of Veterans Affairs. Other interested federal agencies include the U.S. Army Corps of Engineers (USACE), the Natural Resources Conservation Service, the U.S. Environmental Protection Agency, and the National Park Service. State agency stakeholders include Natural Heritage and Endangered Species Program (NHESP), Massachusetts Department of Conservation and Recreation, and the Massachusetts Department of Environmental Protection. As directed under the Executive Office of Environmental Affairs of the Commonwealth of Massachusetts, several environmental agencies have been asked to provide assistance in developing and implementing the INRMP, including the Environmental Management Commission (EMC), as required by Chapter 47, the Acts of 2002. The Environmental Officer for JBCC should be included in the INRMP update process and implementation. The Science Advisory Council and Community Advisory Council assist the EMC, providing advice on issues related to the protection of the water supply and wildlife habitat within the Camp Edwards Training Area and the Upper Cape Water Supply Reserve, and are external stakeholders with an interest in the Camp Edwards INRMP.

The Wampanoag Tribe of Gay Head (Aquinnah) and the Wampanoag Tribe of Mashpee are federally recognized tribes of Native Americans that consider Camp Edwards to be within their ancestral lands. All actions, including those associated with the implementation of the INRMP, that have the potential for impacting tribal cultural resources must be reviewed by the tribe under the Section 106 process of the National Historic Preservation Act. Failure to consult with the Wampanoag Tribe prior to a federal undertaking could result in a foreclosure of the activity to prevent any potential impacts to cultural resources, including natural resources of cultural significance.

3.1.2 Natural Resources Management Staffing

Nightjar Surveys

The Camp Edwards Natural Resource Office requires a staff of six full-time and seven part-time personnel to conduct the ITAM Program and manage the natural resources on Camp Edwards. The present full-time staffing of the office includes a Natural Resources Manager, Conservation Biologist, GIS Manager, and GIS Technician. Funding has been requested to add a full-time wetlands biologist as well as a full-time fire manager to the personnel in the Natural Resources Office. Natural resources staff also include seasonal and part-time personnel, who serve as field crew members. The responsibilities of the field crew typically include conducting annual Range and Training Land Assessment surveys, collecting field data for research projects (e.g., whip-poor-will and New England cottontail), and assisting with Land Rehabilitation and Maintenance projects. The Camp Edwards Facilities Engineers Roads and Grounds Crew is comprised of three individuals who are responsible for maintaining all the roads and grounds of Camp Edwards.

In order to supplement staffing to accomplish the implementation of the INRMP and management of natural resources, additional external resources may be used to support the Natural Resources Office. These include:

- Federal agencies (for example, USFWS, Natural Resources Conservation Service)
- State agencies
- Troop labor
- Local and regional Universities (e.g., University of Massachusetts at Amherst)
- Conservation groups and nonprofits (e.g., The Nature Conservancy, Audubon Society, and sportsmen's clubs)
- Contractors.

Universities have served as past cooperators for natural resources management, including burn program and planning, GIS data collection, and biological research. Contractors have been and will continue to be employed for large-scale environmental rehabilitation and remediation projects that exceed in-house asset capability.

Implementation of several projects discussed in this INRMP will require active outside assistance. The outside assistance could 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 the Memorandum of Understanding and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements. The level of additional resources necessary to fully implement this INRMP should be assessed during the INRMP annual review process to determine the extent to which outside assistance will be required.

3.1.3 Monitoring Integrated Natural Resources Management Plan Implementation

A variety of metrics will be used to measure the extent of INRMP implementation. In general, the Environmental Manager will be responsible for implementing the goals, objectives, and projects described in this INRMP. The following monitoring criteria have been established for each resource management.

- ***Natural Resources Program Management***—Monitoring criteria will include documented completion of the annual coordination meeting with USFWS and MassWildlife. When the annual INRMP review is conducted, concurrence from the signatory agencies will be obtained, and the INRMP document will be amended accordingly.

- ***Fish and Wildlife Management***—Monitoring criteria will include accessing habitat and wildlife on the installation to ensure healthy populations. This includes monitoring of prescribed burning to understand the health of vegetative communities at Camp Edwards.

- ***Outdoor Recreation and Public Access to Natural Resources***—Monitoring criteria will include the use of recreational resources, including hunting, by civilians and installation personnel, when applicable.

- ***Threatened and Endangered Species and Habitats Management***—Monitoring criteria will include annual updates of the listed rare, threatened, and endangered species or their habitats occurring on the installation. Management actions will be implemented to avoid or minimize impacts to any listed species or habitats.

- ***Water Resource Protection***—Monitoring criteria will include regular monitoring of surface water and groundwater resources on the installation, as well as inspections of stormwater and erosion and sediment control measures to ensure water quality protection.

- ***Wetland Protection***—Monitoring criteria for wetlands will include assessing the occurrence and function of wetlands at Camp Edwards and ensuring that actions that affect wetlands are appropriately mitigated in compliance with regulations.

- ***Grounds Maintenance***—Monitoring criteria will include regular assessment of habitat management to ensure it supports native species. Erosion and sedimentation resulting from bare ground and mission activities will also be monitored to ensure that problems do not occur. Monitoring of road maintenance and conditions will also be completed to ensure that roadway puddles are properly managed based in accordance with the Conservation and Management Plan for clam shrimp and to protect other listed species.

- ***Forest Management***—Monitoring criteria will include regular surveys to determine the health of the forested habitat throughout the installation and to monitor the use of management tools, including prescribed fire and mechanical thinning.

- ***Wildland Fire Management***—Monitoring criteria will include surveys to determine if prescribed burns are an effective measure to manage invasive species and to maintain herbaceous habitat.

- ***Integrated Pest Management***—Monitoring criteria will include ensuring that IPM practices are incorporated into pest management approaches on the installation. After treatment of invasive species and removal of nuisance species, post-monitoring will be implemented to determine the success of the effort. Monitoring will continue of newly introduced invasive species, when applicable.

- ***Public Outreach—***Monitoring criteria will include assessing the overall success of programs offered at the installation.

- ***GIS—***Monitoring will include measuring the effectiveness and accuracy of the spatial natural resources data to ensure that updates are completed as needed.

- ***Climate Change***—Monitoring criteria will include assessing the short-term and long-term impacts of climate change and implementing Best Management Practices to mitigate the effects climate change has on Camp Edwards.

3.2 ANNUAL INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN REVIEW AND COORDINATION REQUIREMENTS

Under the requirements of the Sikes Act, this INRMP must be reviewed internally on an annual basis to assess the management practice alternatives in terms of their appropriateness for current conditions at Camp Edwards. Signatory agencies (USFWS and MassWildlife) must be invited to participate in the annual review, but are not required to attend. Monitoring is a critical component of the INRMP implementation. Personnel from the Natural Resource Office on Camp Edwards should also meet semi-annually with trainers and commanders from the Camp Edwards Training Site, the EMC, as well as with representatives from the Massachusetts NHESP, to discuss the effectiveness of INRMP implementation. Meetings should be held at least once annually to discuss management projects that will be or were carried out, respectively.

3.3 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN UPDATE AND REVISION PROCESS

The INRMP will be reviewed for operation and effect at a minimum every 5 years. At that time, all signatories will decide whether to re-sign the INRMP as is, update the INRMP, or revise the INRMP.

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APPENDICES

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APPENDIX A – REFERENCES

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APPENDIX B – ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
ACEC	Area of Critical Environmental Concern
ACS	Agassiz clam shrimp
AR	Army Regulation
ARNG	Army National Guard
BEOD	Bournedale Environmental Overlay District
BMP	Best Management Practice
CC	Climate Change
CFMO	Construction and Facilities Management Office
CFR	Code of Federal Regulations
CMP	Conservation and Management Permit
CMR	Code of Massachusetts Regulations
CWA	Clean Water Act
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoDM	Department of Defense Manual
EMC	Environmental Management Commission
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPS	Environmental Performance Standards
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FM	Forest and Grassland Management
FWM	Fish and Wildlife Management
FY	Fiscal Year
GIS	Geographic information systems
GM	Grounds Maintenance
HQAES	Headquarters for Army Environmental System
IAGWSP	Impact Area Groundwater Study Program
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IPM	Integrated Pest Management
IRP	Installation Restoration Program
ITAM	Integrated Training Area Management
IWFMP	Integrated Wildland Fire Management Plan
JBCC	Joint Base Cape Cod
LRAM	Land Rehabilitation and Maintenance
MAARNG	Massachusetts Army National Guard
MANG	Massachusetts National Guard

MassDEP	Massachusetts Department of Environmental Protection
MassWildlife	Massachusetts Division of Fish and Wildlife
MESA	Massachusetts Endangered Species Act
NGB	National Guard Bureau
NHESP	Natural Heritage and Endangered Species Program
NR	Natural Resources
OR	Outdoor Recreation and Public Access to Natural Resources
PO	Public Outreach
REC	Record of Environmental Consideration
RTLA	Range and Training Land Assessment
SRA	Sustainable Range Awareness
STEP	Status Tool for Environmental Programs
TE	Threatened and Endangered Species and Habitats
TRI	Training Requirements Integration
USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WFM	Wildland Fire Management
WMA	Wildlife Management Area
WP	Wetland Protection
WPA	Wetlands Protection Act
WRP	Water Resources Protection

APPENDIX C – INSTALLATION OVERVIEW

1.1 LOCATION AND AREA

The Camp Edwards Training Site (41° 42’ 30” N, 70° 32’ 30” W) is located in southeastern Massachusetts approximately 50 miles southeast of Boston, at the base of Cape Cod (i.e., Barnstable County) (Figure C-1). Camp Edwards lies within the towns of Sandwich and Bourne. U.S. Route 6 and State Routes 28 and 130 border Camp Edwards to the north, west, and east, respectively. Camp Edwards comprises approximately 70 percent of Joint Base Cape Cod (JBCC) of which the southern portion is occupied by the Veterans Administration Cemetery and land leased to the U.S. Coast Guard and to the U.S. Air Force.

The Camp Edwards Training Site is 14,433 acres in size and comprises the majority of JBCC, which covers nearly 21,000 acres (Figure C-2). Within the JBCC are five uniformed service commands including: the MAARNG at Camp Edwards; the Massachusetts Air National Guard at Otis Air National Guard Base and the Otis Air National Guard Base; the U.S. Air Force; and the U.S. Coast Guard at Air Station Cape Cod. Although the JBCC is situated within four towns—Bourne, Sandwich, Falmouth, and Mashpee—Camp Edwards lies only within the boundaries of Bourne and Sandwich (MAARNG 2019a) (Figure C-3).

The land that currently comprises Camp Edwards is owned by the Commonwealth of Massachusetts (Department of Capital Asset Management and Maintenance), which leases the property to the Department of the Army, who in turn has leased the land to MAARNG for soldier training. The current lease held by the U.S. Army expires in the year 2051. The majority of Camp Edwards (the approximately northern 13,500 acres) was designated as the Upper Cape Water Supply Reserve through Chapter 47 of the Acts of 2002 (Massachusetts General Law). This designation also transferred care, custody, and control of the land—subject to the existing lease—to MassWildlife.

1.2 INSTALLATION HISTORY

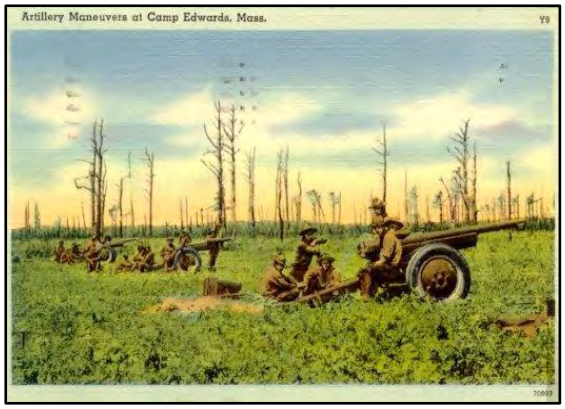
While not formally established as Camp Edwards until 1935, MANG training within the area that comprises Camp Edwards and JBCC started as early as 1908, when soldiers conducted weekend and annual training and live firing. This training was primarily in the south and west of what is now the JBCC (MANG 2018a). After initiating a search for a new campsite, Camp Edwards was created in 1935 primarily from 12,600 acres of land acquired from the purchase of the Coonamesset Sheep Ranch. In this same year, the War Department approved the purchase or lease of up to 200,000 acres of land within Cape Cod for training purposes (MANG 2018a).

Initial construction on Camp Edwards occurred between 1935 and 1940 and consisted of 63 buildings and 2 runways (MANG 2018a). Construction ramped up between 1940 and 1941 with the threat of war and ahead of plans for a year-long training effort; during this time more than 1,300 buildings were constructed in the cantonment area, with the completion of 30 buildings a day (MANG 2018a). However, by 1941, the threat of war stimulated the construction of facilities to house 30,000 troops as well as a 1,722-bed hospital (MANG 2001).

At the onset of World War II in 1941, 6,457 acres of Shawme-Crowell State Forest was added to Camp Edwards. Eight years later, an additional 1,090 acres was added for military use. Throughout the course of World War II, numerous Army Infantry Divisions and other major units trained on Camp Edwards prior to fighting in Europe and the Pacific (MANG 2001). During World War II, Camp Edwards served several uses, including the core of the Anti-aircraft Artillery Training Center, a Convalescent Hospital, a Prisoner of War Camp for captured German soldiers, and a Temporary Separation Center for discharging soldiers (MANG 2018a).

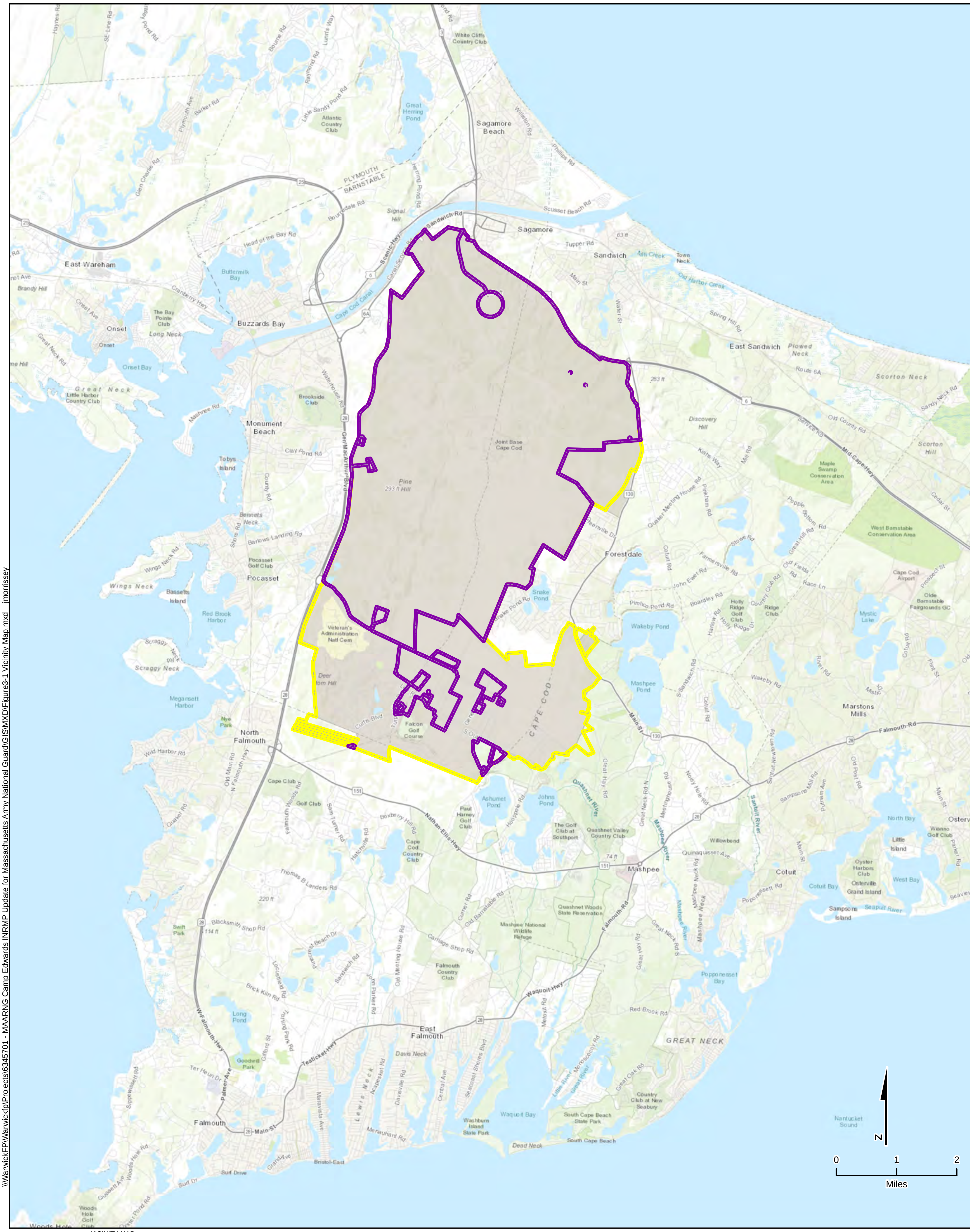
After World War II, the U.S. Army deactivated Camp Edwards, which was then used for training the Army National Guard. However, at the start of the Korean War in 1950, Camp Edwards was reactivated to train U.S. Army troops. The U.S. Army withdrew from Camp Edwards in 1973, and MAARNG assumed operational control of the site (MANG 2018a). Throughout the course of training on Camp Edwards by the U.S. Army and MAARNG, ranges have been used for firing various weapons including pistols, rifles, machine guns, rocket launchers, long-range artillery, mortars, and anti-aircraft weapons.

In May 1997, the U.S. Environmental Protection Agency (EPA), citing potential groundwater contamination from actual or potential releases emanating from the Training Ranges and Impact Area, delivered Administrative Order 1 to MAARNG. As a result, range use and other training on Camp Edwards was extremely limited. Newer copper ammunition (enhanced performance round) and innovative range design including broad stakeholder involvement and regulatory engagement have led to the resumption of small arms training at Camp Edwards on multiple ranges while remaining compliant with EPA orders and the EPS.

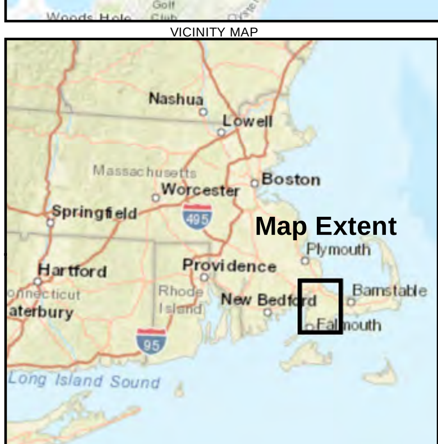


Early 1940s postcard depicting military activities at Camp Edwards

Surrounding population growth and the depletion and pollution of residential groundwater supplies emphasized the need for remediation at Camp Edwards. In October 1999, the Governor of Massachusetts, Argeo Paul Cellucci, drafted an EO to establish an Upper Cape Water Supply Reserve and Commission to oversee the management of Camp Edwards Training Area as a water supply and for wildlife habitat. In October 2001, a Memorandum of Agreement was signed establishing a management and oversight structure for the Reserve. In March 2002, Chapter 47 of the Acts of 2002 codified into law the Memorandum of Agreement and a set of EPS ensuring the permanent protection of the drinking water supply and wildlife habitats in the Reserve, while allowing compatible military training. This legislation also created the EMC to independently verify the compatibility of training with environmental protection. The most recent EPS are from 2017 and are provided in Appendix E.



VICINITY MAP



Legend

- Installation Boundary
- Camp Edwards Boundary

Figure C-1
Vicinity Map
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

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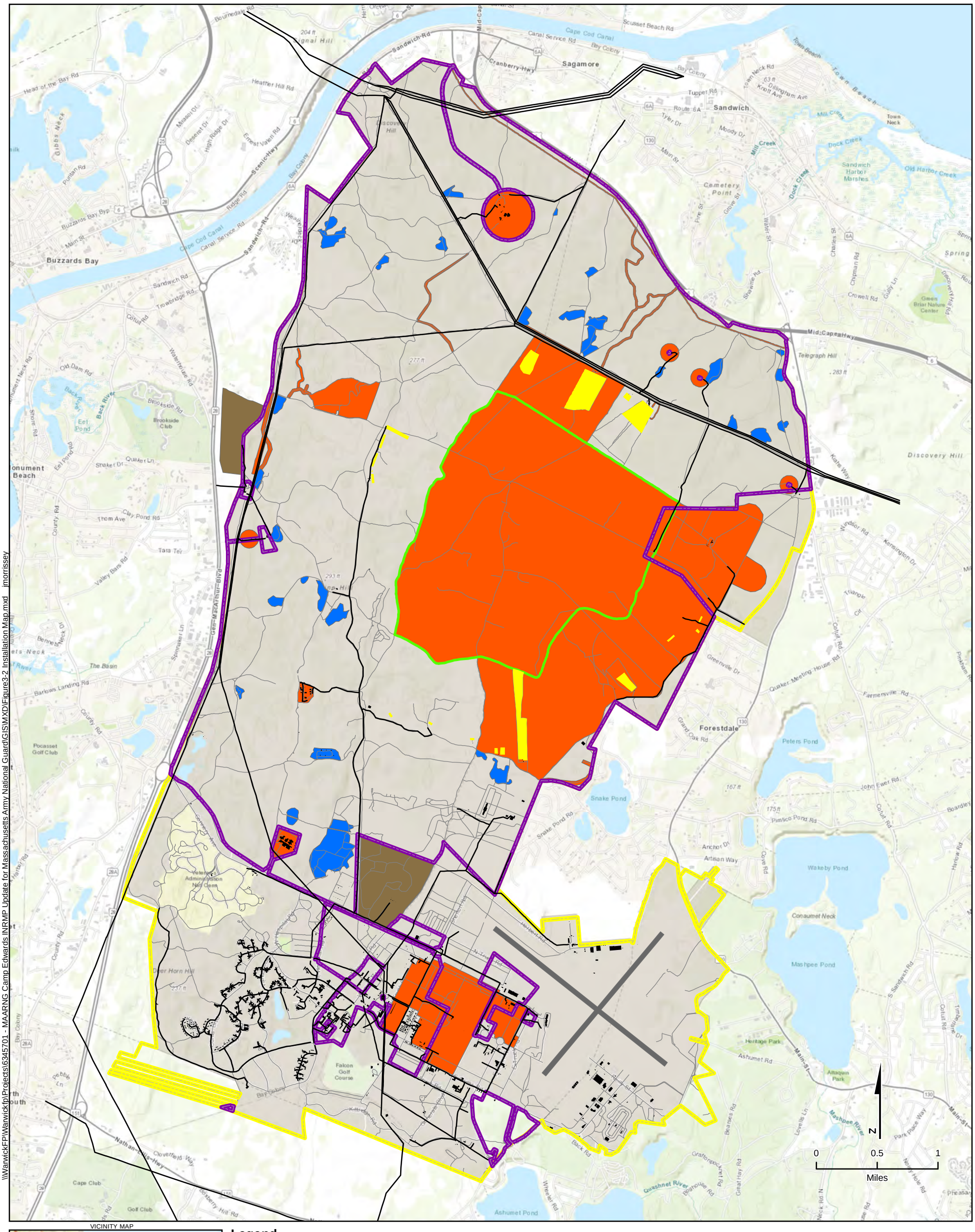

VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary
- Impact Area
- Building
- Range
- Runway
- Landfill
- Bivouac Sites
- Restricted Areas
- Roads
- powerlines

Figure C-2
Installation Map
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

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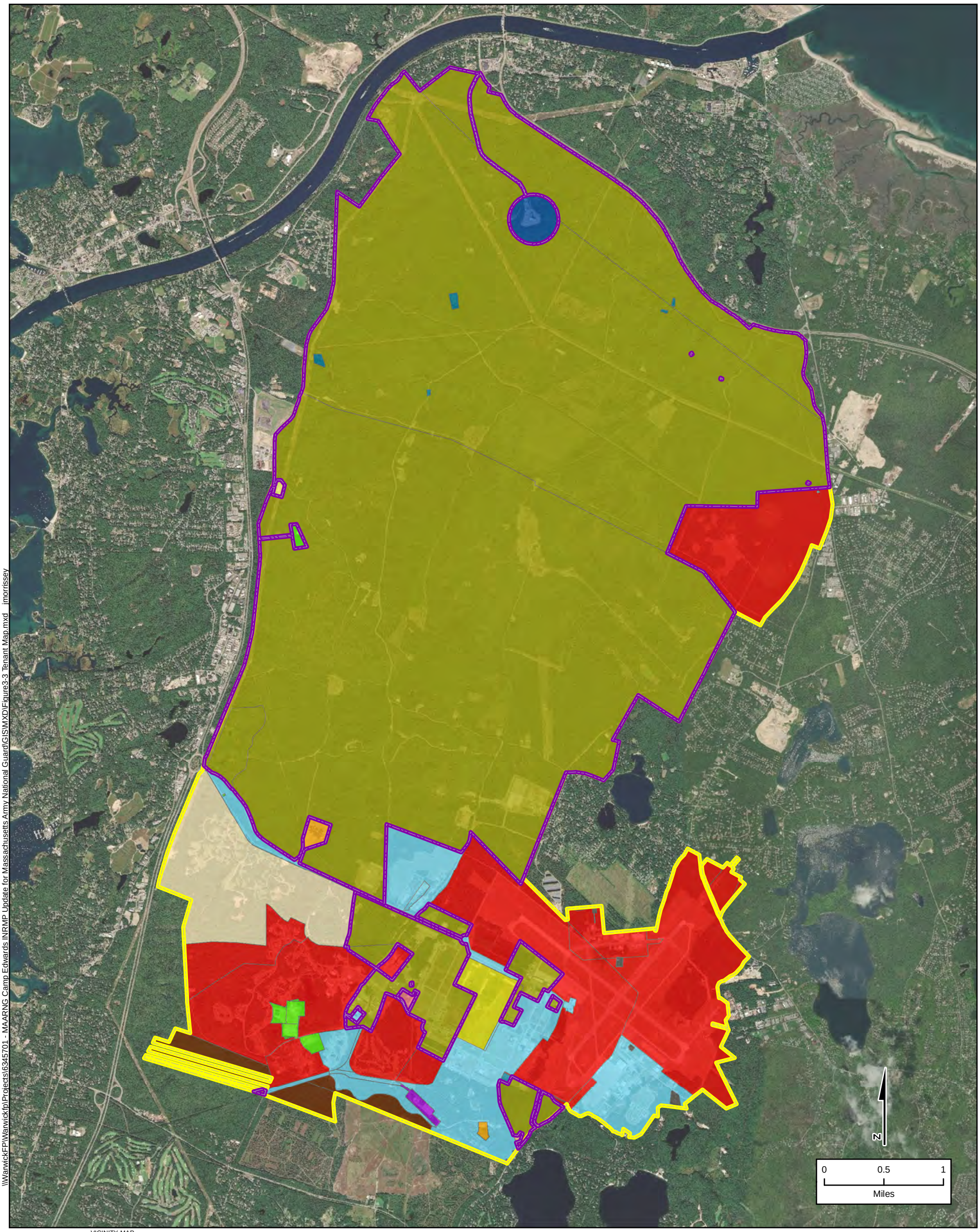

VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary

Tenants

- Barnstable County
- MA Air National Guard
- MA Army National Guard
- Cape Cod Water Coop
- Commonwealth of MA
- FAA
- MA Fisheries and Wildlife
- MA Maratime Acadamy
- MA Medical Examiner
- National Cemetary
- NSTAR Electric
- Town of Bourne
- Town of Falmouth
- Town of Mashpee
- MassWildlife
- Cape Cod Air Force Station
- US Coast Guard
- USDA

Figure C-3
Parcel Management at JBCC
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

\\WarwickFP\Warwickfp\Projects\63457701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure3-3 Tenant Map.mxd jmorrissey

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1.3 MILITARY MISSIONS

The MAARNG on Camp Edwards serves the public interest in two primary areas. The federal mission of the MAARNG is to support the national military strategy of the U.S. Army. As a result, the MAARNG must maintain a capable force of soldiers that have received high-quality realistic training. Achieving training objectives and overall force readiness depends, in part, upon the availability of adequate training lands. The state mission of the MAARNG is to provide assistance to the Commonwealth of Massachusetts, under the direction of the Governor, during natural disasters or other emergencies under the Army National Guard's Innovative Readiness Training program. Furthermore, the MAARNG assists local communities with improvements to public properties such as athletic fields, landscaping, and playgrounds (MANG 2001).

Camp Edwards serves as a major training facility for soldiers from New England, as well as for civilian first responders and law enforcement. Facilities to support soldier training at Camp Edwards include rappel towers, simulated weapons training and obstacle course, leadership reaction course, call for fire trainer, virtual convoy operations trainer, and several training areas and ranges. Undeveloped lands at Camp Edwards provide lands for maneuvering and patrol training; small arms ranges; helicopter landing zones; nuclear, biological, and chemical training bunkers; and convoy training (MANG 2018b).

Camp Edwards specializes in supporting military training for infantry exercises. Range operations and training activities are conducted in accordance with Camp Edwards Training Site 210-5 Range Control Standard Operating Procedures. Camp Edwards supports training activities including assembly, tactical maneuvering, tactical bivouacking, small arms range firing, engineering, ammunition storage, support, maintenance, and aviation facilities, and environmental management. Tactical maneuvering, either on foot throughout the training area or in vehicles along roads, occurs as soldiers travel from the assembly area to their area of operation. From the area of operation, soldiers engage in training missions specific to their mission requirements (e.g., engineering, infantry, medevac) throughout the training area. Small arms range firing and ammunition storage at the Ammunition Supply Point also occur in the northern training area. The support, maintenance, and aviation facilities exist in a centralized region within the cantonment area (MAARNG 2019a).

Mission training activities at Camp Edwards

MAARNG has approximately 5,880 soldiers who train on average one weekend per month and one 2-week cycle during a training year. These soldiers, as well as other soldiers from the region, come to Camp Edwards for training activities. Other military users of Camp Edwards include the Massachusetts Air National Guard, New York Army National Guard, New Hampshire Army National Guard, Army Reserve, U.S. Coast Guard and U.S. Coast Guard Reserve, U.S. Air Force, Marine Corps, and Navy (MANG 2019a).

In 2018, Camp Edwards supported training use at ranges, training areas, and training support areas totaling more than 2,118 training days for more

than 103,864 military personnel and 1,673 civilian personnel (MANG 2019a). These activities included firing at ranges, land navigation and bivouacs, Soldier Validation Lanes, meteorological data collection, engineer/infantry/artillery skills training, driver training, and Reserve Officer Training Corps training (MANG 2019a). Examples of past civilian users at Camp Edwards include the Boy Scouts of America, Massachusetts Environmental Police, The Massachusetts Institute of Technology, and participants in fire training.

In recent years, the training range requirements for Camp Edwards have increased dramatically due to state and federal mission statements. Camp Edwards' primary mission is to prepare soldiers for combat missions overseas as well as missions to serve and protect the homeland stateside. The Federal Mission is "…to provide well-equipped, well-trained Soldiers to support National Security Objectives and interests." The State Mission is to provide the Governor of Massachusetts with trained, equipped, and organized units to assist civil authorities in the preservation of life and property (MAARNG 2019a).

1.4 SURROUNDING COMMUNITIES

Camp Edwards falls within the towns of Bourne and Sandwich, but also is within proximity to Mashpee. Camp Edwards is zoned within the Town of Sandwich and the Town of Bourne as a Government District (Town of Bourne 2011; Town of Sandwich 2017). The surrounding area is designated for a variety of business, residential, and industrial uses. The installation also borders a Scenic Development District in the Town of Bourne.

The Camp Edwards cantonment area in the southern portion of Camp Edwards intermixed with the majority of other services and facilities at JBCC. This includes Otis Air National Guard Base, U.S. Coast Guard Base Cape Cod and Air Station Cape Cod, Massachusetts National Cemetery (Veterans Administration), Falcon Golf Course, etc. The Coast Guard transmitter station is adjacent to Camp Edwards at its eastern border. The U.S. Air Force PAVE PAWS radar station is located within the northern portion of Camp Edwards.

Although the upper portion of Cape Cod was sparsely populated in the 1930s when Camp Edwards was first established, the residential population has exhibited one of the fastest rates of growth in the United States. Approximately 70 percent of the perimeter of Camp Edwards is surrounded by residential development. In these areas, residential development is within one-half mile of the boundary of Camp Edwards and often directly adjacent to the fences. The only parts of Camp Edwards that are not directly bordered by development are at the northern and southern ends of the perimeter. The far northwestern end of Camp Edwards is adjacent to the Cape Cod Canal. Although no development currently exists in this area, the land is highly sought after for residential homes.

1.5 LOCAL AND REGIONAL NATURAL AREAS

Camp Edwards Training Site is located within the Cape Cod Peninsula, which provides several regional natural areas. The northeastern boundary of Camp Edwards abuts the Shawme-Crowell State Forest, while the Crane Wildlife Management Area (WMA) is also found in close proximity to the installation, adjacent to the southern boundary of JBCC.

The Shawme-Crowell State Forest directly abuts Camp Edwards and provides approximately 700 acres of pitch pine and scrub oak forest. Shawme-Crowell is managed by the Massachusetts Division of Conservation and Recreation (State of Massachusetts 2019). Recreational resources include hiking trails and horseback riding trails, as well as camping. The state forest also provides basketball courts, a playground, picnic area, and other facilities (State of Massachusetts 2019). Shawme-Crowell is the most highly used state forest in southeastern Massachusetts (MANG 2001). Shawme-Crowell State Forest is highly fragmented, and residential development is always less than one-half mile from and often in contact with the boundary of Camp Edwards within the forest.

The only other relatively large public land in close proximity to Camp Edwards is the Frances A. Crane WMA, which includes approximately 2,400 acres managed by MassWildlife (MassWildlife 2019a). It is located south of Otis Air National Guard Base and the Coast Guard Base Cape Cod. The WMA supports sandplain grassland and pitch-pine oak woodlands habitat that supports threatened and endangered species. The property provides opportunities for hunting upland game birds and other game animals and is stocked with ring-necked pheasant. Fishing is also available at the Ashumet Pond. Other recreational activities at the WMA include wildlife viewing and mountain biking (MassWildlife 2019a).

Partnerships have been developed between MAARNG and MassWildlife on Crane WMA and the Massachusetts Department of Conservation and Recreation on Shawme-Crowell State Forest. Other natural areas found regionally near the Camp Edwards Training Site include the Myles Standish State Forest, Sandy Neck Beach Park, Cape Cod National Seashore, South Cape Beach State Park, Fisk Forestdale WMA, Quashnet WMA, Haskell Swamp WMA, and several smaller conservation areas and parks.

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APPENDIX D – ANNUAL WORK PLANS

The purpose of this section is to present a road map for the execution of specific actions to achieve management goals and objectives identified in this INRMP. Specific management objectives and strategies have been identified in a number of subject areas that affect the natural resources present on and immediately adjacent to Camp Edwards. This section provides the goals and objectives for future natural resources management on the installation. A goal should reflect the values of the installation by expressing a vision of the desired condition for the installation's natural resources in the foreseeable future. Each goal is supported by one or more objectives. An objective indicates a management initiative or strategy that will be used to achieve the stated goal. Projects or tasks are the individual component actions required to achieve an objective. Project statements describe the specific methods and procedures that will be used to achieve the objective supported.

Management objectives established in this INRMP were initially developed during the evaluation of the natural resources present on Camp Edwards. In accordance with AR 200-1 and the principles of adaptive ecosystem management, subject areas were identified, and management alternatives developed by an interdisciplinary team of ecologists, biologists, geologists, planners, and environmental scientists. The revision of this INRMP involved a complete review of the original subject areas and management alternatives accomplished since the 2009 INRMP Update. This revised section presents the preferred management alternatives based on the professional opinions of the Natural Resources Program staff, USFWS, MassWildlife, and considerations of other internal and external stakeholders. Through these evaluations, the original natural resources planning and management goals have been reevaluated to ensure they represent the most current theories on adaptive ecosystem-based planning. Selection of these management goals has been tempered with the fact that the operational mission at Camp Edwards Training Site takes primacy over natural resources management. However, through the multiple-use adaptive paradigms used, sound ecological management on the installation should supplement the operational effectiveness and safety of the military missions while enhancing the natural environment. Ecosystem management provides a means for the Army to conserve biodiversity and to provide high-quality military readiness. The INRMP is a mechanism through which Camp Edwards can maintain sustainable land use through ecosystem management.

Natural resource management concerns at Camp Edwards have been reviewed and updated in this INRMP, and management goals and objectives are presented in each subject matter appendix. The purpose of this section is to identify the projects under these goals and objectives for each installation to obtain workable and useful solutions for each management issue identified. For simplicity and clarity within this work plan table, each natural resource subject area is assigned an individual "issue number." Each subject area has been abbreviated, as shown in Table D-1. For example, the first management objective in the Natural Resources Program Management, appendix is identified as NRP-1, the first objective under this goal would be NRP 1.1, and the first project under this objective would be NRP 1.1.1. The projects/tasks are consecutively numbered for each management objective. A summary of the management objectives is provided on table annual project implementation tables.

Some of the projects described in this section will be accomplished through interactive partnerships with federal, state, and local organizations. Natural resources management staff will initiate partnerships based on the benefits to the regional ecosystem and the local environment. MAARNG will work with the USFWS and MassWildlife to complete annual updates to the INRMP, including any necessary updates to the goals, objectives, and projects needed as part of adaptive management or changing management needs.

Table D-1. Integrated Natural Resources Management Plan Subject Area Abbreviations

Appendix	INRMP Subject Area	Abbreviation
H	Natural Resources Program Management	NRP
I	Fish and Wildlife Management	FWM
J	Outdoor Recreation and Public Access to Natural Resources	OR
K	Threatened and Endangered Species and Habitats	TE
L	Water Resources Protection	WRP
M	Wetland Protection	WP
N	Grounds Maintenance	GM
O	Forest and Grassland Management	FM
P	Wildland Fire Management	WFM
Q	Integrated Pest Management Program	IPM
R	Cultural Resource Protection	CR
S	Public Outreach	PO
T	Geographic Information System	GIS
U	Climate Change	CC

Table D-2 summarizes the management actions identified in Appendices H to U for the Camp Edwards Training Site and propose priorities for their implementation from 2020 through 2024. The actions proposed for this INRMP are aggressive and might not be accomplished within the established timelines due to a number of factors (e.g., budget and manpower constraints, wartime tasks). However, their importance to the proper management of the installation's natural resources cannot be understated. Therefore, the management actions presented in these tables should be modified as part of the annual review of this INRMP by the INRMP Working Group to ensure that these goals are continually emphasized and accomplished when practicable.

This INRMP reflects the commitment set forth by Camp Edwards to conserve, protect, and enhance the natural resources present on the installation. This INRMP is the final plan that will direct the natural resources management at the installation from Fiscal Years (FY) 2020 through 2024. An ecosystem approach was used to develop the management measures for each resource area. Implementation of the management measures will maintain, conserve, and enhance the ecological integrity of the installation and the biological communities occurring on the installation. In addition, the natural resources management measures described in this plan will protect the installation's ecosystems and their components from unacceptable damage or degradation and identify and restore previously degraded habitats.

Natural resources and land use management issues are not the only factors contributing to the development and implementation of the INRMP. Installation management and other seemingly

unrelated issues affect the implementation of this plan. It is of utmost importance to the implementation of this INRMP that installation personnel take "ownership" of the plan (i.e., individual or organizational primary responsibility to implement the INRMP), provide the necessary resources (i.e., personnel and equipment), and allocate the appropriate funding to enact the plan. The Sikes Act requires that an INRMP Working Group be established to aid in the continued development of and commitment to the implementation of this INRMP. The INRMP Working Group should be comprised of key installation personnel, and the signatory agencies (USFWS and MassWildlife). The INRMP Working Group must meeting annually in person to complete an annual update of the INRMP.

Any requirement for the obligation of funds for projects in this INRMP shall be subject to the availability of funds appropriated by Congress, and none of the proposed projects shall be interpreted to require obligation or payment of funds in violation of any applicable federal law. Implementation of the actions and projects described in this INRMP are guided by how budget priorities are assessed for environmental work on DoD installations. This is described in DoDI 4715.03, *Natural Resources Conservation Program*, which implements policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources on property under DoD control.

The Office of Management and Budget considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act, to be a high priority; however, the reality is that not all of the projects and programs identified in this INRMP will receive immediate funding. As such, these programs and projects have been placed into four priority-based categories:

Priority 0 – Day-to-day recurring projects
Priority 1 – High priority projects
Priority 2 – Medium importance projects
Priority 3 – Low importance projects.

The prioritization of the projects is based on need, and need is based on a project's importance in moving the natural resources management program closer toward successfully achieving its goal. DoDI 4715.03 defines recurring and non-recurring conservation requirements as follows:

RECURRING AND NON-RECURRING CONSERVATION REQUIREMENTS

Priority 0: Recurring Natural Resources Conservation Management Requirements
a. Administrative, personnel, and other costs associated with managing the DoD Natural Resources Conservation Program that are necessary to meet applicable compliance requirements in federal and state laws, regulations, EOs, and DoD policies, or in direct support of the military mission.
b. DoD components shall give priority to recurring natural resources conservation management requirements associated with the operation of facilities, installations, and deployed weapons systems. These activities include day-to-day costs of sustaining an effective natural resources management program, and annual requirements, including manpower, training, supplies, permits, fees, testing and monitoring, sampling and analysis, reporting and recordkeeping, maintenance of natural resources conservation equipment, and compliance self-assessments.

RECURRING AND NON-RECURRING CONSERVATION REQUIREMENTS

Priority 1 (High): Non-Recurring Natural Resources Management Requirements. Current Compliance.

Includes installation projects and activities to support:

a. Installations currently out of compliance (e.g., received an enforcement action from an authorized federal or state agency or local authority).

b. Signed compliance agreement or consent order.

c. Meeting requirements with applicable federal and state regulations, standards, EOs, or DoD policies.

d. Immediate and essential maintenance of operational integrity or military mission sustainment.

e. Projects or activities that will be out of compliance if not implemented in the current program year including the following:

i. Environmental analyses for natural resources conservation projects, and monitoring and studies required to assess and mitigate potential impacts of the military mission on conservation resources.

ii. Planning documentation, master plans, compatible development planning, and INRMPs.

iii. Natural resources planning-level surveys.

iv. Reasonable and prudent measures included in incidental take statements of Biological Opinions; biological assessments; surveys; monitoring; reporting of assessment results; or habitat protection for listed, at-risk, and candidate species so that proposed or continuing actions can be modified in consultation with the USFWS or National Marine Fisheries Service.

v. Mitigation to meet existing regulatory permit conditions or written agreements.

vi. Non-point source pollution or watershed management studies or actions needed to meet compliance dates cited in approved state coastal non-point source pollution control plans, as required to meet consistency determinations consistent with Coastal Zone Management.

vii. Wetlands delineations critical for the prevention of adverse impacts on wetlands, so that continuing actions can be modified to ensure mission continuity.

Compliance with missed deadlines established in DoD-executed agreements.

Priority 2 (Medium): Non-Recurring Natural Resources Management Requirements. Maintenance Requirements.

Includes those projects and activities needed to meet an established deadline beyond the current program year and maintain compliance. Examples include the following:

a. Compliance with future deadlines.

b. Conservation, GIS mapping, and data management to comply with federal, state, and local regulations; EOs; and DoD policy.

c. Efforts undertaken in accordance with non-deadline specific compliance requirements of leadership initiatives.

Priority 2 (Medium): Non-Recurring Natural Resources Management Requirements. Maintenance Requirements.
d. Compliance with future deadlines. e. Conservation, GIS mapping, and data management to comply with federal, state, and local regulations; EOs; and DoD policy. f. Efforts undertaken in accordance with non-deadline specific compliance requirements of leadership initiatives. g. Wetlands enhancement to minimize wetlands loss and enhance existing degraded wetlands. h. Conservation recommendations in biological opinions issued pursuant to the Endangered Species Act.
Priority 3 (Low): Non-Recurring Natural Resources Management Requirements. Enhancement Actions Beyond Compliance.
Includes those projects and activities that enhance conservation resources or the integrity of the installation's mission, or are needed to address overall environmental goals and objectives, but are not specifically required by law, regulation, or EO, and are not of an immediate nature. Examples include: a. Community outreach activities, such as International Migratory Bird Day, Earth Day, National Public Lands Day, Pollinator Week, and Arbor Day activities. b. Educational and public awareness projects, such as interpretive displays, oral histories, Watchable Wildlife areas, nature trails, wildlife checklists, and conservation teaching materials. c. Restoration or enhancement of natural resources when no specific compliance requirement dictates a course, or timing of action. d. Management and execution of volunteer and partnership programs.

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Table D-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
NRP	**Natural Resources Program Management**							
NRP – 1.1.1	Continue ongoing annual funding for the Natural Resource Manager and Wildlife Conservation Biologist positions.	2 (Medium)	X	X	X	X	X	
NRP – 1.1.2	Hire and annually fund half of the salary for a Wildland Fire Program Coordinator (cost shared with CFMO).	2 (Medium)	X	X	X	X	X	
NRP – 1.1.3	Hire and annually fund the salary for a Wetlands and Vegetation Conservation Biologist.	2 (Medium)	X	X	X	X	X	
NRP – 1.1.4	By FY2022 convert two contract seasonal technician positions to full-time staff and annually provide funding for positions.	2 (Medium)	X	X				
NRP – 1.1.5	Annually hire and fund seasonal contract technicians (1–4 positions) as needed based on planned and funded projects.	2 (Medium)	X	X	X	X	X	
NRP – 1.1.6	Effectively implement the Employee Performance Appraisal System through tri-annually meeting with each full-time employee, evaluating performance, and discussing expectations.	0 (Recurring)	X	X	X	X	X	
NRP – 1.1.7	Implement regular NR-ITAM Program meetings (e.g., monthly) to facilitate team function, collaboration, and clear prioritization of tasks.	0 (Recurring)	X	X	X	X	X	
NRP – 1.1.8	Openly engage workforce (i.e., “manpower”) studies and data calls as assigned to ensure sufficient staffing approvals.	0 (Recurring)	X	X	X	X	X	
NRP – 1.2.1	Provide resources to allow Natural Resource Program personnel to attend local and national conferences, such as the annual National Military Fish and Wildlife Association Training Workshop or applicable natural resource management courses, and other relevant conferences.	2 (Medium)	X	X	X	X	X	
NRP – 2.1.1	Annually update the Natural Resources project lists, cost estimates, and overall budget to include accounting for past and current year implementation and changing conditions (March).	0 (Recurring)	X	X	X	X	X	
NRP – 2.1.2	Annually ensure budget approval within the Status Tool for Environmental Programs via direct project and budget entry (including supporting documents) and coordination with appropriate support and approval elements (e.g., ETSS, EPM, NGB).	0 (Recurring)	X	X	X	X	X	
NRP – 2.2.1	Annually complete Environmental Quality data calls from NGB according to the instructions for that year. Typical data calls include: • Endangered Species: ARNG Headquarters for Army Environmental System (HQAES) TE Species and Expenditures, ARNG HQAES Other TE Species and Expenditures • INRMP: ARNG HQAES INRMP Metrics, NGB List of INRMPs • Wetlands: ARNG HQAES Wetlands Survey_ • Wildlife Fire: ARNG HQAES Wildland Fire Survey_ • Pest Management: Pesticide Update Form, IPM Certification List	0 (Recurring)	X	X	X	X	X	
NRP – 2.2.2	Respond to specific data calls from NGB and others throughout the year to better access and justify sufficient resources. These typically are related to wildland fire and endangered species, but can cover a variety of program areas depending on funding or leadership questions and priorities.	0 (Recurring)	X	X	X	X	X	
NRP – 3.1.1	Annually contract INRMP review and update support to include document preparation, meeting coordination and facilitation, and finalization (e.g., signatures, document finalization, distribution).	0 (Recurring)	X	X	X	X	X	
NRP – 3.1.2	Conduct annual internal stakeholder meeting to discuss the operation and management of the INRMP to ensure goals and objectives are understood and to identify changes deemed necessary. Ensure that management actions developed in the INRMP are consistent with current management instructions and plans. Document in writing the items discussed during the meeting and send to attendees to confirm in writing what was discussed and what was agreed to.	0 (Recurring)	X	X	X	X	X	
NRP – 3.1.3	Conduct annual external stakeholder meeting to include USFWS and MassWildlife (required Sikes Act partners) to discuss progress in regard to projects completed in the preceding year, the need for any updates to goals and objectives, and projects to be completed in the coming year. Document in writing the items discussed during the meeting and send to attendees to confirm in writing what was discussed and what was agreed to.	0 (Recurring)	X	X	X	X	X	
NRP – 3.1.4	Update the INRMP goals, objectives, and projects utilizing internal and external stakeholder comments and discussions. Ensure signatures are fully completed on the “Annual Review and Coordination Documentation” page for the appropriate year and include the completed page in the updated INRMP.	0 (Recurring)	X	X	X	X	X	
NRP – 4.1.1	Attend Camp Edwards staff call meetings as they are held to keep current with ongoing activities and upcoming plans.	0 (Recurring)	X	X	X	X	X	
NRP – 4.1.2	Attend and assist planning and facilitation of Sustainable Range Program meetings as held to ensure interdisciplinary planning of training area projects and proactively implement review and permitting as needed.	0 (Recurring)	X	X	X	X	X	
NRP – 4.1.3	Attend or ensure representation at CFMO meetings to facilitate Natural Resources input on current issues, interdisciplinary planning of projects, and proactively implement review and permitting as needed.	0 (Recurring)	X	X	X	X	X	
NRP – 4.2.1	Maintain a well-trained staff familiar with local resources, relevant environmental rules and regulations, conducting formal impacts analyses, and agency, local, state, and federal processes.	0 (Recurring)	X	X	X	X	X	
NRP – 4.2.2	Coordinate frequently with project managers and typical proponents to proactively identify projects requiring environmental review, documentation, and/or permitting, in addition to meetings identified above (NRP 4.1).	0 (Recurring)	X	X	X	X	X	

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
NRP – 4.2.3	Attend project study, design, scoping, and oversight meetings coordinated by project managers to facilitate impact minimization, educate on permitting requirements, and ensure understanding of project requirements and elements. Advise Environmental Program Manager, project managers, and CFMO of specific project requirements, appropriate funding mechanism (e.g., Environmental or proponent).	0 (Recurring)	X	X	X	X	X	
NRP – 4.2.4	Monitor compliance with project specific review and permitting requirements for Natural Resources as implemented by other programs (e.g., CFMO, Camp Edwards). Facilitate development of scopes of work and deliverables for contracted project permitting support including field assessments and permitting documents.	0 (Recurring)	X	X	X	X	X	
NRP – 4.2.5	Coordinate an interdisciplinary (at a minimum within NR-ITAM, ideally at installation level) team review of most projects to facilitate more holistic and effective review and suggestions of scope revisions to minimize or avoid impacts where possible while meeting the purpose and need of a proposed action. Integrate scientific literature, professional experience, and expert opinion (including external specialists, managers, and regulators) to accurately and effectively document likely outcomes and develop alternatives and/or mitigation/minimization actions.	0 (Recurring)	X	X	X	X	X	
NRP – 4.2.6	Concisely, but thoroughly document reasonably expected impacts to rare species, natural communities, and other resources and maintain effective records of reviews and impacts analyses.	0 (Recurring)	X	X	X	X	X	
NRP – 4.3.1	Ensure federal ESA Section 7 requirements are met for federal projects to include agency determination on the Record of Environmental Consideration (REC) at minimum and implementation of consultation as appropriate based on determination.	1 (High)	X	X	X	X	X	
NRP – 4.3.2	Ensure Massachusetts Endangered Species Act requirements are met for all projects and, at a minimum, document specific review, determination, and requirements on the REC.	1 (High)	X	X	X	X	X	
NRP – 4.3.3	Ensure Clean Water Act and Massachusetts Wetlands Protection Act requirements are met for all projects and, at a minimum documents specific review, determination, and requirements on the REC or other project review documentation. Coordinate permitting and external review through the appropriate mechanism, which will typically be advising project managers to include such actions through contracts funded by project proponents.	1 (High)	X	X	X	X	X	
NRP – 4.4.1	Obtain and maintain all necessary federal, state, and local permits and any necessary plans for mitigation activities. Ensure mitigation is completed in a manner consistent with permits and plans.	1 (High)	X	X	X	X	X	
NRP – 4.4.2	Purchase field equipment and other supplies necessary to carry out mitigation activities.	2 (Medium)		X	X	X	X	
NRP – 4.4.3	Ensure implementation of mitigation actions as planned and outlined in the Conservation and Management Plan and any subsequent annual reports/meetings. Contract services (e.g., prescribed fire, fuels treatments) as appropriate for Natural Resources mitigation actions. Coordinate and facilitate actions of others as necessary for in-house projects (e.g., Camp Edwards Roads and Grounds) or when projects are implemented through other funding streams (e.g., ordnance areas, CFMO).	0 (Recurring)	X	X	X	X	X	
NRP – 4.4.4	Provide annual reporting of MANG projects and mitigation actions completed and planned as agreed in the Conservation and Management Plan. Coordinate and document annual meeting to discuss implementation, monitoring, and upcoming actions	0 (Recurring)	X	X	X	X	X	
NRP – 5.1.1	Develop a plan with a prioritization strategy and timeline for analyzing existing natural resource data collected in the past at Camp Edwards. The plan could include a summary of the existing available data and the current condition of the analysis of this data. Identify contract needs for external expertise on complex datasets.	2 (Medium)	X	X				
NRP – 5.1.2	Once a plan has been developed, complete analysis of existing natural resource data at Camp Edwards based on the method and timeline provided in the prepared plan, including in-house and contracted efforts.	2 (Medium)			X	X		
NRP – 5.1.3	Seek out collaborative opportunities for data analysis and reporting, especially where Camp Edwards data may be integrated with external data sets and ongoing analysis projects. Facilitate transfer of data for mutual benefit (e.g., larger data set for analysis and analysis/reporting implemented by third party).	0 (Recurring)	X	X	X	X	X	
NRP – 5.1.4	Once data analysis is complete, determine any appropriate management adaptations or responses that may be needed based on the additional data analysis.	2 (Medium)					X	
NRP – 5.1.5	Determine appropriate level of reporting for each dataset and/or project and complete according to prioritization schedule. Reporting should range from internal/informal reports to peer-reviewed scientific publications.	2 (Medium)					X	
NRP – 5.1.6	Contract data analysis and resource specific specialists to develop synthesis data analyses for bat acoustic surveys and New England Cottontail research datasets. Both species are foundational to resource management at Camp Edwards and have potential for significant mission impact. New England cottontail synthesis of multiple research efforts over roughly 10 years is critical to understanding impacts and resource use/management, but was an unfunded requirement for the last three years). Complete in 2021.	2 (Medium)		X				
FWM	**Fish and Wildlife Management**							
FWM – 1.1.1	Annually coordinate with Sikes Act and internal stakeholders to determine if additional planning level surveys are warranted based upon anticipated species listings, installation master plans, critical information gaps, or currency of previous efforts.	0 (Recurring)	X	X	X	X	X	
FWM – 1.1.2	Develop list of planning level survey gaps and develop prioritized implementation plan with justifications to address primary knowledge gaps. Complete in FY2020.	2 (Medium)	X					

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
FWM – 1.1.3	Update the Camp Edwards planning level survey of natural communities and associated map(s) to better reflect current conditions and community ecology. Complete in FY2021.	2 (Medium)		X				
FWM – 1.1.4	Implement floristic inventories of targeted natural communities beginning with sandplain/managed grassland habitats in FY2021 and continuing annually based on results of above projects FWM 1.1.1, 1.1.2, and 1.1.3. At this time this is highest priority based on the lack of a robust flora planning level survey and a significant number of state and federally listed plants occurring in this natural community type.	2 (Medium)		X	X	X	X	
FWM – 1.1.5	Continue implementation of general fauna surveys (i.e., non-listed, multi-species) including: • Annual bat acoustic monitoring. • Annual breeding bird surveys site-wide (including grassland set of points); • Ongoing damselfly and dragonfly surveys every fifth year; • Annual informal diurnal lepidopteran surveys; • Comprehensive migratory bird surveys • Comprehensive reptile surveys, including snakes and spotted turtles; and • Comprehensive amphibian surveys. • Supplemental surveys as warranted to include upland game bird surveys approximately every four years. These surveys should be conducted in conjunction with an assessment and mapping of the base's natural communities as discussed in the projects under GIS.	2 (Medium)	X	X	X	X	X	
FWM – 1.1.6	Update existing species lists and other flora and fauna resources to account for any updated occurrences or changes in species presence or abundance.	2 (Medium)	X	X	X	X	X	
FWM – 1.2.1	Working with MassWildlife, develop a survey protocol for Massachusetts watchlist plant species with the potential to occur at Camp Edwards.	2 (Medium)		X				
FWM – 1.2.2	Once a survey protocol has been approved, complete a survey for watchlist plant species, including an identification of species or populations suitable for translocation or augmentation.	3 (Low)			X			
FWM – 1.3.1	Rehabilitate nesting boxes for cavity nesting birds and other wildlife as previously installed boxes are in severe disrepair (bluebirds, bats, wood ducks, owls).	3 (Low)				X		
FWM – 3.1.1	Develop a grassland monitoring strategy to address additional grassland habitat management questions and concerns (e.g., return interval, seasonality of management, trends of focal/indicator plants, etc.).	2 (Medium)	X					
FWM – 3.1.2	Once developed, implement a grassland monitoring strategy within current or potential sandplain grassland habitat on Camp Edwards.	2 (Medium)		X	X			
FWM – 4.1.1	Provide funding for ongoing conservation and maintenance activities that support wildlife habitat restoration.	2 (Medium)	X	X	X	X	X	
FWM – 4.1.2	Purchase necessary equipment for the management of flora and fauna species at Camp Edwards, including personal protective equipment.	0 (Recurring)	X	X	X	X	X	
FWM – 4.1.3	Integrate general ecosystem and habitat considerations into more focal habitat improvement projects (e.g., mitigation implementation).	0 (Recurring)	X	X	X	X	X	
FWM – 4.1.4	Ensure data analysis and reporting for surveys and monitoring completed in Project FWM 1.1.5 to evaluate and communicate effectiveness of ongoing management and restoration and identify needed changes or concerns where such may exist.	2 (Medium)	X	X	X	X	X	
FWM – 4.1.5	Consolidate all bird, herptile, and mammal avoidance and minimization measures into a single document for easy reference during mowing and maintenance activities. Incorporate measures outlined in the *Partners in Amphibian and Reptile Conservation Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States* (Mitchell, Breisch, and Buhlmann, 2006).	3 (Low)	X	X	X			
OR	**Outdoor Recreation and Public Access to Natural Resources**							
OR – 1.1.1	Coordinate annual pre-hunt meeting and annual after-action review meeting with all relevant stakeholders to include Camp Edwards, Camp Edwards Range Control, Camp Edwards Security, Massachusetts Environmental Police, MassWildlife Southeast District, and EMC Environmental Officer.	0 (Recurring)	X	X	X	X	X	
OR – 1.1.2	Facilitate conflict resolution among stakeholders and between stakeholders and participants as needed. Every year associated with the hunt there are miscommunications, complaints, or disagreements to be addressed with the Natural Resources Officer designated as the hunting facilitation lead.	0 (Recurring)	X	X	X	X	X	
OR – 1.1.3	Conduct annual hunter engagement through direct interaction and annually required survey forms to provide forums for feedback from participants to inform hunt management decisions and comply with EPS requirements.	0 (Recurring)	X	X	X	X	X	
OR – 1.2.1	Support recreational hunting at Camp Edwards.	2 (Medium)		X	X	X	X	
OR – 1.2.2	Working with MassWildlife, the towns, and other stakeholders, develop a strategy to increase the hunting base at Camp Edwards, including expanding promotional opportunities through the towns.	2 (Medium)	X	X	X			
OR – 1.2.3	Evaluate opportunities for automation of hunter management and coordinate with internal and external stakeholders to test one of the toolkits. Complete in 2021.	3 (Low)		X	X	X	X	
OR – 1.2.4	Investigate opportunities and benefits of providing an increased area for no drive hunting.	2 (Medium)	X	X				

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
OR – 2.1.1	Explore the potential to increase or expand grassland bird tours, as well as opportunities to provide whip-poor-will tours, botany tours, and other natural resource field trips or experiences at Camp Edwards.	3 (Low)	X	X	X	X	X	
TE	**Management of Threatened and Endangered Species and Habitats**							
TE – 1.1.1	Hire technicians to conduct annual acoustic bat monitoring.	1 (High)	X	X	X	X	X	
TE – 1.1.2	Purchase software and other technology needed for annual bat monitoring and data management and ensure properly trained staff for field deployment and software use.	2 (Medium)	X	X	X	X	X	
TE – 1.1.3	Provide funding for a bat survey or acoustic support as part of annual surveys including contracting expert acoustic data analysis and reporting.	2 (Medium)	X	X	X	X	X	
TE – 1.1.4	Coordinate with Massachusetts Department of Transportation and MassWildlife to incorporate bat data collected at Camp Edwards into a statewide acoustic database to aid in a better regional understanding of bat movements and populations	3 (Low)	X					
TE – 1.1.5	Identify key knowledge gaps from previous planning level surveys and monitoring efforts to prioritize future surveys.	2 (Medium)					X	
TE – 1.1.6	At least every 5 years synthesize and report on past efforts to include identifying longer term and/or broader spatial scale patterns and trends from annual surveys.	2 (Medium)			X			
TE – 1.2.1	Continue annual surveys of New England cottontail consistent with regional efforts guided and overseen by the New England cottontail Technical Committee.	0 (Recurring)	X	X	X	X	X	
TE – 1.2.2	Contract expert data analysis support (post-doctorate or similar) to synthesize all the past New England cottontail surveys and research at Camp Edwards, including home range, habitat use, and diet analysis.	0 (Recurring)			X	X		
TE – 1.2.3	Continue annual implementation of at least 100 acres/year of habitat management (prescribed fire and/or mechanical pitch pine-scrub oak/scrub oak shrubland management) to support New England cottontail populations. Inform management prescriptions with results of Project 1.2.2.	0 (Recurring)	X	X	X	X	X	
TE – 1.3.1	Purchase equipment for federally threatened and endangered species and priority species monitoring.	2 (Medium)	X	X	X	X		
TE – 1.3.2	Contract and complete a targeted survey for likely or potential rare plant species on the state and federal lists of threatened and endangered species with prioritized and focused efforts over the next 5 years Complete in conjunction with Project FWM 1.1.4.	2 (Medium)		X	X	X	X	
TE – 1.3.3	Coordinate with and support regional survey efforts for at-risk species or those under status assessment.	3 (Low)	X	X	X	X	X	
TE – 2.1.1	Purchase equipment for state-listed threatened and endangered species monitoring.	2 (Medium)	X	X	X	X	X	
TE – 2.1.2	Hire seasonal technicians for annual bird, odonate, and lepidopteran surveys.	2 (Medium)	X	X	X	X	X	
TE – 2.1.3	Hire seasonal technicians for turtle, clam shrimp, and plant surveys.	2 (Medium)	X	X	X	X	X	
TE – 2.1.4	Complete habitat improvement activities for state-listed species, including mechanical thinning and prescribed burning to support grassland habitats and other important habitats for state-listed species with a target of at least two prescribed burn operations and one mechanical treatment annually.	2 (Medium)	X	X	X	X	X	
TE – 2.1.5	Complete conservation and management planning for state-listed species at Camp Edwards as warranted based on completed surveys or regional collaborations.	3 (Low)	X					
TE – 2.2.1	Discuss and evaluate options for reintroduction of the federally-listed species sandplain gerardia and American chaffseed in newly restored grassland habitat Camp Edwards. Assess costs, benefits, and potential agreements that would be required to implement reintroduction. is critical to ensure that any such reintroductions would not be in conflict with the training mission, fire management, and habitat restoration.	3 (Low)			X	X		
TE – 3.1.1	Enact the recommendations presented in the *Conservation and Management Plan for the Camp Edwards Road Repairs and Clam Shrimp Relocation* (Oxbow Associates, Inc. 2018). This includes puddle replacement and monitoring.	1 (High)	X	X	X	X	X	
TE – 3.1.2	Collaborate with MassWildlife to develop mutually acceptable solutions and management plan to allow for regular road maintenance and prioritized repair of occupied features while also conserving Agassiz clam shrimp as widely distributed through Camp Edwards. Road maintenance is critical to the training mission, emergency response, resource management, erosion control, and minimizing roadway impacts to other wildlife (e.g., box turtles and amphibians). Complete in 2021.	1 (High)		X				
TE – 3.2.1	Complete the Conservation and Management Plan for the Multipurpose Machine Gun Range and mitigation bank, including bi-party signatures and completing real estate actions to include transfer of parcels and issuance of management license from MassWildlife to MAARNG following transfer of Parcel H of Unit K for grassland mitigation.	1 (High)	X	X	X			
TE – 3.2.2	Complete mitigation activities to support box turtles, such as pre-construction surveys, telemetry monitoring for both construction and long-term habitat use and adapt the Turtle Protection Plan for the Multipurpose Machine Gun Range to other large construction projects.	1 (High)	X	X	X	X	X	
TE – 3.2.3	Complete mitigation activities to support moths, including the development of a statistically robust monitoring plan (2020) to detect response to management and range development actions and implement monitoring according to the developed plan.	2 (Medium)	X	X		X		
TE – 3.2.4	Coordinate and hold annual meeting as required for oversight and coordination for implementation of mitigation actions in the *Conservation and Management Plan for the Multipurpose Machine Gun Range at Camp Edwards*. The annual meeting will outline development project actions/progress, mitigation actions implemented, monitoring efforts and results, and project plans for all three categories in the following years.	2 (Medium)		X	X	X	X	

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
TE – 3.2.5	Ensure implementation of at least one significant management/maintenance project within the grasslands mitigation area and pine barrens mitigation areas annually, guided by results of annual coordination meetings. Annual targets for maintenance, prior to additional consultation, are 100 acres of pine barrens and 40 acres of grassland through fire. Additional maintenance targets include herbicide treatments as appropriate in grassland and mechanical treatments approximating 20 acres in pine barrens and 10 acres in grassland.	2 (Medium)	X	X	X	X	X	
TE – 3.2.6	Develop more specific 5-year mitigation and maintenance project plan for coordination and approval as an adaptive management plan during the FY2020 annual review meeting for the Conservation and Management Plan establishing the mitigation bank. Incorporate this project plan as an addendum to the INRMP project table.	2 (Medium)	X					
TE – 3.2.7	Develop a consistent mitigation tracking system for the mitigation bank that facilitates review, approval, and future planning including construction impacts (e.g., debits), mitigation implementation (e.g., investment), and balances/status of the bank.	2 (Medium)						
TE – 3.2.8	FY2020 mitigation implementation should include intensive understory shrub/tree mowing and at least one prescribed burn day within the grassland mitigation area. FY2020 mitigation implementation should also include at least five prescribed burn operations within pine barrens focal areas, with emphasis on C-14 and RAW4 burn units and scrub oak shrubland restoration in C13. Additionally, planning to facilitate FY2021 burning and mechanical treatments should be implemented to include burn planning for BA1/BA7 and forestry assessment and cutting plan for RAW3.	2 (Medium)	X	X				
TE – 3.2.9	FY2021 mitigation implementation should include management within the grasslands focal area, particularly targeted invasive plant treatment and thinning of remaining wooded areas. FY2021 mitigation implementation should include at least 5 burn days within pine barrens focal areas (potentially C13, BA7) and mechanical harvesting within RAW3. Continued planning for additional burning and mechanical treatment requirements will be completed to support FY2022 planning.	2 (Medium)		X	X			
WRP	**Water Resources Protection**							
WRP – 1.1.1	Continue ongoing coordination with the Impact Area Groundwater Study Program and EMC's Environmental Officer.	0 (Recurring)	X	X	X	X	X	
WRP – 1.1.2	Determine feasibility, Best Management Practices (BMPs), and agency coordination for potential water withdrawals associated with water purification training exercises.	1 (High)	X					
WP	**Waters of the United States / Wetland Protection**							
WP – 1.1.1	Develop a plan for the creation of vernal pools. Vernal pool creation is needed to provide habitat for obligate vernal pool species outside of wetlands that have formed in roadways, which presents a hazard to these species.	2 (Medium)	X					
WP – 1.1.2	Develop and implement a pool creation and mitigation plan for the proposed filling of pools that support the state listed Agassiz's clam shrimp in roadways and result in threats to other rare species (box turtles) and impair roads/trails and their use for military training, resource management, and emergency access.	1 (High)	X	X	X	X		
WP – 1.1.3	Work with the town Conservation Agents and Commissions to develop a plan with BMPs that allows for conservation management within wetland buffers (e.g., prescribed fire and other vegetation management).	1 (High)	X	X	X	X	X	
WP – 1.1.4	Assist personnel requiring permits to impact Waters of the U.S., including wetlands in the preparation of permit application documents.	0 (Recurring)	X	X	X	X	X	
WP – 1.1.5	Review existing wetlands information (2001, 2012, 2014) and current regulations and identify appropriate PLS actions to undertake.	2 (Medium)	X				X	
GM	**Grounds Maintenance**							
GM – 1.1.1	Provide funding for the purchase and maintenance of major equipment required predominantly for habitat management activities.	2 (Medium)	X	X	X	X	X	
GM – 1.1.2	Develop BMPs and Standard Operation Procedures for mowing and other ground maintenance activities to include minimization and avoidance of rare resources.	2 (Medium)	X					
GM – 1.1.3	Work with Camp Edwards Dynamic Force Employment and Roads and Grounds to develop a long-term (e.g., 5-year) workplan for maintenance and development of semi-improved and improved grounds (firebreaks, roads/trails, grounds) to support proper resourcing of personnel and equipment, reduce natural resources impacts through planning, and allow for proactive permitting or planning where required (2021).	2 (Medium)		X				
GM – 1.2.1	Conduct mowing and other grassland maintenance activities on a rotational basis to maintain large grassland tracts in accordance with listed species restrictions from 1 May through 31 July. During this time there is no mowing or maintenance in the designated Managed Grassland. Manage grassland vegetation restoration areas by mowing to a height of at least 10 inches.	0 (Recurring)	X	X	X	X	X	
GM – 1.2.2	Control tall trees and snags in the interior of grasslands. Conduct mowing operations to effectively control woody vegetation including combining mowing with other management techniques and targeted timing.	0 (Recurring)	X	X	X	X	X	
GM – 1.2.3	Minimize erosion along roadways and in other areas where erosion presents an impact to natural resources. Identify and repair problem erosional areas.	2 (Medium)	X	X	X	X	X	
GM – 1.2.4	Implement erosion and sediment control plans	0 (Recurring)	X	X	X	X	X	

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
FM	**Forest Management**							
FM – 1.1.1	Undertake mechanical forestry activities as part of mitigation bank actions. Known planned activities for FY 2020 include forest thinning in 40 acres for frost-bottom restoration and 30 acres for scrub oak management. Mechanical forest relief will be any forestry project increasing tree stem spacing to approximately 20 feet or more, on average for the stand. This will include a range of projects from shaded fuel breaks to large, shrub savannah restorations.	1 (High)	X	X	X	X	X	
FM – 1.1.2	Undertake mechanical forestry activities as part of mitigation bank actions to restore sandplain grassland habitats. This includes land clearing, for example, the removal of dense growth of red cedar and pitch pine at Parcel H – Unit K to develop grassland habitat.	1 (High)		X	X		X	
FM – 2.1.1	Develop BMPs to streamline the implementation of forest management practices and timber harvests at Camp Edwards.	2 (Medium)	X					
FM – 2.1.2	Develop and implement targeted monitoring to ensure intended management effects are occurring or identify unintended impacts and allow for adaptive management.	2 (Medium)		X	X	X		
FM – 2.1.3	Collaborate to develop a grant funded (e.g., Strategic Environmental Research and Development Program, Legacy) analysis of carbon balances relative to mechanical forestry and prescribed fire managed areas compared to both unmanaged systems and realistic scenarios (e.g., range ignited wildfire in unmanaged fuels).	3 (Low)				X	X	
WFM	**Wildland Fire Management**							
WFM – 1.1.1	Fund and contract the update of the Integrated Wildland Fire Management Plan (IWFMP) to ensure it is current and that management practices and goals are consistent with those developed in the INRMP and other management documents. This document should outline the specific guidance, procedures, and protocols in wildfire management and the planning and operating procedures involved with prescribed burning. Additionally, the IWFMP should include an evaluation of current and expected fuels conditions and wildfire hazard to onsite and offsite resources.	2 (Medium)		X	X		X	
WFM – 1.1.2	Incorporate fire management planning sufficiency into the annual INRMP reviews and update as appropriate with new information	1 (High)	X	X	X	X	X	
WFM – 1.2.2	Sufficiently resource and support the new Wildland Fire Program Coordinator to update the IWFMP, modernize standards, and collaborate with key internal and external stakeholders as appropriate.	1 (High)		X	X			
WFM – 1.3.1	Ensure continued close collaboration between NR-ITAM, CFMO, Camp Edwards, and JBCC Fire Department to include coordinated planning of trainings, emergency response planning, and resource planning.	0 (Recurring)	X	X	X	X	X	
WFM – 1.3.2	Establish a Camp Edwards Wildland Fire Working Group including at a minimum the Fire Chief, Deputy Fire Chief, Camp Edwards Administrative Officer, Camp Edwards Facilities Manager, Wildland Fire Program Coordinator, and Natural Resources Manager with at least quarterly meetings to address long-term planning for project and resource requests and coordinated information flow between MAARNG and NGB for wildland fire.	2 (Medium)		X	X			
WFM – 1.3.3	Develop a long-term and prioritized plan for wildland fire infrastructure needs (firebreaks, equipment garages, etc.), project plans with funding requirements, facilities maintenance activities, heavy equipment needs including engines, and smaller equipment needs including tools and protective equipment.	2 (Medium)				X	X	
WFM – 2.1.1	Fund and host annual fall wildland fire mini-academy to provide high quality training with classroom and field topics in wildland fire management for internal and partner organization/agency personnel. The annual mini-academy serves in part as an in-kind partner service for wildland fire support.	0 (Recurring)	X	X	X	X	X	
WFM – 2.1.2	Hold Fire Safety Refresher Trainings to provide a refresher of classroom and field topics in fire safety for internal personnel. Courses help fire management personnel to recognize and mitigate risk and maintain safe and effective practices.	0 (Recurring)	X	X	X	X	X	
WFM – 2.2.1	Fund prescribed burning for habitat maintenance, including the purchase of needed equipment for prescribed burning and fire management. Subject to additional coordination annual targets for ecosystem conservation management including 600 acres of pine barrens and 40 acres of grassland.	0 (Recurring)	X	X	X	X	X	
WFM – 2.2.2	As part of mitigation bank actions, complete prescribed burning activities for habitat restoration and maintenance. This includes a target of 160 acres in 2020 for pine barrens restoration and a likely long-term objective of at least 100 acres per year in pine barrens and 40 in grasslands.	1 (High)	X	X	X	X	X	
WFM – 2.3.1	Regularly maintain and repair, as needed, at a minimum a Type-6 engine and utility terrain vehicle engine at least approaching Type-7 status.	0 (Recurring)	X	X	X	X	X	
WFM – 2.3.2	Establish year-round storage and maintenance area for wildland fire vehicles and equipment. Basic requirement exists for a two-bay garage with heat for year-round fire engine storage and maintenance and capacity for at least three full-size vehicles. Current status without such storage has led to severe degradation of equipment, decreased readiness through damaged equipment, and high maintenance costs. Ensure sufficient personal protective equipment for all personnel and sufficient cache of hand tools, hoses, nozzles, etc. based on IWFMP standards.	2 (Medium)			X	X		
WFM – 2.3.3	Ensure sufficient personal protective equipment for all personnel and sufficient cache of hand tools, hoses, nozzles, etc. based on IWFMP standards.	1 (High)	X	X	X	X	X	

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
IPM	**Integrated Pest Management**							
IPM – 1.1.1	Consistent with the IPM Plan, implement invasive species management procedures at Camp Edwards to help prevent the introduction and spread of invasive species.	2 (Medium)	X	X	X	X	X	
IPM – 1.1.2	Continue to minimize the use of chemical application where possible as part of integrated pest management at Camp Edwards while providing for wise and effective use where and how warranted.	2 (Medium)	X	X	X	X		
IPM – 1.1.3	Once noted, target small or newly discovered populations of invasive species with rapid and intensive management actions to prevent the larger introduction or spread of these species.	2 (Medium)	X	X	X	X		
IPM – 1.2.1	Complete the final draft IPM Plan in FY 2020 with staffing, review, and signatures complete by the end of FY2021.	1 (High)	X	X				
IPM – 1.2.2	Participate in the 5-year review and update of the IPM Plan to ensure natural resource and other environmental conditions/issues are addressed, and review the IPM Plan on a regular basis to ensure that any updates are addressed	1 (High)					X	
IPM – 1.3.1	Conduct baseline surveys to gauge the presence, locations, and abundance of invasive, nuisance, and noxious species.	2 (Medium)				X		
IPM – 2.1.1	Coordinate with appropriate leadership (e.g., Director of Facilities Engineering, Base Commander, CFMO, etc.) to ensure compliance with the IPM Plan, including assignment of critical positions (Pest Management Quality Assurance Evaluator).	2 (Medium)		X	X	X	X	
IPM – 2.1.2	Coordinate with project managers and Pest Management Quality Assurance Evaluators to review project plans and ensure compliance and IPM for contracted and in-house/self-help pest management actions.	2 (Medium)	X	X	X	X	X	
IPM – 2.1.3	Work with core personnel to reduce the use of chemicals for facilities maintenance, especially those with significant potential for non-target impacts, including evaluating alternative products and more integrated methodologies.	2 (Medium)				X	X	
CR	**Cultural Resources Protection**							
CR – 1.1.1	At least annually engage the Tribal Historic Preservation Office and Natural Resources Office of the Mashpee Wampanoag Tribe to discuss culturally important natural resources, natural resources management projects, and partnership opportunities.	0 (Recurring)	X	X	X	X	X	
CR – 1.1.2	Consider and coordinate on mutually beneficial resource use during habitat management projects including removal of eastern red cedar and other culturally important vegetation	2 (Medium)	X	X	X	X	X	
CR – 1.1.3	Continue pine barrens management actions with intent of conserving and improving a culturally relevant landscape and provide for regular visitation of managed areas by Tribal representatives.	0 (Recurring)	X	X	X	X	X	
CR – 1.1.4	Ensure field personnel are aware of plant species of focal interest that may be opportunistically observed in the field.	3 (Low)	X	X	X	X	X	
CR – 1.1.5	Ensure minimization and avoidance measures are included in natural resources management projects to protect physical cultural resources.	2 (Medium)	X	X	X	X	X	
PO	**Public Outreach**							
PO – 1.1.1	Coordinate with towns to provide notifications to neighboring areas about prescribed burns and other natural resource management actions at Camp Edwards.	3 (Low)	X	X	X	X	X	
PO – 1.1.2	Develop media and news interviews, public meeting materials, and outreach materials to increase the public awareness and knowledge of natural resource management goals and activities at Camp Edwards. This may include outreach to sportsman's organizations, the EMC Science Advisory Council and the Community Advisory Council, and the JBCC Cleanup Team, among other groups.	3 (Low)	X	X	X	X	X	
PO – 1.1.3	Develop robust outreach campaign to engage surrounding communities regarding wildland fire management and wildland-urban interface issues. Include open and honest communication to address potential risk, potential impacts, actions being taken to protect communities, and support needs.	3 (Low)	X	X	X	X	X	
PO – 1.2.1	Consider hosting training activities, which include an open house to invite the community on to the installation. These events can foster a relationship with the local community.	3 (Low)	X	X	X	X	X	
PO – 1.2.2	Consider outreach opportunities that relate to migratory birds and public access, including participation in International Migratory Bird Day, Endangered Species Day, Earth Day, National Public Lands Day, Breeding Bird Survey, and the Christmas Bird Count.	3 (Low)	X	X	X	X	X	
GIS	**Geographic Information Systems**							
GIS – 1.1.1	Maintain an active GIS program at Camp Edwards and ensure that any spatial natural resource data are maintained appropriately.	0 (Recurring)	X	X	X	X	X	
GIS – 1.1.2	Update the Natural Community GIS mapping at Camp Edwards to provide a more current data layer of habitat cover and vegetation that can be used in the management of natural resources.	2 (Medium)		X				
GIS – 1.1.3	Modernize and develop a clean GIS reference set updated annually or as needed from working datasets. Facilitate GIS Program development of tools including geodatabases or other relevant tools and techniques to standardize datasets, ensure long-term viability, and facilitate data sharing.	2 (Medium)	X	X	X	X	X	
CC	**Climate Change**							
CC – 1.1.1	Incorporate climate change into research and management objectives to ensure that adaptations are being made to address the effects of climate change.	0 (Recurring)	X	X	X	X	X	

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APPENDIX E – PHYSICAL ENVIRONMENT

1.1 CLIMATE

The climate of the region in which Camp Edwards is situated is rather temperate due to the influence of the Atlantic Ocean. Winters are generally cold, with an average daily temperature of 31 degrees Fahrenheit (°F), and summers are generally warm, averaging 68°F. Average annual precipitation is 49 inches, 23 inches of which fall between April and September. The average annual snowfall is about 24 inches. Mean relative humidity is 70 percent in mid-afternoon and 80 percent at dawn (Soil Conservation Service 1993). Table E-1 provides a summary of average temperatures and precipitation in Barnstable County, Massachusetts, from 1981 to 2010 (PRISM Climate Group 2020).

Table E-1. Climate Summary for Hyannis, Massachusetts, 1981–2010

Month	Normal Temperature (°F)—Daily			Total Rain (Inches)—Monthly
	Maximum	Minimum	Mean	
January	37.1	20.8	29.0	4.13
February	39.0	22.7	30.8	3.50
March	44.8	28.9	36.8	5.20
April	53.8	37.5	45.6	4.49
May	63.9	46.8	55.4	3.48
June	72.2	56.9	64.9	3.84
July	78.7	63.3	71.0	3.39
August	77.8	62.4	70.1	3.91
September	71.3	55.2	63.2	3.90
October	61.2	44.7	53.0	4.24
November	52.5	36.1	44.3	4.51
December	42.6	26.7	34.6	4.58
Annual	57.6	42.0	49.8	49.2
Source: PRISM Climate Group 2020.				

1.2 LANDFORMS

The surface topography of Camp Edwards varies greatly between the northern and western portion and the southern portion of the training area (Figure E-1). The northern and western portion of Camp Edwards is part of the Sandwich and Buzzards Bay glacial moraines, respectively. Large glacial deposits dominate this area with high topographic relief of rolling hills and deep kettle holes (Figure E-1). Slopes range from 0 to 15 percent, with a mean slope of 3.4 percent. The greatest change in topographic relief in this area of Camp Edwards is approximately 90 feet. The highest point on Cape Cod is Wheelock Overlook (308 feet), which was artificially raised approximately 5 feet in the 1970s to be above Pine Hill, the historic high point of Cape Cod at 306 feet. Pine Hill is situated in the western portion of Camp Edwards, atop the Buzzards Bay Moraine. Camp Edwards is found within the Atlantic Coastal Plain physiographic province (MAARNG 2013).

In contrast, the southern portion of Camp Edwards, which resides entirely within the Mashpee pitted outwash plain, has relatively low elevation (approximately 100 feet above sea level) and little topographic relief. Although slopes range from 0 to 15 percent in the outwash plain, the

mean slope of 1.5 percent is considerably less than in the moraine. The majority of the outwash plain has a slope of 0–2 percent, with the exception of the approximately 20 kettle holes within the area.

1.3 GEOLOGY AND SOILS

1.3.1 Geology

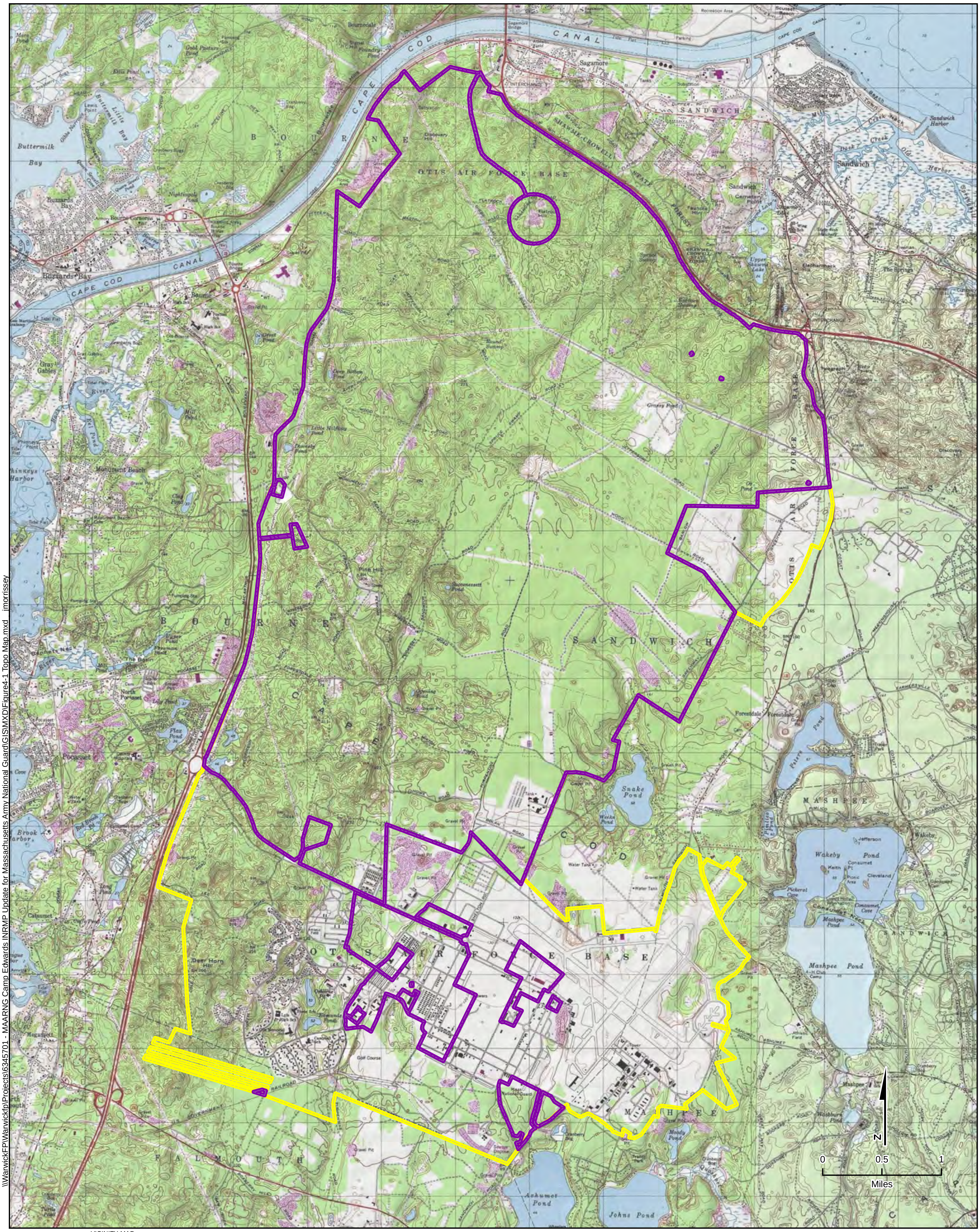
The geologic origin of Cape Cod dates back to approximately 12,000 years ago at the end of the Wisconsin Period of glaciation. During the retreat of the Laurentide ice sheet, moraines of glacial till were deposited by the Cape Cod Bay Lobe to form the Sandwich moraine, the main peninsula of the Cape, and by the Buzzards Bay Lobe, which formed the Buzzards Bay Moraine, the western edge of the Cape and the Elizabeth Islands (Strahler 1966). Camp Edwards is situated on the northwest corner of Cape Cod where these two moraines converge. Approximately 40 percent of Camp Edwards resides on the glacial moraines. As a result, much of the geologic material with which much of Camp Edwards and Cape Cod was formed is an amalgam of well-scoured rock fragments that originated in northern New England.

As the Laurentide Ice Sheet melted and retreated over the course of hundreds or thousands of years, rivers and streams of melt water deposited material from the moraines southward to the ocean. Much of the loam and clay washed into the Atlantic Ocean while the sand, gravel, and cobble was deposited closer to the moraines, forming the Mashpee pitted outwash plain (Strahler 1966). This outwash plain is broad sloping land that forms the southern side of Cape Cod, extending from the terminal moraines to the Atlantic Ocean. The southeastern portion of Camp Edwards, approximately 60 percent of the land, is situated on the Mashpee pitted outwash plain. As a result, much of the soil in the area is a loose sand material.

Prior to the development of the Sandwich and Buzzards Bay moraines, the Laurentide ice sheet had advanced further south, creating the islands of Martha's Vineyard and Nantucket (Strahler 1966). During the period when the glacier retreated northward across what is now Cape Cod, large blocks of ice were left scattered throughout what would become the Mashpee pitted outwash plain. As the outwash plain was formed, soil was deposited around the blocks of glacial ice. The glacial ice eventually melted, leaving deep, steep-sided cavities that are referred to as kettle holes. Some of these kettle holes filled with water, creating kettle hole ponds or lakes, which are present throughout Camp Edwards.

1.3.2 Soils

In general, the soil of Camp Edwards is well-drained sand or sandy loam often containing stones or boulders (Figure E-2). For the sake of description, the soils of Camp Edwards can be classified in two categories—soils of the Sandwich and Buzzards Bay terminal moraines and soils of the outwash plain. Figure E-2 includes the soils located within Camp Edwards; a description of these soils is presented below.



Legend

- Installation Boundary
- Camp Edwards Boundary

Figure **E**-1
Topographic Map
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

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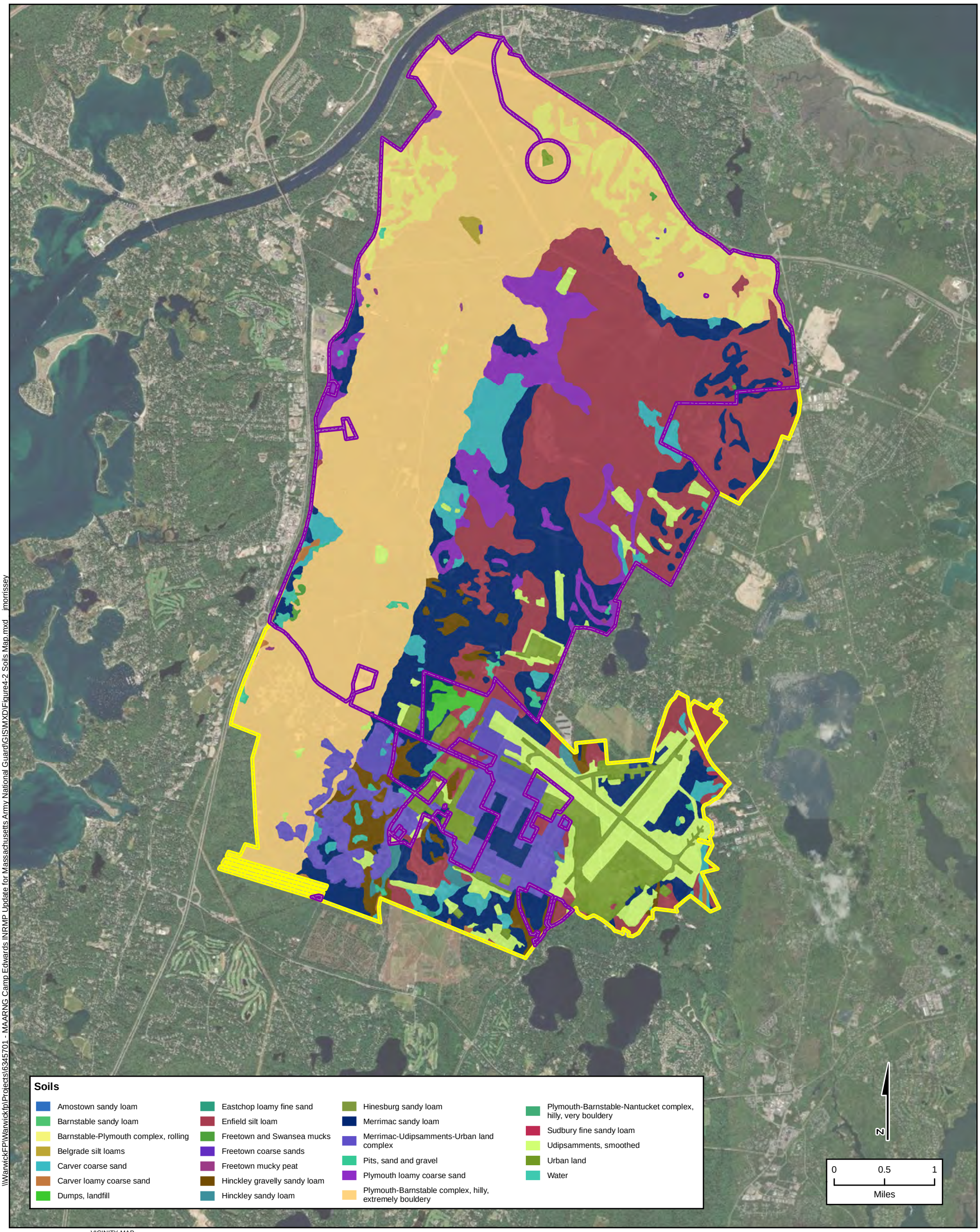

VICINITY MAP

Legend

Installation Boundary

Figure **E**-2
Soils Map
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

\\WarwickFP\Warwickfp\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure4-2 Soils Map.mxd jmorrissey

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Soils of the Sandwich and Buzzards Bay Terminal Moraines—The soils of the Sandwich and Buzzards Bay terminal moraines are classified as rolling or hilly, and containing many boulders. These excessively drained or well-drained soils are typically found on slopes ranging from 3 to 15 percent and on hills of glacial moraine areas. Plymouth-Barnstable complex soils and Plymouth loamy coarse sand (7,066 acres), and Barnstable-Plymouth complex soils (791 acres) comprise the entirety of the terminal moraine soils on Camp Edwards. The Plymouth-Barnstable and Barnstable-Plymouth complex soils are mixtures of Plymouth, Barnstable, and other soils in varying proportions. These soils are typically covered with an inch of organic matter above the highly permeable soil. The relatively high susceptibility of these soils to erosion is a management concern (Soil Conservation Service 1993).

Soils of the Outwash Plains—The soils of the outwash plains on Camp Edwards are primarily Enfield silt loams and Merrimac sandy loams. Both of the Enfield and Merrimac loams have been classified as very deep well-drained soil commonly found in broad areas on outwash plains. These soils have been described at a range of slopes between 0 and 15 percent throughout outwash plains. Erosion is a management concern where these soils exist on moderate to steep slopes (Soil Conservation Service 1993).

Other soil types that have been described on the outwash plain of Camp Edwards include Plymouth loamy coarse sand, Carver coarse sand, Hinckley gravelly sandy loam, and gravelly sandy loam. These soils are often found on moderate or steep slopes of swales on outwash plains. Like the Enfield and Merrimac loams, these soils are described as excessively drained, often resulting in high erodibility, especially at steeper slopes (Soil Conservation Service 1993). Soil types associated with development on the outwash plain include sand and gravel pits from which sand or gravel have been removed, smoothed Udipsamments, which are areas that have been leveled or smoothed during construction, and urban land that includes buildings and pavement (Soil Conservation Service 1993).

1.4 HYDROLOGY

Water resources presented in this INRMP include surface and groundwater resources. The water resources of Camp Edwards are scarce on the surface of the land, but plentiful beneath. Surface water resources comprise bogs, ponds, and swamps; no large lakes, rivers, or streams exist on the property (Gravatt et al. 1999). The excessively drained sandy soils of Camp Edwards are not conducive to surface water retention. As a result, 45 percent of the annual rainfall on Camp Edwards infiltrates the soil and contributes to the groundwater supply. Groundwater properties are often described in terms of depth to aquifer, aquifer or well capacity, water quality, and surrounding geologic composition. The quality and availability of surface and groundwater are addressed in this section. Figure E-3 highlights the water resources present at Camp Edwards.

1.4.1 Surface Water

Surface water resources are sparse on Camp Edwards. Although there are 31 wetlands on the training site, they comprise only 69 of the 14,433 acres, or 0.39 percent, of land. No large lakes, rivers, or streams exist on the property, only small palustrine (i.e., marshy) wetlands and ponds (Gravatt et al. 1999). As determined using the National Wetlands Inventory classification system, there are 17 palustrine emergent, 8 palustrine open water, 6 palustrine scrub-shrub,

5 palustrine forested, 2 palustrine emergent/scrub shrub, 1 palustrine forested/scrub shrub, 1 palustrine emergent/open water, and 1 palustrine aquatic bed wetlands on Camp Edwards.

By definition, these palustrine wetlands are well-vegetated nontidal wetlands that are dominated by trees, shrubs, or emergent plants and have salinity below 0.5 part per thousand. If vegetation is not present, then the wetlands must be less than 8 hectares, lacking in wave-formed or bedrock shores, and have a maximum water depth less than 2 meters at low water (Cowardin et al. 1979). Most of the wetlands and surface waters in the Sandwich and Buzzards Bay moraines on Camp Edwards are considered to be perched (USACE 2000). Table E-2 outlines the waterbodies, including wetlands present at Camp Edwards, their Natural Heritage and Endangered Species Program (NHESP) classification and if they are certified as vernal pools. Wetlands at Camp Edwards and the ecological communities they support are described in greater detail in Appendix F, Section 1.5.

Runoff from roadways and other developed areas creates surface water in some parts of Camp Edwards. A stormwater drainage system is lacking on most of the roads in the cantonment area, resulting in runoff draining into the shoulders of the roads. In contrast to the roads in the cantonment area, a relatively small percentage of roads in the northern training area of Camp Edwards are paved. The majority of the roads in the northern training area are unimproved single-vehicle trails that are utilized by wheeled vehicles for training and remediation purposes.

Monument Swamp Cistern
Monument Swamp
Monument Swamp Red Maple
Spruce Swamp
Raccoon Swamp E
Raccoon Swamp B
Cranberry Bog
Deep Bottom Pond
Red Maple Swamp
Round Swamp
Gibbs Pond
Bailey"s Pond
Grassy Pond
Little Halfway Pond
Donnely Pond
Wood Road Wetland
Ox Pond
CG Tower Pond
Succonsett Pond
Rod and Gun Club Shrub Swamp
Opening Pond
Rod and Gun Club North
GP-3 Pond
UTES Pond
Connery South Wetland
Rod and Gun Club South
A-2 Pond
Bypass Bog
Trailer Pond
JWell Wetland
Beaman Street Wetland
Leather Leaf Bog
Osbourne Pond
USDA West
Leather Leaf Bog
Edmunds Pond
Spit Pond
Munitions Wetland
N
0 0.5 1
Miles

\\WarwickFP\Warwickfp\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure4-3 WaterResources Map.mxd jmorrissey

VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary
- Groundwater Reserve
- Pond
- Wetland
- Certified Vernal Pool

Figure **E**-3
Water Resources Map
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

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Table E-2. Waterbodies (Wetlands and Ponds) of Camp Edwards, Massachusetts

Name	Acres	National Wetlands Inventory	Massachusetts NHESP	Certified Vernal Pool
A-2 Pond	0.2	Palustrine Emergent/ Scrub Shrub	Shrub Swamp	Yes
Bailey's Pond	0.9	Palustrine Emergent	Coastal Plain Pondshore	No
Beaman Street Wetland	0.0	Palustrine Emergent/ Open Water	Shrub Swamp	No
Bypass Bog	0.9	Palustrine Emergent/ Scrub Shrub	Coastal Plain Pondshore	No
Cranberry Bog	2.3	Palustrine Emergent	Kettlehole Level Bog	Yes
Deep Bottom Pond	1.3	Palustrine Open Water	Coastal Plain Pondshore	Yes
Donnely Pond	2.1	Palustrine Open Water	Coastal Plain Pondshore	No
Gibbs Pond	0.6	Palustrine Emergent	Basin Depression	Yes
GP-3 Pond	0.5	Palustrine Emergent	Kettlehole Wet Meadow	No
Grassy Pond	0.5	Palustrine Emergent	Shrub Swamp	Yes
Little Halfway Pond	0.7	Palustrine Scrub Shrub	Coastal Plain Pondshore	Yes
Monument Swamp	2.3	Palustrine Emergent	Kettlehole Level Bog	Yes
Monument Swamp Cistern	0.1	Palustrine Open Water	Woodland Vernal Pool	No
Monument Swamp Red Maple	0.8	Palustrine Forested	Forest Seep Community	No
Opening Pond	1.0	Palustrine Open Water	Coastal Plain Pondshore	Yes
Ox Pond	1.0	Palustrine Forested/ Scrub Shrub	High Bush Blueberry Thicket / Red Maple Swamp	No
Raccoon Swamp A	0.1	Palustrine Open Water	Woodland Vernal Pool	Yes
Raccoon Swamp B	0.0	Palustrine Emergent	Shrub Swamp	Yes
Raccoon Swamp C	0.0	Palustrine Emergent	Shrub Swamp	No
Raccoon Swamp D	0.4	Palustrine Emergent	Woodland Vernal Pool	No
Raccoon Swamp E	0.5	Palustrine Emergent	Kettlehole Level Bog	No
Red Maple Swamp	0.6	Palustrine Forested	Red Maple Swamp	No
Rod & Gun Club Red Maple Swamp	0.6	Palustrine Forested	Red Maple Swamp	No
Rod & Gun Club Red Maple Swamp	0.8	Palustrine Forested	Red Maple Swamp	No
Rod & Gun Club S Shrub Swamp	1.7	Palustrine Scrub Shrub	Shrub Swamp	No
Rod & Gun Club S Shrub Swamp	1.5	Palustrine Scrub Shrub	Shrub Swamp	No
Rod and Gun Club 3	0.2	Palustrine Emergent	Coastal Plain Pondshore	No
Rod and Gun Club North	6.7	Palustrine Open Water	Coastal Plain Pondshore	No
Rod and Gun Club Shrub Swamp	2.1	Palustrine Scrub Shrub	Shrub Swamp	No
Rod and Gun Club Shrub Swamp	2.7	Palustrine Scrub Shrub	Shrub Swamp	No
Rod and Gun Club South	8.3	Palustrine Open Water	Coastal Plain Pondshore	No
Rod and Gun Club West	0.9	Palustrine Open Water	Coastal Plain Pondshore	No
Round Swamp	0.5	Palustrine Scrub Shrub	High Bush Blueberry Thicket / Red Maple Swamp	No

Table E-2. Waterbodies (Wetlands and Ponds) of Camp Edwards, Massachusetts

Name	Acres	National Wetlands Inventory	Massachusetts NHESP	Certified Vernal Pool
Spruce Swamp	0.0	Palustrine Emergent	Shrub Swamp / Coastal Atlantic White Cedar Swamp	No
Succonsett Pond	1.3	Palustrine Aquatic Bed	Coastal Plain Pondshore	Yes
Tank Trail Wetland	0.0	Palustrine Emergent	Woodland Vernal Pool	No
USDA East	0.2	Palustrine Forested	Shrub Swamp	No
USDA West	0.2	Palustrine Emergent	Shrub Swamp	No
UTES Pond	0.2	Palustrine Emergent	Shrub Swamp	No
Wood Road Wetland	0.1	Palustrine Emergent	Shrub Swamp	No
Source: Gravatt et al. 1999; MAARNG 2009.				

1.4.2 Groundwater

Camp Edwards sits atop the Sagamore Lens of the Cape Cod Aquifer. This aquifer has been designated as a "sole-source" aquifer by EPA, since it meets the definition of supplying greater than 50 percent of the drinking water. With the exception of bottled water, it supplies 100 percent of the drinking water to the residents of Upper Cape Cod. The Camp Edwards Training Site is within the Upper Cape Water Supply Reserve, which provides up to 3 million gallons of clean drinking water per day to JBCC and the four Upper Cape Cod towns of Sandwich, Bourne, Falmouth, and Mashpee. The Upper Cape Water Supply Reserve was established by Chapter 47 of the Acts of 2002 as public conservation land dedicated to three primary purposes: (1) water supply and wildlife habitat protection; (2) the development and construction of public water supply systems; and (3) the use and training of the military forces of the commonwealth as long as military use and training is compatible with the natural resource purposes of water supply and wildlife habitat protection (MANG 2019a) (Figure E-3).

Groundwater altitude in the Sagamore Lens is monitored at Camp Edwards at a U.S. Geological Survey (USGS) well (USGS MA-SDW 537-0107); at this well, groundwater levels change with natural seasonal and year-to-year variation based on precipitation levels (MANG 2019a). At JBCC there are two major cleanup programs that have investigated and implemented significant remediation of soil and groundwater contamination caused by past activities. They are the Installation Restoration Program (IRP) managed by the Air Force Civil Engineer Center and the Impact Area Groundwater Study Program (IAGWSP) managed by the Army Environmental Center. The IRP is a Comprehensive Environmental Response, Compensation, and Recovery Act based investigation and remediation program, and the IAGWSP investigation and remediation decisions are based on the Safe Drinking Water Act. The IAGWSP area of investigation is in the Camp Edwards training area with the sources of contamination linked to some military training and government contract weapons testing; the significant contaminants to groundwater include RDX and perchlorate, both of which are explosive by-products. Additionally, USGS has conducted a variety of studies on the aquifer to provide information to the two cleanup programs, the EPA and the Massachusetts Department of Environmental Protection (MassDEP), as well as standalone research on the water resources of Massachusetts. These remediation activities have had significant success at reducing contamination plumes and cleaning groundwater.

APPENDIX F – ECOSYSTEMS AND THE BIOTIC ENVIRONMENT

1.1 ECOSYSTEM CLASSIFICATION

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. Much of Cape Cod, including Camp Edwards, is within the Atlantic Coastal Pine Barrens Ecoregion. This ecoregion includes disjunct pine forests in New Jersey, Long Island, and on Cape Cod, Nantucket, Martha's Vineyard, and other Massachusetts islands. Atlantic coastal pine barrens have sandy porous soils, and vegetation is typically heavily dictated by fire disturbance (USGS 2003). Camp Edwards is at the base of Cape Cod and has a variety of natural communities. In general, the natural communities of Camp Edwards are within the Atlantic coastal pine barrens and can be referred to as pine barren mosaic.

Camp Edwards has one of the few remaining stands of pine barrens in the nation and is the largest pine barrens system north of New Jersey. Pitch pine/scrub oak barrens occur on deep, coarse, well-drained sands derived from glacial outwash, in the coastal plain, the Connecticut River Valley, and other scattered areas throughout the northeast. The sands are acidic, nutrient poor, and drought prone. The low vegetation and sandy soils contribute to a tendency to be hotter than more mesic sites on summer days, with greater cooling at night, and so have great temperature variations daily. The dry environment with low humidity contributes to the loss of heat at night, as in a desert. Exposure to the temperature variations may make plants more susceptible to other damaging factors such as insects or disease. In pitted outwash plains or rolling moraines, some low bowls, or kettles, are frost pockets and have more heath and lichen and less oak and pine. Deeper kettles may intersect the water table and have a Coastal Plain pond at the bottom.

1.2 VEGETATION

1.2.1 Historic Vegetative Cover

Much of Upper Cape Cod has been dominated by pitch pine and scrub oak barrens since the period of colonial settlement (Ruffner and Patterson 2000). Thomas Bourne stated in 1769 that "a large barren wilderness of small pitch pines and scrub oaks make up the space between the settlements [of Sandwich] and indeed the center and for the greater part of the township" (Lovell 1984). The area was maintained in an early successional state as a result of timber harvesting and a catastrophic fire that occurred in 1772 (Sawyer 1988). The first fire recorded by Europeans on Cape Cod was set by Native Americans in 1603 to scare off sassafras hunters, but reports of fires during colonial times are not common (Component Plan A). In another early attempt at fire management, selectmen of the Town of Sandwich implemented the practice of annually burning portions of the woods to reduce wildfire hazard through the mid-1700s with the last such entry occurring in 1754 (Lovell 1984). Fire Frequency increased in the 19th century, averaging a major fire roughly every 22 years; these fires were large, averaging 10,730 acres in size (Component Plan A). By the first half of the 20th century, large fires burned the forests of the Upper Cape approximately every 3.3 years. Military action at Camp Edwards resulted in a high fire frequency after the 1950s (Component Plan A).

Scotch pine was likely introduced to Camp Edwards in the late 1920s and the early 1930s as plantations in Shawme State Forest (U.S. Department of Agriculture [USDA] 1932). Prior to the creation of JBCC) in 1935, the area north of Wood Road was managed as pine, spruce, and fir plantations as part of Shawme State Forest. Areas were frequently burned over and planted with Austrian pine (*Pinus sylvestris*), white pine (*P. strobus*), red pine (*P. resinosa*), Spanish pine (*Pinus* sp.), Douglas fir (*Pseudotsuga menziesii*), balsam fir (*Abies balsamea*), Norway spruce (*Picea abies*), and larch (*Larix* sp.) between 1925 and 1934 (USDA 1932). Military use of Camp Edwards also resulted in frequent fires, which created a vegetative community that was predominantly scrub oak or early successional disturbed areas.

1.2.2 Current Vegetative Cover

The plant communities of Camp Edwards are generally classified as mid to late successional forest with intermittent early successional disturbed areas and kettle hole ponds and wetlands. The climax plant community on Camp Edwards is likely an oak-pine forest with gray birch (*Betula populifolia*), American beech (*Fagus grandifolia*), and bitternut hickory (*Carya cordiformis*) (Foster and Motzkin 1999). Many of the plant communities at Camp Edwards have been influenced by several different factors including fire, ice storms, frost, drought, insect outbreaks, hurricanes, tropical storms, and historic logging and grazing. Natural or human-induced fires have played an important role in creating and maintaining the plant communities on Camp Edwards. The species diversity of the forests of Camp Edwards is generally quite low. On average, 53 species of plants were documented in each plant community of Camp Edwards, which, when compared to most fertile woods of western New England that typically have up to 200 plant species, is relatively low (Jenkins 1994). A description of the predominant vegetation communities present at Camp Edwards is provided in Table F-1.

Table F-1. Vegetation Communities at Camp Edwards, Massachusetts

Community	Description
Scrub Oak Shrubland	This plant community represents one of the earliest states of vegetative succession on Camp Edwards and consists primarily of scrub oak (*Quercus ilicifolia*) with essentially no pitch pine (*Pinus rigida*). Other common plants in the scrub oak barrens include black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium* spp.), cat brier (*Smilax glauca*), and wintergreen (*Gaultheria procumbens*).
Pitch Pine – Scrub Oak Community	In areas of forest from which hardwood trees were historically cleared, the plant community is almost entirely pitch pine with an understory of sometimes very dense scrub oak. Other tree species that are present but not common to the community are scotch pine (*P. sylvestris*), white oak (*Q. alba*), and scarlet oak (*Q. coccinea*).
Pitch Pine – Scrub Oak Forest / Woodland	The structure of the forest ranges from a low canopy with a dense shrub layer to a taller canopy with a sparser shrub layer. In general, the plant community is in a mid-successional state where trees and shrubs are increasing in number, while forbs and grasses are becoming less abundant.
Black Oak – Scarlet Oak Forest/ Woodland	Some limited stands of hardwood trees exist in the northeastern corner of the training area. Although the community comprises approximately 2 percent of Camp Edwards, it represents the most advanced state of succession of the plant communities on the installation. These communities have been encroached upon by pitch pine.

Table F-1. Vegetation Communities at Camp Edwards, Massachusetts

Community	Description
Sandplain Grassland	An open community dominated by grasses found predominantly within the cantonment area, former parade grounds, and areas surrounding the airfield used by the Air National Guard. Species include little blue stem grass (*Schizachyrium scoparium*), Pennsylvania sedge (*Carex pensylvanica*), and poverty grass (*Danthonia spicata*), as well as goldenrods (*Solidago* and *Euthamia* spp.) and milkweeds (*Asclepias* sp.). This community is maintained through mowing and prescribed fire.
Aquatic Habitats	Aquatic habitats include ponds, irrigation ditches, and wetlands. These habitats account for a limited amount of the vegetative community at Camp Edwards. Many of these areas have open water and little vegetative cover, but species found include cattails and rushes.
Disturbed Natural Communities	Developed areas are largely paved or dominated by grasses, further divided into three subsets including bivouacs, burns, and other disturbed areas (e.g., areas mowed or subject to vehicle traffic). This includes mowed ranges, landscaped areas, and other heavily managed non-native landscapes.
Sources: Jenkins 1994; Swain 2016.	

An initial floristic survey of JBCC identified 433 species of vascular plants (Jenkins 1994), but subsequent surveys as part of the annual Range and Training Land Assessment (RTLA) and rare plant surveys have identified an additional 124 specimens, increasing the total number of known plant species on Camp Edwards to 557. Plant species found at Camp Edwards are provided in Appendix F. The vegetative communities at Camp Edwards can be classified according to the Massachusetts NHESP's Natural Communities Classification (Swain 2016). Some smaller undescribed plant communities, such as aspen (*Populus* spp.) depressions also exist within the predominant natural communities. Figure F-1 shows the natural communities of Camp Edwards.

1.2.2.1 Scrub Oak Shrubland

The scrub oak shrubland is typically defined as dense growth of scrub oaks (*Quercus ilicifolia*) and dwarf chinquapin oak (*Q. prinoides*) with few to no stems of pitch pine (*P. rigida*). These communities are found interspersed within pitch pine – scrub oak communities (Swain 2016). Fire and frost effects typically suppress the growth of pitch pine and other tree species while promoting the growth of scrub oak. Fire scarring causes scrub oak acorns to germinate more readily and terminal buds to die, resulting in the growth of lateral branches. Frequent late spring frosts result in chronic dieback of developing leaves, slow growth rates, and reduced stem height, which promotes shrub growth. Eventually, large herds of sheep were grazed throughout the Upper Cape, which limited tree growth and promoted the establishment of the scrub oak barren habitats.

1.2.2.2 Pitch Pine – Scrub Oak Community

Pitch pine – scrub oak communities are typically dominated by dense scrub oak shrub cover with scattered pitch pine tree cover. These communities occur on low nutrient and acidic soils and are fire-dependent systems (Swain 2016). The structure of the pitch pine – scrub oak communities varies greatly with age. Younger stands are short, dense thickets of immature pitch pine. Immature pitch pine is relatively low in plant diversity and often occurs along roads, old

firebreaks, or other previously disturbed areas, and comprises a total of 1 percent of Camp Edwards. The primary value of the immature pitch pine is habitat for prairie warblers. As the pitch pine matures, the forest has a more closed canopy, which ultimately outcompetes scrub oak for sunlight. However, in areas where pitch pine has been cleared, scrub oak often grows in extremely dense patches. In the pitch pine – scrub oak community, trees and shrubs in general are growing at a rate greater than in any other plant community, indicating a somewhat young, but rapidly maturing forest.

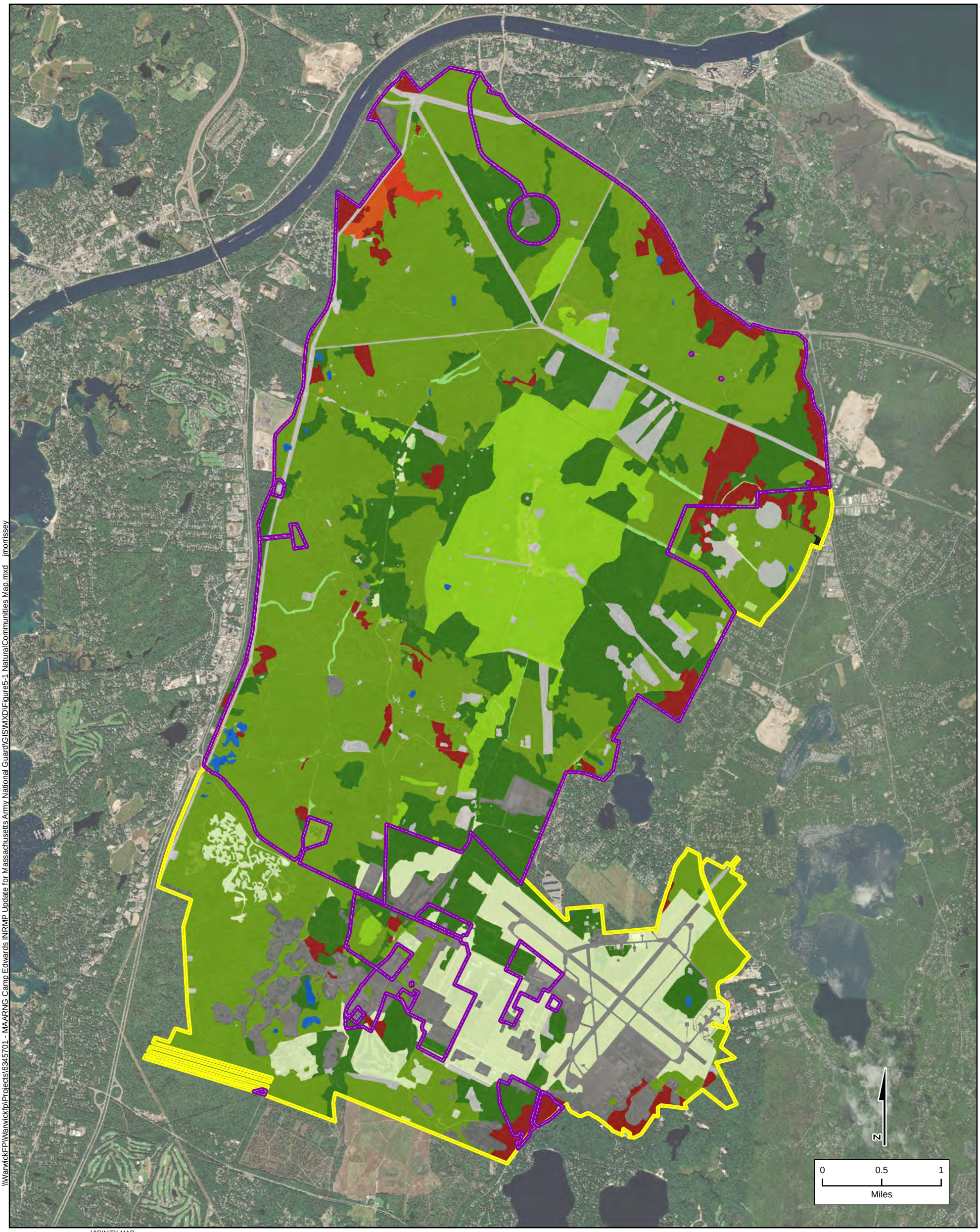
Pitch pine-scrub oak community at Camp Edwards

1.2.2.3 Pitch Pine – Scrub Oak Forest / Woodland

Pitch pine – scrub oak forests are found on low-nutrient, highly acidic soils, typically in moraines, rocky slopes, and sandplains with sporadic disturbance. This community ranges from a sparse tree cover with a relative open canopy to a densely growing understory, and is often found interspersed with pitch pine – scrub oak community in a mosaic (Swain 2016). The Pitch pine – oak forest woodland of Camp Edwards varies with degree of maturity. The woodlands in the northern area of Camp Edwards tend to have a higher and denser canopy than the other forest communities. This may be due to less historic disturbance, resulting in a more mature forest. The pitch pine – oak forest woodland of Camp Edwards has a low canopy of pitch pine, tree oaks including black oak (*Q. velutina*), scarlet oak (*Q. coccinea*), and white oak (*Q. alba*) and a moderately continuous shrub layer of blueberry (*Vaccinium* spp.), black huckleberry (*Gaylussacia baccata*), sheep laurel (*Kalmia angustifolia*), and scrub oak. The sparse forb layer consists of bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*). The low forest canopy, about 10–15 meters tall, indicates a relatively young forest of no more than 100 years old.

1.2.2.4 Black Oak – Scarlet Oak Forest/ Woodland

Black oak – scarlet oak forest communities are maintained with limited fire and are found at dry sites with gravelly or sandy soils. The dominant canopy species are black oak with scarlet oak, as well as white oak and red maple (*Acer rubrum*) (Swain 2016). Some small stands of hardwood trees exist in the northeastern corner of the Camp Edwards training area. Although the community comprises approximately 2 percent of Camp Edwards, it represents the most advanced state of succession of all the plant communities. Oaks dominate the tree canopy of these stands and the shrub layer is similar to the pitch pine-mixed oak forest. The structure of the community varies with age from stands of immature hardwoods to more mature forest with a closed canopy and sparse understory.



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VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary
- Cultural grassland
- Immature pitch pine
- Pitch pine community
- Pitch pine oak forest
- Pitch pine scrub oak community
- Scrub oak shrubland
- Black oak scarlet oak forest
- Scotch pine pitch pine scrub oak community
- Scotch pine pitch pine oak forest
- Red maple swamp
- Plantation
- Developed
- Disturbed
- Wet area

Figure **F**-1
Natural Communities
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 1/28/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

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1.2.2.5 Sandplain Grassland

Sandplain grasslands are open cover communities found in coastal communities dominated by native grasses and forbs with sparse shrub cover. They are found on sandy or dry low nutrient soils and occur within openings in pitch pine – scrub oak communities (Swain 2016). Species found in sandplain grasslands include little bluestem grass (*Schizachyrium scoparium*), Pennsylvania sedge, and poverty grass (*Danthonia spicata*). Shrub species include bearberry (*Arctostaphylos uva-ursi*), scrub oak, stiff aster (*Ionicus linariifolia*), and bayberry (*Morella pensylvanica*) while forbs noted include goldenrods (*Solidago* and *Euthamia* spp.), yellow wild indigo (*Baptisia tinctoria*), butterfly weed (*Asclepias tuberosa*), and bird's foot violet (*Viola pedata*) (Swain 2016). This community is maintained through mowing and prescribed fire and has been the focus of restoration efforts in recent years at Camp Edwards.

1.2.2.6 Aquatic Habitats

Aquatic habitats include ponds and wetlands, which comprise only 55 acres, or 0.39 percent, of Camp Edwards but support the most diverse plant community on the installation. A total of 67 plant species have been documented in the wetlands of Camp Edwards. Section 1.5 describes the wetlands of Camp Edwards and their vegetative communities in greater detail.

1.2.2.7 Disturbed Natural Communities

The developed grasslands are one of the least diverse plant communities on Camp Edwards, with only 37 identified species. The community is dominated by grass species including filiform fescue (*Festuca tenuifolia*), little bluestem, switchgrass (*Panicum virgatum*), hairgrass (*Deschampsia flexuosa*), redtop (*Agrostis gigantea*), poverty grass, and Pennsylvania sedge. The only common tree species is immature pitch pine and red cedar (*Juniperus virginiana*). Sweetfern (*Comptonia peregrina*) was found in dense thickets less than a meter in height, whereas bayberry (*Myrica pensylvanica*), blueberry, and scrub oak were present, but less common. Many non-native species occur in the developed grasslands of Camp Edwards and JBCC. There are ongoing management efforts to remove these exotic, invasive plant species.

A Vegetation Management Plan for Camp Edwards was developed in 2017 to assess invasive plant species coverage at Camp Edwards and the impact of invasive or exotic species on rare plant species at the installation (Wilkinson Ecological Design 2018). Invasive species have also been tracked in past surveys and during annual RTLA surveys. The results showed that although certain species may be abundant in small, localized areas, they are generally not widely dispersed throughout the installation. Ten exotic invasive plant species have been documented as potentially posing a threat to native plant communities. Plans for removal of exotic or invasive species from Camp Edwards are coordinated with appropriate representatives from the Massachusetts NHESP to reduce risk to state-listed rare plant species. Prescribed fire and firebreak maintenance will play an important role in control and management of invasive plant species on Camp Edwards. The following is the list of the 10 exotic invasive plant species documented on Camp Edwards that potentially pose a threat to native plant communities.

Invasive species noted at Camp Edwards include multiflora rose (*Rosa multiflora*), Asiatic bittersweet (*Celastrus orbiculatus*), shrub honeysuckle (*Lonicera morrowii* x *bella*), Japanese

barberry (*Berberis thunbergii*), glossy buckthorn (*Frangula alnus*), border privet (*Ligustrum* sp.), vine honeysuckle (*Lonicera japonica*), and black locust (*Robinia pseudoacacia*) (Wilkinson Ecological Design 2018). Other species that have been found in past surveys include Japanese knotweed (*Polygonum cuspidatum*), scotch broom (*Cytisus scoparius*), common reed (*Phragmites australis*), knapweed (*Centaurea maculosa*), Scotch pine, and Autumn olive (*Elaeagnus umbellata*).

Extensive surveys have been conducted to inventory the fauna of Camp Edwards. Annual RTLA surveys have monitored the long-term trends in bird and small mammal populations since 1993 while other projects have surveyed faunal populations for 1 to 8 years. These surveys and inventories have provided an enormous database of the fauna of Camp Edwards and their associated habitats.

1.3 FISH AND WILDLIFE

Extensive surveys have been conducted to inventory the fauna of Camp Edwards. Annual surveys have monitored the long-term trends in bird populations since 1993 while other projects have surveyed other faunal populations for 1 to 8 years. The list of fauna species of Camp Edwards is updated based on recent surveys and when new species are observed. Information from past fauna surveys and studies conducted at Camp Edwards is presented below. See Appendix F for a full list of fauna species known from Camp Edwards.

1.3.1 Birds

A total of 105 bird species have been documented on Camp Edwards since 1993 during annual bird surveys as well as during surveys of grasslands, the Impact Area, and other areas of Camp Edwards (Appendix F). The data from the bird surveys are used to determine abundance and species richness of birds throughout the natural communities of Camp Edwards.

Camp Edwards supports a relatively large amount of habitat for bird species that are characteristic of oak and pitch pine–scrub oak habitats. Many of these species, including the eastern towhee (*Pipilo erythrophthalmus*), field sparrow (*Spizella pusilla*), song sparrow (*Melospiza melodia*), prairie warbler (*Setophaga discolor*), whip-poor-will (*Caprimulgus vociferus*), and gray catbird (*Dumetella carolinensis*) that have exhibited significant regional declines are relatively abundant on Camp Edwards (MAARNG 2009). Overall, birds that favor woodland habitat have been increasing over time at Camp Edwards, even species that have shown regional decreases in the same time period. For example, the scarlet tanager (*Piranga olivacea*) has increased at Camp Edwards despite a decrease at a regional scale, and ruffed grouse *(Bonasa umbellus*) and whip-poor-will both occur at Camp Edwards at higher densities than in most parts of Massachusetts where they are declining (McCumber 2015). Camp Edwards provides

Prairie warbler (Setophaga discolor)

high-quality late successional woodland with sufficient diversity of habitat types, but may not provide as much habitat for early to mid-successional bird species (McCumber 2015).

Camp Edwards supports several regionally uncommon grassland bird species in the sandplain grassland habitat and cantonment areas, as well as state-listed bird species, which are discussed in Section 1.4.2.3. Grassland birds are surveyed annually at Camp Edwards. An additional study was completed in 2015 to research the grassland bird species of JBCC, with a focus on at-risk grassland species, which noted 38 species of grassland birds, with the most frequently detected species being savannah sparrow (*Passerculus sandwichensis*), Eastern towhee, and grasshopper sparrow (*Ammodramus savannarum*) (Renfrew and Hill 2015). Other grassland bird species observed in recent years include killdeer (*Charadrius vociferus*), eastern meadowlark (*Sturnella magna*), and American kestrel (*Falco sparverius*).

The wetlands of Camp Edwards were surveyed in 1995 for secretive waterbirds, some species of which are declining in or have disappeared from the Commonwealth of Massachusetts (Veit and Petersen 1993). Only one species of secretive waterbird, the green heron (*Butorides striatus*), was observed during the study (Wilson and Cavanaugh 1996). Other documented wetland bird species were the great blue heron (*Ardea herodias*), the Canada goose (*Branta canadensis*), the wood duck (*Aix sponsa*), the mallard (*Anas platyrhynchos*), and the mute swan (*Cygnus olor*). None of the bird species observed were state-listed rare species in Massachusetts.

MassWildlife developed and implemented a wild turkey (*Meleagris gallopavo*) reintroduction program beginning in 1972. Between 1979 and 1996, 561 turkeys were released throughout the Commonwealth. MassWildlife successfully reintroduced wild turkey to the forests of Camp Edwards, one of the two locations on Cape Cod where turkeys were released. Eighteen turkeys, 6 males and 12 females, were released during the winter months of 1989. Since this time, wild turkeys have been a common sight on Camp Edwards. The first organized wild turkey harvest was held in Spring 2000, and wild turkey harvests have been held annually since 2004. During the May 2018 5-day wild turkey hunting season in the Reserve, 86 hunters took 17 turkeys (MANG 2019b).

1.3.2 Mammals

A total of 30 species of mammals have been documented or observed at Camp Edwards in past surveys and during monitoring. This includes small mammals, bats, ungulates, and carnivores, which are discussed below. A full list of mammals observed at Camp Edwards is provided in Appendix F.

Small mammal species are abundant at Camp Edwards. Frequently encountered are the white-footed mouse (*Peromyscus leucopus*), which occurs in almost every habitat type, and the southern red-backed vole (*Clethrionomys gapperi*), which is found in communities dominated by pitch pine. Other small mammal species observed include meadow vole (*Microtus pennsylvanicus*), short-tailed shrew (*Blarina brevicauda*), southern flying squirrel (*Glaucomys volans*), masked shrew (*Sorex cinereus*), long-tailed weasel (*Mustela frenata*), eastern chipmunk (*Tamias striatus*), red squirrel (*Tamiasciurus hudsonicus*), eastern mole (*Scalopus aquaticus*), grey squirrel (*Sciurus carolinensis*), and meadow jumping mouse (*Zapus hudsonius*). Small mammals have been monitored since 1994.

Most of the medium-sized mammals on Camp Edwards are species that are common to Southeastern Massachusetts, such as muskrat (*Ondatra zibethicus*), porcupine (*Erethizon dorsatum*), red fox (*Vulpes vulpes*), and racoon (*Procyon lotor*). Fisher (*Martes pennanti*) and the New England cottontail (*Sylvilagus transitionalis*) are two less common species that have been observed at Camp Edwards. The geographic range of the fisher formerly did not extend as far south as Cape Cod (Burt and Grossenheider 1980), but fisher have now expanded throughout Cape Cod.

The New England cottontail is a medium-sized cottontail rabbit, weighing approximately 2.2 pounds. This lagomorph is considered an early successional forest species with suitable habitat comprising both forested and shrub lands with dense understory growth. The introduction of the Eastern cottontail in the 1930s, fragmentation of habitat as the human population grows, and higher predation and hunting rates as the habitat is more and more fragmented have all contributed to the decline of this species. It has been found that large patches of habitat, like that of Camp Edwards, are essential for sustaining populations of this species. The New England cottontail was considered as a candidate for federal listing, but USFWS made a determination that the listing was not warranted in 2015 (USFWS 2015a). Part of the decision not to list this species was based on the assurances of continued work by partners to manage for the species. The New England cottontail remains a high-priority species and while listing under the Endangered Species Act (ESA) was determined to be not warranted, it is considered "at-risk" by USFWS. Monitoring of New England cottontails started in 2010 and is ongoing.

Large mammals at Camp Edwards are the coyote (*Canis latrans*) and the white-tailed deer (*Odocoileus virginianus*). White-tailed deer are common, and populations have been managed for several years through the implementation of the recreational hunting program at Camp Edwards. The hunting program at Camp Edwards has been ongoing since the 1950s.

Seven species of bat have been documented on Camp Edwards: the big brown bat (*Eptesicus fuscus*), the little brown bat (*Myotis lucifugus*), the eastern red bat (*Lasiurus borealis*), the hoary bat (*Lasiurus cinereus*), the northern long-eared bat (*Myotis septentrionalis*), the silver-haired bat (*Lasionycteris noctivagans*), and the tricolored bat (*Perimyotis subflavus*). In the past the occurrence of the eastern small-footed bat (*Myotis leibii*) has been suspected but not confirmed (Tetra Tech 2015), though a preliminary analysis of data from the 2019 monitoring season may indicate the presence of this species. A full analysis of acoustic data will be completed in 2020. Northern long-eared bats are federally threatened, while the little brown bat and tricolored bat are state listed. These bat species are discussed in Section 1.4. Acoustic and mist-net surveys have been conducted over several seasons at Camp Edwards.

Domesticated cats are not common to Camp Edwards, but have been observed in the housing and cantonment areas of JBCC. Domestic cats may pose a threat to ground-nesting grassland birds. In the event that feral cats are observed in the grasslands, consultation with MassWildlife will occur to determine the appropriate method of removal.

1.3.3 Reptile and Amphibians

Camp Edwards supports populations of 12 species of reptiles, though little effort has been made to systematically document reptiles at the installation. Camp Edwards has a population of the state-listed eastern box turtle (*Terrapene carolina*), which is discussed in Section 1.4.2.2. Other reptiles noted at Camp Edwards during past surveys and from incidental sightings include spotted turtle (*Clemmys guttata*), snapping turtle (*Chelydra serpentine*), musk turtle (*Sternotherus odoratus*), eastern painted turtle (*Chrysemys picta picta*), black racer (*Coluber constrictor*), smooth green snake (*Opheodrys vernalis*), garter snake (*Thamnophis sirtalis sirtalis*), eastern ribbon snake (*Thamnophis sauritus sauritus*), northern ring-necked snake (*Diadophis punctatus edwardsii*), milk snake (*Lampropeltis triangulum*), and eastern hog-nosed snake (*Heterodon platirhinos*). Spotted turtle trapping was conducted in 2016. The most recent survey of reptiles was completed in 2018 and focused on black racer and eastern hog-nose snake, which are both proposed for state listing as special concern species.

Although there are limited surface water resources at Camp Edwards, 11 species of amphibians have been documented at the installation. Amphibian species at Camp Edwards have not been comprehensively surveyed, though surveys have been conducted at specific wetlands and vernal pools. Amphibians commonly found on Camp Edwards include bullfrogs (*Rana catesbeiana*), green frogs (*Rana clamitans*), grey treefrogs (*Hyla versicolor*), wood frog (*Rana sylvatica*), spring peepers (*Pseudacris crucifer*), American toads (*Bufo americanus*), spotted salamanders (*Ambystoma maculatum*), eastern newts (*Notophthalmus viridescens*), redback salamander (*Plethodon cinereus*), and pickerel frog (*Rana palustris*). Breeding has been documented for several of these species, including in roadway puddles and vernal pools. Despite surveys of puddles, swales, and vernal pools, as well as acoustic surveys, spadefoot toads (*Scaphiopus holbrooki*) have not been documented at Camp Edwards.

1.3.4 Fisheries

Camp Edwards supports limited fisheries habitat in wetlands on the installation, but generally surface water is scarce on the installation. The following fish have been documented within wetlands of Camp Edwards: golden shiner (*Notemigonus crysoleucas*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), and largemouth bass (*Micropterus salmoides*).

1.3.5 Invertebrates

Camp Edwards has populations of invertebrate species, and several past survey efforts have documented invertebrates, including damselfly and dragonfly (odonate) surveys, butterfly and moth surveys, bee surveys, and moth surveys. These surveys have resulted in the identification of more than 68 damselfly and dragonfly species, 634 moth species, 40 butterfly species, 63 beetle species, and 128 bee species. Many of these invertebrate species are state-listed and are discussed in Section 1.4.2.4. Recent surveys have included several years of bee monitoring (2013, 2014, 2017, and 2019), moth surveys (2016 and 2017), and damselfly and dragonfly surveys (1995 to 2015).

1.4 THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

USFWS and MassWildlife were contacted regarding the presence of threatened and endangered species pursuant to the requirements of Section 7(c) of the ESA (16 U.S.C. 1536) and the Massachusetts Endangered Species Act (MESA) (Massachusetts General Law c.131A revised and implemented under 321 Code of Massachusetts Regulations [CMR] 10.00). Under the ESA, an "endangered species" is defined as any species that is in danger of extinction throughout all or a significant portion of its range. A "threatened species" is defined as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

1.4.1 Federally Listed Species

Federal status, as a threatened or endangered species, is derived from the ESA of 1973 (16 U.S.C. 1531 et seq.) and is administered by USFWS. Table F-2 presents the federally listed species that have the potential to occur at Camp Edwards. Only one federally listed species is known to occur at Camp Edwards, the northern long-eared bat (*Myotis septentrionalis*). The American chaffseed (*Schwalbea americana*) is also identified as having the potential to occur at Camp Edwards (USFWS 2020a).

Table F-2. Federally Listed Species with the Potential to Occur at Camp Edwards

Common Name	Scientific Name	Federal Status
Northern long-eared bat**	*Myotis septentrionalis*	T
American chaffseed	*Schwalbea americana*	E
****Species has been documented at Camp Edwards.** E = Endangered; T = Threatened Source: USFWS 2020a		

1.4.1.1 Northern Long-Eared Bat (*Myotis septentrionalis*)

Northern long-eared bats are federally threatened and state endangered in Massachusetts. Due to declines caused by white-nose syndrome and continued spread of the disease, the northern long-eared bat was listed as threatened under the ESA on 2 April 2015 (USFWS 2019b). On 16 January 2016, USFWS released a Section 4(d) rule under the ESA for the northern long-eared bat in the Federal Register. The 4(d) rule defines take and the range map for the species and provides management guidelines to allow for protection of areas impacted by white-nose syndrome while still allowing certain activities to be completed by landowners and managers within the species' range without formal consultation (USFWS 2016). USFWS has not designated critical habitat for the northern long-eared bat, as summer habitat is not limited or threatened range wide.

Northern long-eared bats are between 3 and 3.7 inches, with a wingspan of 9 to 10 inches with a brown backside and tawny underside. They are distinguishable by their long ears. Similar to Indiana bats, northern long-eared bats hibernate in caves during the winter with steady temperatures, high humidity, and no air currents (USFWS 2015b). Summer roosting habitat requirements are more flexible than those of the Indiana bat, and Northern long-eared bats roost under bark or in tree cavities, caves, or cervices. Northern long-eared bats may also use

buildings. Pregnant females also form summer maternity colonies where females give birth and raise young. The population of northern long-eared bats has been decimated by white-nose syndrome, and the disease has spread rapidly in the northern long-eared bat's core range, where it has resulted in a population decline of up to 99 percent (USFWS 2015b).

Northern long-eared bats have been documented at Camp Edwards in a 2014 planning-level survey (Tetra Tech 2014), as well as in acoustic surveys every year from 2014 to 2018. In 2015, two lactating female northern long-eared bats were captured during mist-net surveys. These individuals were outfitted with transmitters. While one bat was not tracked again, the other female was tracked to one roost site on base and one roost site off base. The off-base roost tree where this species was identified was observed to have northern long-eared bats during emergence surveys (Tetra Tech 2015). A qualitative analysis of acoustic recordings from 2016 resulted in the detection of northern long-eared bats at 15 sampling sites across Camp Edwards, and mist-net surveys completed during this time also resulted in the capture of two lactating female northern long-eared bats (Sichmeller and Hammond 2017). Females were tracked with a transmitter to two off-base roost sites located in close proximity to the roost site observed in 2015 (Sichmeller and Hammond 2017). One non-reproductive male northern long-eared bat was captured in a separate 2016 mist-net survey with physical impact damage visible. This male was outfitted with a transmitter, and was tracked to five man-made structures, including four buildings located off base and one on-base building (Tetra Tech 2017). One hibernaculum has been mapped on or near Camp Edwards (Mass.gov 2019).

1.4.2 State-Listed Species

The Cape Cod Ecoregion has the highest number and one of the highest densities of state-listed rare plant and animal species within the 13 ecoregions in Massachusetts (Barbour et al. 1999). Within the Cape Cod ecoregion, the greatest number of state-listed rare species can be found at JBCC. Thirty-five species of state-listed or special concern animals and nine species of state-listed or special concern plants have been documented on Camp Edwards, for a total of 44 state-listed endangered (E), threatened (T), and special concern (SC) species (Table F-3).

Table F-3. State Listed Species Known to Occur at Camp Edwards

Scientific Name	Common Name	State Status
Mammals		
Myotis septentrionalis	Northern Long Eared Bat	E
Myotis lucifugus	Little Brown Bat	E
Myotis leibii	Eastern Small-Footed Bat	E
Perimyotis subflavus	Tricolored Bat	E
Reptiles and Amphibians		
Terrapene carolina	Eastern Box Turtle	SC
Heterodon platirhinos	Eastern Hog-nosed Snake	SC
Birds		
Bartramia longicauda	Upland Sandpiper	E
Ammodramus savannarum	Grasshopper Sparrow	T
Circus cyaneus	Northern Harrier	T
Parula americana	Northern Parula	T
Sturnella magna	Eastern Meadowlark	SC
Pooecetes gramineus	Vesper Sparrow	T
Caprimulgus vociferus	Eastern Whip-poor-will	SC

Table F-3. State Listed Species Known to Occur at Camp Edwards		
Scientific Name	**Common Name**	**State Status**
Damselflies and Dragonflies		
Enallagma carunculatum	Tule Bluet	SC
Enallagma recurvatum	Pine Barrens Bluet	T
Moths		
Acronicta albarufa	Barrens Dagger Moth	T
Hemileuca maia	Barrens Buckmoth	SC
Catocala herodias gerhardi	Gerhard's Underwing Moth	SC
Cicinnus melsheimeri	Melsheimer's Sack Bearer	T
Dargida rubripennis	Pink Streak	T
Papaipema sulphurata	Water-Willow Borer Moth	T
Cingilia catenaria	Chain-dot Geometer	SC
Abagrotis nefascia benjamini	Coastal Heathland Cutworm	SC
Metarranthis pilosaria	Coastal Swamp Metarranthis	SC
Papaipema sp.	Ostrich Fern Borer	SC
Zale lunifera	Pine Barrens Zale	SC
Psectraglaea carnosa	Pink Sallow	SC
Euchlaena madusaria	Sandplain Euchlaena	SC
Chaetaglaea cerata	Waxed Sallow Moth	SC
Cycnia inopinatus	Unexpected Cycnia	T
Lycia ypsilon	Pine Barrens Lycia	T
Speranza exonerata	Pine Barrens Speranza	SC
Sympistis riparia	Dune Nocturnid Moth	SC
Apamea inebriata	Drunken Apamea	SC
Butterflies		
Callophrys irus	Frosted elfin	SC
Bees		
Anthophora walshii	Walsh's Anthora	E
Crustaceans		
Eulimnadia agassizii	Agassiz's Clam Shrimp	E
Plants		
Triosteum perfoliatum	Broad Tinker's Weed	E
Ophioglossum pusillum	Adder's Tongue Fern	T
Eleocharis ovata	Ovate Spike-sedge	E

Sources: MassWildlife 2019b; Mello 2018, Veit 2019

Notes: E = Endangered.
T = Threatened.
SC = Special Concern.

Table F-4 below shows species that have the potential to occur at Camp Edwards but have not been identified in past surveys or have not been studied adequately to determine if they are present.

Table F-4. Potential Listed Species That Have Not Been Identified at Camp Edwards

Scientific Name	Common Name	State Status
Reptiles and Amphibians		
Scaphiopus holbrooki	Eastern Spadefoot[1]	T
Moths		
Hemaris gracilis	Slender Clearwing Sphinx[1]	SC
Beetles		
Cicindela purpurea	Purple Tiger Beetle[1]	SC
Plants		
Agalinis acuta	Sandplain gerardia[2]	E
Rhynchospora torreyana	Torrey's Beak-Sedge[2]	E
Schwalbea Americana	American Chaffseed[2]	E
Juncus debilis	Weak Rush[2]	E
Malaxis bayardii	Bayard's Green Adder's Mouth[2]	E
Scleria pauciflora	Papillose Nut-Sedge[2]	E

Sources: MassWildlife 2019b; Mello 2018; MassWildlife 2020;
Notes: E = Endangered.
T = Threatened.
SC = Special Concern.
[1] - Past studies have not documented this species at Camp Edwards.
[2] - Additional studies needed to determine presence of this species at Camp Edwards.

1.4.2.1 Mammals

State-listed mammal species at Camp Edwards include four bat species: the northern long-eared bat, little brown bat, tricolored bat, and eastern small-footed bat. Previous surveys for bat species are outlined above in Sections 1.3.2 and 5.4.1.1, as most of these surveys were completed to assess the presence of the federally listed northern long-eared bat. All of the state-listed bat species have been observed during several studies in both mist-net and acoustic surveys, with the exception of the eastern small-footed bat. The occurrence of the eastern small-footed bat is suspected from 2015 and 2018 acoustic data but not confirmed (Tetra Tech 2015). A preliminary analysis of 2019 data indicates that this species may have been recorded during 2019 monitoring; a full analysis of acoustic data will be completed in 2020.

1.4.2.2 Reptiles and Amphibians

The eastern box turtle (*Terrapene carolina*) is the only state-listed reptile known to occur at Camp Edwards. The eastern box turtle is a state species of concern and has been observed in nearly every natural community on Camp Edwards, including grasslands, forests, and disturbed areas (e.g., bivouacs and powerline easements). Sightings of the species have occurred throughout the entire installation. Eastern box turtles have been studied at Camp Edwards for several years to inform management and provide greater population and habitat use data. Eastern box turtles were fitted with radio transmitters during 1998–2004 to monitor their movements on Camp Edwards. Radio telemetry data have indicated that eastern box turtles on Camp Edwards often travel in relatively small home ranges within a particular natural community. However, individuals have been documented traveling more than 1 kilometer across more than one natural community. Therefore, the distribution of eastern box turtles extends throughout all of Camp Edwards.

Box turtles face several threats to their population. Conservation of the eastern box turtle on Camp Edwards will include minimizing the fragmentation of forest and scrub oak barrens habitat and education of troops and other land users as to the presence of the species throughout the installation. One threat to the eastern box turtle is habitat loss due to fragmentation, but on Camp Edwards the largest threat to box turtles is sources of potential mortality. Eastern box turtles have been found using habitat in roadway puddles, which presents a concern about the potential for injuries or mortality to these turtles from heavy equipment use. Grounds and maintenance personnel move turtles in roadway puddles when they are located. Another concern for box turtle management is potential mortality associated with prescribed burning. Although burning is needed to maintain large tracts of diverse successional habitat, individual turtles may be injured or killed during fires.

The Eastern Hog-nosed Snake (*Heterodon platirhinos*), a species frequently found on base, was added as a Massachusetts Species of Special Concern in 2020. Habitat management activities that occur on base, including prescribed fire, forestry, and vegetation management, are thought to benefit the species (MassWildlife 2020). This species is expected to benefit from the mitigation actions outlined in the CMP.

The eastern spadefoot toad (*Scaphiopus holbrooki*) has been documented on the Veteran's cemetery land to the south of Camp Edwards but has not been found on the installation during past surveys of puddles, swales, and vernal pools, or during past acoustic surveys.

1.4.2.3 Birds

Camp Edwards provides high-value pitch pine – scrub oak habitat and grassland habitat that supports several listed bird species. Eastern whip-poor-will is a ground-nester that inhabits oak-pine forests (Cleere 1998). This species has experienced a regional decline in population over the last several years. Whip-poor-will have been studied at Camp Edwards as part of annual monitoring for several years. In recent years of whip-poor-will counts at survey points, the highest density of birds has been found along the northern edge of the impact area, and along the eastern side of the impact area.

The grasslands of Camp Edwards are important habitat for four state-listed rare bird species. These species include the endangered upland sandpiper (*Bartramia longicauda*), and the threatened grasshopper sparrow, vesper sparrow (*Pooecetes graminus*), and northern harrier (*Circus cyaneus*). The largest population of upland sandpipers, 14 pairs, observed by White and Melvin (1985) in Massachusetts occurred in the cantonment area grasslands. The sandpipers used mowed and unmowed areas of the grasslands for feeding, loafing, courtship, nesting, and brood-rearing. However, the numbers of upland sandpipers have declined since the initial survey (White and Melvin 1985), perhaps due to the gradual succession of the grasslands, including recolonization of pitch pine.

The Eastern Meadowlark (*Sturnella magna*) was listed as a Massachusetts Species of Special Concern in 2020. This species utilizes the grasslands on base as summer nesting habitat and regularly overwinters in lower abundance. The protective measures and habitat management in place already in the grassland management area is consistent with activities to protect and

promote this species. This species is expected to benefit from the mitigation actions outlined in the CMP.

Camp Edwards supports the second largest population of grasshopper sparrows in Massachusetts; 22 pairs were observed in the unmowed portions of the cantonment area grasslands. The population of grasshopper sparrows declined from 22 pairs in 1985 to 10 individuals in 1998, but numbers increased since that time, which reflects the shift in the mowing schedule of the runway to a later spring mow. A recent study in 2015 found the highest densities of grasshopper sparrows in undisturbed grasslands, including the cantonment area and landfill (Renfrew and Jill 2015).

Northern harriers have been observed in the grasslands and scrub oak shrublands of Camp Edwards. One pair of northern harriers is observed hunting in the grasslands most years; however, a nest has not been located. A female northern harrier was observed with three recently fledged young in the Impact Area during a 1998 survey. Although a nest was not located, the presence of the young suggests that the female may have nested nearby. Although the vesper sparrow was not observed during the White and Melvin (1985) survey, it has been documented within the cantonment area grasslands several times since in 1995, 2004, and 2005.

1.4.2.4 Invertebrates

Frosted elfin (Callophrys irus)

Twenty-two species of moths, butterflies, and damselflies and dragonflies that are listed as state threatened, endangered, or special concern inhabit Camp Edwards. Many of these species depend upon the scrub oak barrens of Camp Edwards for at least part of their life cycle. Mello et al. (1999) identified the habitats on Camp Edwards that contain scrub oak and an open forest canopy as important habitat for state-listed rare moths. A 2016–2017 follow-up survey of lepidopterans focused on state-listed species and resulted in the observation of 16 listed moth species and one listed butterfly species (Mello 2018). A comparison of the earlier study indicated that seven species were unchanged, none had increased, five had decreased, and seven had too few individuals in both years to complete a comparison (Mello 2018). Frosted elfins (*Callophrys irus*) are present at Camp Edwards, and were documented in the 1999 Mello et al. survey and have been observed annually from 2016 to 2019 in the cantonment area grasslands. The other species of state-listed rare moths have been documented in either grasslands, wetlands, or forested habitats on Camp Edwards. The Slender Clearwing Sphinx (*Hemaris gracilis*) has been observed at the Cape Cod Air Force Station but has not been found at Camp Edwards. The conservation of state-listed rare moth species is discussed in Appendix K of this document.

Despite surveys of tiger beetles in 2016 and 2017, the purple tiger beetle (*Cicindela purpurea*) was not found at Camp Edwards (Mello 2018).

Walsh's Anthophora (*Anthophora walshii*) was added to the Massachusetts state list as Endangered in 2020. Walsh's Anthora has primarily been observed in the Cantonment Area grasslands in areas experiencing frequent management activities. The species has also been observed on powerline right of ways and one range area on base. From surveys conducted by in 2019, the species was found to be more abundant in heavily managed areas (mowing, fire, and herbicide use) (Veit 2019). Hence, this species will not change management activities occurring in the grasslands or other early successional areas. This species is expected to benefit from the mitigation actions outlined in the CMP.

Agassiz's clam shrimp (*Eulimnadia agassizi*) was first discovered in 1999 during an aquatic invertebrate study in UTES Pond, a heavily impacted stormwater outflow that provided the exclusion of other species necessary to support the clam shrimp (Oxbow Associates, Inc. 2018). In 2015, natural resources staff completed a study to relocate several isolated former observations of listed species and reconfirmed the species at UTES Pond, and subsequently in several roadway puddles. More intensive surveys in recent years have resulted in multiple observation sites, and MAARNG has been coordinating with NHESP on monitoring and management since this time. Numerous localities supporting this species have since been identified. A Conservation and Management Plan was developed for the Agassiz's clam shrimp in 2018 as part of a MESA Conservation and Management Permit to allow for take of this species associated with roadway puddle maintenance (Oxbow Associates, Inc. 2018).

1.4.2.5 Plants

Three species of state-listed plants have been observed at Camp Edwards. Broad tinker's-weed (*Triosteum perfoliatum*), a state-endangered species, was documented during the initial floristic survey of Camp Edwards in 1994 (Jenkins 1994). As a result of annual flora surveys, two additional listed species have been identified, the ovate spike sedge (*Eleocharis ovata*) and adder's tongue fern (*Ophioglossum pusillum*). In all cases, state-listed rare plant species exist in relatively small, localized populations on Camp Edwards. Each of these species was first documented during the initial floristic survey, site inspections, or annual plant surveys. A 2018 Vegetation Management Plan included surveys of locations of known rare plant communities to determine the presence of adder's tongue and broad tinker's-weed, the impact of shading and competition from bracken fern and other invasive species, and provide management methods (Wilkinson Ecological Design, Inc. 2018). Broad tinker's-weed and adder's tongue fern were both recorded during annual surveys as recently as 2019. Ovate spike sedge has been recorded, but additional surveys are needed to determine the extent of the population at Camp Edwards.

Torrey's beak rush (*Rhynchospora torreyana*) was incorrectly reported as occurring at Camp Edwards but only occurs on Coast Guard property. American chaffseed (*Schwalbea Americana*), Bayard's green adder's mouth (*Malaxis bayardii*), and papillose nut-sedge (*Scleria pauciflora*) have not been found at Camp Edwards during past surveys. Sandplain gerardia (*Agalinis acuta*), a state and federally listed species, and weak rush (*Juncus debilis*), a state listed species, have not been found at Camp Edwards but additional surveys are needed to determine the potential presence of these species.

The sites at which the rare plants were observed are revisited every 3 years (a third of the sites are visited each year) to reassess the size and relative health of the populations. Rare plant

observation forms are completed and submitted to the Massachusetts NHESP at the end of each field season. The successional state of the habitat in which the plants occur and prefer will also be documented to benefit the long-term management of the species. If the habitat in which a state-listed rare plant species occurs is gradually succeeding toward a less desirable state, then management strategies will be implemented to benefit the species. Prior to being conducted, all activities within the vicinity of these species must be reviewed and approved by the Camp Edwards Range Control Officer and the Natural Resource Office.

1.4.3 At-Risk Species

The USFWS also considers at-risk species, or species that are proposed for listing as threatened or endangered under ESA, are candidate species for listing, or have been petitioned by a third party for listing. The little brown bat and tricolored bat have been identified at Camp Edwards, and spotted turtles have been observed incidentally. The spotted turtle (*Clemmys guttata*) and frosted elfin (*Callophrys irus*) are each undergoing a 12-month status review by USFWS to determine if listing under the ESA is warranted. USFWS determination is scheduled for 2023. A list of at-risk species that have the potential to occur at Camp Edwards based on presence USFWS information and habitat is provided on Table F-5.

Table F-5 At-Risk Species with the Potential to Occur at Camp Edwards

Common Name	Scientific Name	At-Risk Status	Occurrence at Camp Edwards
Mammals			
Little brown bat	*Myosis lucifugus*	Discretionary Status Review/PLPCH	Known to occur
Tricolored bat	*Perimyotis subflavus*	12M/PLPCH	Known to occur
Reptiles			
Spotted turtle	*Clemmys guttata*	12M/PLPCH	Known to occur
Invertebrates			
Monarch butterfly	*Danaus plexippus plexippus*	12M/PLPCH	Potential to occur
Regal fritillary	*Speyeria idalia*	12M/PLPCH	Potential to occur
Frosted elfin	*Callophrys irus*	Discretionary Status Review/PLPCH	Known to occur

Sources: USFWS 2020b; MassWildlife 2019b.
Notes:
12M/PLPCH – 12-month finding on a petition to list a species.
Discretionary Status Review/PLPCH – Status review undertaken by discretion of USFWS.
PLPCH – Proposed listing determination for candidate species.

1.4.4 Migratory Birds of Concern

Migratory birds are protected under the Migratory Bird Protection Act (16 USC §§ 703-711), a law making unlawful the kill, capture, buy, sell, import, or export of migratory birds, eggs, feathers, or other parts. USFWS implements the provisions of the Migratory Bird Protection Act through regulations in Parts 10, 13, 20, 21, and 22 of Title 50 of the Code of Federal Regulations. The DoD developed a Memorandum of Understanding to address EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* "to promote the conservation of migratory bird populations while sustaining the use of military managed lands and airspace for testing, training, and operations."

USFWS is required under the Fish and Wildlife Conservation Act to identify nongame migratory birds that would likely become candidates for listing under the ESA without additional conservation measures. These birds are considered Birds of Conservation Concern. Appendix F presents a list of birds present at Camp Edwards. Of the 29 birds of conservation concern that could be present at Camp Edwards as identified by USFWS (USFWS 2020a), three species are known to occur at Camp Edwards. The birds of conservation concern that are known to occur or have the potential to occur at Camp Edwards are shown in Table F-6.

Table F-6 Migratory Bird Species of Conservation Concern Known to Occur and with Potential to Occur at Camp Edwards

Common Name	Scientific Name	Priority	Known to Occur	Potential to Occur
American Oystercatcher	*Haematopus palliatus*	Highest		X
Bald Eagle	*Haliaeetus leucocephalus*	Moderate		X
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Not Ranked – Watch List Species	X	
Bobolink	*Dolichonyx oryzivorus*	Not Ranked – Watch List Species		X
Buff-breasted Sandpiper	*Calidris subruficollis*	High		X
Canada Warbler	*Cardellina canadensis*	Moderate		X
Clapper Rail	*Rallus crepitans*	High		X
Dunlin	*Calidris alpina arcticola*	High		X
Eastern Whip-poor-will	*Antrostomus vociferus*	High		X
Evening Grosbeak	*Coccothraustes vespertinus*	Not Ranked – Watch List Species		X
Gull-billed Tern	*Gelochelidon nilotica*	Highest		X
Kentucky Warbler	*Oporornis formosus*	High		X
Least Tern	*Sterna antillarum*	High		X
Lesser Yellowlegs	*Tringa flavipes*	Moderate		X
Long-eared Owl	*Asio otus*	Not Ranked – Watch List Species		X
Nelson's Sparrow	*Ammodramus nelsoni*	Not Ranked – Watch List Species		X
Prairie Warbler	*Setophaga discolor*	Highest	X	
Prothonotary Warbler	*Protonotaria citrea*	High		X
Purple Sandpiper	*Calidris maritima*	High		X
Red-throated Loon	*Gavia stellata*	Highest		X
Ruddy Turnstone	*Arenaria interpres morinella*	Highest		X
Rusty Blackbird	*Euphagus carolinus*	High		X
Seaside Sparrow	*Ammodramus maritimus*	Moderate		X
Semipalmated Sandpiper	*Calidris pusilla*	High		X
Short-billed Dowitcher	*Limnodromus griseus*	High		X
Snowy Owl	*Bubo scandiacus*	Not Ranked – Watch List Species		X
Whimbrel	*Numenius phaeopus*	Highest		X
Willet	*Tringa semipalmata*	High		X
Wood Thrush	*Hylocichla mustelina*	Highest	X	

Sources: USFWS 2020a; Bird Studies Canada and U.S. North American Bird Conservation Initiative 2008; Rosenberg et al. 2016

1.5 WETLANDS AND FLOODPLAINS

1.5.1 Wetlands

EO 11990, *Protection of Wetlands,* directs all federal agencies to avoid to the maximum extent possible, the long- and short-term adverse impacts associated with the occupancy, destruction, or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (USACE 1987). Wetland functions include groundwater recharge/discharge, flood/flow alteration, sediment stabilization, sediment and toxicant retention, nutrient removal and transformation, aquatic and terrestrial diversity and abundance, and uniqueness. In Massachusetts, activities occurring within or near a wetland are regulated by MassDEP under the Massachusetts Wetlands Protection Act (WPA) under Massachusetts General Law Chapter 131, Section 40 and its Regulations (310.CMR 10.00) and by USACE. Wetlands are also protected and regulated by the Bourne Wetland Protection By-Law Article 3.7, Wetland and Natural Resources Protection*,* Bourne Wetlands Regulations, and the Sandwich Wetland By-Laws (Chapter 7). Local Conservation Commissions are responsible for administering the WPA in Massachusetts. Camp Edwards is bound by state and local wetland laws, so compliance is non-discretionary.

Wetlands not considered jurisdictional by USACE may still be considered jurisdictional under the WPA and municipal regulations. Specifically, federal, state, and municipal delineations of wetlands vary, and wetlands considered to be non-jurisdictional under federal regulations may still meet the definition of a wetland under state or municipal regulations. Wetlands delineated at Camp Edwards in 2013 were largely not considered to be federally jurisdictional, but were jurisdictional under the regulations of Bourne and Sandwich (AMEC 2013). This was a result of many features lacking hydric soils and/or hydrologic connectivity to other waterbodies.

1.5.1.1 Federal Regulations

Federally, wetlands are protected as a subset of the "waters of the United States" under Section 404 of the Clean Water Act (CWA). The term "waters of the United States" has broad meaning under the CWA and incorporates deep water aquatic habitats and special aquatic habitats (including wetlands). The October 22, 2019 final rule from EPA and USACE repealed the Clean Water Rule formerly followed by Massachusetts. The final rule became effective December 23, 2019, and a new definition of waters of the United States was released on 21 April 2020. Under an earlier definition found in the 2008 Rapanos guidance (USACE and EPA 2019), jurisdictional waters of the United States are areas regulated under the CWA and also include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, vernal pools, and "other" waters that if degraded or destroyed could affect interstate commerce. Based on the definition released in April 2020, jurisdiction waters that are federally regulated include: (1) territorial seas and traditional navigable waters; (2) perennial and intermittent tributaries to such waters; (3) certain lakes, ponds, and impoundments of jurisdictional waters; and (4) wetlands adjacent to other jurisdictional waters (USACE 2020). Under the final rule, ephemeral features, groundwater, some ditches, and prior converted cropland are no longer

considered jurisdictional, among other exceptions (USACE 2020). Under the USACE *Wetlands Delineation Manual* (USACE 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)* (USACE 2012), wetland areas must meet the following three parameters:

- ***Hydrophytic Vegetation***—Classified by the estimated probability of occurrence in wetland versus non-wetland areas throughout its distribution.

- ***Hydric Soils***—Soils that are saturated, flooded, or ponded for sufficient periods during the growing season and that develop anaerobic conditions in their upper layers.

- ***Hydrological Characteristics***—Determined by the frequency of flooding, duration of inundation, and soil saturation.

Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredged or fill materials into the waters of the United States, including wetlands. Therefore, even an inadvertent encroachment into wetlands or other waters of the United States that results in displacement or movement of soil or fill materials has the potential to be viewed as a violation of the CWA if an appropriate permit has not been issued by USACE.

Wetlands are also federally protected under EO 11990, *Protection of Wetlands* (43 Federal Register 6030) (National Archives and Records Administration 1977). The purpose of this EO is to reduce adverse impacts associated with the destruction or modification of any wetlands, not only those considered jurisdictional.

1.5.1.2 State Regulations

Compliance with state and local wetland laws is non-discretionary for Camp Edwards. Wetlands are protected in Massachusetts under the WPA, which is administered by MassDEP as well as through local Conservation Commissions. The delineation of wetlands in Massachusetts under these regulations is based on the presence of areas where soils are saturated or inundated for a period long enough to support plants adapted to these periodically wet conditions. Wetlands in Massachusetts are delineated based on the guidance in *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act: A Handbook* (Jackson 1995). In certain cases, wetlands may be delineated under the WPA based on hydrophytic vegetation alone, but in most cases, wetlands should be delineated based on both vegetation and indicators of hydrology, including the presence of hydric soils. Wetlands bounded under federal jurisdiction do not have a wetland buffer, but if wetlands are considered jurisdictional by MassDEP, a 100-foot buffer zone is applicable. This buffer zone is extended to 200 feet in areas adjacent to rivers and perennial streams. Fill and other activities in wetlands are prohibited under the Massachusetts WPA without a permit issued by MassDEP or a violation of WPA if a permit has not been issued by MassDEP.

Under the WPA, isolated wetlands are not regulated unless they meet the criteria of the jurisdictional resource Isolated Land Subject to Flooding, which is defined as an “isolated

depression or closed basin without an inlet or an outlet. It is an area which at least once a year confines standing water to a volume of at least ¼ acre-feet and to an average depth of at least six inches."

Vernal pools are protected by the state if they meet the following biological and physical criteria for certification of a vernal pool in Massachusetts: (1) breeding evidence of obligate vernal pool amphibian species or fairy shrimp, and no permanently flowing outlet; or (2) breeding evidence of two or more facultative vernal pool amphibian species, and no permanently flowing outlet, and evidence of the pool in a dry state (excludes the possibility of reproducing fish populations).

1.5.1.3 Town of Bourne

The Town of Bourne considers wetland resource areas as they are defined in state regulations, but expands on the state definition to also include all areas that (1) support a wetland plant community, (2) provide breeding habitat for certain water dependent fauna species, or (3) have a vegetational community that is composed of 50 percent or more wetland plant species. Bourne regulations provide protection for wetlands and waterbodies as well as areas within a 100-foot wetland buffer and a 200-foot wetland buffer in areas of Areas of Critical Environmental Concern (ACEC) or within the Bournedale Environmental Overlay District (BEOD). Vernal pools are defined beyond the federal and state definitions in Bourne to include areas mapped and certified by the NHESP or areas considered eligible for certification. Under regulations in Bourne, wetlands may not be filled without a permit, and all filled wetlands must be mitigated by wetland replication of a wetland of at least equal size. Any change to the conditions of wetland areas is not permitted without a permit, including alterations in flow patterns, sedimentation, and flood retention; placement of brush; cutting of trees or plant life; application of pesticides; changes in water temperature or other physical or chemical properties; or pollution of waterbodies.

1.5.1.4 Town of Sandwich

Local regulations in Sandwich are similar to those in Bourne and have the same definition of wetland resource areas, which is expanded from the state regulatory definition. Similarly, Sandwich regulations provide protection for wetlands and waterbodies as well as areas within a 100-foot wetland buffer and a 200-foot wetland buffer in areas of ACEC or within the BEOD. Fill of wetlands in Sandwich also requires a permit and mitigation of wetland impacts as described for Bourne. In addition, Sandwich does not allow any alteration, fill, dredging, or excavation in wetlands classified as a white cedar swamp.

1.5.1.5 Wetlands at Camp Edwards

Federally delineated ponds and wetlands comprise 69 acres, or 0.39 percent, of Camp Edwards, but it is likely that there is additional wetland acreage that is under the jurisdiction of Bourne or Sandwich at Camp Edwards due to the presence of ephemeral features that develop because of training and roadway use (Figure E-3). In addition, wetlands were last delineated at Camp Edwards in 2013, and it is likely that the extent and type of wetlands has changed during this time.

Ponds and wetlands are the most diverse plant community at Camp Edwards, and a total of 67 plant species have been documented in the wetlands. There are six different types of wetlands classes that occur at Camp Edwards as characterized in the *Classification of Natural Communities in Massachusett*s: Ponds, Coastal Plain Pond Shore, Kettle Hole Level Bogs, Red Maple Swamps, Highbush Blueberry Thickets, and Woodland Vernal Pools. These wetland types are described below.

Ponds – The Coastal Plain Ponds of Camp Edwards are referred to as kettle ponds. Kettle ponds are typically deep ponds formed during the last Ice Age by large chunks of ice breaking off retreating glaciers resulting in depressions in the ground called kettle holes. When the hole is deep enough to reach groundwater, it is then filled with water and is called a kettle pond. Seasonal changes in groundwater level are mirrored by changes in the levels of these ponds. The fluctuating water levels alternately flood and expose the shore like a slow-moving tide. This rate and depth of fluctuation is a main determinant of the plant types that can live in a Coastal Plain pond shore.

Coastal Plain Pond Shore – Coastal plain pond shores are herbaceous communities of exposed pond shore. The ponds consist of shallow, acidic, exposed groundwater in the glacial outwash plain, with no inlet or outlet. Water levels rise and fall with changes in the water table (Swain 2016). These changes can be quite dramatic and result in distinct Coastal Plain pond flora. In general, the Coastal Plain pond shore communities of Camp Edwards can be classified as having four concentric circular zones of vegetation. The first zone is the deepest area of the wetland where open water is present. This zone is often vegetated by floating plants including spotted bladderwort (*Utricularia purpurea*), water shield (*Brasenia schreberi*), and water-lily (*Nymphaea odorata*). The presence of this vegetation depends entirely upon the water levels in these wetland communities. The zone of emergent vegetation surrounds the open water zone and is located in the shallower water of the wetlands. Common emergent plant species are usually grasses, including bur-reed (*Sparganium americanum*), wool grass (*Scirpus cyperinus*), and three-way sedge (*Dulichium arundinaceum*).

Beyond the shoreline of the wetlands lies a transitional zone that is occupied by many emergent species but is dominated by forbs. Lance-leaf violet (*Viola lanceolata*), northern bugleweed (*Lycopus uniflorus*), swamp candles (*Lysimachia terrestris*), beggar ticks (*Bidens frondosa*), hyssop-hedge-nettle (*Stachys hyssopifolia*), rush (*Juncus* spp.), and sedges (*Carex* spp.) are common throughout the forb zone. As the wetland transitions into the surrounding forest community, a distinct shrub zone including highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), hardhack (*Spirea tomentosa*), inkberry (*Ilex verticillata*), leatherleaf (*Chamaedaphne calyculata*), swamp dewberry (*Rubus hispidus*), and goldenrod (*Solidago* spp.) is present. Common tree species in this zone include red maple, pitch pine, and various oaks.

Although the four zones of vegetation can describe most wetlands of Camp Edwards, there are some exceptions. Monument Swamp, a Kettle Hole Level Bog, is primarily a bog of sphagnum moss (*Sphagnum* spp.) and cranberry (*Vaccinium macrocarpon*). In addition, many of the Woodland Vernal Pools, and Highbush Blueberry Thickets that lack standing water for much of the year do not have the distinct vegetation zones described above.

Kettle Hole Level Bogs – These bogs occur in kettle depressions, and have zoned vegetation. They are typically small, round, and lack inlets and outlets. Often the outermost ring is a wet moat that acts as a vernal pool when water remains for 2–3 months. They are surrounded by highbush blueberry (*Vaccinium corymbosum*) and swamp azalea (*Rhododendron viscosum*). The central mat has a mixture of members of the heath family.

Red Maple Swamps – Red maple swamps consist of 5 percent of the total wetlands on Camp Edwards. The hydrogeologic setting is the primary determinant of water regime and plant community in red maple swamps. On Camp Edwards, they are seasonally flooded, fed by groundwater seepage, and overland flow. The red maple itself typically provides 90 percent of the canopy cover. The shrub layer is often dense and well developed and consist of sweet pepperbush (*Clethra alnifolia*), swamp azalea (*Rhododendron viscosum*), and highbush blueberry. The herbaceous layer is highly variable with abundant ferns.

Highbush Blueberry Thicket – This natural community is characterized by acidic peat lands dominated by dense highbush blueberry bushes and sphagnum hummocks. These tall thickets are generally flooded in the spring and early summer with water levels dropping below surface levels by late summer. Many examples are located in kettle holes.

Woodland Vernal Pools – Woodland vernal pools are small, shallow depressions with little or no vegetation within upland forests. They are temporally flooded, provide important breeding habitat for amphibians, and are typically isolated from other surface waters and are typically dry in the summer. They do not support fish populations. Vernal pools support diverse invertebrate and amphibian fauna that is not adapted to fish predation. Most wetlands on Camp Edwards are either vernal pools or function as one.

1.5.2 Floodplains

EO 11988, *Floodplain Management,* issued 24 May 1977, requires all federal agencies to provide leadership and take action to reduce the risk of flood loss; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values of floodplains when acquiring, managing, or disposing of federal lands. EO 11988 is implemented through the CWA and 44 Code of Federal Regulations (CFR) Part 9, *Floodplain Management and Protection of Wetlands*. Floodplains are defined in this EO as "the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year." Flooding in the 100-year floodplain is expected to occur from a flood that has a 1 percent probability of occurring in any given year; therefore, the 100-year floodplain has an annual probability of exceedance of 1 percent. The towns of Bourne and Sandwich also have bylaws that restrict activities within the 100- and 500-year floodplain.

The entirety of Camp Edwards either has not been mapped by the Federal Emergency Management Agency (FEMA) or is mapped as an area of minimal flood hazard (FEMA 2019). Camp Edwards is located at one of the highest points of Cape Cod and, as such, is outside of floodplains identified by FEMA.

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Attachment F-1

List of Species on Camp Edwards

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PLANT SPECIES OF CAMP EDWARDS, MA

Common Name	Scientific Name
Adder's-tongue fern	*Ophioglossum vulgatum*
Alfalfa	*Medicago sativa*
Alternate leaved dogwood	*Cornus alternifolia*
American beech	*Fagus grandifolia*
American cow wheat	*Melampyrum lineare*
American hazel	*Corylus americana*
American holly	*Ilex opaca*
American starflower	*Trientalis borealis*
American willow-herb	*Epilobium ciliatum*
Apple	*Malus sylvestris*
Arrow-leaved tearthumb	*Polygonum sagittatum*
Arrow-wood	*Viburnum recognitum*
Asparagus	*Asparagus officinalis*
Aster	*Aster* spp.
Autumn bentgrass	*Agrostis perennans*
Autumn olive	*Elaeagnus umbellata*
Awl-aster	*Aster pilosus*
Bachelor's buttons	*Centaurea cyanus*
Barnyard-grass	*Echinochloa crusgalli*
Bayberry	*Myrica pensylvanica*
Bayonet rush	*Juncus militaris*
Beach pinweed	*Lechea maritima*
Bead-grass	*Paspalum setaceum*
Beaked hazel-nut	*Corylus cornuta*
Bearberry	*Arctostaphylos uva-ursi*
Bedstraw	*Galium pilosum*
Beggar ticks	*Bidens fondosa*
Bellwort; Merrybells	*Uvularia sessilifolia*
Bentgrass	*Agrostris* sp.
Big-toothed aspen	*Populus grandidentata*
Bird-foot violet	*Viola pedata*
Birdsfoot-trefoil	*Lotus corniculata*
Bittersweet nightshade	*Solanum dulcamara*
Black bindweed	*Polygonum convolvulus*
Black cherry; Wild cherry	*Prunus serotina*
Black gum	*Nyssa sylvatica*
Black highbush blueberry	*Vaccinium atrococcum*
Black huckleberry	*Gaylussacia baccata*
Black locust	*Robinia pseudoacacia*
Black medick	*Medicago lupulina*
Black Nightshade	*Solanum nigrum*
Black oak	*Quercus velutina*
Black raspberry	*Rubus occidentalis*
Black snakeroot	*Sanicula marilandica*
Black swallowwort	*Cynachum nigrum*
Black willow	*Salix nigra*
Blackberry	*Rubus alleghaniensis*
Black-eyed Susan	*Rudbeckia hirta*
Blue toadflax	*Linaria canadensis*
Blueberry; cranberry	*Vaccinium* sp.
Bluecurls	*Trichostema dichotomum*
Bluegrass	*Poa* sp.
Bluejoint	*Calamagrostis canadensis*
Blue-stemmed goldenrod	*Solidago caesia*
Bluets	*Houstonia caerula*
Blunt spikerush	*Eleocharis obtusa*
Blunt-leaved sandwort	*Moehringia lateriflora*
Bluntscale-bulrush	*Scirpus smithii*
Bracken fern	*Pteridium aquilinum*
Bracted plantain	*Plantago aristata*
Bright-green spikerush	*Eleocharis olivacea*
Bristly sarsaparilla	*Aralia hispida*
Broad-leaf cattail	*Typha latifolia*
Broad-leaf meadowsweet	*Spiraea alba* var. *latifolia*
Brown knapweed	*Centaurea jacea*
Brown-fruit rush	*Juncus pelocarpus*
Brownish beakrush	*Rhynchospora capitellata*
Brownish sedge	*Carex brunnescens*
Bulbous buttercup	*Ranunculus bulbosus*
Bull thistle	*Cirsium vulgare*
Bur-reed	*Sparganium americanum*
Bushy bluestem	*Andropogon glomeratus*
Butter-and-eggs	*Linaria vulgaris*
Butterflyweed	*Asclepias tuberosa*
Buttonweed; Poorjoe	*Dioda teres*
Canada bluegrass	*Poa compressa*
Canada bunchberry	*Cornus canadensis*
Canada goldenrod	*Solidago canadensis*
Canada hawkweed	*Hieracium canadense*
Canada mayflower	*Maianthemum canadense*
Canada rush	*Juncus canadensis*
Canada St. John's-wort	*Hypericum canadense*
Carey's knotweed	*Polygonum careyi*
Carolina lovegrass	*Eragrostis pectinacea*
Carpetweed	*Mollugo verticillata*
Cat brier	*Smilax glauca*
Catnip	*Nepeta cataria*
Cat's ear	*Hypochoeris radicata*
Cherries	*Prunus* spp.
Chicory	*Cichorium intybus*
Choke cherry	*Prunus virginiana*
Christmas fern	*Polystichum acrostichoides*
Churchmouse three-awn	*Aristida dichotoma*
Cinnamon fern	*Osmunda cinnamomea*
Clasping dogbane	*Apocynum sibiricum*
Cleavers	*Galium aparine*
Climbing false buckwheat	*Polygonum scandens*
Coastal mannagrass	*Glyceria obtusa*
Colt's-foot	*Tussilago farfara*
Common boneset	*Eupatorium perfoliatum*
Common buckthorn	*Rhamnus cathartica*
Common burdock	*Arcticum minus*
Common cinquefoil	*Potentilla simplex*

Common Name	Scientific Name	Common Name	Scientific Name
Common dandelion	*Taraxacum officinale*	English plantain	*Plantago lanceolata*
Common dodder	*Cuscuta gronovii*	European mountain-ash	*Sorbus aucuparia*
Common elder	*Sambucus canadensis*	European silvery cinquefoil	*Potentilla inclinata*
Common greenbrier	*Smilax rotundifolia*	Evening primrose	*Oenothera biennis*
Common ground-nut	*Apios americana*	Evergreen wood fern	*Dryopteris intermedia*
Common horsetail	*Equisetum arvense*	Fall panic grass	*Panicum dichotomiflorum*
Common milkweed	*Asclepias syriaca*	Fall-dandelion	*Leontodon autumnalis*
Common mouse-ear chickweed	*Cerastium vulgatum*	False heather	*Hudsonia ericoides*
Common mugwort	*Artemisia vulgaris*	False nutsedge	*Cyperus strigosus*
Common mullein	*Verbascum thapsus*	False pimpernel	*Lindernia dubia*
Common pinweed	*Lechea intermedia*	False Solomon's seal	*Smilacina racemosa*
Common plantain	*Plantago major*	Feverwort	*Triosteum perfoliatum*
Common quickweed	*Galinsoga quadriradiata*	Field pennycress	*Thlaspi arvense*
Common reed	*Phragmites australis*	Field pussytoes	*Antennaria neglecta*
Common rush	*Juncus effusus*	Field-cress	*Lepidium campestre*
Common snailseed-pondweed	*Potamogeton bicupulatus*	Filiform fescue	*Festuca tenuifolia*
Common velvet grass	*Holcus lanatus*	Fireweed; Great willow-herb	*Epilobium angustifolium*
Common vetch	*Vicia sativa*	Flat topped goldenrods	*Euthamia* sp.
Common winter cress	*Barbarea vulgaris*	Floating bladderwort	*Utricularia radiata*
Common wood rush	*Luzula multiflora*	Flowering dogwood	*Cornus florida*
Common yarrow	*Achillea millefolium*	Foam-flower	*Tiarella cordifolia*
Common yellow flax	*Linum medium*	Forked rush	*Juncus dichotomus*
Common yellow wood-sorrel	*Oxalis stricta*	Fox grape	*Vitis labrusca*
Common yellow-cress	*Rorripa palustris*	Fragrant bedstraw	*Galium triflorum*
Corn speedwell	*Veronica arvensis*	Fragrant cudweed	*Gnaphalium obtusifolium*
Corn spurry	*Spergula arvensis*	Frostweed	*Helianthemum propinquum*
Crawford's sedge	*Carex crawfordii*	Gall-of-the-earth	*Prenanthes trifoliolata*
Crown vetch	*Coronilla varia*	Glossy buckthorn	*Rhamnus frangula*
Curled dock	*Rumex crispus*	Goat's rue	*Tephrosia virginica*
Cypress witchgrass	*Dichanthelium dichotomum*	Goblet-aster	*Aster lateriflorus*
Dangleberry	*Gaylussacia frondosa*	Golden ragwort	*Senecio aureus*
Dark green bulrush	*Scirpus atrovirens*	Goldenrod	*Solidago* spp.
Day-lily	*Hemerocallis fulva*	Grass leaved goldenrod	*Euthamia graminifolia*
Deertongue grass	*Dichanthelium clandestinum*	Gray birch	*Betula populifolia*
Dense-tuft hairsedge	*Bulbostylis capillaris*	Gray goldenrod	*Solidago nemoralis*
Deptford pink	*Dianthus armeria*	Gray-stemmed dogwood	*Cornus foemina*
Doorweed; Common knotgrass	*Polygonum aviculare*	Greater coreopsis	*Coreopsis major*
Dooryard violet	*Viola sororia*	Green foxtail-grass	*Setaria viridis*
Dotted smartweed	*Polygonum punctatum*	Greene's rush	*Juncus greenei*
Downy chess	*Bromus tectorum*	Ground cedar	*Lycopodium tristachyum*
Downy goldenrod	*Solidago puberula*	Ground pine	*Lycopodium obscurum*
Downy Juneberry	*Amelenchier arborea*	Groundsel tree	*Baccharis halimifolia*
Dwarf chinkapin oak	*Quercus prinoides*	Hairgrass	*Aira praecox*
Dwarf cinquefoil	*Potentilla canadensis*	Hairgrass	*Deschampsia flexuosa*
Dwarf dandelion	*Krigia virginica*	Hairy bush clover	*Lespedeza hirta*
Dwarf huckleberry	*Gaylussacia dumosa*	Hairy goldenrod	*Solidago hispida*
Dwarf St. John's-wort	*Hypericum boreale*	Hairy pinweed	*Lechea mucronata*
Early goldenrod	*Solidago juncea*	Hairy small-leaved tick treefoil	*Desmodium ciliare*
Early lowbush blueberry	*Vaccinium angustifolium*	Hairy thorough-wort	*Eupatorium pilosum*
Eastern hemlock	*Tsuga canadensis*	Hardhack	*Spiraea tomentosa*
Eaton's rosette grass	*Dichanthelium spretum*	Hawkweed	*Hieracium* sp.
Enchanter's nightshade	*Circaea lutetiana*	Hawthorne	*Crataegus* spp.
Engelmann's arrowhead	*Sagittaria engelmanniana*	Hay-scented fern	*Dennestaedtia punctilobula*

Common Name	Scientific Name
Hemlock witchgrass	*Dichanthelium sabulorum*
Highbush blueberry	*Vaccinium corymbosum*
Hispid swamp dewberry	*Rubus hispidus*
Hoary bitter-cress	*Cardamine hirsuta*
Hoary mountain mint	*Pycnanthemum incanum*
Hoary sedge	*Carex canescens*
Hog peanut	*Amphicarpaea bracteata*
Horse gentian	*Triosteum aurantiacum*
Horse nettle	*Solanum carolinese*
Horseweed	*Conyza canadensis*
Hyssop hedge nettle	*Stachys hyssopifolia*
Indian cucumber root	*Medeola virginiana*
Indian pipe	*Monotropa uniflora*
Indian-hemp	*Apocynum cannabinum*
Inkberry	*Ilex glabra*
Interrupted fern	*Osmunda claytoniana*
Japanese barberry	*Berberis thunbergii*
Japanese honeysuckle	*Lonicera japonica*
Japanese wisteria	*Wisteria floribunda*
Jimson-weed	*Datura stramonium*
Johnny-jump-up	*Viola tricolor*
Juneberry; Serviceberry; shadbush	*Amelanchier* sp.
Kentucky bluegrass	*Poa pratensis*
Kentucky fescue	*Festuca arundinacea*
Kidney leaf buttercup	*Ranunculus abortivus*
King-devil	*Hieracium caespitosum*
Knawel	*Schleranthus annuus*
Lady-fern	*Athyrium filix-femina*
Lady's thumb	*Polygonum persicaria*
Lance-leaved coreopsis	*Coreopsis lanceolata*
Lance-leaved violet	*Viola lanceolata*
Large cranberry	*Vaccinium macrocarpon*
Large purple false foxglove	*Agalinis purpurea*
Late lowbush blueberry	*Vaccinium pallidum*
Least hop clover	*Trifolium dubium*
Least pinweed	*Lechea minor*
Leatherleaf	*Chamaedaphne calyculata*
Leathery grape fern	*Botrychium multifidum*
Lesser daisy fleabane	*Erigeron strigosus*
Lesser stitchwort	*Stellaria graminea*
Little bluestem	*Schizachyrium scoparium*
Locust-weed	*Chamaecrista fasciculata*
Long brached frostweed	*Helianthemum canadense*
Long-stalked aster	*Aster dumosus*
Low cudweed	*Filaginella uliginosa*
Low hop clover	*Trifolium campestre*
Low showy aster	*Aster spectabilis*
Lupine	*Lupinus perennis*
Maple leaved viburnum	*Viburnum acerifolium*
Marsh fern	*Thelypteris palustris*
Marsh skullcap	*Scutellaria galericulata*
Maryland tick-trefoil	*Desmodium marilandicum*
Meadow beauty	*Rhexia virginica*
Mermaid weed	*Proserpinaca palustris*
Mild water pepper	*Polygonum hydropiperoides*
Mixed bladderwort	*Utricularia geminiscapa*
Mockernut hickory	*Carya tomentosa*
Morrow's honeysuckle	*Lonicera morrowii*
Moss pink	*Phlox subulata*
Moth mullein	*Verbascum blattaria*
Mountain laurel	*Kalmia latifolia*
Mountain-holly	*Nemopanthus mucronatus*
Mouseear hawkweed	*Hieracium pilosella*
Muhly	*Muhlenbergia frondosa*
Muhly	*Muhlenbergia uniflora*
Multiflora rose	*Rosa multiflora*
Narrow leaved mountain mint	*Pycnanthemum tenuifolium*
Narrow-leaf goldenrod	*Euthamia galetorum*
Narrow-leaved bush clover	*Lespedeza angustifolia*
Narrow-leaved white-topped aster	*Aster solidagineus*
Needle grass; Black oatgrass	*Piptochaetium avenaceum*
New York fern	*Thelypteris noveboracensis*
Nodding bur marigold	*Bidens cernua*
Nodding fescue	*Festuca obtusa*
Nodding foxtail-grass	*Setaria faberi*
Nodding ladies' tresses	*Spiranthes cernua*
Nodding smartweed	*Polygonum lapathifolium*
Northern bugleweed	*Lycopus uniflorus*
Northern catalpa	*Catalpa speciosa*
Northern crab-grass	*Digitaris sanguinalis*
Northern dewberry	*Rubus flagellaris*
Northern downy violet	*Viola sagittata*
Northern white cedar	*Thuja occidentalis*
Norway spruce	*Picea abies*
Nutall's milkwort	*Polygala nuttallii*
Oakes' pondweed	*Potamogeton oakesianus*
Oblong-leaf Juneberry	*Amelanchier canadensis*
Orange grass	*Hypericum gentianoides*
Orchard grass	*Dactylis glomerata*
Oriental bittersweet	*Celastrus orbiculata*
Ovate spike-rush	*Eleocharis ovata*
Ox-eye daisy	*Chrysanthemum leucanthemum*
Ox-eye daisy	*Leucanthemum vulgare*
Pale manna grass	*Puccinellia pallida*
Panic grass	*Dichanthelium acuminatum*
Panic-grass	*Panicum* sp.
Partridgeberry	*Mitchella repens*
Pasture rose	*Rosa carolina*
Pasture-thistle	*Cirsium pumilum*
Path rush	*Juncus tenuis*
Pear tree	*Pyrus communis*
Pearly everlasting	*Anaphalis margaritacea*
Pennsylvania blackberry	*Rubus pensilvanicus*
Pennsylvania sedge	*Carex pensylvanica*
Perennial pea	*Lathyrus latifolius*

Common Name	Scientific Name
Petticoat climber, Purple lovegrass	*Eragrostis spectabilis*
Pickerel weed; Tuckahoe	*Pontederia cordata*
Pignut hickory	*Carya glabra*
Pilewort; Fireweed	*Erechtites hieracifolia*
Pin cherry	*Prunus pensylvanica*
Pinesap; False beechdrops	*Monotropa hypopithys*
Pink knotweed	*Polygonum pensylvanicum*
Pink ladies' slipper	*Cypripedium acaule*
Pink tickseed	*Coreopsis rosea*
Pinweed	*Lechea* spp.
Pitch pine	*Pinus rigida*
Plains snakecotton	*Froelichia floridana*
Pointed broom sedge	*Carex scoparia*
Poison ivy	*Toxicodendron radicans*
Pokeweed	*Phytolacca americana*
Poor-man's pepper	*Lepidium virginicum*
Poverty grass	*Danthonia spicata*
Poverty-grass	*Sporobolus vaginiflorus*
Prairie cord-grass	*Spartina pectinata*
Prairie three-awn	*Aristata oligantha*
Prickly bog sedge	*Carex atlantica*
Primrose-leaf violet	*Viola primulifolia*
Prince's pine	*Chimaphila umbellata*
Purple bladderwort	*Utricularia purpurea*
Purple chokeberry	*Aronia x prunifolia*
Purple St. Johns-wort	*Triandenum virginicum*
Purpletop	*Tridens flavus*
Pussy-willow	*Salix discolor*
Quaking aspen	*Populus tremula*
Queen Anne's Lace	*Daucus carota*
Rabbit-foot clover	*Trifolium arvense*
Racemed milkwort	*Polygala polygama*
Ragweed	*Ambrosia artemisiifolia*
Rattlesnake mannagrass	*Glyceria canadensis*
Rattlesnake weed	*Hieracium venosum*
Red baneberry	*Actaea rubra*
Red cedar	*Juniperus virginiana*
Red chokeberry	*Aronia arbutifolia*
Red clover	*Trifolium pratense*
Red fescue	*Festuca rubra*
Red hickory	*Carya ovalis*
Red maple	*Acer rubrum*
Red pine	*Pinus resinosa*
Red raspberry	*Rubus idaeus*
Red spruce	*Picea rubens*
Red-stemmed dogwood	*Cornus stolonifera*
Red-stemmed plantain	*Plantago rugelii*
Reed-grass	*Calamagrostis cinnoides*
Rhode Island bent	*Agrostis capillaris*
Rhodora	*Rhododendron canadense*
Rice cut-grass	*Leersia oryzoides*
Ricegrass	*Oryzopsis pungens*
Robbin's spikerush	*Eleocharis robbinsii*
Robin's plaintain	*Erigeron pulchellus*
Rock polypody	*Polypodium virginianum*
Rough barnyard-grass	*Echinochloa muricata*
Rough cinquefoil	*Potentilla norvegica*
Rough-fruited cinquefoil	*Potentilla recta*
Rough-stemmed goldenrod	*Solidago rugosa*
Round leaved sundew	*Drosera rotundifolia*
Round-headed bush clover	*Lespedeza capitata*
Roundleaf juneberry	*Amelanchier sanguinea*
Round-leafed pyrola	*Pyrola rotundifolia*
Roundseed panic grass	*Dichanthelium sphaerocarpon*
Royal fern	*Osmunda regalis*
Rugosa rose	*Rosa rugosa*
Running pine	*Lycopodium clavatum*
Ryegrass	*Lolium perenne*
Sage	*Salvia officinalis*
Sand cherry	*Prunus pumila*
Sand jointweed	*Polygonella articulata*
Sand spurrey	*Spergularia rubra*
Sassafras	*Sassafras albidum*
Scarlet oak	*Quercus coccinea*
Scotch broom	*Cytisus scoparius*
Scotch pine	*Pinus sylvestris*
Scrub-oak	*Quercus ilicifolia*
Sedge	*Carex* spp.
Selfheal; Heal-all	*Prunella vulgaris*
Sensitive fern	*Onoclea sensibilis*
Sessile-leaved horehound	*Lycopus amplectens*
Shallow sedge	*Carex lurida*
Sheep fescue	*Festuca ovina*
Sheep sorrel	*Rumex acetosella*
Sheep-laurel	*Kalmia angustifolia*
Shining sumac; Winged sumac	*Rhus copallina*
Shinleaf	*Pyrola elliptica*
Sickle-leaved golden aster	*Heterotheca falcata*
Silky dogwood	*Cornus amomum*
Silvery cinquefoil	*Potentilla argentea*
Siver-hairgrass	*Aira carophyllea*
Skunk cabbage	*Symplocarpos foetidus*
Slender bush clover	*Lespedeza virginica*
Slender fimbry	*Fimbristylis autumnalis*
Slender ladies' tresses	*Spiranthes lacera*
Slender pondweed	*Potamogeton pusillus*
Slender wheatgrass	*Elymus trachycaulus*
Small-headed aster	*Aster vimineus*
Small-leaved Linden	*Tilia cordata*
Smooth brome-grass	*Bromus inermis*
Smooth Winterberry	*Ilex laevigata*
Soapwort; Bouncing bet	*Saponaria officinalis*
Southern sneezeweed	*Helenium flexuosum*
Southern three-lobed bedstraw	*Galium tinctorium*
Southern yellow wood-sorrel	*Oxalis dillenii*

Common Name	Scientific Name
Speargrass	*Poa annua*
Spike-rush	*Eleocharis acicularis*
Spotted spurge; Milk-purslane	*Euphorbia maculata*
Spotted St. John's-wort	*Hypericum punctatum*
Spotted touch-me-not	*Impatiens capensis*
Spotted wintergreen	*Chimaphila maculata*
Spreading dogbane	*Apocynum androsaemifolium*
Squarrose white aster	*Aster ericoides*
St. John's-wort	*Hypericum perforatum*
St. John's-wort	*Hypericum* spp.
Staghorn sumac	*Rhus typhina*
Star-thistle; Knapweed	*Centaurea maculosa*
Starved panic grass	*Dichanthelium depauperatum*
Sticky hawkweed	*Hieracium scabrum*
Stiff aster	*Aster linariifolius*
Swamp beggar ticks	*Bidens connata*
Swamp candles	*Lysimachia terrestris*
Swamp rose	*Rosa palustris*
Swamp-azalea	*Rhododendron viscosum*
Swan's sedge	*Carex swannii*
Sweet fern	*Myrica asplenifolia*
Sweet gale	*Myrica gale*
Sweet goldenrod	*Solidago odora*
Sweet pepper-bush	*Clethra alnifolia*
Sweet vernal grass	*Anthoxanthum odoratum*
Sweet William silene	*Silene armeria*
Sweetgrass	*Hierochloe odorata*
Sweet-scented water-lily	*Nymphaea odorata*
Swith-grass	*Panicum virgatum*
Tall beakrush	*Rhyncospora macrostachya*
Tall lettuce	*Lactuca canadensis*
Tansy	*Tanacetum vulgare*
Taper-tip rush	*Juncus acuminatus*
Tawny cotton-grass	*Eriophorum virginicum*
Thimble Weed	*Anemone virginiana*
Three-toothed cinquefoil	*Potentilla tridentata*
Three-way sedge	*Dulichium arundinaceum*
Thyme-leaved sandwort	*Arenaria serpyllifolia*
Ticklegrass	*Agrostis hyemalis*
Timothy	*Phleum pratense*
Tiny vetch	*Vicia hirsuta*
Toothed flatsedge	*Cyperus dentatus*
Toothed white-topped aster	*Aster paternus*
Torrey's beakrush	*Rhyncospora torreyana*
Trailing arbutus; Mayflower	*Epigaea repens*
Trailing bushclover	*Lespedeza procumbens*
Tree of heaven	*Ailanthus altissima*
Tumble mustard	*Sisymbrium altissimum*
Umbrella-grass	*Fuirena pumila*
Upland willow; Gray willow	*Salix humilis*
Upright scorpion grass	*Myosotis micrantha*
Velvety sedge	*Carex vestita*
Venus' looking-glass	*Triodanis perfoliata*
Vetch	*Vicia* sp.
Viper's bugloss	*Echium vulgare*
Virginia chain fern	*Woodwardia virginica*
Virginia creeper	*Parthenocissus quinquefolia*
Virginia mountain mint	*Pycnanthemum virginianum*
Virginia rose	*Rosa virginiana*
Virginia yellow flax	*Linum virginianum*
Wand-like bush clover	*Lespedeza intermedia*
Water horehound	*Lycopus americanus*
Water pepper	*Polygonum hydropiper*
Water purslane	*Ludwigia palustris*
Water-bulrush	*Scirpus subterminalis*
Water-milfoil	*Myriophyllum humile*
Watershield	*Brasenia shreberi*
Water-willow	*Decodon verticillatus*
Wavy leaf aster	*Aster undulatus*
Waxy meadow rue	*Thalictrum revolutum*
White ash	*Fraxinus americana*
White avens	*Geum canadense*
White buttons	*Eriocaulon septangulare*
White campion	*Silene pratensis*
White clover	*Trifolium repens*
White colicroot, Stargrass	*Aletris farinosa*
White goosefoot	*Chenopodium album*
White oak	*Quercus alba*
White pine	*Pinus strobus*
White poplar	*Populus alba*
White sweet clover	*Melilotus alba*
White wood aster	*Aster divaricatus*
Whitehair rosette grass	*Dichanthelium villosissimum*
Whitlow-grass	*Draba verna*
Whorled loosestrife	*Lysimachia quadrifolia*
Wild cucumber	*Echinocystis lobata*
Wild garlic	*Allium canadense*
Wild geranium; Purple crane's bill	*Geranuim maculatum*
Wild indigo	*Baptisia tinctoria*
Wild oat grass	*Danthonia compressa*
Wild radish	*Raphanus raphanistrum*
Wild sarsaparilla	*Aralia nudicaulis*
Wild strawberry	*Fragaria virginiana*
Wilow	*Salix* spp.
Winged burningbush	*Euonymus alatus*
Winterberry	*Ilex verticillata*
Wintergreen; Teaberry	*Gaultheria procumbens*
Witch grass	*Panicum capillare*
Withe-rod	*Viburnum cassinoides*
Wolly hudsonia	*Hudsonia tomentosa*
Wood anemone	*Anemone quinquefolia*
Wool grass	*Scirpus cyperinus*
Woolly-fruit sedge	*Carex lasiocarpa*
Wormseed; Mexican tea	*Chenopodium ambrosioides*
Wormseed-mustard	*Erysimum cheiranthoides*
Yellow bartonia	*Bartonia virginica*

Common Name	Scientific Name
Yellow foxtail-grass	*Setaria glauca*
Yellow hedge-hyssop	*Gratiola aurea*
Yellow nutsedge	*Cyperus esculentus*
Yellow stargrass	*Hypoxis hirsuta*
Yellow water-lily	*Nuphar lutea*
Yellow-eyed grass	*Xyris difformis*
Yellowfruit sedge	*Carex annectens*
	Agropyron trachycaulum
	Carex emmonsii
	Carex longii
	Carex rosea
	Carex rugosperma
	Cyperus filiculmis
	Cyperus grayii
	Dichanthelium linearifolium
	Eupatorium hyssopifolium
	Lespedeza nuttallii
	Panicum verrucosum
	Populus nigra var. *italica*
	Viburnum sp.

MACROLEPIDOPTERA (MOTH and BUTTERFLY) SPECIES OF CAMP EDWARDS, MA

Abagrotis alternata
Abagrotis brunneipennis
Abagrotis cupida
Abagrotis nefascia
Achatodes zeae
Acronicta afflicta
Acronicta albarufa
Acronicta americana
Acronicta haesitata
Acronicta hasta
Acronicta increta (="inclara")
Acronicta lithospila
Acronicta lobeliae
Acronicta longa
Acronicta modica
Acronicta noctivaga
Acronicta oblinita
Acronicta ovata
Acronicta retardata (="caesarea")
Acronicta sperata
Acronicta superans
Acronicta tristis
Acronicta tritona
Aethalura intertexta
Agnorisma badinodis
Agriopodes fallax
Agrotis gladiaria
Agrotis ipsilon
Agrotis manifesta
Agrotis stigmosa
Agrotis venerabilis
Agrotis vetusta
Agrotis volubilis
Allotria elonympha
Amolita fessa
Amolita roseola
Amphipoea americana
Amphipyra pyramidoides
Anacamptodes ephyraria
Anacamptodes humara
Anacamptodes vellivolata
Anagoga occiduaria
Anagrapha falcifera
Anaplectoides prasina
Anavitrinelia pampinaria
Anisota stigma
Anisota virginiensis
Anomis commoda
Anorthodes tarda
Antepione thiosaria
Antheraea polyphemus
Anticarsia gemmatalis
Apamea amputatrix
Apamea burgessi
Apamea devastator
Apamea dubitans
Apamea finitima
Apamea helva
Apamea inordinata
Apamea lignicolora
Apamea verbascoides
Apantesis nais
Apantesis phalerata
Apatelodes torrefacta
Apharetra dentata
Aplectoides condita
Argyrostrotis anilis
Autographa ampla
Autographa precationis
Automeris io
Bagisara rectifascia
Baileya ophthalmica
Balsa labecula
Balsa tristrigella
Besma endropiaria
Besma quercivoraria
Biston cognataria
Bleptina caradrinalis
Bomolocha baltimoralis
Bomolocha palparia
Cabera erythemaria
Caenurgina crassiuscula
Caenurgina erechtea

Callopistria cordata
Callopistria mollissima
Callosamia promethea
Campaea perlata
Caripeta sp. Nr. Piniata
Catocala sp. Nr. Lineella
Catocala amica
Catocala andromedae
Catocala antinympha
Catocala badia
Catocala coccinata
Catocala gracilis
Catocala grynea
Catocala herodias
Catocala ilia
Catocala lineella
Catocala micronympha
Catocala paleogama
Catocala praeclara
Catocala relicta
Catocala similis
Catocala sordida
Catocala ultronia
Catocala unijuga
Cepphis armataria
Cerma cerintha
Cerura multiscripta
Chaetaglaea cerata
Chaetaglaea sericea
Chaetaglaea tremula
Charadra deridens
Chlorochlamys chloroleucaria
Chloroclystis rectangulata
Chrysanympha formosa
Chytolita morbidalis
Chytonix palliatricula
Chytonix sensilis
Cicinnus melsheimeri
Cingilia catenaria
Cisseps fulvicollis
Cisthene packardi
Clostera albosigma
Clostera strigosa
Colobochyla interpuncta
Colocasia propinquilinea
Cosmia calami
Crambidia pallida
Crocigrapha normani
Cucullia convexipennis
Cyclophora packardi
Cyclophora pendulinaria
Cycnia oregonensis
Cycnia tenera
Darapsa myron
Darapsa pholus
Dasychira basiflava
Dasychira cinnamomea
Dasylophia anguina
Dasyshira obliquata
Dasyshira pinicola
Datana drexelii
Datana ministra
Derrima stellata
Diacrisia aeroides
Dichorda iridaria
Dolba hyloeus
Drasteria graphica
Drasteria occulta
Drepana arcuata
Dryocampa rubicunda
Dypterygia rozmani
Dyspyralis illocata
Dyspyralis nigella
Dyspyralis puncticosta
Ecpantheria scribonia
Ectropis crepuscularia
Egira alternans
Elaphria festivoides
Elaphria versicolor
Ennomos magnaria
Ennomos subsignaria
Epiglaea apiata
Epiglaea decliva
Epimecis hortaria
Estigmene acrea
Euagrotis (lubricans)

Euagrotis illapsa
Eubaphe mendica
Euchaetes egle
Euchlaena effecta
Euchlaena irraria
Euchlaena johnsonaria
Euchlaena madusaria
Euchlaena marginaria
Euchlaena muzaria
Euchlaena serrata
Eucirroedia pampina
Euclidea cuspidea
Eucoptocnemis fimbriaris
Eudryas unio
Eueretagrotis attenta
Eufidonia convergaria
Eufidonia discospilata
Eufidonia nototaria
Eugonobapta nivosaria
Eulithis diversilineata
Eulithis explanata
Eumacaria latiferrugata
Eumorpha pandorus
Euparthenos nubilis
Euphyia unangulata
Euplexia benesimilis
Eurois occulta
Eusarca confusaria
Eutrapela clemataria
Euxoa bostoniensis
Euxoa obeliscoides
Euxoa perpolita
Euxoa pleuritica
Euxoa tessellata
Euxoa vellerpennis
Euxoa violaris
Faronta diffusa
Feltia geniculata
Feltia herilis
Feltia jaculifera
Feltia subgothica
Furcula borealis
Furcula modesta
Gabara subnivosella
Galgula partita
Glena cognataria
Glena cribrataria
Gluphisia septentrionis
Grammia figurata
Grammia parthenice
Grammia virgo
Gueneria similaria
Halysidota tessellaris
Haploa clymene
Harrisimemna trisignata
Helicoverpa zea
Heliomata cycladata
Heterocampa biundata
Heterocampa guttivitta
Heterocampa obliqua
Heterocampa umbrata
Hethemia pistasciaria
Holomelina aurantiaca
Holomelina ferruginosa
Holomelina laeta
Holomelina opella
Homochlodes fritillaria
Homorthodes furfurata
Hyalophora cecropia
Hydrelia condensata
Hydria prunivorata
Hypagyrtis esther
Hypagyrtis piniata
Hypagyrtis unipunctata
Hyparpax aurora
Hypenodes fractilinea
Hyperaeschra georgica
Hyperstrotia flaviguttata
Hyperstrotia villificans
Hyphantria cunea
Hypomecis umbrosaria
Hypoprepia fucosa
Hyppa xylinoides
Idia aemula
Idia americalis
Idia diminuendis

Idia forbesi
Idia julia
Idia lubricalis
Idia rotundalis
Idia scobalis
Idia sp. Nr. "concisa"
Ipimorpha pleonectuosa
Iridopsis larvaria
Itame argillacearia
Itame pustularia
Itame sp. 1
Itame sulphurea
Lacanobia atlantica
Lacinipolia anguina
Lacinipolia meditata
Lacinipolia renigera
Lacosoma chiridota
Lambdina fervidaria
Lambdina fiscellaria
Lambdina pellucidaria
Lapara bombycoides
Lapara coniferarum
Leucania commoides
Leucania extincta
Leucania inermis
Leucania insueta
Leucania lapidaria
Leucania linita
Leucania phragmatidicola
Leucania pseudargyria
Leucania ursula
Leuconycta diphtheroides
Lithacodia albidula
Lithacodia bellicula
Lithacodia carneola
Lithacodia muscosula
Lithacodia synochitis
Lobocleta ossularia
Lobophora nivigerata
Lochmaeus manteo
Lomographa semiclarata
Lomographa vestaliata
Lophocampa caryae
Lycophotia phyllophora
Lymantria dispar
Lytrosis unitaria
Macrochilo absorptalis
Macrochilo litophora
Macrochilo orciferalis
Macruocampa marthesia
Magusa orbifera
Malacosoma americanum
Malacosoma disstria
Marathyssa inficita
Meganola minuscula
Meganola phylla
Meganola spodia
Melanolophia canadaria
Melanolophia signataria
Metalectra discalis
Metalectra quadrisignata
Metalectra richardsi
Metanema inatomaria
Metarranthis amyrisaria
Metarranthis angularia
Metarranthis broweri
Metarranthis duaria
Metarranthis hypocharia
Metarranthis indeclinata
Metarranthis obfirmaria
Metarranthis pilosaria
Metarranthis sp. Nr. Lateritiaria
Metaxaglaea inulta
Metaxaglaea semitaria
Morrisonia confusa
Morrisonia evicta
Morrisonia mucens
Nacophora quernaria
Nadata gibbosa
Nedra ramosula
Nematocampa resistaria
Nemoria bistriaria (=rubromarginaria)
Nemoria mimosaria
Nemoria rubrifrontaria
Nephelodes minians

Noctua pronuba
Nola clethrae
Nola pustulata
Notodonta scitipennis
Nycteola frigidana
Ochropleura plecta
Oligia illocata
Oligia mactata
Oligia modica
Oligocentra lignicolor
Oligocentra semirufescens
Oncocnemis riparia
Oreta rosea (="irrorata")
Orgyia definita
Orgyia leucostigma
Orthodes crenulata
Orthodes cynica
Orthofidonia tinctaria
Orthonama centrostrigaria
Orthonama obstipata
Orthosia revicta
Oruza albocostaliata
Paectes abrostoloides
Paectes pygmaea
Palthis angulalis
Pangrapta decoralis
Panopoda carneicosta
Panopoda rufimargo
Panthea pallescens
Paonias astylus
Paonias excaecatus
Paonias myops
Papaipema baptisiae
Papaipema pterisii
Papaipema sp. 1
Parallelia bistriaris
Patalene olyzonaria
Peridea angulosa
Peridea ferruginea
Peridroma saucia
Pero honestaria
Pero hubneraria
Pero morrisonaria
Petrophora subaequaria
Phalaenophana pyramusalis
Phalaenostola larentioides
Phalaenostola metonalis
Pheosia rimosa
Phlogophora iris
Phlogophora periculosa
Phosphila miseloides
Phosphila turbulenta
Phragmatobia assimilans
Phragmatobia fuliginosa
Phragmatobia lineata
Phyllodesma americana
Phyprosopus callitrichoides
Plagodis alcoolaria
Plagodis fervidaria
Plagodis phlogosaria
Plagodis serinaria
Plathypena scabra
Platyperigea meralis
Platysenta vecors
Platysenta videns
Pleuroprucha insulsaria
Polia detracta
Polia latex
Polygrammate hebraeicum
Polypogon sp. 1
Polypogon cruralis
Polypogon jacchusalis
Polypogon laevigata
Polypogon lituralis
Polypogon obscuripennis
Polypogon ochreipennis
Polypogon protumnusalis
Polypogon theralis
Probole alienaria
Probole amicaria
Probole nepiasaria
Prochoerodes transversata
Proitame virginalis
Protoboarmia porcelaria
Protolampra brunneicollis
Protorthodes oviduca

Proxenus miranda
Psectraglaea carnosa
Pseudaletia unipuncta
Pseudohermonassa bicarnea
Pseudothyatira cymatophoroides
Pyrrharctia isabella
Raphia frater
Redectis vitrea
Renia "adspergillus"
Renia discoloralis
Renia factiosalis
Renia flavipunctalis
Renia nemoralis
Renia salusalis
Renia sobrialis
Rheumaptera hastata
Rhizedra lutosa
Schinia arcigera
Schinia septentrionalis
Schinia spinosae
Schizura apicalis
Schizura badia
Schizura ipomoeae
Schizura leptinoides
Schizura unicornis
Scoliopteryx libatrix
Scopula cacuminaria
Scopula inductata
Scopula limboundata
Semiothisa aemulitaria
Semiothisa bicolorata
Semiothisa bisignata
Semiothisa continuata
Semiothisa granitata
Semiothisa minorata
Semiothisa multilineata
Semiothisa pinistrobata
Semiothisa sexmaculata
Semiothisa transitaria
Semiothisa ulsterata
Sideridis congermana
Sideridis maryx
Sideridis rosea
Smerinthus jamaicensis
Spaelotis clandestina
Spargaloma sexpunctata
Sphinx drupiferarum
Sphinx gordius
Sphinx poecilla
Spilosoma congrua
Spilosoma dubia
Spilosoma latipennis
Spilosoma virginica
Spiramater grandis
Spiramater lutra
Spodoptera frugiperda
Spodoptera ornithogalli
Sunira bicolorago
Sutnya privata
Symmerista albifrons
Syngrapha octoscripta
Tacparia atropunctata
Tacparia detersata
Tarachidia candefacta
Tetracis cachexiata
Tetracis crocallata
Tolype laricis
Tolype velleda
Tricholita signata
Ulolonche culea
Ulolonche modesta
Xanthia togata
Xanthorhoe lacustrata
Xanthotype sospeta
Xanthotype urticaria
Xestia c-nigrum
Xestia c-nigrum/dolosa
Xestia dilucida
Xestia dolosa
Xestia elimata/praevia
Xestia normaniana
Xestia smithii
Xylomoia chagnoni
Xylotype capax
Xystopeplus rufago
Zale aeruginosa

Zale curema
Zale helata
Zale horrida
Zale lunata
Zale metatoides
Zale minerea
Zale obliqua
Zale submediana
Zale unilineata

ODONATE (DRAGONFLY and DAMSELFLY) SPECIES OF CAMP EDWARDS, MA.

Common Name	Scientific name
Amber-winged Spreadwing	*Lestes eurinus*
Atlantic Bluet	*Enallagma doubledayi*
Azure Bluet	*Enallagma aspersum*
Black Saddlebags	*Tramea lacerata*
Black-tipped Darner	*Aeshna tuberculifera*
Blue Corporal	*Libellula deplanata*
Blue Dasher	*Pachydiplax longipennis*
Calico Pennant	*Celithemis elisa*
Carolina Saddlebags	*Tramea carolina*
Citrine Forktail	*Ischnura hastata*
Comet Darner	*Anax longipes*
Common Baskettail	*Epitheca cynosura*
Common Green Darner	*Anax junius*
Common or Sweetflag Spreadwing	*Lestes disjunctus/forcipatus*
Common Sanddragon	*Progomphus obscurus*
Common Spreadwing	*Lestes disjunctus*
Common Whitetail	*Libellula lydia*
Dot-tailed Whiteface	*Leucorrhinia intacta*
Eastern Amberwing	*Perithemis tenera*
Eastern Forktail	*Ischnura verticalis*
Eastern Pondhawk	*Erythemis simplicicollis*
Elegant Spreadwing	*Lestes inaequalis*
Four-spotted Skimmer	*Libellula quadrimaculata*
Fragile Forktail	*Ischnura posita*
Fragile Forktail	*Ishnura posita*
Frosted Whiteface	*Leucorrhinia frigida*
Golden-winged Skimmer	*Libellula auripennis*
Goldenwings	*Libellula auripennis/needhami*
Great Blue Skimmer	*Libellula vibrans*
Green-striped Darner	*Aeshna verticalis*
Halloween Pennant	*Celithemis eponina*
Lancet Clubtail	*Gomphis exilis*
Lilypad Forktail	*Ischnura kellicotti*
Lyre-tipped Spreadwing	*Lestes unguiculatus*
Martha's Pennant	*Celithemis martha*
Mottled Darner	*Aeshna clepsydra*
New England Bluet	*Enallagma laterale*
Northern Bluet	*Enallagma cyathigerum*
Painted Skimmer	*Libellula semifasciata*
Petite Emerald	*Dorocordulia lepida*
Pond Damsel	*Coenagrionidae species*
Ruby Meadowhawk	*Sympetrum rubicundulum*
Scarlet Bluet	*Enallagma pictum*
Seaside Dragonlet	*Erythrodiplax berenice*
Sedge Sprite	*Nehalennia irene*
Shadow Darner	*Aeshna umbrosa*
Skimming Bluet	*Enallagma geminatum*
Skimming Bluet	*Enallagma signatum*
Slaty Skimmer	*Libellula incesta*
Slender Spreadwing	*Lestes rectangularis*
Spangled Skimmer	*Libellula cyanea*
Spatterdock Darner	*Aeshna mutata*
Sphagnum sprite	*Nehalennia gracilis*
Spotted Spreadwing	*Lestes congener*
Spot-winged Glider	*Pantala hymenaea*
Stream Cruiser	*Didymops transversa*
Swamp Spreadwing	*Lestes vigilax*
Sweetflag Spreadwing	*Lestes forcipatus*
Twelve-spotted Skimmer	*Lebellula pulchella*
Twelve-spotted Skimmer	*Libellula pulchella*
Variable Dancer	*Argia fumipennis*
Vesper Bluet	*Enallagma vesperum*
Wandering Glider	*Pantala flavexcens*
White Corporal	*Libelula exusta*
Widow Skimmer	*Libellula luctuosa*
Yellow-legged Meadowhawk	*Sympetrum vicinum*

BEE SPECIES OF CAMP EDWARDS, MA.

Agapostemon virescens
Andrena braccata
Andrena bradleyi
Andrena canadensis
Andrena carlini
Andrena carolina
Andrena crataegi
Andrena hirticincta
Andrena miserabilis
Andrena nasonii
Andrena nubecula
Andrena nuda
Andrena placata
Andrena sigmundi
Andrena vicina
Anthidiellum notatum
Anthidium oblongatum
Anthophora walshii
Apis melifera
Augochlora pura
Augochlorella aurata
Bombus fervidus
Bombus griseocollis
Bombus impatiens
Bombus vagans
Ceratina calcarata
Ceratina mikmaqi
Ceratina strenua
Coelioxys octodentata
Colletes americanus
Colletes compactus
Colletes nudus
Colletes simulans
Colletes simulans
Colletes solidaginis
Epeolus pusillus
Halictus confusus
Halictus ligatus
Halictus parallelus
Halictus rubicundus
Hylaeus affinis
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Hylaeus mesillae
Hylaeus modestus
Lasioglossum acuminatum
Lasioglossum bruneri
Lasioglossum coriaceum
Lasioglossum cressonii
Lasioglossum
leucocomum
Lasioglossum
leucozonium
Lasioglossum pectorale
Lasioglossum pruinosum
Lasioglossum tegulare
Lasioglossum timothyi
Lasioglossum versans
Lasioglossum versatum
Megachile brevis
Megachile campanulae
Megachile centuncularis
Megachile latimanus
Megachile mendica
Megachile sculpturalis
Melissodes desponsa
Melissodes illata Nomada
cuneata Nomada depressa
Nomada maculata
Nomada sayi
Perdita octomaculata
Pseudoanthidium nanum
Sphecodes heraclei
Xylocopa virginica

BIRD SPECIES OF CAMP EDWARDS, MA

Common Name	Scientific name
Acadian flycatcher	*Empidonax veriscens*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*
American robin	*Turdus migratorius*
American woodcock	*Scolopax minor*
Bank swallow	*Riparia riparia*
Barn swallow	*Hirundo rustica*
Belted kingfisher	*Ceryle alcyon*
Black-and-white warbler	*Mniotilta varia*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Black-capped chickadee	*Parus atricapillus*
Blackpoll warbler	*Dendroica striata*
Blue jay	*Cyanocitta cristata*
Broad-winged hawk	*Buteo platypterus*
Brown creeper	*Certhia americana*
Brown thrasher	*Toxostoma rufum*
Brown-headed cowbird	*Molothrus ater*
Canada goose	*Branta canadensis*
Carolina wren	*Thryothorus ludovicianus*
Cedar waxwing	*Bombycilla cedrorum*
Chestnut-sided warbler	*Dendroica pensylvanica*
Chimney swift	*Chaetura pelagica*
Chipping sparrow	*Spizella passerina*
Clay-colored sparrow	*Spizella pallida*
Common grackle	*Quiscalus quiscula*
Common loon	*Gavia immer*
Common tern	*Sterna hirundo*
Common yellowthroat	*Geothlypis trichas*
Cooper's hawk	*Accipiter cooperii*
Double-crested cormorant	*Phalacrocorax auritus*
Downy woodpecker	*Picoides pubescens*
Eastern bluebird	*Sialia sialis*
Eastern kingbird	*Tyrannus tyrannus*
Eastern meadowlark	*Sturnella magna*
Eastern phoebe	*Sayornis phoebe*
Eastern wood-pewee	*Contopus virens*
Empidonax flycatchers	*Empidonax spp.*
European starling	*Sturnus vulgaris*
Field sparrow	*Spizella pusilla*
Fish crow	*Corvus ossifragus*
Grasshopper sparrow	*Ammodramus savannarum*
Gray catbird	*Dumetella carolinesis*
Great blue heron	*Ardea herodias*
Great crested flycatcher	*Myiarchus crinitus*
Great horned owl	*Bubo virginianus*
Green-backed heron	*Butorides striatus*
Hairy woodpecker	*Picoides villosus*
Hermit thrush	*Catharus guttatus*
Herring gull	*Larus argentatus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
House wren	*Troglodytes aedon*
Indigo bunting	*Passerina cyanea*
Killdeer	*Charadrius vociferus*
Mallard	*Anas platyrhynchos*
Mourning dove	*Zenaida macroura*
Mourning warbler	*Oporornis philadelphia*
Mute swan	*Cygnus olor*
Northern bobwhite	*Colinus virginianus*
Northern cardinal	*Cardinalis cardinalis*
Northern flicker	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Northern mockingbird	*Mimus polyglottos*
Northern oriole	*Icterus galbula*
N. Rough-winged swallow	*Stelgidopteryx serripennis*
Orchard oriole	*Icterus spurius*
Osprey	*Pandion haliaetus*
Ovenbird	*Seiurus aurocapillus*
Peregrine falcon	*Falco peregrinus*
Pine warbler	*Dendroica pinus*
Prairie warbler	*Dendroica discolor*
Purple finch	*Carpodacus purpureus*
Red knot	*Calidris canutus*
Red-bellied woodpecker	*Melanerpes carolinus*
Red-breasted nuthatch	*Sitta canadensis*
Red-eyed vireo	*Vireo olivaceus*
Red-necked grebe	*Podiceps grisegena*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Rock dove	*Columba livia*
Ruby-throated hummingbird	*Archilochus colubris*
Ruffed grouse	*Bonasa umbellus*
Rufous-sided towhee	*Pipilo erythropthalmus*
Scarlet tanager	*Piranga olivacea*
Sharp-shinned hawk	*Accipiter striatus*
Song sparrow	*Melospiza melodia*
Swamp sparrow	*Melospiza georgiana*
Tree swallow	*Tachycineta bicolor*
Tufted titmouse	*Parus bicolor*

Common name	Scientific name
Turkey vulture	*Cathartes aura*
Upland sandpiper	*Bartramia longicauda*
Veery	*Catharus fuscescens*
Vesper sparrow	*Pooecetes gramineus*
Whip-poor-will	*Caprimulgus vociferous*
White-breasted nuthatch	*Sitta carolinensis*
White-eyed vireo	*Vireo griseus*
Wild turkey	*Meleagris gallopavo*
Wood thrush	*Hylocichla mustelina*
Yellow warbler	*Dendroica petechia*
Yellow-billed cuckoo	*Coccyzus americanus*

MAMMAL SPECIES OF CAMP EDWARDS, MA

Common Name	Scientific name
Big brown bat	*Eptesicus fuscus*
Coyote	*Canis latrans*
Domestic cat	*Felis domesticus*
Domestic dog	*Canis familiaris*
Eastern chipmunk	*Tamias striatus*
Eastern cottontail	*Sylvilagus floridanus*
Eastern mole	*Scalopus aquaticus*
Eastern red bat	*Lasiurus borealis*
Fisher	*Martes pennanti*
Gray fox	*Urocyon cinereoargenteus*
Gray squirrel	*Sciurus carolinensis*
Hoary bat	*Lasiurus cinereus*
Little brown bat	*Myotis lucifugus*
Long-tailed weasel	*Mustela frenata*
Masked shrew	*Sorex cinereus*
Meadow jumping mouse	*Zapus hudsonius*
Meadow vole	*Microtus pennsylvanicus*
Muskrat	*Ondatra zibethicus*
New England cottontail	*Sylvialgus floridanus*
Northern long-eared bat	*Myotis septentrionalis*
Opossum	*Didelphis virginiana*
Porcupine	*Erethizon dorsatum*
Raccoon	*Procyon lotor*
Red bat	*Lasiurus borealis*
Red fox	*Vulpes vulpes*
Red squirrel	*Tamiasciurus hudsonicus*
Short-tailed shrew	*Blarina brevicauda*
Silver-haired bat	*Lasionycteris noctivagans*
Southern flying squirrel	*Glaucomys volans*
Southern red-backed vole	*Cleithrionomys gapperi*
Striped skunk	*Mephitis mephitis*
Tricolored bat	*Perimyotis subflavus*
White-footed mouse	*Peromyscus leucopus*
White-tailed deer	*Odocoileus virginianus*
Woodchuck	*Marmota monax*

REPTILE SPECIES OF CAMP EDWARDS, MA

Common Name	Scientific name
Eastern box turtle	*Terrapene c. carolina*
Spotted turtle	*Clemmys guttata*
Snapping turtle	*Chelydra serpentina*
Musk turtle	*Sternotherus odoratus*
Eastern painted turtle	*Chrysemys p. picta*
Black racer	*Coluber constrictor*
Smooth green snake	*Opheodrys vernalis*
Garter snake	*Thamnophis sirtalis sirtalis*
Eastern ribbon snake	*Thamnophis sauritus sauritus*
Northern ring-necked snake	*Diadophis punctatus edwardsii*
Milk snake	*Lampropeltis triangulum*
Eastern hog-nosed snake	*Heterodon platirhinos*

AMPHIBIAN SPECIES OF CAMP EDWARDS, MA

Common Name	Scientific name
Bullfrog	*Rana catesbeiana*
Green frog	*Rana clamitans*
Wood frog	*Rana sylvatica*
Pickerel frog	*Rana palustris*
Grey treefrog	*Hyla versicolor*
Spring peeper	*Pseudacris crucifer*
American toad	*Bufo americanus*
Fowler's toad	*Bufo woodhousei fowleri*
Spotted salamander	*Ambystoma maculatum*
Eastern newt	*Notophthalmus viridescens*
Redback salamander	*Plethodon cinereus*

APPENDIX G – MISSION IMPACTS ON NATURAL RESOURCES

1.1 NATURAL RESOURCES CONSTRAINTS TO MISSIONS AND MISSION PLANNING

The Sikes Act requires that INRMPs provide for "…*no net loss in the capability of military installation lands to support the military mission of the installation*" (16 U.S.C. §670 et seq.). The INRMP enables the installation to meet the requirements of the military mission within the limitations and legal restrictions of the baseline natural resources at Camp Edwards.

Environmental considerations, such as the presence of endangered species, influence where and when certain types of activities can occur to ensure regulatory compliance and long-term sustainability of natural resources on the installation. However, natural resources are also required to fulfill the training needs of the MAARNG and to support the military mission; these resources are referred to as the missionscape. The missionscape includes all existing habitats and Camp Edwards, including those being actively managed to support the dual goals of ecological diversity and training landscape diversity. Figure G-1 shows the resource constraints that may impact training activities at Camp Edwards.

1.2 LAND USE

The term "land use" refers to real property classifications that indicate either natural conditions or the types of human activity occurring within a specified area. Army installation land use planning commonly uses 12 general land use classifications (i.e., airfields, maintenance, industrial, supply/storage, administration, training/ranges, unaccompanied personnel housing, family housing, community facilities, medical, outdoor recreation, and open space). Army installation land use planning is focused on providing facilities (i.e., training installations) that support an overall quality environment for military forces needed to maintain national security (MAARNG 2019a).

Overall, land use on the installation can be divided into two general categories: improved or developed lands and natural lands. Improved lands include all areas occupied by buildings, other structures, and intensely maintained lawns/landscaping as well as areas with more periodically maintained lawns/landscaped areas. Natural lands are less regularly maintained areas that provide habitat and realistic training scenarios, such as forested areas, grasslands, scrub-shrub habitats. These areas are periodically maintained at Camp Edwards through the use of prescribed fire, mechanical thinning or vegetation control, and the limited use of herbicides. Camp Edwards is comprised of approximately 582 acres (4 percent) of improved grounds, 675 acres (5 percent) of semi-improved grounds, and 13,311 acres (91 percent) of unimproved grounds (MAARNG 2019a).

Training is completed at Camp Edwards at ranges and bivouacs, as well as along roads, in maneuver areas, in dig areas, and at other sites. Tactical maneuvering, either on foot throughout the training area or in vehicles along roads, occurs as soldiers travel from the assembly area to their area of operation, which is one or more training areas. Roads at Camp Edwards are largely unimproved dirt single-track roads, with the exception of roads within the cantonment area, which are largely paved. Unimproved roads and trails are used by wheeled and tracked vehicles

for training purposes within the training area. Other transportation facilities at Camp Edwards include a railroad spur that ends in the cantonment area that is occasionally used to bring in large equipment. The Army National Guard also has an aviation facility housed at Air Station Cape Cod managed by the Air National Guard. This facility primarily supports the use of UH60 (Blackhawk) helicopters and C26 fixed-wing airplanes. Twenty-six helicopter landing zones are located in Camp Edwards for training exercises, but not all of the existing landing zones are in useable condition.

The Camp Edwards Impact Area (totaling 2,200 acres) was the primary target area for artillery, mortar, and other firing activities from the early 1900s until firing ceased in 1997 due to contamination concerns. The Impact Area is considered a high hazard impact area due to unexploded ordnance from weapon systems and, due to safety concerns, no public access is allowed in this portion of the installation. The Known Distance Range is located immediately south and separated from the Central Impact Area by Wheelock Road, an unimproved dirt road. This range is currently used for unmanned aerial vehicle trainings for soldiers and development of unmanned aerial vehicles through partnerships. There are six active small arms ranges on Camp Edwards, which the MAARNG uses for weapons familiarization, weapons zeroing, and qualification. These small arms ranges are located within the buffer of the impact area but shoot towards the impact area. Camp Edwards has a series of paved and dirt roads throughout the area that is used for training, in addition to over 7,600 acres of training areas comprised primarily of woodlands (MAARNG 2019a).

Camp Edwards is not subject to the requirements of local zoning ordinances as State-owned lands and military installations are not subject to local zoning or building permit codes. The activities within Camp Edwards are managed through the EPS, which are standards for performance that guide both military and civilian users in the protection of Camp Edwards' natural and cultural resources and the groundwater beneath the Reserve during conduct of compatible military training and civilian use activities, such as hunting (Appendix E).

1.3 CURRENT MAJOR IMPACTS

Camp Edwards provides an integral training area for soldiers from across New England. Actions and facilities that support the mission of Camp Edwards and training objectives have the potential to cause impacts to resources and the environment. An important part of the military's vision on Camp Edwards is to be committed to excellence in all aspects of environmental protection and management of the Camp Edwards Training Site. Furthermore, the MAARNG seeks to constantly improve upon training practices that protect the future of the ecosystem and training lands of Camp Edwards. The primary potential impacts of natural resources and their management on the mission are the vigorous and dense regrowth of understory vegetation and the development of snag (i.e., dead or declining tree) hazards following prescribed burns. Snag development has been found to be particularly severe when prescribed burns are followed or preceded by an insect pest (e.g., gypsy moth, pine beetle). Additionally, experience is demonstrating a period of disproportionately high oak mortality when burns are conducted between roughly the last week of April and the first 2 weeks of May, regardless of intensity. Snags primarily impact the mission through safety risk to soldiers and the potential need to shut down a training area if the risk becomes too great for use. Additional impacts are continued and/or emerging prevalence of invertebrate-borne pathogens that may present a health hazard to

soldiers, such as Lyme disease (black-legged ticks) and West Nile virus (mosquitoes). Other major impacts of the mission include the development of roadway puddles through the use of heavy equipment. These puddles can attract reptiles and amphibians, including rare and protected species such as box turtles, to the roadway. The presence of these species in roadway puddles results in an increased risk of injury or mortality from being run over or crushed by vehicles and heavy equipment on the roadway. Mission vehicle travel into and across Camp Edwards can contribute to the spread of invasive plant species. Implementation schedules of some missions could also impact sensitive breeding periods for birds and herpetofauna.

All activities that are part of the military mission have the potential for impacting the natural resources of the Camp Edwards Training Site. However, all training practices are restricted to areas and schedules established in the EPS and approved by the Natural Resource Office at Camp Edwards. Any training activities having significant destructive impacts on sensitive resources are currently prohibited on Camp Edwards. These activities include firing lead ammunition without capture and containment, anti-tank missile fire, artillery or mortar fire, deforestation, burning gun powder, demolition, creation and use of open latrines, vehicle refueling in the field, as well as any training activity, except for foot travel, within the following areas (MANG 2001):

- 400 feet from a water supply well
- 100-foot wetland buffer
- cultural resource locations with high sensitivity
- the Impact Area
- any IRP remediation site
- any area not approved by Range Control and the Natural Resource Office.

These restrictions effectively exclude approximately 2,704 acres of land from most training activities. Most of this land, 2,161 acres, consists of the Impact Area, which is currently restricted to all training activities due to the presence of unexploded ordinance. The Impact Area does have the potential to be used as training land (convoy training, vehicle maneuvers, etc.) if it is deemed appropriate by training and environmental staff. The remaining 543 acres consists of wetland buffers (395 acres), cantonment area grasslands (113 acres), and water supply well buffers (135 acres), in which only foot travel is allowed for at least part of the year.

With no live fire training within the Impact Area there is the absence of wildland fire within this fire adapted natural community (Scrub Oak Shrubland Community). Efforts are being made to introduce prescribed fire into the Impact Area to avoid the loss of this fire adapted natural community type. The lack of fire in the Impact Area presents a significant fire hazard, which could result in a significant impact on training and the environment if there was a wildfire before hazard reduction actions are implemented. To achieve this end, several years of planning and fuels management projects are needed to provide for safer operations, and coordination among environmental agencies and the MAARNG is needed provide for safety and not to interfere with these efforts. Funding and other appropriate resources will have to be secured to provide for resources needed to undertake prescribed fire activities within the Camp Edwards Impact Area.

Off-Limits Grassland Bird Area

Bivouacking by soldiers during their annual training also has potential to negatively affect the natural resources of Camp Edwards. Vehicle traffic within the bivouac areas and throughout the training area has the potential to cause mortality of flora and fauna. Animals such as deer, raccoons, squirrels, toads, and box turtles have been documented as cases of vehicle mortality. Bivouacking and heavy activity in disturbed areas has historically impacted the natural resources in a negative manner, resulting in soil compaction, and lower plant and mammal diversity. These areas have been shown to have lower plant and animal diversity and abundance when compared to other areas on the installation. Rotational use of these sites is used to minimize training impacts. In addition, the use of bivouacs has decreased in recent years and the NR-ITAM assessment, restoration, and rehabilitation of bivouac sites has substantially increased, providing for a better habitat and species diversity while also providing better training opportunities. Sites are managed and rehabilitated as needed to increase plant and animal species diversity and repair any training damage. Bivouacs and battle positions, while having lower plant diversity, offer an important habitat resource for both forest and early successional wildlife. Focal bird surveys and other efforts have demonstrated that both restored battle positions and open understory bivouacs tend to have a high animal diversity, particularly for birds as there are more seasonal water sources, edge habitat, differing food resources, and mating display sites.

1.4 POTENTIAL FUTURE IMPACTS

Camp Edwards is by far the largest Army National Guard training site in the northeastern United States and its future use is intended as a squad level feeder site to support larger platoon sized training at larger Army training sites. Upcoming major projects within the Camp Edwards Master Plan to support training activities may have impacts on natural resources in the coming years. To support MAARNG in the development of new training areas and resources, master planning is ongoing. Examples of major projects within the master plan include (MAARNG 2019b):

- Development of a Multipurpose Machine Gun Range at the existing Known Distance Range. The Known Distance range area is currently 36 acres of managed grassland, mitigation for the Tactical Training Base Landing Zone. The project includes a conversion of approximately 180 acres with target mounds, bullet capture mound, and a mowed range floor of native grasses and forbs. While range construction will directly convert about 180 acres of habitat to maintained range (e.g., mowed grass/forbs), the surrounding habitat and fuels management is anticipated to be a net benefit for pine barrens habitat and species while also reducing overall fire risk. This project has been reviewed under the National Environmental Policy Act and is funded for FY 2020. Impacts to state-listed species and habitats are being mitigated extensively through implementation of the MANG JBCC Mitigation Strategy.

- Expansion of the existing Automated Record Fire range (Sierra Range) in the northeastern range complex to meet Army standards of 16 firing lanes (up from the existing 10). This expansion will be approximately 11 acres, though design and maintenance would be identical to the existing range area. Impacts would be mitigated for as part of the JBCC Mitigation Strategy.

Expansion of existing Tango Range from 8 lanes to 32 lanes, though lanes would have a smaller footprint. The firing line and target line would be moved 20 meters to the north to allow for co-use with the Sierra Range. Maintenance would be consistent with the current condition and use. Impacts would be mitigated for as part of the JBCC Mitigation Strategy.

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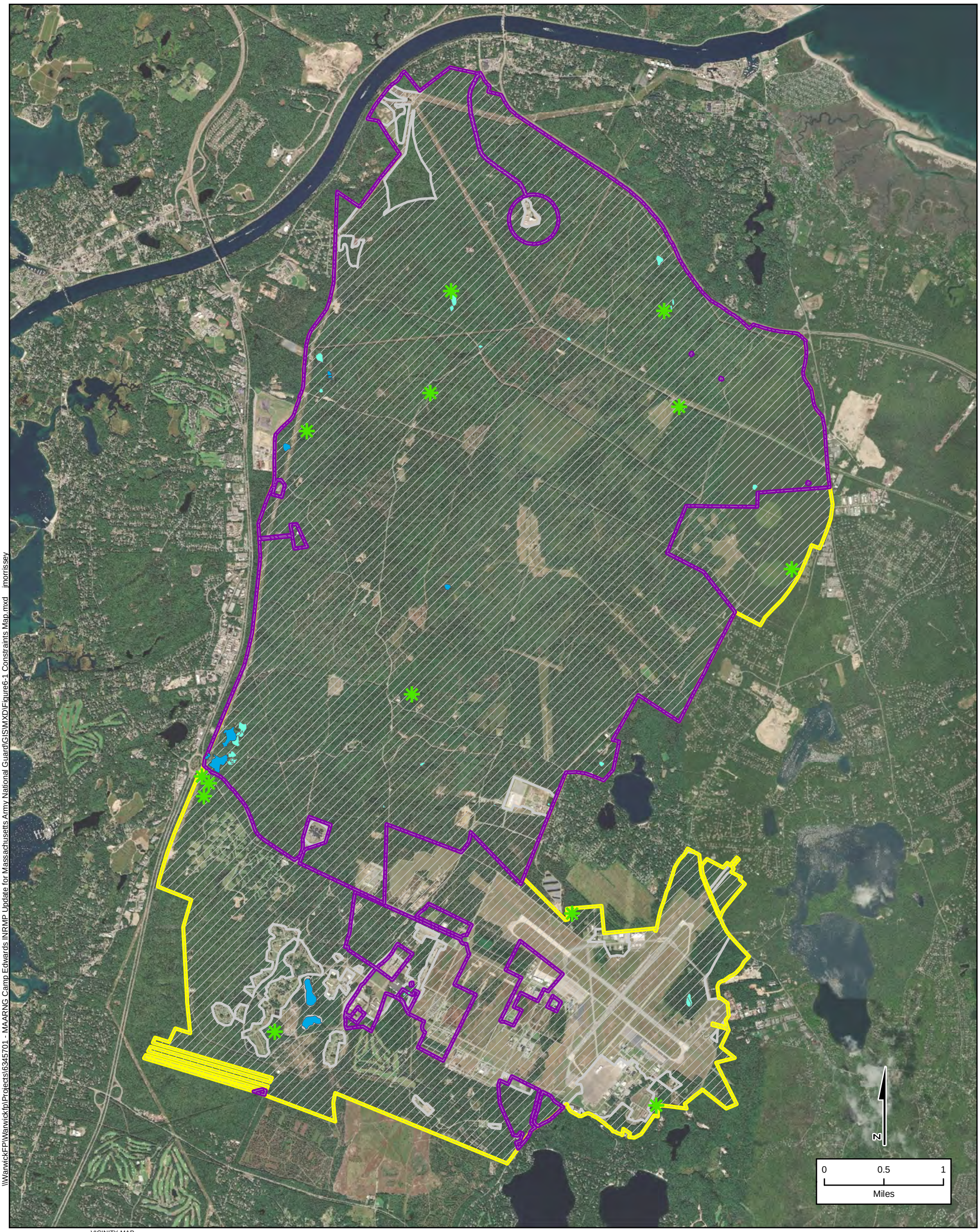

VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary
- Primary Habitat for Rare Species
- Pond
- Wetland
- Certified Vernal Pool

Figure G-1
Constraints Map
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

\\WarwickFP\Warwickfp\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure6-1 Constraints Map.mxd jmorrissey

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- Development of a near-standard Infantry Squad Battle Course at the former Infantry Battle Course location west of Sierra Range in order to minimize impacts. This range is live-fire ammunition combined with soldier movement (i.e., no static firing line) through the isolated engagement sites. This site would be maintained overall as woodland/shrubland natural habitat through prescribed burning and regular maintenance and mowing. However, habitat will be broken up by targets, engagement areas, and maneuver pathways within the overall habitat matrix. The intent is for a natural and realistic battle landscape.

- Expansion of gym facilities to allow increased parking and infrastructure. This project would include 2–3 acres of parking expansion (clearing and paving) as well as clearing of 3–5 acres for development of a running track and other associated facilities (equipment shed, latrines). The area would be maintained as a landscaped athletic field area.

- Development of three facilities for transient troop headquarters. Each facility would include 3–5 buildings and associated parking. Though sites have not been selected, facilities may be constructed in maintained grasslands that support grasshopper sparrows. The total project development would include conversion of approximately 18–20 acres.

The increased range development will bring additional training site use from Massachusetts and surrounding states. Additionally, support facilities in cantonment (e.g., simulators, Tactical Training Base, etc.) and the training area (e.g., bivouac sites) will receive more use and damage. Monitoring and repair of training lands is funded through ITAM and the active rehabilitation ongoing for bivouac and battle position sites provides for greater site resiliency and reduces the use of any particular site by providing more dispersed options. The increased training site use and range use will drive a greater need for natural resources management and will, ultimately, provide for larger scale implementation of early successional habitat work. Monitoring of flora and fauna will be critical to inform adaptive management and detect changes early. However, an increase in prescribed burning and mechanical improvements is expected to benefit the primary habitats and dependent species of the pine barrens. Collaborative planning of mitigation efforts and landscape management will be key to sustainably managing for future impacts and habitat resiliency.

Projects identified in master planning are needed to support modernization efforts including construction, expansion, or redevelopment of multiple small arms ranges and modernization of cantonment infrastructure. However, the impacts of these activities to species and habitats protected under MESA requires regulatory permitting and demonstration of "net benefit" to the species through mitigation. To minimize impacts to natural resources and to mitigate for projects, MAARNG has developed a mitigation bank and strategy (MAARNG 2019c). As part of this strategy, actions include land transfers to MassWildlife to meet mitigation needs and provide a reduced mitigation ratio for pitch pine-oak forest species. In addition, MAARNG is undertaking mitigation actions at Camp Edwards, including habitat management, monitoring, and research (MAARNG 2019c). Actions are focused in different areas on forest cover retention, grasslands creation, pine barrens improvement and restoration (Figure G-2). This mitigation bank was developed in close coordination with MassWildlife and other partners.

1.5 NATURAL RESOURCES NEEDED TO SUPPORT THE MILITARY MISSION

The mission of the NR-ITAM program at Camp Edwards is to maintain and enhance training lands and training opportunity through land management, interagency partnerships, environmental planning, and permit coordination. The primary purpose of the natural resource management at Camp Edwards is to support the military mission by maintaining sustainable natural resources and ecological integrity of the site as a critical asset for the military training mission. This includes a goal to have no net loss in training capacity or natural resources while supporting existing and future mission capabilities and ensuring the MAARNG is in compliance with all applicable environmental and natural resource regulations. Natural resources required to fulfill the training needs of the MAARNG and to support the military mission are referred to as the missionscape and include all existing habitats on Camp Edwards. The diversity of habitats on Camp Edwards offer the vegetation types, density, and structure required for light infantry maneuvers and common task training, including map reading, terrain orientation, camouflage training, and ambush and defense training. Bivouac operations training requires bivouac sites with closed canopy and a relatively sparse understory for aerial and horizontal concealment. These areas are used for establishing command and control areas during training maneuvers as well as for tactical assembly areas. Open areas with little vegetation are used for engineering training, administrative assembly areas. and for establishing and maintaining helicopter landing zones.

This INRMP integrates the various aspects of natural resources management into the military mission and is the primary tool for ecosystem management at Camp Edwards while ensuring the successful, efficient accomplishment of the military mission. A multiple-use approach will be implemented using the INRMP to best promote mission-oriented activities through improving the habitat diversity and creating a multifaceted training site for MAARNG, as well as high quality natural resources. Implementation of this INRMP will promote stewardship practices that protect and enhance natural resources for multiple use and biological integrity, while supporting the military mission. Mission activities at Camp Edwards benefit from the promotion of habitat diversity and resilience.

B-12

Tract 1 and 2 (SMRC)

Tract 3 (SMRC)

Tract 4 (SMRC)

Tract 5

ParcelH-UnitK

N

0 0.5 1
Miles

VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary
- Land protection parcels

Mitigation Areas

- Forest cover retention
- Alternate grassland mitigation
- Pine barrens improvement
- Pine barrens improvement - MPMG area

Figure G-2
Mitigation Areas
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 10/8/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

\\WarwickFP\Warwickfp\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure6-2 Mitigation Areas Map.mxd jmorrissey

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APPENDIX H – NATURAL RESOURCES PROGRAM MANAGEMENT

The INRMP Program has been organized to ensure the implementation of year-round, cost-effective management activities and projects that meet the requirements of the Camp Edwards Training Site. The Sikes Act requires that INRMPs provide for no net loss in the capability of military installation lands to support the military mission of the installation. Professionally trained natural resources management staff and natural resources enforcement are required to implement this INRMP. The Sikes Act Improvement Act Section 670g defines a "professional" as one who has an undergraduate degree or graduate degree in a natural resources-related science.

1.1 EXISTING CONDITIONS

At Camp Edwards, the Natural Resources Program is combined with the ITAM. The ITAM program is the element of the U.S. Army Sustainable Range Program that provides Army land managers with the capabilities to manage and maintain training and testing lands by integrating mission requirements with land management practices and environmental requirements. The ITAM program consists of the following four components:

- Range and Training Land Assessment (RTLA)—The RTLA program inventories and monitors natural resource conditions and manages and analyzes natural resource information. Results are pertinent to management of training and testing lands from training area to installation scales and provides input to decisions that promote sustained and multiple uses on military lands. The RTLA program evaluates relationships between land use and condition through the collection of physical and biological resource data. Some RTLA projects are long term, while others are relatively short. The key to RTLA success is the evaluation and analysis of collected data.

- Land Rehabilitation and Maintenance (LRAM)—LRAM is the component of the ITAM Program that provides a preventive and corrective land rehabilitation and maintenance procedure to reduce the long-term impacts of training and testing on an installation. It includes training area redesign and/or reconfiguration to meet training requirements.

- Training Requirements Integration (TRI)—TRI is the component of the ITAM Program that provides a decision support procedure that integrates training requirements with land management, training management, and natural and cultural resources management processes and data derived from RTLA and Army Conservation Program components.

- Sustainable Range Awareness (SRA)—Sustainable Range Awareness is the component of the ITAM Program that provides a proactive means to develop and distribute educational materials to users of range and training land assets. Materials relate procedures that reduce the potential for inflicting avoidable impacts on range and training land assets, including the local natural and cultural resources. ITAM SRA addresses specific environmental sensitivities at the installation level, to inform land users of restrictions and activities to avoid so as to prevent damage to natural and cultural resources.

The ITAM Program at Camp Edwards is administered by the Camp Edwards Natural Resource Office with cooperation and support from Operations and Range Control at Camp Edwards. The RTLA portion of the ITAM Program is carried out by the seasonal and permanent staff of the Camp Edwards Natural Resource Office. LRAM Projects are initiated by the Camp Edwards Natural Resource Office, with most of the work conducted by the Roads and Grounds crew within the Camp Edwards Division of Facilities Engineering. TRI initiatives are coordinated between the Camp Edwards Natural Resource Office, the Environmental and Readiness Center, Range Control, and trainers. The EA portion of the ITAM Program is conducted by the Camp Edwards Natural Resource Office with an emphasis not only on the soldiers that train at Camp Edwards, but also people and organizations outside the MAARNG (e.g., the public, local school groups).

The NR-ITAM program is overseen by a program director, and includes conservation biologists and other natural resources staff. The Natural Resources Program at Camp Edwards works in close collaboration with stakeholders and partners in the management of natural resources. These partners include the INRMP signatory agencies (USFWS and Mass Wildlife) as well as on-base stakeholders and regional stakeholders.

Implementing the Camp Edwards INRMP is ultimately the responsibility of the Adjutant General of the MAARNG. The cooperation and participation of the MAARNG Training Site Commander; the Construction and Facilities Management Officer; the Plans, Operations, and Training Officer; and Camp Edwards Range Control with the Natural Resources Program is essential throughout the development and implementation process. However, the day-to-day coordination and implementation of the management proposed in the INRMP will be the responsibility of the Camp Edwards Natural Resource Program.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Natural resources management at Camp Edwards is conducted by natural resources program, installation personnel, and other installation stakeholders. Coordination with installation operators and consistency of natural resources management goals and objectives developed in the INRMP with other installation operational plans and documents will ensure that natural resources management can be implemented successfully in a manner consistent with the missions of Camp Edwards.

Natural resources program management involves maintaining or enhancing both the missionscape and the ecological integrity of Camp Edwards. Camp Edwards has a long history of human disturbance and alteration, but supports diverse and regionally important ecosystems that are in some cases a result of this disturbance history. The natural resource management goals, objectives, and projects are listed below. These goals focus on supporting the natural resources program in conserving and enhancing biodiversity and natural resources of Camp Edwards.

The following goals apply to NRP projects listed for Camp Edwards in Appendix D, Table D-2.

NRP GOAL 1: SUPPORT NATURAL RESOURCES MANAGEMENT PERSONNEL AND PROFESSIONAL TRAINING

- **NRP OBJECTIVE 1.1:** Plan for and resource sufficient personnel positions to support natural resource management needs at Camp Edwards, including maintaining current positions and adding new positions as needed.

- **NRP OBJECTIVE 1.2:** Fund ongoing training for Natural Resource Program personnel in wildlife and natural resource management. This allows for managers and biologists to learn new techniques and discuss management issues and science with peers.

NRP GOAL 2: ENSURE SUFFICIENT RESOURCES ARE AVAILABLE FOR THE NATURAL RESOURCES PROGRAM AND INRMP IMPLEMENTATION

- **NRP OBJECTIVE 2.1:** Maintain a robust, realistic, and ambitious 7-year budget to best ensure funding availability through the Status Tool for Environmental Programs. This is achieved through the projects below, as well as following projects: NRP 4.1.1, 4.1.2, 4.1.3, and 4.4.3.

- **NRP OBJECTIVE 2.2:** Ensure completion and cooperation on all programmatic and/or pillar specific data calls through appropriate systems.

NRP GOAL 3: CONDUCT AN ANNUAL REVIEW OF THE INRMP

- **NRP OBJECTIVE 3.1:** Coordinate with all relevant stakeholders (installation organizations, Sikes Act partners) to annually review and update the INRMP as needed based on review and collaborative input.

NRP GOAL 4: ENSURE EFFECTIVE INTEGRATION OF NATURAL RESOURCES REQUIREMENTS, REGULATIONS, AND PLANS INTO INSTALLATION PROCESSES AND ACTIONS

- **NRP OBJECTIVE 4.1:** Participate in Camp Edwards and MAARNG coordination and stakeholder meetings.

- **NRP OBJECTIVE 4.2:** Facilitate and conduct environmental review and impacts analysis for natural resources and relevant rules and regulations to ensure mission needs are met while minimizing environmental impacts. This is achieved through the projects below, as well as following projects: NRP 4.1.1, 4.1.2, 4.1.3, FWM 1.1.3, 1.1.4, 1.1.5, 1.2.2, TE 1.2.1, and 1.3.2.

- **NRP OBJECTIVE 4.3:** Coordinate external agency review and permitting as required for Camp Edwards projects potentially impacting Natural Resources as identified during environmental impacts analysis.

- **NRP OBJECTIVE 4.4:** Coordinate and oversee implementation and compliance with the MESA mitigation bank and strategy being established for MANG projects at JBCC.

NRP GOAL 5: COMPLETE ANALYSIS AND REPORTING OF DATA COLLECTED BY THE NATURAL RESOURCES PROGRAM

- **NRP OBJECTIVE 5.1:** Devise and implement an approach for the analysis of existing natural resource data collected at Camp Edwards. Currently, much of the data collected in past surveys have not been fully analyzed and/or reported in any form. At a minimum, internal reports are critical for realizing the investments made into projects as well as adaptive management through understanding of resources and impacts of management and/or projects. Incorporating into external reports (e.g., scientific publications, informal papers, conference presentations, etc.) is beneficial to collaborative management and agency relations.

APPENDIX I – FISH AND WILDLIFE MANAGEMENT

1.1 EXISTING CONDITIONS

Wildlife management is defined as manipulation of the environment and wildlife populations to produce desired objectives. Management can be performed in a manner that enhances biodiversity through the reestablishment of native habitats. Conversely, habitat management could be required to decrease the abundance of certain wildlife species to reduce animal damage. AR 200-1 requires the conduct of Army habitat management efforts in a manner that conserves and enhances biological diversity, while being consistent with Army goals to accomplish the military mission. The regulation also requires that the management of environmentally sensitive areas and areas of special management concern receive primary consideration.

Habitat management activities at the Camp Edwards Training Site are directed toward the maintenance and restoration of a pine barren mosaic ecosystem. Camp Edwards manages for both natural communities as a whole and for specific species. Natural community management is based on a holistic, systems-oriented approach, and not predicated on single species management or maximizing the prevalence of a small group of organisms. However, rare species management should absolutely complement the conservation of a healthy, biologically diverse system. It is important to note that, although this plan takes an ecosystem approach to managing the lands of Camp Edwards, the MESA still protects against a "take," or loss, of state-listed rare species and their habitats. Combining both management objectives will ensure that the natural communities maintain their integrity, their constituent species, and dynamics to continue to support vulnerable species.

Wildlife population and habitat management at Camp Edwards is focused on promoting a mix of pitch pine – scrub oak savannah, pitch pine – oak forest, and sandplain grassland. These ecosystems support wildlife habitat by providing a complex mixture of plant communities or cover types that all play a role in meeting the needs of species. The arrangement and interspersion of cover types or plant communities is important to wildlife, as wildlife distributions can vary depending on management of habitat types and the combinations and scattering of cover types. Habitat management objectives for these habitat types are detailed below.

1.1.1 Scrub Oak Shrubland

The scrub oak shrublands habitat on Camp Edwards has been traditionally maintained from live artillery fire into the Impact Area over the past 60–70 years. Prescribed burning is used as a management tool to maintain the scrub oak habitat. The Fire Management Plan for Camp Edwards describes the methods for burning each unit of the Impact Area as well as other land management units of Camp Edwards. In this fire adapted habitat, prescribed fire is required to improve rare species habitat and dismounted maneuver training. The majority of the impact area has not seen fire in 20 years, and it is dominated by high wildfire risk fuels. Combined with extreme urban encroachment surrounding JBCC this presents a significant need for prescribed fire and mechanical vegetation management to reduce wildfire risk to resources on and off site. Efforts to manage this ecosystem include the following:

- Use of prescribed burning in appropriate areas, as well as mechanical treatment to reduce unsafe fuel loads.
- Measures to reduce the spread or introduction of invasive species.
- Preservation of features that provide wildlife habitat, including snags and dead logs.

1.1.2 Pitch Pine – Scrub Oak Community

Pitch pine – scrub oak communities are well-adapted to fire, which is a critical component of the natural community's ecology. Mature pitch pine can survive regular low intensity ground fires; and most saplings have the ability to sprout after being top-killed by fire. Fire also contributes to the health of pitch pine – scrub oak communities by recycling plant nutrients and removing substances of plant origin that accumulate in the duff and litter and are toxic to some plants and other organisms. Without fire, the character of vegetation would change, and the health of plant communities would decline. Many of the plant species in the pitch pine – scrub oak communities are maintained and perpetuated by fire, which stimulates seed germination in some brush species and creates the necessary conditions of disturbance that promote seedling establishment of others. Management of this ecosystem includes the following:

- Use of prescribed burning and selective cutting to maintain pitch pine – scrub oak savannahs in various age classes and structures.
- Measures to reduce the spread or introduction of invasive species.
- Preservation of features that provide wildlife habitat, including snags and dead logs.

1.1.3 Pitch Pine – Scrub Oak Forest/Woodland

The pitch pine oak forest on Camp Edwards represents an intermediate successional state between the pitch pine – scrub oak community and black oak – scarlet oak forest natural communities. As a result, the characteristic species of the pitch pine – oak forest woodland is essentially a composite of those from the pitch pine – scrub oak community and the black oak – scarlet oak forest. However, the sparse understory of the pitch pine – oak forest woodland results in a relatively lower abundance of scrub oak, a plant essential to several state-listed rare species. Furthermore, the pitch pine – oak forest woodland comprises 40 percent of Camp Edwards, the greatest proportion of any natural community. This community is maintained at Camp Edwards through the implementation of the following measures:

- Use of prescribed burning and selective cutting to maintain pitch pine – scrub oak forests.
- Measures to reduce the spread or introduction of invasive species.
- Preservation of features that provide wildlife habitat, including snags and dead logs.

1.1.4 Sandplain Grassland

The grasslands of Camp Edwards support several listed bird species, including the upland sandpiper. Grasslands at Camp Edwards also support rare plants. The management of sandplain grasslands at Camp Edwards has included the habitat restoration. Restoration has helped to improve habitat for grassland birds and has increased the number of grassland bird species found at Camp Edwards. Sandplain grasslands have been treated by removing trees, late spring

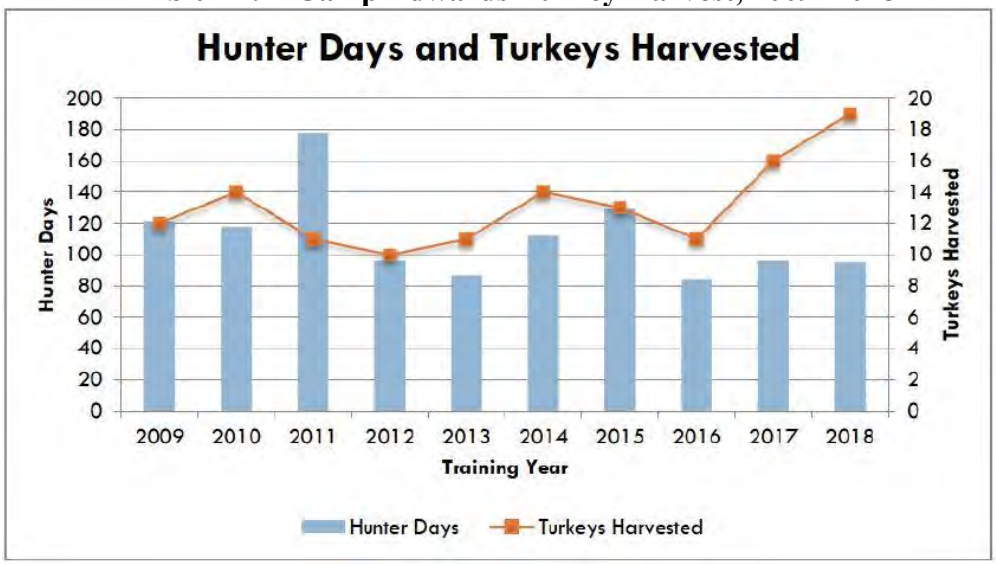
prescribed burning, and when necessary, mowing. Management of sandplain grasslands includes the implementation of the following measures:

- Use of prescribed burning and selective cutting to maintain pitch pine – scrub oak forests.
- Measures to reduce the spread or introduction of invasive species.

1.1.5 Management of Game Species

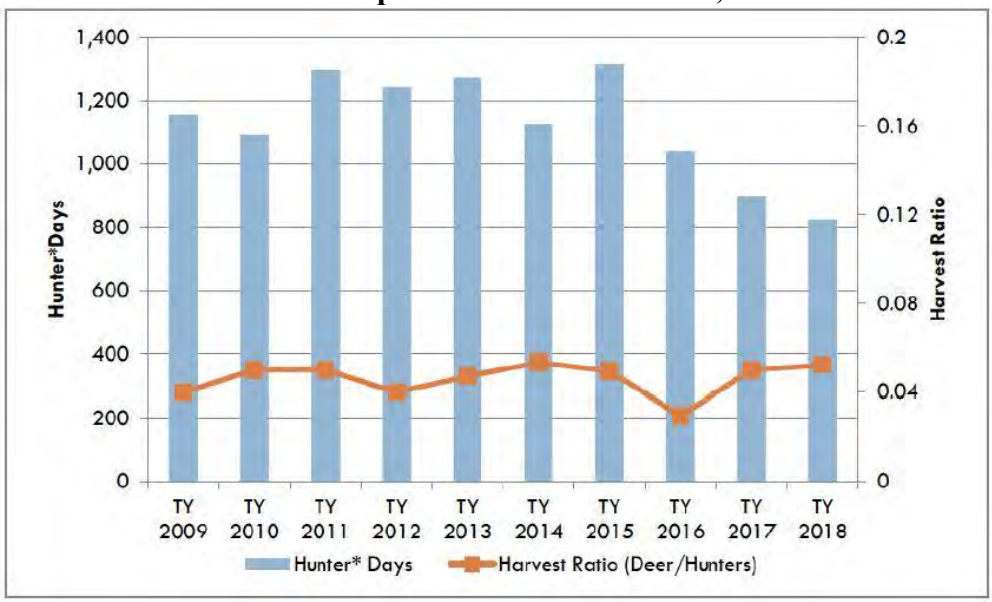
MassWildlife developed and implemented a wild turkey reintroduction program beginning in 1972. Between 1979 and 1996, 561 turkeys were released throughout the Commonwealth. MassWildlife successfully reintroduced wild turkey to the forests of Camp Edwards, one of the two locations on Cape Cod where turkeys were released. Eighteen turkeys, 6 males and 12 females, were released during the winter months of 1989. Since this time, wild turkeys have been a common sight on Camp Edwards. The first organized wild turkey harvest was held in Spring 2000, during which a total of 121 hunters shot 11 turkeys. The harvest has since been conducted yearly with a maximum of 19 turkeys harvested in 2018 (Exhibit 7-1). Techniques used when hunting wild turkey in the spring favors the harvest of males over females, thereby minimizing the long-term impact to the overall population (Massachusetts National Guard 2019a). Beginning in the 1950s, an annual white-tail deer hunt has taken place on Camp Edwards. Exhibit 7-2 shows the ratio of deer caught per hunter from 2009 to 2018. A yearly average of 60 harvested deer is needed to meet the objective of maintaining healthy deer herds and ecosystems (MANG 2019a). This yearly harvesting is also aimed at providing recreational opportunities to the public and military. Currently, there are no fees collected for hunting at Camp Edwards.

Exhibit I-1. Camp Edwards Turkey Harvest, 2009–2018



Source: MANG 2019a.

Exhibit I-2. Camp Edwards Deer Harvest, 2009–2018



Source: MANG 2019a.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Wildlife management can be employed to enhance biodiversity and wildlife habitat through the reestablishment and maintenance of native habitats. The variety of habitats present on the installations (e.g., wetland complexes, upland forests, grasslands) contributes to the diversity of species found on each installation. The primary goal of fish and wildlife management at Camp Edwards is to restore and maintain wildlife diversity in areas where practicable conservation measures are implemented so that they are not in direct conflict with the military mission. Within natural community management, goals and objectives are developed for each natural community and decisions made based upon a predetermined desired future condition for the landscape.

MAARNG fish and wildlife management is undertaken to support a mosaic of interacting natural communities at Camp Edwards linked by hydrologic flow, nutrient cycling, fire, animal movement, and transitions between natural communities.

The following goals apply to FWM projects listed for Camp Edwards in Appendix D, Table D-2.

FWM GOAL 1: COMPLETE BIOLOGICAL SURVEYS TO MONITOR FAUNA AND FLORA RESOURCES PRESENT ON THE INSTALLATION

- **FWM OBJECTIVE 1.1:** Evaluate and conduct planning level surveys to ensure sufficient information is available for broad-level planning and environmental impacts analysis. A planning level survey will ensure that viable populations of native species found in the ecosystem (including rare, threatened, and endangered species and species of concern, and migratory bird species) are protected, restored, and maintained in accordance with state and federal laws and regulations. Planning level surveys inform prioritization of focal survey efforts, provide an early warning system for species-listing

impacts, and guide planning and decision making for land and habitat management, project planning/scoping and military training activities.

- **FWM OBJECTIVE 1.2:** Working with MassWildlife, develop and conduct surveys for watchlist plant species and other plant communities to ensure appropriate management of these species.

- **FWM OBJECTIVE 1.3:** Identify general fish and wildlife (e.g., not listed species) conservation needs and implement conservation measures as appropriate.

FWM GOAL 2: ENHANCE AND MAINTAIN PITCH PINE – SCRUB OAK HABITATS AT CAMP EDWARDS IN VARIOUS STATES OF SUCCESSION TO SUPPORT DIVERSE WILDLIFE POPULATIONS.

- **FWM OBJECTIVE 2.1:** Continue to undertake management actions that maintain and increase scrub oak shrubland habitat at Camp Edwards for the purposes of state-listed rare species and natural community protection, wildlife food and cover, and military training. This is achieved through the following projects: FM 1.1.1, TE 1.2.3, 2.1.4, WFM 2.2.2.

- **FWM OBJECTIVE 2.2:** Continue to undertake management actions that maintain and increase pitch pine – scrub oak shrubland habitat at Camp Edwards for the purposes of state-listed rare species and natural community protection, wildlife food and cover, and military training. This is achieved through the following projects: FM 1.1.1, TE 1.2.3, 2.1.4, WFM 2.2.2.

- **FWM OBJECTIVE 2.3:** Continue to undertake management actions that maintain pitch pine – scrub oak forested habitat at Camp Edwards for the purposes of state-listed rare species and natural community protection, wildlife food and cover, and military training. This is achieved through the following projects: FM – 1.1.1, TE 1.2.3, 2.1.4, WFM 2.2.2.

FWM GOAL 3: ENHANCE AND MAINTAIN SANDPLAIN GRASSLAND HABITATS AT CAMP EDWARDS TO SUPPORT WILDLIFE POPULATIONS.

- **FWM OBJECTIVE 3.1:** Continue to undertake management actions that maintain sandplain grassland habitat at Camp Edwards for the purposes of state-listed rare species and natural community protection, wildlife food and cover, and military training. This is achieved through the projects below, as well as following projects: FM 1.1.1, 1.1.2, TE 1.2.3, 2.1.4, 3.2.5, 3.2.8, 3.2.9, WFM 2.2.2, GM 1.2.1, 1.2.2.

FWM GOAL 4: SUPPORT ONGOING MANAGEMENT AND RESTORATION OF WILDLIFE HABITAT AT CAMP EDWARDS.

- **FWM OBJECTIVE 4.1:** Continue to undertake management actions that conserve and restore habitats at Camp Edwards that support wildlife populations.

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APPENDIX J – OUTDOOR RECREATION AND PUBLIC ACCESS TO NATURAL RESOURCES

1.1 EXISTING CONDITIONS

Whenever practical, Army lands with suitable natural resources will be managed to allow for outdoor recreational opportunities. Installations having natural resources suitable to outdoor recreation in addition to hunting, fishing, and trapping are encouraged to develop cooperative agreements with appropriate state and federal agencies to facilitate the development and management of those programs. Public access to Army properties for outdoor recreation will be allowed whenever compatible with public safety and mission activities. Natural resources used for outdoor recreation on Army land are considered part of the land and belong to the public. DoDI 4715.03, *Natural Resources Conservation Program*, states that installations should "implement a program for the development, enhancement, operation, and maintenance of outdoor recreation resources at all appropriate military installations. These resources shall be made available to the public whenever feasible." Camp Edwards has extensive outdoor recreation opportunities such as:

- Hunting
- Wildlife viewing (e.g., grassland birds)
- Camping and training opportunities for scouting groups (e.g., Boy Scouts, Sea Cadets)
- Collection of flora and fauna for cultural use.

Camp Edwards provides 8,600 huntable acres, including approximately 1,000 acres of land where deer driving is not permitted that is designated for still hunting and stalking. Huntable areas also include youth, military, and paraplegic specific hunting areas, and dedicated archery only areas during all hunts. Camp Edwards has relatively few hunters, typically 50–100 hunters per day during regular season hunts.

Camp Edwards has been a limited access facility since 11 September 2001. Persons interested in utilizing Camp Edwards for recreational or other purposes must request access from Camp Edwards Headquarters, Range Control, and the Environmental and Readiness Center. Hunting and other recreational activities are available to the public but require permissions and other measures to ensure safety of the public and installation resources. Due to the presence of hazards related to training activities, the Impact Area is always closed to public access. Some possible threats to public safety related to training activities include live firing, training residue (e.g., unexploded ordnance, training "fox" holes), and training mechanisms (for example, moving targets). All of these are potential hazards within and surrounding the Impact Area. For this reason, public access to the Impact Area is strictly prohibited, without exception.

Certain recreational activities are prohibited on Camp Edwards, due to potential risks and conflicts with military training activities and potential damage to natural resources. These activities may include, but not necessarily be limited to, motorcycle, all-terrain vehicle, mountain bike, and horseback riding, camping, and building fires. Any person entering the training site for any purpose prohibited by law or lawful regulation is trespassing. It may endanger the life of the

person entering the training site as well as potentially endangering lives of the MAARNG and interfering with training.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

There are outdoor recreation opportunities at Camp Edwards, but these activities are limited due to the dangers associated with the installation's mission. The level of enjoyment that is derived from these activities is directly related to the quality of the natural resources present.

Maintaining a quality outdoor recreation program is dependent on proper management of natural resources and efficient program administration and oversight. Support of a hunting program at Camp Edwards involves the management of natural resources as well as public education and management objectives to support the safety of recreational users at the installation.

The following goals apply to OR projects listed for Camp Edwards in Appendix D, Table D-2.

OR GOAL 1: PROVIDE QUALITY HUNTING EXPERIENCES WHILE SUSTAINING ECOSYSTEM INTEGRITY AND PUBLIC SAFETY. ENSURE THAT HUNTING ACTIVITIES ARE NOT IN CONFLICT WITH MISSION PRIORITIES.

- **OR OBJECTIVE 1.1:** Coordinate the hunting program for MAARNG at Camp Edwards to facilitate sustainable wildlife and habitat management.

- **OR OBJECTIVE 1.2:** Support recreational hunting at Camp Edwards.

OR GOAL 2: PROVIDE QUALITY NON-CONSUMPTIVE OUTDOOR RECREATION EXPERIENCES THAT ARE NOT IN CONFLICT WITH MISSION PRIORITIES.

- **OR OBJECTIVE 2.1:** Support existing non-consumptive outdoor recreation activities and explore opportunities to support additional non-consumptive recreation that is aligned with mission priorities, habitat sustainability, and public safety.

APPENDIX K – MANAGEMENT OF THREATENED AND ENDANGERED SPECIES AND HABITATS

1.1 EXISTING CONDITIONS

1.1.1 Management of Threatened and Endangered Species and Habitats

An objective of the Camp Edwards INRMP is to protect and conserve listed and rare species while continually achieving the training requirements of the MAARNG. Identifying the distribution, abundance, and requirements of these species is essential in conservation. One federally listed species (northern long-eared bat) and 44 state-listed species occur on Camp Edwards. No critical habitat as designated by USFWS exists on Camp Edwards. MAARNG is required to manage federally listed threatened and endangered species; like all activities that may impact listed species this management may require ESA Section 7 consultation with USFWS. State-listed threatened and endangered species management and game species management requires consultation with MassWildlife. Any management activities that are proposed for conserving listed rare species will be coordinated with recommendations and advice from the appropriate federal and/or state environmental agencies.

Past research has been conducted on specific species, as well as on guilds, to support listed species management. The results of past surveys for listed species and their results are outlined in Appendix F, Section 1.4 of this INRMP. Management actions to support listed species at Camp Edwards include:

- Habitat management of pitch pine – scrub oak vegetative communities through prescribed fire, and selective thinning to promote listed species
- Restoration and conservation of sandplain grassland habitat
- Retaining snags and dead trees for habitat
- Management of invasive plant species
- Surveys of listed species populations.

1.1.2 Agassiz Clam Shrimp Conservation and Management Permit

The MAARNG and Military Division hold a Conservation and Management Permit (CMP) under the Massachusetts Endangered Species Act (Massachusetts General Law c.131A) for the Agassiz clam shrimp (ACS), dated November 8, 2018 (Attachment K-1). This permit is based on the CMP application submitted in July 2018. As briefly discussed in Appendix F, the ACS has been found to be widespread and abundant at Camp Edwards, primarily occurring in roadway puddles. Puddles on dirt roads have a strong tendency to turn into significant features through use and eventually preclude the use of the road and/or expand the road into adjacent habitat. Additionally, such puddles tend to attract other wildlife such as vernal pool breeding amphibians and the eastern box turtle. The CMP for ACS primarily focuses on two sections of road requiring major maintenance and repair to support vehicle traffic to include soldier training, site

maintenance and conservation, and emergency access. The project areas are sections of Cat Road and Herbert Road.

This is the first known attempt to provide management for Agassiz clam shrimp and the conservation plan was developed in close cooperation with MassWildlife to include intentional experimentation in the interest of developing effective and efficient methods for road repair and clam shrimp conservation. Repair and mitigation actions include a variety of methods from repair and replacement of puddles to hardening of existing puddles that are either known to already support ACS or known to not previously support ACS, but be effective relocation sites. All mechanical actions were completed by the end of 2019 and monitoring requirements for ACS under the permit are being completed in 2020. Additional detail regarding conditions of the permit and compliance may be found in Attachment K-1.

Mitigation areas providing net benefit of the species are intended to be permanently protected. However, given the dynamic nature of road conditions and roadway puddles the mitigation features should primarily be signed as such and monitored for long-term conditions. If maintenance is required and/or it becomes necessary to develop new or additional features coordination must occur with MassWildlife. Sites may change and the current mitigation sites will be evaluated along with development of a site-wide ACS conservation plan that provides for effective road network maintenance while conserving this species.

1.1.3 Multi-purpose Machine Gun Range and "Master Plan" Conservation and Management Permit

The MAARNG and Military Division will hold a CMP under the MESA (Massachusetts General Law c.131A) for the construction of the Multi-purpose Machine Gun Range and other associated master planning developments with planned permit finalization in September 2020 (Attachment K-1). This permit is based on the CMP application submitted in April 2020. As described in detail in the CMP application and CMP, the permit arose due to the proposal to develop new or expanded ranges and facilities on ±308 acres of Priority Habitat as part of six different primary actions. This level of impact and potential for these actions to occur within a 5-year period led to the development of a "master plan" review and mitigation proposal. The largest and first of the six actions is the development of a Multi-purpose Machine Gun Range at the current location of KD Range at Camp Edwards. Additional actions expansion of grounds at the gymnasium to include a track and field, Transient Troop Headquarters in the 1300 area, expansion of Sierra and Tango Ranges, and development of an Infantry Squad Battle Course at the previous Infantry Battle Course location. Additionally, the application and permit address supplemental actions (e.g., fire breaks and fuel reduction), maintenance of these ranges and facilities, and widespread mitigation actions.

Mitigation actions proposed and included in the permit include land transfers to the Department of Fish and Game, habitat management and improvement, habitat conversion, long-term species monitoring, and a perpetual maintenance requirement. Parcel transfers include Special Military Reservation Commission tracts 1 through 5 (260 acres) and Military Division Parcel H of Unit K (150 acres), which was transferred to the Military Division in May 2020. Habitat management and box turtle protection are addressed through identifying large blocks of training land as "focal areas" to establish mitigation banking. The use of focal areas concentrates mitigation efforts for

maximized benefit and facilitates long-term planning and understanding of what projects are counted towards mitigation and long-term maintenance. Focal Area and Forest Canopy Reserve Area (box turtle protection) designations do not preclude or limit soldier training or habitat management, with the exception of management to reduced canopy cove in the Forest Canopy Reserve Area.

Pine Barrens Focal Areas are zones to focus pine barrens improvement and habitat management actions including tree harvest, mechanical mowing, prescribed burning, and targeted herbicide application as appropriate. Grasslands management areas will be treated in the same manner with focus on diverse sandplain grassland condition supporting a range of species requirements from frosted elfin (clumped savannah) to Upland Sandpiper (open prairie). The Forest Canopy Reserve Areas, in contrast are zones where we agree to not implement pine barrens style management, but rather to manage for closed canopy forest. This does not preclude the use of management tools (e.g., forestry and prescribed fire), but where such are used it will be with the intent of maintaining shaded forest with particularly emphasis on box turtle conservation. Figure G-2 displays the primary development projects and mitigation areas.

Establishment of such a broad permit and mitigation plan and banking system introduces numerous requirements for project planning, project management, and long-term resource planning. The permit, its requirements, and restrictions are specific to the included projects, but allow for future inclusion of additional projects consistent with the established plan and structure. This provides substantial benefit and consistency for both agencies. MESA requires project proponents meet a Net Benefit threshold for mitigation. All mitigation proposals to include land protection, monitoring, and habitat management must be able to demonstrate long term Net Benefit for impacted state-listed species.

All General Conditions and Special Conditions included in the permit are compulsory under Massachusetts General Law and require multiple entities with MAARNG and Military Division, and their contractors, to establish funding mechanisms and meet planning, reporting, and project execution requirements. A draft project compliance sheet has been developed as an internal aid for Natural Resources, facilities managers, and project managers. The use of this aid should facilitate permit compliance for project planning, review and approval processes prior to project initiation, and reporting. Additional programmatic requirements are also compulsory and require engagement of external resources such as the Department of Capital Asset Maintenance and Management. This includes registry of the permit to the deed of all affected parcels and future registry of certificate of compliance once such is issued. Likewise, the permit introduces additional annual reporting and INRMP requirements, including using the INRMP as a communication and planning tool for permit compliance and long-term monitoring and habitat management. MAARNG should ensure the INRMP is regularly updated to include CMP specific resource monitoring plans and results and 5- to 7-year schedules for habitat management.

The permit includes very specific language addressing the permanent requirement for habitat management and maintenance and the use of INRMP annual reviews to address mitigation planning and review of monitoring and management results. Appendix D provides additional detail for project implementation and Attachment K-1 provides the draft Permit and additional Permit documentation to include annual reports.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Federally listed species are protected under the ESA of 1973 as amended, while state-listed rare species are protected under the MESA (G.L. c. 131A) and its implementing regulations (321 CMR 10.00). MESA prohibits a "take" of state-listed rare species. "Take," in reference to animals, means to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding, or migratory activity, or attempt to engage in any such conduct, or to assist such conduct, and in reference to plants means to collect, pick, kill, transplant, cut, or process or attempt to engage or assist in any such conduct. Management activities proposed for Camp Edwards that have the potential to affect rare species will follow regulations set forth within 321 CMR 10.00.

Management actions must minimize impacts to listed species, and habitat should be modified to mitigate impacts. Adherence to the goals set for threatened and endangered species management will ensure that the installation remains in compliance with the ESA and applicable state regulations.

The following goals apply to TE projects listed for Camp Edwards in Appendix D, Table D-2.

TE GOAL 1: CONTINUE SURVEYS, MONITORING, AND ADAPTIVE MANAGEMENT OF FEDERALLY LISTED AND PRIORITY SPECIES AT CAMP EDWARDS

- **TE OBJECTIVE 1.1:** Continue ongoing efforts to monitor and manage for endangered and threatened bat populations at Camp Edwards.

- **TE OBJECTIVE 1.3:** Provide resources necessary for the ongoing survey of other listed and at-risk species and for management actions in response to monitoring efforts and ensure program capacity to respond to short-notice priorities from USFWS.

TE GOAL 2: SUPPORT THE CONSERVATION AND MANAGEMENT OF FEDERALLY-LISTED AND STATE-LISTED THREATENED AND ENDANGERED SPECIES

- **TE OBJECTIVE 2.1:** Provide resources necessary for the ongoing survey of state-listed species and for management actions in response to monitoring efforts.

- **TE OBJECTIVE 2.2:** Provide resources and support management actions necessary for to support federally-listed species.

TE GOAL 3: CONDUCT ACTIVITIES ASSOCIATED WITH MITIGATION FOR LISTED SPECIES AT CAMP EDWARDS

- **TE OBJECTIVE 3.1:** Develop and implement mitigation actions to prevent and minimize impacts to Agassiz's clam shrimp at Camp Edwards.

- **TE OBJECTIVE 3.2:** Develop and implement mitigation actions to implement the *Conservation and Management Plan for the Multipurpose Machine Gun Range at Camp Edwards*, which further served to establish a mitigation bank at JBCC and address impacts from near-term (e.g., 5–10 years) construction projects.

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Attachment K-1

Conservation and Management Permits

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MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

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MA ENDANGERED SPECIES ACT (G.L. c.131A)
CONSERVATION AND MANAGEMENT PERMIT

DATE		November 8, 2018
CONSERVATION PERMIT NO.:		018-327.DFW
NHESP FILE NO.		17-37184
PERMIT HOLDER		MA Army National Guard Military Division ATTN: Colonel Timothy A. Mullen, State Quartermaster 2 Randolph Road Hanscom Air Force Base, MA 01731
PROJECT		Road Repair and Clam Shrimp Relocation

Pursuant to the authority granted in the Massachusetts Endangered Species Act (" MESA") (G.L. c. 131A) and its implementing regulations (321 CMR 10.23), the Director of the Massachusetts Division of Fisheries & Wildlife (the "Division") hereby issues a Conservation and Management Permit (the "Permit") to the MA Army National Guard Military Division (the "Permit Holder"). This Permit authorizes the Take of the State-listed Agassiz's Clam Shrimp (*Eulimnadia agassizii*), which is listed as "Endangered," pursuant to the MESA, arising out of the proposed Road Repair and Clam Shrimp Relocation (the "Project"), on a ±15,000 acre site (Camp Edwards Training Site) located in the towns of Bourne and Sandwich, Massachusetts (Book 409, Page 8, and Book 518, Page 124, Barnstable County Registry of Deeds; the "Property").

The Division has determined that the Project would result in a Take of Agassiz's Clam Shrimp (*Eulimnadia agassizii*) through direct mortality and the permanent loss of habitat for State-listed species as a result of the Project. Approximately 3,339 square feet (5 puddles) identified to include Agassiz's Clam Shrimp will be lost.

Under the authority granted by and in accordance with MGL c131A§3 and 321 CMR 10.23, the Director may permit the Take of a State-listed species for conservation and management purposes provided that there is a long-term Net Benefit to the conservation of the impacted species. If the Director determines that the applicant for a permit has avoided, minimized and mitigated impacts to the State-listed species consistent with the following Performance Standards, then the Director may issue a conservation and management permit, provided:

(a) the applicant has adequately assessed alternatives to both temporary and permanent impacts to State-listed species;
(b) an insignificant portion of the local population would be impacted by the Project or Activity, and;

(c) the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the State-listed species that has been approved by the Director, as provided in 321 CMR 10.23(5), and shall be carried out by the applicant.

The Director has determined that the applicant for this Permit has met the above noted Performance Standards and that the conservation and management plan described herein provides a long-term Net Benefit to the conservation of the Agassiz's Clam Shrimp.

Pursuant to this Permit, the Permit Holder shall (a) develop and implement a clam shrimp survey/monitoring plan; (b) implement an experimental relocation and monitoring plan;

Therefore, the Project can be permitted pursuant to the MESA. This Permit is issued to condition the Project and to provide a long-term Net Benefit to Agassiz's Clam Shrimp.

In accordance with the documents submitted to the Division entitled:

- "Conservation and Management Permit Application" (dated 7/30/18, prepared Oxbow Associates, Inc.; the "Application");

and any other plans and documents referenced herein, this Permit is issued with the following conditions:

General Conditions:

1.		The Project authorized by this Permit shall be completed within five (5) years from the date of issuance. If needed, the Permit Holder shall submit a written request to the Division for an extension of time to complete said Project and the Division will review the Project pursuant to MESA for any continuing impacts as described herein and for any new impacts to any State-listed species found subsequent to the issuance date of this Permit.
2.		This Permit shall not preclude the review of future projects on the Property that are subject to the Wetlands Protection Act regulations (310 CMR 10.37, 10.58(4)(b), 10.59), as applicable, by the Natural Heritage & Endangered Species Program ("NHESP") of the Division.
3.		The work authorized by this Permit involves road repair and clam shrimp relocation, as shown/described in the "Project Plan" (Conservation and Management Permit Application). The Work also includes any other on-site activity required by the Division as a condition of this Permit.
4.		Division representatives shall have the right to enter and inspect the Property subject to this Permit at reasonable hours to evaluate Permit compliance and require the submittal of any reasonable information not otherwise required by this Permit but deemed necessary by the Division to complete its evaluation.
5.		Any proposed change to any plan identified in this Permit, or to the State-listed species conservation plan required by way of this Permit, shall require the Permit Holder to inquire of the Division, in writing, whether the change is significant enough to require the filing of a new Conservation and Management Permit Application, and or require additional long-term Net Benefit for affected State-listed species. The Division retains the right to require the submittal of additional, reasonable information to evaluate the plan change.
6.		This Permit shall apply to, and inure to the benefit of, the Permit Holder and any successor-in-interest of the Permit Holder, or to a subsequent successor-in-control of the Property or portion thereof subject to

		this Permit should the Permit Holder convey its record ownership of the Property to said successor-in-control, as well as to any contractor or other person performing Work conditioned by this Permit. Within three (3) days of the transfer of an interest in the Property or a portion thereof, any successor-in-interest or subsequent successor-in-control [i.e., subsequent owners or operators] of the Property or a portion thereof shall provide the Division with a letter indicating (1) that the successor is the successor-in-interest of the Permit Holder or the successor-in-control [i.e., current owner or operator] of the Property or a portion thereof, and (2) that said successor will perform the obligations of the Permit Holder as set forth in this Permit.
7.		Prior to the start of Work, the Permit Holder shall notify the Division in writing of the name, address, email, business and home telephone numbers of the project supervisor(s) and/or contractor(s) responsible for compliance with this Permit. The Permit Holder shall provide updated information in writing to the Division should new or additional project supervisors and/or contractors be hired after Work has commenced. Within three (3) days of the start of Work, the Permit Holder shall send a letter or email to the Division stating the date upon which Work commenced.
8.		Within 30 Days of the Issuance of the Permit, the text of this Permit shall be recorded by the Permit Holder in the Registry of Deeds or the Land Court for the district in which the Property is located so as to become a record part of the chain of title of the Property. In the case of recorded land, the Permit shall be noted in the Registry's Grantor Index under the name of the owner of the Property upon which the proposed Work is to be done. In the case of registered land, the Permit shall be noted on the Land Court Certificate of Title of the owner of the Property upon which the proposed Work is done. The Permit Holder shall submit to the Division a date-stamped and signed copy of said recorded Permit showing the date and book and page of recording of said Permit within five (5) days after recording and/or filing, as applicable. No Work shall begin on the Property until the Permit is recorded and said recorded copy is submitted to the Division, except as otherwise approved by the Division in writing.
9.		At the completion of Work the Permit Holder shall submit to the Division a written request for a Certificate of Permit Compliance, including supporting materials demonstrating the completion of Work and compliance with all conditions herein.
10.		Any land protected to achieve a long-term Net Benefit associated with this Permit, shall remain undeveloped and protected as habitat for State-listed species
11.		The Permit Holder shall comply with all Conditions and Special Conditions contained within this Permit and complete the Project consistent with all Division-approved plans and supporting documents except as otherwise approved by the Division in writing.
12.		The Permit Holder shall submit in writing any documents, plans, reports, or other items required for submission in accordance with this Permit, for review and written approval by the Division, unless otherwise stipulated in this Permit or by the Division in writing.
13.		A violation of any condition of this Permit will result in an unauthorized Take pursuant to M.G.L. c. 131A and may be subject to civil and or criminal penalties pursuant to M.G.L. c. 131A.

Special Conditions:

14.		Authorized Construction and Uses: This Permit authorizes construction and uses on the Property as described above. All Work shall be confined to the area of the Property within the limits of Work as

		shown/described in the Conservation and Management Permit Application.
15.		Agassiz's Clam Shrimp Survey and Monitoring plan: Prior to the start of work, the Division shall review and approve the proposed survey and monitoring protocols. In addition, the Division shall review and approve the associated data sheets and reporting protocols. It is anticipated that the Permit Holder will survey/monitor a minimum of 10 puddles annually during 2018, 2019, and 2020. An annual report of the efforts shall be included in the Annual State of the Reservation Report, which will be submitted to the Division.
16.		Agassiz's Clam Shrimp Experimental Relocation and Monitoring plan: The Permit Holder shall implement the proposed experimental relocation and monitoring plan as detailed in the Application. Within 3 months of the completion of the work, a report detailing the work that has occurred and the as-built conditions shall be submitted to the Division for review and approval. Following this report, monitoring of these sites shall be incorporated into the reporting/requirements in Special Condition #15.
17.		Construction Staff Education: All construction, landscaping, and other sub-contractors associated with the Project shall be informed in writing of the likely presence of State-listed species on the Property and what measures should be implemented to minimize direct harm to State-listed species. Further, no wildlife shall be removed from the Property without approval of a qualified wildlife biologist or the Division except as necessary to receive veterinary treatment in the case of harm during construction.
18.		The Division shall be notified, in the form of the MA Army National Guard Camp Edwards annual "State of the Reservation Report" of any State-listed species within or outside the limits of work. Preferably notification will be through the Division's data submittal tool, the Vernal Pool & Rare Species (VPRS) Information System. VPRS and our paper observations forms can be found at: http://www.mass.gov/dfw/nhesp/vprs.
19.		Notice of Appeal Rights: This Determination is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.23. Any person aggrieved by this decision shall have the right to an adjudicatory hearing at the Division pursuant to M.G.L. c. 30A, s.11 in accordance with the procedures for informal hearings set forth in 801 CMR 1.02 and 1.03. Any notice of claim for an adjudicatory hearing shall be made in writing and be accompanied by a filing fee in the amount of $500.00. The notice of claim shall be sent to the Division by certified mail, hand delivered or postmarked within twenty-one (21) days of the date of the Division's Determination to: Mark Tisa Director Division of Fisheries and Wildlife Field Headquarters One Rabbit Hill Road Westborough, MA 01581 Any notice of claim for an adjudicatory hearing shall include the following information: 1. The file number for the project; 2. The complete name, address and telephone number of the person filing the request, and the name, address and telephone number of any authorized representative; 3. The specific facts that demonstrate that a party filing a notice of claim satisfies the requirements of an "aggrieved person," including but not limited to (a) how they have a definite interest in the matters in contention within the scope of interests or area of concern of M.G.L. c. 131A or the

		regulations at 321 CMR 10.00 and (b) have suffered an actual injury which is special and different from that of the public and which has resulted from violation of a duty owed to them by the Division; 4. A clear statement that an adjudicatory hearing is being requested; 5. A clear and concise statement of facts which are grounds for the proceeding, the specific objections to the actions of the Division and the basis for those objections; and the relief sought through the adjudicatory hearing; and a statement that a copy of the request has been sent by certified mail or hand delivered to the applicant and the record owner, if different from the applicant.

Mark S Tisa, Director
Massachusetts Division of Fisheries & Wildlife

On this 8th day of November, 2018, before me, the undersigned notary public, personally appeared Mark S Tisa, Director, proved to me through satisfactory evidence of identification, which was personal knowledge, to be the person whose name is signed on the preceding or attached document, and who swore or affirmed to me that the contents of the document are truthful and accurate to the best of his/her knowledge and belief.

Emily Melissa Holt, Notary Public
My Commission expires: July 12, 2024

Conservation Permit 018-327.DFW

Issued this 8th day of November, 2018

Work must be completed by: 8 November 2023

EMILY MELISSA HOLT
NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
MY COMM. EXPIRES JULY 12, 2024

ACKNOWLEDGEMENT AND ACCEPTANCE OF ALL TERMS OF THIS CONSERVATION PERMIT

The undersigned below agrees that commencement of any work authorized by and described in this Conservation and Management Permit constitutes acknowledgement and acceptance of all terms of this Permit.

Timothy A Muller

Signatory 1
Organization Military Division, Comm of MA.

COMMONWEALTH OF MASSACHUSETTS

On this 16th day of November 2018, before me, the undersigned notary public, personally appeared Timothy A. Muller, proved to me through satisfactory evidence of identification which was Military ID to be the person whose name is signed on the preceding or attached document, and who swore or affirmed to me that the contents of the document are truthful and accurate to the best of his/her knowledge and belief.

Notary Public

Nancy S. Walton

SEAL

My commission expires: 4/4/2025

Distribution List

Oxbow Associates, Inc.
Bourne Board of Selectmen
Bourne Conservation Commission
Bourne Planning Board
DEP Southeast Regional Office, Wetlands Program
Jason Zimmer, DFW Southeast Wildlife District Office

MASSWILDLIFE

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MA ENDANGERED SPECIES ACT (M.G.L. c.131A)
CONSERVATION AND MANAGEMENT PERMIT

DATE		September 29, 2020
CONSERVATION PERMIT NO.:		020-358.DFW
NHESP FILE NO.		18-37434
PERMIT HOLDERS		Massachusetts National Guard c/o Timothy Mullen Joint Force Headquarters 2 Randolph Road Hanscom Air Force Base, MA 01731-3001
PROJECT		Camp Edwards Multi-Purpose Machine Gun (MPMG) Range and Master Development Plan

A. Permit Authority

Pursuant to the authority granted in the Massachusetts Endangered Species Act ("MESA") (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.23), the Director of the Massachusetts Division of Fisheries & Wildlife (the "Division") hereby issues a Conservation and Management Permit (the "Permit") to the Massachusetts National Guard (the "Permit Holder"). This Permit authorizes the Take of the species below pursuant to the MESA, arising from the construction of the Camp Edwards Multi-Purpose Machine Gun ("MPMG") Range and Master Development Plan (collectively, the "Project"), within the bounds of Joint Base Cape Cod in the Towns of Bourne and Sandwich, Massachusetts (Barnstable County Registry of Deeds; the "Property"). Joint Base Cape Cod is approximately 21,000 acres in size, roughly bounded by Crane Wildlife Management Area to the south, MA Route 28 to the west, US Route 6 to the north, MA Route 130 to the northeast, the village of Forestdale (Sandwich) to the central-east, and the Mashpee National Wildlife Refuge to the southeast.

Species	**MESA Status**
Barrens Buckmoth (*Hemileuca maia*)	Special Concern
Barrens Dagger Moth (*Acronicta albarufa*)	Threatened
Chain Dot Geometer (*Cingilia catenaria*)	Special Concern
Coastal Healthland Cutworm (*Abagrotis benjamini*)	Special Concern
Eastern Box Turtle (*Terrapene carolina*)	Special Concern

Eastern Hognose Snake (*Heterodon platirhinos*)	Special Concern
Eastern Meadow Lark (*Sturnella magna*)	Special Concern
Eastern Whip-poor-will (*Antrostomus vociferus*)	Special Concern
Frosted Elfin (*Callophrys irus*)	Special Concern
Grasshopper Sparrow (*Ammodramus savannarum*)	Threatened
Heath Metarranthis (*Metarranthis pilosaria*)	Special Concern
Herodias Underwing Moth (*Catocala herodias*)	Special Concern
Melsheimer's Sack Bearer (*Cicinnus melsheimeri*)	Threatened
Northern Harrier (*Circus hudsonius*)	Threatened
Pine Barrens Speranza (*Speranza exonerata*)	Special Concern
Pine Barrens Zale (*Zale lunifera*)	Special Concern
Pink Sallow Moth (*Psectraglaea carnosa*)	Special Concern
Purple Tiger Beetle (*Cicindela purpurea*)	Special Concern
Scrub Euchlaena (Euchlaena madusaria)	Special Concern
Slender Clearwing Sphinx Moth (*Hemaris gracilis*)	Special Concern
The Pink Streak (*Dargida rubripennis*)	Threatened
Upland Sandpiper (Bartramia longicauda)	Endangered
Vesper Sparrow (*Pooecetes gramineus*)	Threatened
Waxed Sallow Moth (*Chaetaglaea cerata*)	Special Concern
Wooly Gray (*Lycia ypsilon*)	Threatened

B. Description of Take

The project, as currently proposed, includes the construction of the MPMG Range and other projects described below (the "Master Development Plan"), which may include, additional future phases of development determined by the Division to be part of the Master Development Plan:

Project	**Area of Disturbance**
Multi-Purpose Machine Gun (MPMG) Range	±207 Acres (*Phase 1: 142 Acres Phase 2: 65 Acres*)
Gym Expansion	±5 Acres
Transient Troop Headquarters	±18 Acres
Sierra Range Expansion	±11 Acres
Tango Range Expansion	±2 Acres
Infantry Squad Battle Course	±65 Acres

The Division has determined (letter dated August 6, 2020) that the Project, as proposed, will result in a Take of the above referenced State-listed species through the harming or killing of individuals, interference with feeding, breeding, over-wintering and migratory activities, and the permanent loss of suitable habitat.

C. Permit Performance Standards

Under the authority granted by and in accordance with M.G.L. c. 131A §3 and 321 CMR 10.23, the Director may permit the Take of a State-listed species for conservation and management purposes provided that there is a long-term Net Benefit to the conservation of the impacted species. If the Director determines that the applicant for a permit has avoided, minimized and mitigated impacts to the State-listed species consistent with the following Performance Standards, then the Director may issue a conservation and management permit, provided:

(a) the applicant has adequately assessed alternatives to both temporary and permanent impacts to State-listed species;
(b) an insignificant portion of the local population would be impacted by the Project or Activity, and;
(c) the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the State-listed species that has been approved by the Director, as provided in 321 CMR 10.23(5), and shall be carried out by the applicant.

The Director has determined that the applicant for this Permit has met the above noted Performance Standards and that the conservation and management plan described herein provides a long-term Net Benefit to the conservation of the above referenced State-listed species.

D. Conservation and Management Plan

In order to meet the long-term Net Benefit mitigation requirements for the State-listed species impacted by the Project, the Permit Holder has proposed, by way of the Permit Application, to: (a) permanently protect ±261 acres of high quality habitat for Eastern Box Turtles through a transfer in fee to the Department of Fish and Game; (b) permanently protect and manage ±150 acres of high quality habitat for grassland birds through a transfer in fee to the Department of Fish and Game with conversion of ±90 acres to grassland; (c) establish ±1,177 acres of the Property as Forest Canopy Reserves to benefit Eastern Box Turtles; (d) establish and adaptive manage up to ±3,402 acres of Pine Barrens Mitigation Focal Areas on the Property to benefit State-listed pine barren species as described in the Conservation and Management Permit Application; (e) implement a State-listed species monitoring and research plan, including long-term lepidoptera monitoring, a five (5) year Eastern Box Turtle telemetry study, annual Eastern Whip-poor-will surveys and research, and annual base wide avian surveys. In order to avoid and minimize impacts to the State-listed species impacted by the Project, the Permit Holder has proposed, by way of the Permit Application, to: (f) implement protection plans to protect State-listed species during construction associated with each phase of development. Additional grassland habitat mitigation is identified if necessary, through (g) conversion of secondary Grassland Mitigation Focal Areas within Camp Edwards totaling ±107 acres to benefit State-listed grassland birds, with no action planned unless need is identified.

The Division notes that permanent protection and or management of suitable habitat required to meet the long-term Net Benefit for the State-listed species impacted by the Project is outlined in the following table:

Net Benefit Ratios

Guild Associations	Net Benefit Ratio	Net Benefit
Pine Barrens	2:1	Land Protection and Habitat Management
Pine Barrens	4:1	Habitat Management Only
Grassland	2:1	Land Protection and Habitat Management
Grassland	4:1	Conversion/Restoration and Habitat Management
Eastern Box Turtle	1.5:1	Land Protection

Applied Net Benefit

Project	Land Protection	Habitat Management
Multi-Purpose Machine Gun (MPMG) Range	Pine Barrens: 133 Acres (Land Transfer) Eastern Box Turtle: 310.5 Acres -261 Acres (Land Transfer) -49.5 Acres (Forest Canopy Reserve)	Pine Barrens: 551 Acres Grassland: 36 Acres (1:1)
Gym Expansion	Eastern Box Turtle: 8 Acres (Forest Canopy Reserve)	Pine Barrens: 20 Acres

Transient Troop Headquarters	Grassland: 9 acres (Land Transfer)	Grassland: 54 Acres
Sierra Range Expansion	Eastern Box Turtle: 17 Acres (Forest Canopy Reserve)	Pine Barrens: 44 Acres
Tango Range Expansion	Eastern Box Turtle: 3 Acres (Forest Canopy Reserve)	Pine Barrens: 8 acres
Infantry Squad Battle Course	Eastern Box Turtle: 98 Acres (Forest Canopy Reserve)	Pine Barrens: 260 Acres

The balance of remaining habitats to be protected and or managed pursuant to this Permit, as outlined in the following table, are to be considered mitigation credit toward the mitigation requirements of a future project(s) proposed by the Permit Holder on the Property requiring a conservation and management plan providing a long-term Net Benefit to State-listed species. The conditions under which this habitat protection and or management shall be considered mitigation credit are more fully described within the Conservation and Management Permit Application.

Net Benefit Credit for Future Projects

Net Benefit Type	**Acres**
Forest Canopy Reserve	1,001.5 Acres
Pine Barrens Mitigation Focal Areas	2,519 Acres
Grassland Land Transfer and Management	141 Acres
Grassland Mitigation Focal Areas (if converted)	107 Acres

Therefore, the Project can be permitted pursuant to the MESA. This Permit is issued to condition the Project and to provide a long-term Net Benefit to the above referenced State-listed species.

E. Documents and Plans of Records

In accordance with the documents and plans of record submitted to the Division entitled:

- "Conservation and Management Permit Application" (dated 4/29/2020, prepared by AECOM; the "Permit Application");
- AUTOMATED MULTIPURPOSE MACHINE GUN RANGE (MPMG) CAMP EDWARDS JOINT BASE CAPE COD BOURNE, MASSACHUSETTS (dated 3/26/2019, Sheets: V-200, SP201, and C-003, prepared by Michael Baker International; the "Project Plan"; Attachment 1);
- MESA Determination (dated August 6, 2020; issued by the Division; Attachment 2);
- Proposed MPMG Range (Phase 1) Eastern Box Turtle Construction Period Monitoring and Protection Plan (dated February 2020, prepared by AECOM; the "Turtle Protection Plan"; Attachment 3);
- Colonel Timothy Mullen's email correspondence detailing the status and intent of Parcel H of Unit K (totaling ±150 acres) as Net Benefit (Dated 8/21/2020); Attachment 4;

and any other plans and documents referenced herein (collectively, the "Plans of Record"), this Permit is issued with the following conditions:

F. General Conditions

GC 1.		The Permit Holder shall comply with all General and Special Conditions of this Permit and complete the Project consistent with all Division-approved plans and supporting documents referenced herein, except as otherwise approved by the Division in writing.
GC 2.		A violation of any General or Special Condition of this Permit will result in an unauthorized Take and may be subject to civil and or criminal penalties pursuant to M.G.L. c. 131A. The Division reserves the right to require an immediate cessation of Work (as defined in Special Condition #1), in whole or in part and at its sole discretion, should the Permit Holder violate any General or Special Condition of this Permit.
GC 3.		The Permit Holder shall submit in writing any documents, plans, reports, or other items required for submission in accordance with this Permit, for review and written approval by the Division, except as otherwise approved by the Division in writing.
GC 4.		Division representatives shall have the right to enter and inspect the Property subject to this Permit at reasonable hours to evaluate Permit compliance and require the submittal of additional, reasonable information not otherwise required by this Permit but deemed necessary by the Division to complete its evaluation. Due to security requirements and potential for active Army training activities, visits will be planned and coordinated at least a week in advance. Security checks and MAARNG escort will be required.
GC 5.		Any land protected to achieve a long-term Net Benefit associated with this Permit shall remain undeveloped and protected as habitat for State-listed Species in perpetuity. If land protected and remaining held by MAARNG to achieve Net Benefit is required for future development to support the training mission, full coordination with the Division will occur to include development of an alternatives analysis and Net Benefit plan.
GC 6.		This Permit shall not preclude the review of future projects on the Property that are subject to the Massachusetts Wetlands Protection Act (M.G.L. c. 131, s. 40) and Regulations (310 CMR 10.37, 10.58(4)(b), 10.59), as applicable, by the Division.
GC 7.		This Permit does not relieve the Permit Holder of the necessity of complying with all applicable federal, state or local statues, ordinances, bylaws or regulations, including but not limited to those administered by the Towns of Bourne and Sandwich Conservation Commission and the Massachusetts Department of Environmental Protection.
GC 8.		All Work shall be in conformance with the Plans of Record. Any changes, updates, or revisions to the Project, or any additional work beyond that shown on the Plans of Record, shall require additional review and approval by the Division prior to implementation, pursuant to General Condition #9.
GC 9.		Any proposed change to any plan identified in this Permit, or to the State-listed species conservation and management plan required by way of this Permit, shall require the Permit Holder to inquire of the Division, in writing, whether the change is significant enough to require the filing of a new Conservation and Management Permit Application, and or require additional long-term Net Benefit for affected State-listed Species. The Division retains the right to require the submittal of additional, reasonable information to evaluate the proposed plan change.
GC 10.		This Permit shall apply to, and inure to the benefit of, the Permit Holder and any successor-in-interest of the Permit Holder, or to a subsequent successor-in-control of the Property or portion thereof subject to this Permit should the Permit Holder convey its record ownership of the Property to said successor-in-control, as well as to any contractor or other person performing Work conditioned by this Permit.

		Within three (3) days of the transfer of an interest in the Property or a portion thereof, any successor-in-interest or subsequent successor-in-control [i.e., subsequent owners or operators] of the Property or a portion thereof shall provide the Division with a letter indicating (1) that the successor is the successor-in-interest of the Permit Holder or the successor-in-control [i.e., current owner or operator] of the Property or a portion thereof, and (2) that said successor will perform the obligations of the Permit Holder as set forth in this Permit.
GC 11.		**Prior to the initiation of Work**, the Permit Holder shall notify the Division in writing of the name, address, email, business and home telephone numbers of the project supervisor(s) and/or contractor(s) responsible for compliance with this Permit. The Permit Holder shall provide updated information in writing to the Division should new or additional project supervisors and/or contractors be hired after Work has commenced. **Prior to the initiation of Work**, said project supervisor(s) and/or contractor(s) shall be provided a copy of this Permit. Said project supervisor(s) and/or contractor(s) may be held responsible for violations of this Permit performed by said project supervisor(s) and/or contractor(s).
GC 12.		**Within six (6) months of the initiation of Work**, the Permit Holder will provide a full list of parcel information for all affected parcels and a timeline for registering the text of this Permit in partnership with the Department of Capital Asset Maintenance and Management. The text of this Permit shall be recorded by the Permit Holder in the Registry of Deeds or the Land Court for the district in which the Property is located so as to become a record part of the chain of title of the Property. In the case of recorded land, the Permit shall be noted in the Registry's Grantor Index under the name of the owner of the Property upon which the proposed Work is to be done. In the case of registered land, the Permit shall be noted on the Land Court Certificate of Title of the owner of the Property upon which the proposed Work is done. The Permit Holder shall submit to the Division a date-stamped and signed copy of said recorded Permit showing the date and book and page of recording within five (5) business days after recording and/or filing, as applicable.
GC 13.		**Prior to the initiation of Work**, the Permit Holder shall send a summary report to the Division which: (a) demonstrates compliance with all pre-Work General and Special Conditions of the Permit; and (b) requests permission to initiate the Work authorized by the Permit. Unless otherwise authorized by the Division in writing, **no Work may be initiated on the Property** until the Permit Holder has received written confirmation from the Division confirming compliance with all pre-Work General and Special Conditions and authorizing the initiation of Work. **Within three (3) days of the initiation of Work**, the Permit Holder shall send a letter to the Division confirming the date upon which Work commenced.
GC 14.		The Project authorized by this Permit shall be completed within twenty (20) years from the date of issuance. If needed, the Permit Holder shall submit a written request to the Division for an extension of time to complete said Project, and the Division will review the Project pursuant to MESA for any continuing impacts as described herein and for any new impacts to any State-listed species found subsequent to the issuance date of this Permit. Said request shall be submitted to the Division at least sixty (60) days prior to expiration of this Permit and shall include a summary report demonstrating compliance with all General and Special Conditions of this Permit.
GC 15.		**Within (3) months of the completion of Work** the Permit Holder shall submit to the Division a written request for a Certificate of Permit Compliance (the "Certificate"), including as-built plans and other supporting materials demonstrating the completion of Work and compliance with all General and Special Conditions of the Permit. The text of the Division-issued Certificate shall be recorded by the Permit Holder in the Registry of Deeds or the Land Court for the district in which the Property is located so as to become a record part of the chain of title of the Property. Unless an extension is granted in writing by the Division pursuant to

		General Condition #14, the Permit Holder shall record the Division-issued Certificate **prior to expiration of the Permit**. The Permit Holder shall submit to the Division a date-stamped and signed copy of said recorded Certificate showing the date and book and page of recording **within five (5) business days after recording and or filing**, as applicable.

G. Special Conditions

SC 1.		Work Authorized by the Permit: This Permit authorizes the construction of the Multi-Purpose Machine Gun (MPMG) Range. Work on the MPMG Range will occur in two phases; Phase 1 includes ±142 Acres of disturbance, and Phase 2 includes ±65 acres of disturbance. This Permit also authorizes construction of other phases of the Master Development Plan described above. Collectively, the Work will result in a minimum of ±308 acres of disturbance as shown on the Project Plan (the "Work"; Attachment 1) and further detailed in the Permit Application. Unless otherwise approved in writing by the Division, all Work shall be confined to the area of the Property within the limits of Work shown on the Project Plan (Attachment 1) and further detailed in the Permit Application. The Work also includes additional, future phases of development proposed by the Permit Holder and determined by the Division to be part of the Master Development Plan. The Work also includes any other on-site activity required by the Division as a condition of this Permit. **Prior to the start of work on Phase 2 of the MPMG Range, the Permit Holder shall submit site development plans and a proposal to meet Net Benefit to the Division for review and written approval.**
SC 2.		Construction Phasing: Prior to the start of Work on any individual phase of the Project, the Permit Holder shall provide to the Division a project description and site plan associated with that phase. Said site plan shall include parcel boundaries, the total parcel acreage, and the total acreage within the proposed limits of Work. **The Permit Holder shall submit site development plans and a proposal to meet Net Benefit to the Division for review and written approval.**
SC 3.		Permanent Protection of Habitat - Fee Transfers: In order to provide a Long-term Net Benefit to the conservation of the Eastern Box Turtle, State-listed Grassland Birds, and State-listed Lepidoptera, the Permit Holder has proposed, by way of the Permit Application, to permanently protect the following parcels, as shown on Figures 5.2 "Mitigation Tracts 1-4", 5.3 "Mitigation Tract 5", and 5.4 "Mitigation Parcel H-Unit K" of the Permit Application, by deeding fee ownership to the Massachusetts Department of Fish and Game. **Prior to the start of work on Phase 1 of the MPMG Range, the parcels identified below shall be transferred to the Massachusetts Department of Fish and Game.** The Permit Holder shall provide proof of conveyance of said land, with a copy of the recorded deed submitted to the Division within five (5) business days of recordation. 1) Special Military Reserve Commission Parcels 1, 2, 3, 4 and 5 (totaling 261 acres), owned by the Commonwealth of Massachusetts). Once grassland conversion on Parcel H, Unit K has been completed, this acreage will be available to use as Net Benefit mitigation for grassland impacts. The land transfer of Parcel H, Unit K to the Massachusetts Department of Fish and Game is in process and land preservation credits will be applied when all parties agree that conversion has occurred. This is affirmed in Colonel Timothy Mullens email dated August 21, 2020 (Attachment 4.) Military Division shall transfer this parcel prior to initiation of Work on the Transient Troop Headquarters or within one (1) year from the issuance of the CMP, whichever is earlier. The MAARNG will apply for a license to maintain and manage this area as outlined herein. The Permit Holder shall provide proof of conveyance of said land to the Massachusetts

		Department of Fish and Game, with a copy of the recorded deed submitted to the Division within five (5) business days of recordation. 2) Massachusetts Military Division Parcel H of Unit K (totaling ±150 acres).
SC 4.		<u>Permanent Protection of Habitat - Establishment of Forest Canopy Reserves, Pine Barrens Mitigation Focal Areas, and Grassland Mitigation Focal Areas:</u> In order to provide a Long-term Net Benefit to the conservation of the State-listed species impacted by the Project, the Permit Holder has proposed, by way of the Permit Application, to establish and permanently protect the following areas, as shown on Figures 5.6 "Forest Canopy Reserve Areas" and 5.7 "Pine Barrens Mitigation Focal Areas" and as further detailed and described in the Permit Application (Section 5). 1) **Forest Canopy Reserves (1,177 acres):** The Forest Canopy Reserve Areas (FCRA) are comprised of 1,177 acres in two separate areas within Camp Edwards as shown on Figure 5.1 and Figure 5.6 of the CMP Application. The intent of these FCRAs are to be "set aside" for management planning for the goal of retention of the forest canopy to preserve a closed canopy condition which is valuable for the Eastern Box Turtle. That is, these areas are for the preservation of more forested later successional areas. These areas are primarily vegetated with mature pitch pine oak forest (PPOF) with closed canopy. These FCRAs will also allow woods with less of a canopy cover to evolve into a more closed canopy condition. 2) **Pine Barrens Mitigation Focal Areas (3,402 acres):** The Pine Barrens Mitigation Focal Areas are comprised of 3,402 acres over three different areas within Camp Edwards as shown in Figure 5.1 and Figure 5.7 of the CMP Application. The intent is to implement needed management of these focal areas in order to maintain the pitch pine scrub (PPSO) and scrub oak shrublands (SOS) communities. 3) **Grassland Mitigation Focal Areas (107 acres):** The Grassland Mitigation Focal Areas are comprised of 107 acres in two different areas within the JBCC Cantonment Areas as shown in Figure 5.1 and Figure 5.8 of the CMP Application. The intent is to hold these areas in reserve for grassland conversion in the event additional area is needed or conditions/agreements change relative to the primary mitigation area (Parcel H – Unit K). Neither area would be as beneficial for State-listed species as intensive improvement/management in this primary location, but if needed they can provide nearby grassland habitat by removing existing woodland. **Prior to the start of work on Phase 1 of the MPMG Range, the Forest Canopy Reserves, Pine Barrens Mitigation Focal Areas, and Grassland Mitigation Focal Areas shall be incorporated into the 2020 revision of the Camp Edwards Integrated Natural Resources Management Plan (INRMP) and all INRMPs thereafter.** As described in the conservation and management plan, the protection of these areas does not preclude any normal use for the Camp Edwards Training Site, to include soldier and other training activities, maintenance and repair of existing infrastructure and training areas, habitat management consistent with this permit and the INRMP, and all other regular actions**. Such activities and/or use areas must preserve the character of the respective mitigation zone and meet the goals of the Forest Canopy Reserve or Mitigation Focal Area. Where activities are not compatible with mitigation, alternative sites should be identified or amendments to mitigation zones should be evaluated by the Permit Holder and the Division, requiring written approval from the Division.** The boundaries of focal areas and forest canopy reserves were identified to provide excessive acreage for mitigation banking purposes and are not anticipated to be managed in full as mitigation unless project implementation and habitat management planning guide such action. Boundaries of Focal Areas and Reserves are intended to be stable and established. Any proposed changes to these boundaries shall be

		requested in writing to the Division. The request shall be reviewed and if approved, received written authorization by the Division. Prior to any formal request, early interagency coordination and INRMP review is required. Proposed adjustments (additions or removals) must evaluate and present the impacts to Net Benefit planning and the overall mitigation bank.
SC 5.		Vegetation Management of MPMG Range, Fire Breaks, and Fuel Treatment Areas: Management of vegetation and the floor of the MPMG Range shall adhere to the Division approved protocols described in the Permit Application (Appendix A, Sections 3.4.3 and 6) unless otherwise approved by the Division. Fire breaks consist of a ±15 foot gravel or hardpacked dirt road with ±30 feet of winter mowed grass/forbs/shrubs on each side. In addition, there is a ±200 foot fuel management buffer (shaded fuel break) on each side. This area is comprised of a mosaic of mowed understory and 20-40 foot spacing of the canopy. Mowing, tree thinning, and prescribed fire are the proposed primary management tools. Future management actions will be adaptively refined based on research (see Special Condition #6) and monitoring (see Special Condition #9). The Permit Holder shall meet with the Division annually to review research and monitoring results and observed changes to vegetation structure and composition in response to management operations, in order to refine management actions and maximize benefit for State-listed species.
SC 6.		State-listed Species Monitoring and Research: In order to provide a Long-term Net Benefit to the conservation of state-listed species impacted by the Project, the Permit Holder has proposed, by way of the Permit Application, to implement the monitoring and research studies listed below, as further detailed and described in the CMP Application (Section 5.3). 1) Lepidoptera long-term monitoring, beginning in 2021 a. Develop statistical foundation for long-term monitoring plan. b. Implement plan to evaluate population and status trends for state-listed species with particular focus on impacts of range construction and habitat management including both mitigation actions (e.g., pine barrens restoration) and fire hazard reduction actions (e.g., shaded fuel break and prescribed fire management). 2) Annual Eastern Whip-poor-will Survey (EWPW) and support of the Division's EWPW Study a. As relevant, continue coordination and project support for the research efforts by the Division using GPS and other locational technology to investigate life history and site use, which may also inform management actions. b. MAARNG has, in partnership with the Division, conducted the Northeast Nightjar Survey throughout Camp Edwards to monitor long-term population trends and site use dynamics. MAARNG will continue to implement this long-term monitoring and coordinate with the Division to include methods and data transfer. 3) Long Term (5 Year) Eastern Box Turtle radio telemetry study to evaluate the impacts of range development and habitat management actions within Camp Edwards a. MAARNG will monitor Eastern Box Turtles at Tango/Sierra Range and the MPMG Range vicinity for at least the period from 2020 through 2024 to investigate habitat use and response to large scale management and range development. The monitoring will also identify "hot spots" for turtle activity and conservation and evaluate potential threats (e.g., fly larvae, respiratory diseases) and their impacts on box turtles. b. Long-term tracking will primarily be limited to turtles found and tagged during pre-construction surveys within and surrounding project areas. Turtles found truly opportunistically have been and will continue to be tagged and tracked as they are found adjacent to or within proposed project areas with particular emphasis on Tango, Sierra, and MPMG ranges.

		4) Annual Grassland Bird Monitoring a. MAARNG has conducted site-wide breeding bird surveys since 1994, including within the managed grasslands where state-listed birds are concentrated. Beginning in 2014 methodology was shifted to a more robust and static point count methodology. This monitoring provides a wealth of information on avian population trends on base that are compared to external monitoring (e.g., Breeding Bird Surveys) and will now provide baseline data with which to compare future surveys. The site-wide, annual avian point count surveys will continue with emphasis on managed grasslands for the state-listed and otherwise uncommon grassland birds. 5) Monitoring of Invasive Species a. Basic monitoring and reporting of invasive species occurrence in project areas and mitigation areas is critical to developing management plans to address any arising problems. This information will guide invasive plant treatments and may influence adaptive management for mitigation actions and/or other actions such as wildfire hazard reduction, range maintenance, or firebreak maintenance. Methods for monitoring will be standard and fairly simple, but critical to management planning. **The Permit Holder shall coordinate with the Division to develop and refine draft monitoring and survey protocols for each study. Within six (6) months following the start of work on Phase 1 of the MPMG Range, the Permit Holder shall submit final draft protocols for the studies listed above to the Division for final review and written approval unless alternative timelines are otherwise approved. The Permit Holder shall coordinate with the Division throughout implementation of the monitoring and research studies and provide written reports of study results in accordance with the final approved protocols.**
SC 7.		<u>Use of Native Species</u>: Prior to application of seed and/or stabilization activities, the Applicant shall submit, for Division review and approval any proposed plantings and/or seed mixes. All seed mixes and plantings shall be native to Barnstable County, Massachusetts, as provided in The Vascular Plants of Massachusetts: A County Checklist, First Revision (Dow Cullina, Connolly, Sorrie & Somers, 2011); unless approved otherwise by the Division.
SC 8.		<u>Habitat Management:</u> In order to provide a Long-term Net Benefit to the conservation of state-listed species impacted by the Project, the Permit Holder has proposed, by way of the Permit Application, to implement habitat management in the following areas as detailed and in the CMP Application. 1) *Pine Barrens Mitigation Focal Areas*. The goal is to manage fire-adapted pitch-pine and scrub oak communities through prescribed fire, mowing, whole tree harvesting, and invasive species management (including targeted chemical treatment of native and non-native species as appropriate). This is further described in Section 5.2.1 "Pine Barrens Mitigation Focal Areas" of the Permit Application. a. Initial (2019-2023) targets for pine barrens mitigation include an annual average of 160 acres of prescribed burning and 50 acres of mechanical management. b. Long-term maintenance targets for pine barrens mitigation areas include 100 acres of prescribed burning and 20 acres of mechanical management to include prescribed fire support and forestry. 2) *Grassland Mitigation Focal Area* (Parcel H Unit K). The goal is to manage a grassland community through prescribed fire, mowing, whole tree harvesting, brush removal, harrowing, seeding and invasive species management (including targeted chemical treatment of native and non-native species as appropriate). This is further described in Section 5.2.2 "Grassland Mitigation Focal Areas" of the Permit Application.

		a. Initial (2019-2023) targets for grassland mitigation and conversion include an annual average of 40 acres of prescribed burning and 40 acres of mechanical management and/or chemical treatment. b. Long-term maintenance targets for grassland mitigation areas include an annual average of 40 acres of prescribed burning and 10 acres of mechanical management and/or chemical treatment. The Habitat Management Schedule is detailed in Table 5-11 "Actions Proposed by Year" and described throughout the CMP Application (Sections 3-7). Measurable targets as outlined above (both planned and completed) will be assessed annually during the meeting and reporting outlined in Special Condition 9. Adjustments to these objectives will be proposed based on adaptive management and approved and documented through the formal processes described. These targets are included in the Integrated Natural Resources Management Plan for Camp Edwards. Annual targets should be assessed over time to allow for annual variation in accomplishment and external influences on management capacity (e.g., years of more or less implementation success) consistent with long-term management planning. The habitat management areas will be managed in accordance with the goals, objectives, and schedules detailed in the CMP Application and in coordination with the Division. Habitat Management will be informed by research and monitoring and guided by adaptive management principles. The Permit Holder shall meet with the Division annually to determine the performance and success of the habitat management actions.
SC 9.		Long-Term Habitat Monitoring and Management of the Mitigation Focal Areas: The Permit Holder has an established and effective conservation and land management program with demonstrable success in managing sandplain grasslands and pine barrens habitat with commitments and planning documented through the INRMP process. After completion of the initial mitigation requirements detailed in this CMP (i.e. establishment of Forest Canopy Reserves, Pine Barrens Mitigation Focal Areas and Grassland Focal Area; creation of high quality sandplain grassland habitat in Parcel H of Unit K; initial habitat enhancement of Pine Barrens Mitigation Focal Areas), the Permit Holder will work with the Division to set long-term habitat maintenance and management targets for Parcel H of Unit K and the Pine Barrens Mitigation Focal Areas. These long-term habitat maintenance and management targets will be incorporated into the future INRMPs to ensure the long-term compliance with the Permit. The Permit Holder shall provide the Division with annual Permit compliance reports, which will be reviewed and discussed during an annual Permit compliance meeting. Annual Permit compliance meetings will review the implementation of development projects and both ongoing and future mitigation actions. Specific objectives and targets for both initial habitat enhancement actions as well as long-term habitat maintenance and management activities will be discussed and refined. Adaptive management principles will be the foundation for long-term implementation of habitat management actions to maximize net benefit of State-listed species, to be informed by habitat and species monitoring results, the outcomes of previously implemented mitigation projects, and collaborative discussions between the Permit Holder and the Division during annual meetings. The existing INRMP process requires annual, in-person, meetings between the Sikes Act signatory partners including MADFW, the Permit Holder, and US Fish and Wildlife Service. The INRMP, Sikes Act, AR200-1, and the Environmental Performance Standards (Chapter 47, Acts of 2002, M.G.L.) all consider and incorporate management activities for the net benefit and sustainability of state-listed species at Camp Edwards. The annual Permit compliance meetings described above may be coincident with annual INRMP meetings or separate, with either party able to request separate meetings if needed or desired. Long-term habitat management and monitoring of the Pine Barrens Mitigation Focal Areas and the Grassland Mitigation Focal Area is a condition of the Permit and is required in perpetuity. Once initial

		habitat enhancement actions are complete, the Permit Holder and the Division will collaboratively determine management return interval and scope to maintain high quality habitat for State-listed species in perpetuity. Long-term habitat management and monitoring actions required by the Permit will be incorporated into each five (5) year update to the INRMP as objectives and management projects, to be guided and adaptively refined through research and ongoing monitoring.
SC 10.		State-listed Species Protection During Construction: Prior to the initiation of Work, the Permit Holder shall develop and submit a rare species protection plan for each phase of work to the Division for review and written approval. The Division is available for consultation on the development of the project specific protection plans. Prior to and during Work on Phase 1 of the MPMG Range, the Permit Holder shall implement the attached Turtle Protection Plan (Attachment 3), which has been approved by the Division and includes pre-construction turtle sweeps, installation of temporary turtle barriers, construction staff education, and other measures as necessary to protect State-listed turtles during construction. If changes to said Turtle Protection Plan are proposed, said changes must be submitted to the Division for written approval prior to implementation of any changes. Depending on the scope of proposed changes, a new Turtle Protection Plan may be required.
SC 11.		Annual Coordination: The annual meeting may be coincident with the INRMP annual meetings or separate, with either party able to request separate meetings if desired. Annual meetings will review the implementation of development projects and mitigation actions and serve as an audit of overall CMP compliance. Specific targets and objectives for long-term habitat maintenance and management will be addressed through future coordination between the Permit Holder and the Division and incorporated into the INRMP. Adaptive management principles will be the foundation for long-term implementation of habitat management for the Net Benefit of impacted species, to be informed by monitoring efforts, the outcomes of previously implemented mitigation projects, and discussions during the annual meetings integrating this information.
SC 12.		Camp Edwards Integrated Natural Resources Management Plan (INRMP): The conditions and requirements of this Permit shall be incorporated into the 2020 update of the Camp Edwards INRMP and all INRMPs thereafter. The CMP Application and CMP shall be incorporated as an appendix of the INRMP. If not finalized prior to the completion of the 2020 INRMP revision, then they shall be included as a draft and final version of the CMP Application and CMP shall be incorporated as an Appendix during the next annual update. Specific reference to the requirements of the Permit shall be incorporated into the INRMP as objectives and management projects. The INRMP must continue to meet the Permit net benefit requirements for mitigation areas, informed through research and monitoring and guided by adaptive management principles.
SC 13.		Joint Base Cape Cod Environmental Management Commission (EMC): The Permit Holder shall present the Permit to the EMC, provide an overview of the Master Development Plan, the conditions and obligations of the Permit, and how the Permit will be integrated into the INRMP and both ongoing and future base operations.
SC 14.		Construction Staff Education: All construction, landscaping, and other sub-contractors associated with the Project shall be informed in writing of the likely presence of State-listed species on the Property and what measures should be implemented to minimize direct harm to State-listed species. Further, no wildlife shall be removed from the Property without approval of a qualified wildlife biologist or the Division except as necessary to receive veterinary treatment in the case of harm during construction.

SC 15.		Amendment of Permit to Cover Other Portions of the Property: Pending receipt of necessary approvals from the Executive Office of Energy & Environmental Affairs pursuant to the Massachusetts Environmental Policy Act (MEPA), the Permit Holder may at its sole discretion request that this Permit be amended to include future, as yet unspecified projects determined by the Division to be part of the Master Development Plan. The Division may at its sole discretion accept the request for Permit amendment and impose additional conditions as necessary, or deny the request, at which point the Permit Holder will be subject to MESA review procedures in effect at the time, if any.
SC 16.		Rare Species Observations: The Division shall be notified via email within ten (10) days of the observation of any State-listed species within or directly adjacent to the limits of Work. Formal observation submission will be through the Division's data submittal tool, the Vernal Pool & Rare Species (VPRS) Information System with MAARNG annual state-listed species entry. VPRS and our paper observations forms can be found at: http://www.mass.gov/dfw/nhesp/vprs.

H. Notice of Appeal of Rights:

This Permit is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.23. Any person aggrieved by this decision shall have the right to an adjudicatory hearing at the Division pursuant to M.G.L. c. 30A, s.11 in accordance with the procedures for informal hearings set forth in 801 CMR 1.02 and 1.03.

Any notice of claim for an adjudicatory hearing shall be made in writing and be accompanied by a filing fee in the amount of $500.00. The notice of claim shall be sent to the Division by certified mail, hand delivered or postmarked within twenty-one (21) days of the date of issuance of this Permit to:

Mark S. Tisa, Director
Massachusetts Division of Fisheries and Wildlife
Field Headquarters
One Rabbit Hill Road
Westborough, MA 01581

Any notice of claim for an adjudicatory hearing shall include the following information:

1. The file number for the project;
2. The complete name, address and telephone number of the person filing the request, and the name, address and telephone number of any authorized representative;
3. The specific facts that demonstrate that a party filing a notice of claim satisfies the requirements of an "aggrieved person," including but not limited to (a) how they have a definite interest in the matters in contention within the scope of interests or area of concern of M.G.L. c. 131A or the regulations at 321 CMR 10.00 and (b) have suffered an actual injury which is special and different from that of the public and which has resulted from violation of a duty owed to them by the Division;
4. A clear statement that an adjudicatory hearing is being requested;
5. A clear and concise statement of facts which are grounds for the proceeding, the specific objections to the actions of the Division and the basis for those objections; and the relief sought through the adjudicatory hearing; and a statement that a copy of the request has been sent by certified mail or hand delivered to the applicant and the record owner, if different from the applicant.

Jonathan Regosin, Deputy Director
Massachusetts Division of Fisheries & Wildlife

On this 29th day of September, 2020, before me, the undersigned notary public, personally appeared Jonathan Regosin, Deputy Director, proved to me through satisfactory evidence of identification, which was personal knowledge, to be the person whose name is signed on the preceding or attached document, and who swore or affirmed to me that the contents of the document are truthful and accurate to the best of his/her knowledge and belief.

Emily Melissa Holt, Notary Public
My Commission expires: July 12, 2024

Conservation Permit 020-358.DFW

Issued September 29, 2020

Work must be completed by September 29, 2040

ACKNOWLEDGEMENT AND ACCEPTANCE OF ALL TERMS OF THIS CONSERVATION PERMIT

The undersigned below agrees that commencement of any work authorized by and described in this Conservation and Management Permit constitutes acknowledgement and acceptance of all terms of this Permit.

Timothy A. Mullen

Signatory 1
Massachusetts Army National Guard

COMMONWEALTH OF MASSACHUSETTS

On this 30th day of Sept, 2020 before me, the undersigned notary public, personally appeared Timothy A. Mullen, proved to me through satisfactory evidence of identification which was Military ID to be the person whose name is signed on the preceding or attached document, and who swore or affirmed to me that the contents of the document are truthful and accurate to the best of his/her knowledge and belief.

Notary Public

Tracy S. Walton

SEAL

My commission expires: 4/4/2025

Distribution List

Jake McCumber, Massachusetts Army National Guard
Kathryn Barnicle, AECOM
Bourne, Falmouth, and Sandwich Board of Selectmen
Bourne, Falmouth, and Sandwich Conservation Commissions
Bourne, Falmouth, and Sandwich Planning Boards
DEP Southeastern Regional Office, Wetlands Program
DFW Southeast Wildlife District Office
Environmental Management Commission, Upper Cape Water Supply Reserve
Page Czepiga, MA Environmental Policy Act Office

APPENDIX L – WATER RESOURCES PROTECTION

1.1 EXISTING CONDITIONS

Although surface water resources at Camp Edwards are limited, the installation sits atop the Sagamore Lens of the Cape Cod Aquifer, which is a "sole-source" aquifer that supplies 100 percent of the drinking water to the residents of Upper Cape Cod.

1.1.1 Surface Water Management

Surface water at Camp Edwards is managed in accordance with measures to provide protection to this limited resource. Water quality management on Camp Edwards includes adherence to the federal and state surface water protections, as well as the Spill Prevention, Control, and Countermeasures Plan. Measures to protect water quality of surface water include:

- Limiting the impact on water bodies and riparian buffers caused by training exercises.
- Maintaining water quality by preventing erosion and sedimentation through the maintenance of adequate vegetative cover on soils and through the maintenance of appropriate drainage structures.
- Conducting routine water quality analyses (monitoring surface water quality, biomonitoring) on all water bodies within the boundaries of the installation to ensure that water quality standards comply with state and federal standards.

1.1.2 Groundwater Management

As part of groundwater management, all land uses on the Camp Edwards Training Site must conform to MAARNG, Camp Edwards, DoD, local town, and Massachusetts State regulations pertaining to groundwater resources and wellhead protection. These regulations include the Safe Drinking Water Act (40 CFR 141, 144-147), CWA (40 CFR 61, 33 U.S.C. 1251-1387), State Drinking Water Regulations (310 CMR 22.00), State Wellhead Protection Act (310 CMR 22.21), and Water Management Act (310 CMR 36.00).

Land uses on Camp Edwards must not interfere with current or future restoration or remediation projects or with the distribution of water supplies to the surrounding Upper Cape towns. Furthermore, the extraction, use, and transfer of groundwater resources must not degrade or impact natural resources, aquatic, or terrestrial habitats on Camp Edwards. Water quality management on Camp Edwards, as pertaining to public water supply, is based upon compliance with the Groundwater Protection Policy Plan. All land uses on Camp Edwards must adhere to the requirements and regulatory restrictions of the Groundwater Protection Policy Plan. This plan sets requirements, called Environmental Performance Standards (EPS), that must be achieved to protect groundwater quality. These standards are provided in Appendix E.

In 2018, MAARNG complied with the Groundwater EPS. Management activities to protect groundwater resources included limited travel (foot travel and vehicles required for construction,

operation, and maintenance) in Zone 1 Wellhead Protection Areas, fencing and signage to protect Upper Cape Water Supply Cooperative water supply wells, and operation within water withdrawal limits as set by MassDEP (MANG 2019a). For further information regarding groundwater management, consult the current annual State of the Reservation Report.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Water resources protection is important to natural resources management because it directly affects surface and ground water quality and the value of aquatic habitats. MAARNG currently complies with several federal, state, local, and Army environmental regulations for the protection of groundwater and surface water resources. These include federal and state water supply regulations and Spill Prevention, Control, and Countermeasures Plans. The water resource protection objectives and actions presented in this INRMP are designed to ensure that the use, extraction, and transfer of water resources does not impact natural resources. These goals also work to reduce/control nutrient and sediment inputs into the watershed and groundwater while supporting mission activities. In addition, these goals seek to minimize nonpoint source pollution of both surface water and groundwater in the watershed.

Water resource protection is especially critical at Camp Edwards and the Upper Cape Water Supply Reserve. Compliance with the EPS and frequent coordination with the EMC are fundamental to resource management at Camp Edwards.

The following goals apply to WRP projects listed for Camp Edwards in Appendix D, Table D-2.

WRP GOAL 1: IMPLEMENT NATURAL RESOURCE MANAGEMENT IN A MANNER THAT SUPPORTS WATER RESOURCES AND ENSURES COMPLIANCE WITH WATER QUALITY STANDARDS

- **WRP OBJECTIVE 1.1:** Ensure that mission activities and natural resource management support the protection of groundwater and surface water at Camp Edwards

Attachment L-1

2017 Environmental Performance Standards

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ENVIRONMENTAL PERFORMANCE STANDARDS
APRIL 6, 2017

For Massachusetts National Guard Properties at the Massachusetts Military Reservation

CAMP EDWARDS TRAINING AREA GENERAL PERFORMANCE STANDARDS

None of the following banned military training activities shall be allowed in the Camp Edwards Training Areas:
-Artillery live fire
-Mortar live fire
-Demolition live fire training
-Artillery bag burning
-Non-approved digging, deforestation or vegetation clearing
-Use of' 'CS', riot control, or tear gas for training outside the NBC bunkers
-Use of field latrines with open bottoms
-Vehicle refueling outside designated Combat Service Area and Fuel Pad locations
-Field maintenance of vehicles above operator level

Limitations on the use of small arms ammunition and live weapon fire fall into the following two categories:

- Live weapon fire is prohibited outside of established small arms ranges. Live weapon fire is not allowed on established small arms ranges except in accordance with Environmental Performance Standard 19, other applicable Performance Standards, and a range-specific plan approved through the Environmental Management Commission (EMC).

- Blank ammunition for small arms and simulated munitions may be used in areas outside of the small arms ranges, using only blank ammunition and simulated munitions identified on an approved list of munitions. Joint review and approval for inclusion on the list shall be through by the Environmental & Readiness Center (E&RC) and the EMC.

Each user will be responsible for proper collection, management, and disposal of the wastes they generate, as well for reporting on those actions.

Use and application of hazardous materials or disposal of hazardous waste shall be prohibited except as described in the Groundwater Protection Policy.

Vehicles are only authorized to use the existing network of improved and unimproved roads, road shoulders, ranges and bivouac areas, except where necessary for land rehabilitation and management, water supply development, and remediation, or where roads are closed for land rehabilitation and management.

Protection and management of the groundwater resources in the Camp Edwards Training Area will focus on the following:

- Development of public and Massachusetts Military Reservation water supplies.
- Preservation and improvement of water quality and quantity (recharge).

- Activities compatible with the need to preserve and develop the groundwater resources.

All users of the Camp Edwards Training Area must comply with the provisions of the Groundwater Protection Policy and any future amendments or revisions to the restrictions and requirements. These will apply to all uses and activities within the overlays relative to Wellhead Protection, Zone II's within the Cantonment Area, and the Camp Edwards Training Areas.

Development of water supplies will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the Massachusetts Department of Environmental Protection, and the Massachusetts Division of Fish and Wildlife.

All phases of remediation activities will be permitted within the Camp Edwards Training Area after review and approval by the managing agencies, principally the Department of the Army and its divisions, together with the federal and state agencies who will have jurisdiction for remediation.

Pollution prevention and management of the Camp Edwards training ranges will focus on and include the following:

The Camp Edwards Training Area, including the Small Arms Ranges (SAR) and their associated "Surface Danger Zones," and any areas where small arms or other munitions or simulated munitions are used, shall be managed as part of a unique water supply area under an adaptive management program that integrates pollution prevention, and best management practices (BMP), including the recovery of projectiles. This will be done through individual range-specific plans that are written by the Massachusetts National Guard and approved for implementation through the EMC and any other regulatory agency having statutory and/or regulatory oversight. Adaptive, in this context, means making decisions as part of a continual process of monitoring, reviewing collected data, evaluating advances in range monitoring, design and technology, and responding with management actions as dictated by the resulting information and needs of protecting the environment while providing compatible military training within the Upper Cape Water Supply Reserve.

A range plan shall be designed and followed to reduce the potential for an unintended release to the environment outside of the established containment system(s) identified in the range-specific plans. All users must be aware of, and comply with, the Environmental Performance Standards that are applicable to all SAR activities. Any range specific requirements will be coordinated through the E&RC with the EMC, incorporating those specific requirements into the appropriate range-specific plans and range information packets. Camp Edwards SAR Pollution Prevention Plan shall be followed to prevent or minimize releases of metals or other compounds related to the normal and approved operation of each SAR. The adaptive SAR management program components required in each range-specific plan shall include:

- Consultation with applicable agencies with oversight of the training area before undertaking any actions that are subject to state and/or federal regulatory requirements.
- Specific recovery plans for the removal and proper disposition of spent projectiles, residues and solid waste associated with the weapons, ammunition, target systems, and/or their operation and maintenance.
- Reduction of adverse impacts to the maximum extent feasible, including consideration for the design/redesign and/or relocation of the activity or encouraging only those activities that result in meeting the goal of overall projectile and/or projectile constituent containment.
- Internal and external coordination of documentation for the Camp Edwards range management programs and other related Camp Edwards management programs including: the Integrated

- Training Area Management Program, Range Regulations, Camp Edwards Environmental Management System, Civilian Use Manual, and Standard Operating Procedures.
- Long-term range maintenance, monitoring and reporting of applicable parameters and analysis.

The Massachusetts National Guard shall ensure that all training areas where munitions or simulated munitions are used or come to be located, including range areas, range surface danger zones, and any other areas within the Upper Cape Water Supply Reserve that are operational ranges are maintained and monitored following approved management plans that include planning for pollution prevention, sustainable range use and where applicable, restoration.

Protection and management of the vegetation of the Camp Edwards Training Area for focus on the following:

- Preservation of the habitat for federal- and state-listed rare species and other wildlife.
- Preservation of the wetland resource areas.
- Activities compatible with the need to manage and preserve the vegetative resources.
- Realistic field training needs.
- Identification and restoration of areas impacted by training activities.

Goals for the Adaptive Ecosystem Management approach to management of the Camp Edwards properties will be as follows:

- Management of the groundwater for drinking water resources
- Conservation of endangered species.
- Management of endangered species habitat for continuation of the species.
- Ensuring compatible military training activities.
- Allowing for compatible civilian use.
- Identification and restoration of areas impacted by training activities.

The Environmental Performance Standards will be incorporated into the programs and regulations of the Massachusetts National Guard as follows. Those standards relating to natural resources management shall be incorporated as standards into each of the state and federal environmental management programs and attached as an appendix or written into the documentation accompanying the plan or program. All the Environmental Performance Standards will be attached to the Integrated Training Area Management Plan 'Trainer's Guide' and to the Camp Edwards Range Regulations. Modification of the Standards Operating Procedures will include review and conformance with the Environmental Performance Standards for trainers and soldiers at Camp Edwards.

SPECIFIC RESOURCE PERFORMANCE STANDARDS IN THE CAMP EDWARDS TRAINING AREA

1. Groundwater Resources Performance Standards

1.1. All actions, at any location within the Camp Edwards Training Areas, must preserve and maintain groundwater quality and quantity, and protect the recharge areas 1:0 existing and potential water supply wells. All areas within Camp Edwards Training Areas will be managed as State Zone U, and, where designated, Zone I, water supply areas.

1.2 The following standards shall apply to designated Wellhead Protection Areas:

- The 400-foot radius around approved public water supply wells will be protected from all access with signage. That protection will be maintained by the owner and/or operator of the weJl, or the leaseholder of the property.
- No new stormwater discharges may be directed into Zone I areas.
- No in ground septic system will be permitted within a Zone I area.
- No solid wastes may be generated or held within Zone I areas except as incidental to the construction, operation, and management of a well.
- Travel in Zone I areas will be limited to foot travel or to vehicles required for construction, operation, and maintenance of wells.
- No new or existing bivouac activity or area shall be located within a Zone I area.
- All other areas will be considered as Zone II designated areas and will be subject to the standards of the Groundwater Protection Policy.

1.3 Land-use activities that do not comply with either the state Wellhead Protection regulations (310 CMR 22.00 et seq.) or the Groundwater protection Policy are prohibited.

1.4 All activities will suppol1 and not interfere with either the Impact Area Groundwater Study and/or the Installation Restoration Program. All activities shall conform to the requirements of Comprehensive Environmental Response, Compensation and Liability Act, the Massachusetts Contingency Plan, and the Safe Drinking Water Act.

1.5 Extraction, use, and transfer of the groundwater resources must not de- grade [e.g. draw down surface waters] in freshwater ponds, vernal pools, wetlands, and marine waters, unless properly reviewed, mitigated, and approved by the managing and regulating agencies.

1.6 Land uses and activities in the Camp Edwards Training Areas will meet the following standards:

- Will conform to all existing and applicable federal, state and local regulations.
- Must be able to be implemented without interference with ongoing remediation projects.
- Allow regional access to the water supplies on the Massachusetts Military Reservation.

1.7 The following programs and standards will be used as the basis for protecting groundwater resources in the Camp Edwards Training Areas:

- Groundwater Protection Policy.
- Federal and Department of Defense environmental programs: Integrated Natural Resources Management Plan, Integrated Training Area Management Program, Range Regulations, Spill Prevention Control and Countermeasures Plan (or equivalent), Installation Restoration *Plan,* Impact Area Groundwater Study, or other remediation programs.
- State and federal laws and regulations pertaining to water supply.

2. Wetlands and Surface Water Performance Standards

2.1 Since there are relatively few wetland resources found at the Massachusetts Military Reservation, and since they are important to the support of habitat and water quality on the properties, the minimum standard will be no net loss of any of the wetland resources or their 100-foot buffers.

2.2 Land uses and activities will be managed to prevent and mitigate new adverse impacts and eliminate or reduce existing conditions adverse to wetlands and surface water resource areas. Impacts from remediation activities may be acceptable with implementation of reasonable alternatives.

2.3 Wetland area management priorities:

- Protection of existing; wetland resource areas for their contributions to existing and potential drinking water supplies.
- Protection of wetlands for rare species and their habitats.
- Protection of human health and safety.

2.4. Activities will be managed to preserve and protect wetlands and vernal pools as defined by applicable, federal, state, and local regulations. These activities will include replacement or replication of all wetland resource buffer areas, which are lost after completion of an activity or use.

2.5 All land altering activities within 100 feet of a certified vernal pool must be reviewed before commencement by the Massachusetts Department of Environmental Protection/Wetlands Unit and the Natural Heritage and Endangered Species Program within the Division of Fish and Wildlife for impacts to wildlife and habitat. The certification of vernal pools will be supported by the on site personnel and will proceed with the assistance of the appropriate state agencies.

2.6 All new uses or activities will be prohibited within the wetlands and their IOO-foot buffers, except those associated with an approved habitat enhancement or restoration program; those on existing improved and unimproved roads where appropriate sediment and erosion controls are put in place prior to the activity; or those where no practicable alternative to the proposed action is available. No new roads should be located within the 100-foot buffers. Existing roads within such buffers should be relocated provided that:

- The relocation does not cause greater environmental impact to other resources.
- There are funds and resources allocated for resource management and that those resources are approved and available for the relocation.

2.7 During the period of 15 February to 15 May, listed roads/trails within 500 feet of wetlands will be closed to vehicle access to protect the migration and breeding of amphibians. Emergency response and environmental management activities will not be restricted.

- Donnelly and Little Halfway Ponds maneuver trails (excluding the permanently closed section along the eastern edge of Donnelly Pond) from Frank Perkins Road north to Wood Road
- Red Maple Swamp trail from Wood Road north and east to Avery Road
- Orchard and Jefferson Roads (continuous) from Cat Road south and east to Burgoyne Road
- Maneuver trail(s) in powerline easement north of Gibbs Road from Goat Pasture Road west to the boundary of training areas C-13 and C-14
- Grassy Pond trail (side access to Sierra Range) from Gibbs Road south to Sierra Range
- Sandwich Road from the powerline easement north to the gas pipeline right of way
- Bypass Bog/Mike Range Road from entrance to Mike Range south and west to Greenway Road

2.8 No new bivouac area shall be located within 500 feet of any wetland. Any existing bivouac within a wetland buffer shall be relocated provided there are funds and resources allocated for the relocation.

3. Rare Species Performance Standards

3.1 As the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife has identified the entire Massachusetts Military Reservation as State Priority Habitat for state-

listed species (version dated 2000-2001), all activities and uses must comply with the Massachusetts Endangered Species Act and its regulations.

3.2 Where activities and uses are not specifically regulated under the Camp Edwards Training Area Range and Environmental Regulations, including these Environmental Performance Standards, the MMR Environmental and Readiness Center must review the activities for conformance with the Integrated Natural Resource Management Plan, and shall- consult with the Natural Heritage and Endangered Species Program regarding potential impacts to state-listed species.

3.3 All activities impacting rare species habitat must be designed to preserve or enhance that habitat as determined by the MMR Environmental and Readiness Center in consultation with the Natural Heritage and Endangered Species Program.

3.4 Users are prohibited from interfering with state and federal listed species.

3.5 Users will report all sightings of recognized listed species, e.g. box turtles, within any area of the Massachusetts Military Reservation.

4. Soil Conservation Performance Standards

4.1 Activities and uses must be compatible with the limitations of the underlying soils. Limitations on uses and activities may be made where the soils or soil conditions would not support the activity.

4.2 Agricultural soil types will be preserved for future use.

4.3 Any perennial or intermittent stream identified by the Environmental & Readiness Center Office will be protected from siltation by retaining undisturbed vegetative buffers to the extent feasible.

4.4 Cultural resource evaluations must be completed before any earth-moving operation may take place in undisturbed areas with high potential for cultural resources, and earth moving may be limited to specific areas (See Cultural Resource Performance Standards).

4.5 An erosion control analysis will be made part of the land management programs (Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures) for the Camp Edwards Training Area, including appropriate mitigation measures where existing or potential erosion problems are identified.

4.6 For all improved and unimproved roads, ditches and drainage ways:

- All unimproved roads, ditches, roads and drainage ways identified for maintenance will be cleaned of logs, slash and debris.
- Unimproved roads and roads may not otherwise be improved unless approved for modification.
- Any trail, ditch, road, or drainage way damaged by activities will be repaired in accordance with the hazard and impact it creates.

4.7 Erosion-prone sites will be inspected periodically to identify damage and mitigation measures.

5. Vegetation Management Performance Standards

5.1 All planning and management activities impacting vegetation

- Will ensure the maintenance of native plant communities, and
- Shall be performed to maintain the biological diversity.

5.2 Revegetation of disturbed sites will be achieved by natural and artificial recolonization by native species.

5.3 Timber harvesting or clear-cutting of forested areas should not occur on steep slopes with unstable soils or with in the buffers to wetland resources.

5.4 Vegetation management will be subject to a forest management and fire protection program prepared by the users in accordance with federal standards, and carried out in a manner acceptable to the Massachusetts Military Reservation Committee and other state agencies or commissions, as may be designated by the Commonwealth of Massachusetts.

6. Habitat Management Performance Standards

6.l The Camp Edwards Training Area will be managed as a unique rare species and wildlife habitat area under n adaptive ecosystem management program that integrates ecological, socio-economic, and institutional perspectives, and which operates under the following definitions:

- Adaptive means making decisions as part of a continual process of monitoring, reviewing collected data, and responding with management actions as dictated by the resulting information and needs of the system.
- Ecosystem means a system-wide understanding of the arrangements of living and non-living things, and the forces that act upon and within the system.
- Management entails a multi-disciplinary approach where potentially competing interests are resolved with expert analysis, user and local interest considerations, and a commitment to compromise interests when the broader goal is achieved to manage the Camp Edwards Training Area as a unique wildlife habitat area.

6.2 The adaptive ecosystem management program will include:

- Coordinated documentation for the management programs, Integrated Natural Resource Management Plan, the Integrated Training Area Management Program, Range Regulations, Civilian Use, and Standard Operating Procedures.
- The Massachusetts National Guard Environmental and Readiness Center staff and necessary funding to support its ecosystem management plans, as related to the amount of training occurring.
- Cooperative agreements to create a management team of scientific and regulatory experts.
- Long-term land maintenance, monitoring of resources and trends, study and analysis.
- Recovery plans for species and habitats identified for improvement.
- Consultation with Federal and State agencies charged with oversight of the Endangered Species Program before any actions that may affect state and federal-listed species habitat.
- Reduction of adverse impacts to the maximum extent possible, including consideration for the relocation of the activity or encouraging only those activities that result in meeting a habitat management goal.
- Habitat management activities designed to promote protection and restoration of native habitat types.

7. Wildlife Management Performance Standards

7.1 Native wildlife habitats and ecosystems management will focus on the following:

- Protecting rare and endangered species, and,
- Maintaining biodiversity.

7.2 Hunting, recreation and educational trips must be approved, scheduled, planned, and supervised through Range Control.

7.3 Any activity or use will prioritize protection of life, property, and natural resource values at the boundaries of the Camp Edwards Training Area where wildlife interfaces with the surrounding built environment.

7.4 Wildlife management will include the following actions, specific to the species targeted for management:

- Development and implementation of a plan to monitor hunting of game species.
- Planning for multi-use objectives for recreation and hunting that incorporate public input and recommendations.
- Development of suitable monitoring programs for federal and state-listed species, and regular exchange of information with the Natural Heritage and Endangered Species Program.

8. Air Quality Performance Standard

8.1 All uses and activities will be responsible for compliance with both the State Implementation Plan for Air Quality and the Federal Clean Air Act.

8.2 Air quality management activities will include air sampling if required by regulation of the activity.

9. Noise Management Performance Standards

9.1 Noise management activities shall conform to the Army's Environmental Noise Management Program policies for evaluation, assessment, monitoring, and response procedures.

10. Pest Management Performance Standards

10.1 Each user will develop and implement an Integrated Pest Management Program to control pest infestations that may include outside contracting of services. Non-native biological controls should not be considered unless approved by federal and state agencies.

10.2 Each user will be held responsible for management of pests that threaten rare and endangered species, or are exotic and invasive species, Invasive plant species that may be considered pest species are those defined by the United States Fish and Wildlife Service and the Massachusetts Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife office. Site-specific analysis will be performed before implementation of any proposed pest management plans.

10.3 Pest vegetation control must be balanced against environmental impact and any proposed pest management activities, including the use of herbicides and mechanical methods, within rare species habitat areas must be approved by the Natural Heritage and Endangered Species Program, or in the case of federally listed species, by the United States Fish and Wildlife Service.

10.4 Only herbicide formulations approved by the United States Environmental Protection Agency, the Department of Agriculture, the agency managing the user, and the Commonwealth of Massachusetts may be applied.

10.5 Herbicides and pesticides will not be applied by aerial spraying unless required by emergency conditions and approved under applicable state and federal regulations.

11. Fire Management Performance Standards

11.1 All activities and uses shall manage, prevent, detect, and suppress fires on the Camp Edwards Training Area in coordination with the local and state fire services and natural resource managers in the Environmental & Readiness Center.

11.2 Prescribed bums will be used as a habitat management and fire prevention tool. Prescribed burns will be used to reduce natural fire potential and create or maintain diverse and rare species habitat.

11 .3 Pre-suppression activities will include strategic firebreaks and other management of vegetation in high risk and high-incidence areas. The Integrated Natural Resource Management Plan and Fire Management Plan will be consulted for proposed actions.

11.4 Other than the above, no open fires are allowed.

12. Stormwater Management Performance Standards

12.1 All stormwater facilities shall comply with the State Department of Environmental Protection Guidelines for Stormwater Management, including Best Management Practices and all other applicable standards for control and mitigation of increased storm water flow rates and improvement of water quality.

12.2 All increases in stormwater runoff will be controlled within the user's property.

12.3 No new stormwater discharges will be made directly into wetlands or wetland resource areas.

13. Wastewater Performance Standards

13.1 All wastewater and sewage disposal will be in conformance with the applicable Federal and Massachusetts Department of Environmental Protection agency regulations.

14. Solid Waste Performance Standards

14.1 All solid waste streams (i.e., wastes not meeting the criteria for hazardous wastes) will be monitored and managed to substitute, reduce, recycle, modify processes, implement best management practices, and/or reuse waste, thereby reducing the total tonnage of wastes,

14.2 All users will be held responsible for collection, removal and disposal outside of the Camp Edwards Training Areas of solid wastes generated by their activities.

14.3 All users must handle solid wastes using best management practices to minimize nuisance odors, windblown litter, and attraction of vectors.

14.4 No permanent disposal of solid waste within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15. Hazardous Materials Performance Standards

15.1 Where they are permitted, use and application of hazardous materials shall be otherwise minimized in accordance with pollution prevention and waste minimization practices, including material substitution.

15 .2 No permanent disposal of hazardous wastes within the Groundwater protection Policy area/Camp Edwards field training areas will be permitted.

15.3 Fuel Management

15.3.1 Spill Prevention, Control, and Countermeasure Plan, is in place to reduce potential for a release. Camp Edwards Spill Response Plan is in place to respond to a release if an event should occur. All users will comply with these plans at the Camp Edwards Training Area.

15.3.2 If found, non-complying underground fuel storage tanks will be removed in accordance with state and federal laws and regulations to include remediation of contaminated soil.

15 .3.3 No storage or movement of fuels for supporting field activities, other than in vehicle fuel tanks, will be permitted except in approved containers no greater than five gallons in capacity.

15.3.4 New storage tanks are prohibited unless they meet the following requirements:

- Are approved for maintenance heating, or, permanent emergency generators and limited to propane or natural gas fuels.
- Conform to the Groundwater Protection Policy and applicable codes.

15.4 Non-fuel Hazardous Material Storage

15.4 .1 No storage above those quantities necessary to support field training activities will be allowed within the Camp Edwards Training Area except where necessary to meet regulatory requirements, and where provided with secondary containment.

15.4.2 When required by applicable regulation, the user shall implement a Spill Prevention, Control and Containment/Emergency Response or other applicable response plan.

16. Hazardous Waste Performance Standards

16.1 All uses shall comply with applicable local, state, and federal regulations governing hazardous waste generation, management, and disposal (including overlays relative to Wellhead Protection, Zone II' s within the Cantonment Area) .

16.2 Accumulations of hazardous waste shall be handled in accordance with regulations governing accumulation and storage.

16.3 Existing facilities must implement pollution prevention and waste minimization procedures (process modifications, material substitution, recycling, and best management practices) to minimize waste generation and hazardous materials use.

16.4 Occupants and users will be held responsible for removing all solid or hazardous wastes generated during the period of use/tenancy/visitation upon their departure or in accordance with other applicable or relevant regulations.

16.5 Remedial activities undertaken under the Installation Restoration Program, the Impact Area Groundwater Study Program, the Massachusetts Contingency Plan, or other governing remediation programs are exempt from additional regulation (e.g., waste generation volume limits). Removal, storage, and disposal of contaminated material are required to comply with all state, and federal regulations.

16.6 Post-remedial uses and activities at previously impacted sites will be allowed in accordance with terms and conditions of the applicable regulations.

16.7 All hazardous wastes will be transported in accordance with federal Department of Transportation regulations governing shipment of these materials.

16.8 Transport shall reduce the number of trips for transfer and pick-up of hazardous wastes for disposal to extent feasible. Tills may include planning appropriate routes that minimize proximity to sensitive natural resource areas, and reducing internal transfers of material, including transfers from bulk storage tanks to drums, tankers, carboys, or other portable containers or quantities.

16.9 No permanent disposal of hazardous wastes within the Groundwater Protection Policy area/Camp Edwards field training areas will be permitted.

17. Vehicle Performance Standards

17.1 Vehicles within the Camp Edwards Training Area will be limited to the existing improved and unimproved road system except where required for natural resource management or property maintenance or where off-road activity areas are located and approved by the Environmental and Readiness Center in consultation with the Massachusetts Division of Fisheries and Wildlife.

17.2 Unimproved, established access ways will be limited to use by vehicles in accordance with soil conditions as described in the Soil Conservation Performance Standards.

17.3 The number of military and civilian vehicles within the Camp Edwards Training Area will be controlled using appropriate scheduling and signage.

18. General Use and Access Performance Standards

18.1 General User Requirements. Requirements that will apply to all users, both public and private, in the Camp Edwards Training Area include the following:

- All acts that pollute the groundwater supply are prohibited.
- No litter or refuse of any sort may be thrown or left in or on any property.
- All users will be held responsible for providing, maintaining, and re- moving closed-system, sanitary facilities necessary for their use and activity.
- No person shall wade or swim in any water body except for activities approved by the Massachusetts National Guard including remediation, scientific study, or research.
- Vehicles may only be driven on roads authorized and designated for such use and parked in designated areas, and may not cross any designated wetland.
- Public users may not impede the military training activities.

18.2. Civilian Use Manual. To guide public conduct on the Massachusetts Military Reservation, a Civilian Use Manual will be prepared and periodically updated. All civilian users will obtain and follow this Manual.

18.3. Siting and Design Performance Standards

18.3.1 New or expanded buildings should not be proposed within the Camp Edwards Training Areas, with the following exceptions:

- Buildings to support allowed training, operations and activities, including upgrading of those facilities currently in place,
- Buildings used for the purposes of remediation activities,
- Buildings used for the purposes of development, operation and maintenance of water supplies,
- Buildings used for the purpose of natural resource and land management.

19. Range Performance Standards

19.1. All operational ranges including but not limited to small arms ranges (SAR) shall be managed to minimize harmful impacts to the environment within the Upper Cape Water Supply Reserve. Range management at each range shall include to the maximum extent practicable metal recovery and recycling, prevention of fragmentation and ricochets, and prevention of sub-surface percolation of residue associated with the range operations. Camp Edwards shall be held responsible for the implementation of BMPs by authorized range users, including collection and removal of spent ammunition and associated debris.

19.2. Small arms ranges shall only be used in accordance with approved range plans. These plans shall be designed to minimize to the maximum extent practicable the release of metals or other contaminates to the environment outside of specifically approved containment areas/systems. Occasional ricochets that result in rounds landing outside of these containment areas is expected and every effort to minimize and correct these occurrences shall be taken. Failure to follow the approved range plans shall be considered a violation of this EPS.

19.3. All operational SARs shall be closely monitored by the Massachusetts National Guard to assess compliance of the approved range plans as well as the implementation and effectiveness of the range specific BMPs.

19.4. Camp Edwards/Massachusetts National Guard Environmental and Readiness Center shall staff and request appropriate funding to support its SAR management plans.

19.5. All users must use and follow Camp Edwards' Range Control checklists and procedures to:

- Minimize debris on the range (e.g. shell casings, used targets)
- Minimize or control residues on the ranges resulting from training (e.g., unburned constituents, metal shavings from the muzzle blast)
- Ensure the range is being used for the designated purpose in accordance with all applicable plans and approvals

19.6. Camp Edwards is responsible for following range operation procedures and maintaining range pollution prevention systems. Range BMPs shall be reviewed annually for effectiveness and potential improvements in their design, monitoring, maintenance, and operational procedures in an effort to

continually improve them. Each year the annual report shall detail the range-specific activities including, but not limited to, the number of rounds fired, number of shooters and their organization, and the number of days the range was in use. The annual report will also detail active SAR groundwater well and lysimeter results, as well as any range maintenance/management activities that took place that training year and the result of such activities, i.e. lbs of brass and projectiles recovered and recycled, etc. The Massachusetts National Guard shall provide regular and unrestricted access for the EMC to all its data and information, and will provide immediate access to environmental samples from the range, including range management and monitoring systems and any other applicable activities operating on the ranges.

19.7. Range plans and BMPs for training areas shall be reviewed and/or updated at least every three years. Management plans for new and upgraded ranges shall be in place prior to construction or utilization of the range. Range plans, at a minimum, will address long-term sustainable use, hydrology and hydrogeology, physical design, operation, management procedures, record keeping, pollution prevention, maintenance, monitoring, and applicable technologies to ensure sustainable range management. Range plans shall be integrated with other training area planning processes and resources.

19.8. The Massachusetts National Guard shall establish procedures for range maintenance and where applicable, maintenance and/or clearance operations to permit the sustainable, compatible, and safe use of operational ranges for their intended purpose within the Upper Cape Water Supply Reserve. In determining the frequency and degree of range maintenance and clearance operations, the Massachusetts National Guard shall consider, at a minimum, the environmental impact and safety hazards, each range's intended use, lease requirements, and the quantities and types of munitions or simulated munitions expended on that range.

APPENDIX M – WATERS OF THE U.S./WETLAND PROTECTION

Wetlands are protected as a subset of the "waters of the United States" under Section 404 of the CWA. The term "waters of the United States" has broad meaning under the CWA and incorporates deep water aquatic habitats and special aquatic habitats (including wetlands). Jurisdictional waters of the United States are areas regulated under the CWA and also include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, vernal pools, and "other" waters that if degraded or destroyed could affect interstate commerce.

1.1 EXISTING CONDITIONS

A relatively small proportion, 0.39 percent, of Camp Edwards is covered by surface water. As a result, it is especially important to protect the wetlands and surrounding buffers throughout the training site. Any training activities that are potentially destructive to surface water resources of Camp Edwards are prohibited within the wetland habitats and their 100-foot buffers (Massachusetts General Law c. 131 §40, 310 CMR 10) (MANG 2001). Any land use that is proposed to occur within wetlands or their buffers must be reviewed by Camp Edwards Operations and Natural Resource Office (Camp Edwards Regulation 385-63, Range Safety), MassDEP's Wetlands Unit, and the MassWildlife, including the NHESP, at least 45 days before the activity is scheduled to take place.

Although Massachusetts General Law defines a 100-foot buffer to protect wetlands and vernal pools, certain species of wildlife, such as amphibians or damselflies and dragonflies, might require a greater area of upland habitat surrounding wetlands. For instance, adult state-listed rare damselflies and dragonflies that inhabit Camp Edwards may roost in trees up to 250 or 1,000 meters (825 or 3300 feet), respectively, from a wetland. Therefore, aside from protecting the wetland that is inhabited by the damselfly or dragonfly larvae, it is also necessary to consider the upland habitat requirements of the adults. Establishing a buffer that exceeds 100 feet around a particular wetland to protect the natural community or even a single species of plant or animal does not necessarily restrict all activities from taking place. Rather, the apparent threats to the wetland or species should be identified and minimized either altogether or during important activity periods. Activity near most wetlands on Camp Edwards, with the exception of vehicle travel on existing roads and remediation projects, usually does not occur within areas that often exceed the required 100-foot buffer. A 500-foot seasonal buffer has been established for all wetlands per the Final Draft of the Master Plan/Area-Wide Environmental Impact Report (MANG 2001). This buffer restriction is in place from 1 March through 15 June.

Although the Sikes Act requires no net loss of wetlands on Camp Edwards, any loss of wetlands is unacceptable to the MAARNG. If a portion of a wetland or its buffer is negatively impacted due to an activity, it must be restored to the condition prior to the disturbance. An assessment will be made to determine whether natural recovery will be sufficient or if a greater effort is required. For instance, if a vehicle accidentally travels on the edge of a road within a wetland buffer and impacts the vegetation, natural recovery may be appropriate. However, if past activities such as the construction of roads or a land bridge has resulted in erosion and sedimentation of a wetland, a restoration plan will be created as an LRAM project to restore the site to its historic condition. The recovery of the wetland will be monitored using RTLA and

other survey methods to determine if the efforts were successful. If recovery was not successful, restoration efforts will continue until the site has fully recovered.

Wetlands are protected as a subset of the "waters of the United States" under Section 404 of the CWA. The term "waters of the United States" has broad meaning under the CWA and incorporates deep water aquatic habitats and special aquatic habitats (including wetlands). Jurisdictional waters of the United States are areas regulated under the CWA and include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, vernal pools, and "other" waters that if degraded or destroyed could affect interstate commerce.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Wetland and waters of the United States resources at Camp Edwards are scarce, representing less than 1 percent of the installation. However, wetland protection is essential, and activities that have the potential to impact wetland resources at Camp Edwards are prohibited within wetlands and within a 100-foot wetland buffer under Massachusetts General Law c. 131 §40, 310 CMR 10. Land use proposed in wetlands or wetland buffers requires installation review as well as compliance with local, state, and federal regulations.

The following goals apply to WP projects listed for Camp Edwards in Appendix D, Table D-2.

WP GOAL 1: ENSURE WETLAND PROTECTION, RESTORATION, AND COMPLIANCE WITH SECTIONS 404 AND 401 OF THE FEDERAL CLEAN WATER ACT AND MASSACHUSETTS GENERAL LAW C. 131 § 40, 310 CMR 10.

- **WP OBJECTIVE 1.1:** Implement measures to protect, promote, and maintain functional wetlands at Camp Edwards in accordance with wetland regulations while allowing for mission activities and natural resource management.

APPENDIX N – GROUNDS MAINTENANCE

1.1 EXISTING CONDITIONS

Ground maintenance activities are overseen by the Roads and Grounds Crew of the Division of Facilities and Engineers. Common grounds maintenance activities include road grading, mowing, fire line/break maintenance, erosion control, and target maintenance and development. These activities are undertaken to maintain and improve the overall biodiversity and ecosystem health and to maintain training lands for the mission. Currently, measures to avoid or minimize impacts to nesting birds, reptiles, and amphibians are implemented on a project-by-project basis and include coordination, frequent maintenance of maintained areas (primary roadsides, ranges, and lawns) in order to avoid bird nesting. Camp Edwards is currently developing a mowing and maintenance plan which will cover timing of mowing, mowing BMPs, off-limits areas, and seasonal restrictions.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Grounds maintenance personnel perform maintenance activities at Camp Edwards that serve to maintain roads and trails, reduce pest presence, and maintain vegetation. Grounds maintenance manages mowing and other mechanical vegetation control measures that are used to support habitat and ecosystem objectives at Camp Edwards.

The following goals apply to GM projects listed for Camp Edwards in Appendix D, Table D-2.

GM GOAL 1: MANAGE GROUNDS ON-BASE TO PROMOTE NATURAL HABITAT AND NATIVE SPECIES

- **GM OBJECTIVE 1.1:** Provide support to grounds maintenance in ongoing habitat management activities, including mowing and other vegetation management as well as erosion control and road maintenance.

- **GM OBJECTIVE 1.2:** Through work with the grounds maintenance program, complete management activities that minimize degradation of natural resources and promote the restoration of diverse habitats at Camp Edwards.

- **GM OBJECTIVE 1.3:** Complete grounds maintenance to support ecosystem health and restoration by coordination with objectives and projects in fish and wildlife management, management of threatened and endangered species, wildland fire management and integrated pest management. This is achieved through the following projects: FWM 4.1.1, 4.1.3, TE 1.2.3, 2.1.4, 3.2.5, 3.2.8, 3.2.9, FM 1.1.1, 1.1.2, WFM 2.2.2, IPM 1.1.1, 1.1.3.

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APPENDIX O – FOREST MANAGEMENT

1.1 EXISTING CONDITIONS

Although there is no income-generating forestry program at Camp Edwards, forests are managed to support a mix of successional forest classes to provide diverse wildlife habitat. Forests are also managed to reduce fuel loads and fire risk in support of the protection of resources and public safety. Timber is removed by selective thinning at a cost of approximately $2,000 per acre at Camp Edwards. A forest inventory was completed in 2003 as part of the RTLA program, and environmental monitoring plots were established at 224 locations across Camp Edwards (Graves et al. 2005).

Forests at Camp Edwards are monitored to inventory health and address any management issues, and stands are assessed to determine what management (selective thinning, prescribed burning, etc.) is needed to maintain the desired successional state or to support training activities. Snags are left in forested areas unless they pose a threat to human safety.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Forest management at Camp Edwards is undertaken not as a saleable resource, but to promote diverse successional pitch pine and scrub oak habitats. Forest management includes timber harvest and selective thinning. Forest thinning is also part of mitigation measures undertaken for recent projects at Camp Edwards. Areas of past forest management are shown on Figure O-1. These actions were implemented with the primary objectives of improving pine barrens habitat and soldier training. Most of the future forest management over the next 5 years will be focused within the pine barrens and grassland mitigation focal areas.

The following goals apply to FM projects listed for Camp Edwards in Appendix D, Table D-2.

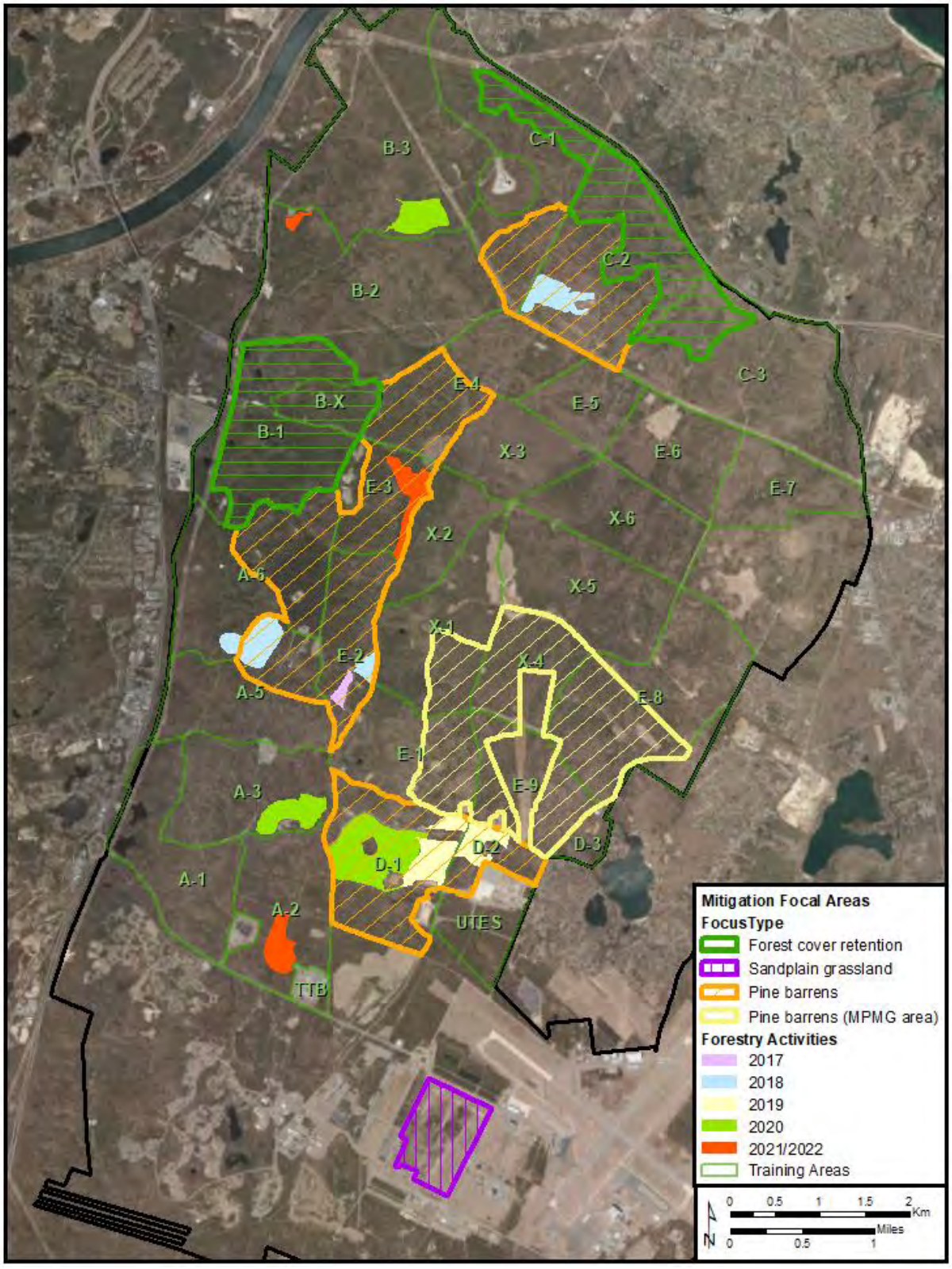
FM GOAL 1: MANAGE FOREST STANDS TO SUPPORT NATIVE SPECIES AND PROMOTE A DIVERSITY OF SUCCESSIONAL PITCH PINE – SCRUB OAK HABITATS.

- **FM OBJECTIVE 1.1:** Manage forested habitats for Mitigation Bank actions through selective thinning and harvest to support habitat diversity, promote rare species, including moths and box turtles, minimize fuel loads, and reduce pine beetle risk. This is achieved through the projects below and through the following projects: FWM 4.1.1, 4.1.3, TE 1.2.3, 2.1.4, WFM 2.2.2.

FM GOAL 2: IMPLEMENT FORESTRY PRACTICES THAT SUPPORT FOREST MANAGEMENT NEEDS AT CAMP EDWARDS.

- **FM OBJECTIVE 2.1:** Determine forest management practices that most efficiently address forest management issues and habitat restoration and conservation needs.

Figure O-1. Forest Management Focal Areas, 2017-2022



APPENDIX P – WILDLAND FIRE MANAGEMENT

1.1 EXISTING CONDITIONS

Wildland fires are described in AR 200-1 as "any non-structural fire that occurs on unimproved grounds. This includes wildfires and prescribed fires." Under AR 200-1, wildland fire management includes reducing wildfire potential through management; development of an Integrated Wildland Fire Management Plan (IWFMP); providing adequate training and resources to personnel involved in wildland fire management; and ensuring that only qualified personnel conduct prescribed burns. Wildland fire management also plays a large role in supporting habitat diversity and listed species at Camp Edwards.

Prescribed Fire at Camp Edwards

In the past, artillery fire often caused brush fires in the Impact Area of Camp Edwards. This disturbance maintained the rare scrub oak shrubland community of the Impact Area. Since artillery fire no longer occurs on most parts of Camp Edwards, the prescribed burn program serves to manage this sensitive natural community. Burn prescriptions have been developed for training areas outside of the Impact Area on Camp Edwards and prescribed burning has been used to successfully improve large areas of habitat while also improving training land condition and reducing wildfire hazard. Due to the high complexity of reintroducing fire to the impact area the current strategy through the foreseeable future is to manage the buffer of the impact area and surrounding training areas with prescribed fire and mechanical (e.g., mastication and whole tree harvest) treatments. Suppression alone will not eliminate the risk for wildfires. Although fires may occur less frequently, they will inevitably occur, and at intensities that will defy control and threaten human resources, both on Camp Edwards and on adjacent public and private property. Prevention, detection, and suppression of wildfires should remain a priority for local fire control organizations, but resource managers must, at the same time, actively work to reduce fuel loads in areas where flammable fuels have accumulated as a result of past management.

Camp Edwards environmental management staff, and JBCC staff in cooperation with MassWildlife, the Massachusetts Bureau of Fire Control, the University of Massachusetts, the Nature Conservancy, and other non-profits, have learned much from past efforts to employ prescribed fire at Camp Edwards. The program has resulted in the burning of thousands of acres since 1983 and has the support of local fire chiefs, and conservation and land management agencies/organizations. In recent years, Camp Edwards has targeted several hundred acres per year for burning. Lands burned from 1982 to 2015 are shown on Figure P-1. Burning is completed in delineated Fire Management Blocks, which are based on factors such as vegetation composition/fuel type, topographic features, training area configurations, reservation boundaries, desired ecological effects, safety for people and property, common management objectives at the local scale, and other management constraints (Figure P-2). Block descriptions, dominant management objectives, and pre-selected strategies to accomplish zone-specific targets are provided in the Integrated Fire Management Plan (Component Plan A).

Awareness of smoke production, transport, and effects in conjunction with knowledge and implementation of control strategies maximizes the effectiveness of using fire as a tool. The purpose of smoke management on Camp Edwards is to prevent health and safety hazards by minimizing the amount of smoke entering sensitive areas (i.e., populated areas, hospitals, nursing homes, etc.), to avoid significant deterioration of air quality, and to eliminate visibility impacts on roadways or runways. Compliance with laws and regulations under the Federal Clean Air Act and Massachusetts Clean Air Act is foremost in all fire management planning and implementation. Smoke management strategies employed at Camp Edwards include:

- Avoidance—using meteorological conditions when planning burns to avoid impingement of smoke into smoke sensitive area.

- Dilution—controlling the amount of emissions for dispersion to ensure tolerable concentrations of smoke in designated areas.

- Emissions reduction—using techniques to minimize the smoke output per unit area and decrease the contribution to regional haze as well as intrusions into smoke-sensitive areas.

These parameters serve as a guide to fire planners and managers when identifying the proper control strategies necessary for local scale management realization.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Camp Edwards supports fire dependent ecosystems resulting through their interaction with fire through time. Successful wildland fire management can be used as a tool to maintain a pine barrens mosaic of various successional stages that promotes a diversity of ecosystems and supports rare species at Camp Edwards. Wildland fire management also aids in preventing an accidental fire that may pose a risk to public safety and nearby communities and reduces fuel loads. Prescribed burns are a frequently used and important management tool at Camp Edwards. A current IWFMP is necessary to ensure appropriate fire management oversight.

The following goals apply to WFM projects listed for Camp Edwards in Appendix D, Table D-2.

WFM GOAL 1: EFFECTIVELY MANAGE THE FIRE MANAGEMENT COMPONENT AS A CRITICAL COMPONENT WITHIN NR-ITAM.

- **WFM OBJECTIVE 1.1:** Update and maintain a current IWFMP that sufficiently provides for programmatic planning for wildland fire operations (prescribed and wild), resource management objectives, compliance with wildland fire crew standards, and facilities management to provide for the safety of resources within and surrounding Camp Edwards.

- **WFM OBJECTIVE 1.2:** Fund and support a dedicated Wildland Fire Program Coordinator Position within the NR-ITAM Program (cost-share between CFMO and Environmental Affairs).

- **WFM OBJECTIVE 1.3:** Continue to develop collaborative working relationships with JBCC Fire Department, Camp Edwards, and the CFMO Fire and Emergency Services lead to ensure wildland fire preparedness.

WFM GOAL 2: IMPLEMENT AND SUPPORT WILDLAND FIRE MANAGEMENT PRACTICES AT CAMP EDWARDS FOR HABITAT MAINTENANCE.

- **WFM OBJECTIVE 2.1:** Fund annual fire training courses to ensure fire management personnel are prepared and knowledgeable about safety and prescribed burn practices.

- **WFM OBJECTIVE 2.2:** Implement prescribed burning to support habitat maintenance and habitat mitigation at Camp Edwards.

- **WFM OBJECTIVE 2.3:** Ensure sufficient program resourcing through equipment and personnel needs to support prescribed burn operations.

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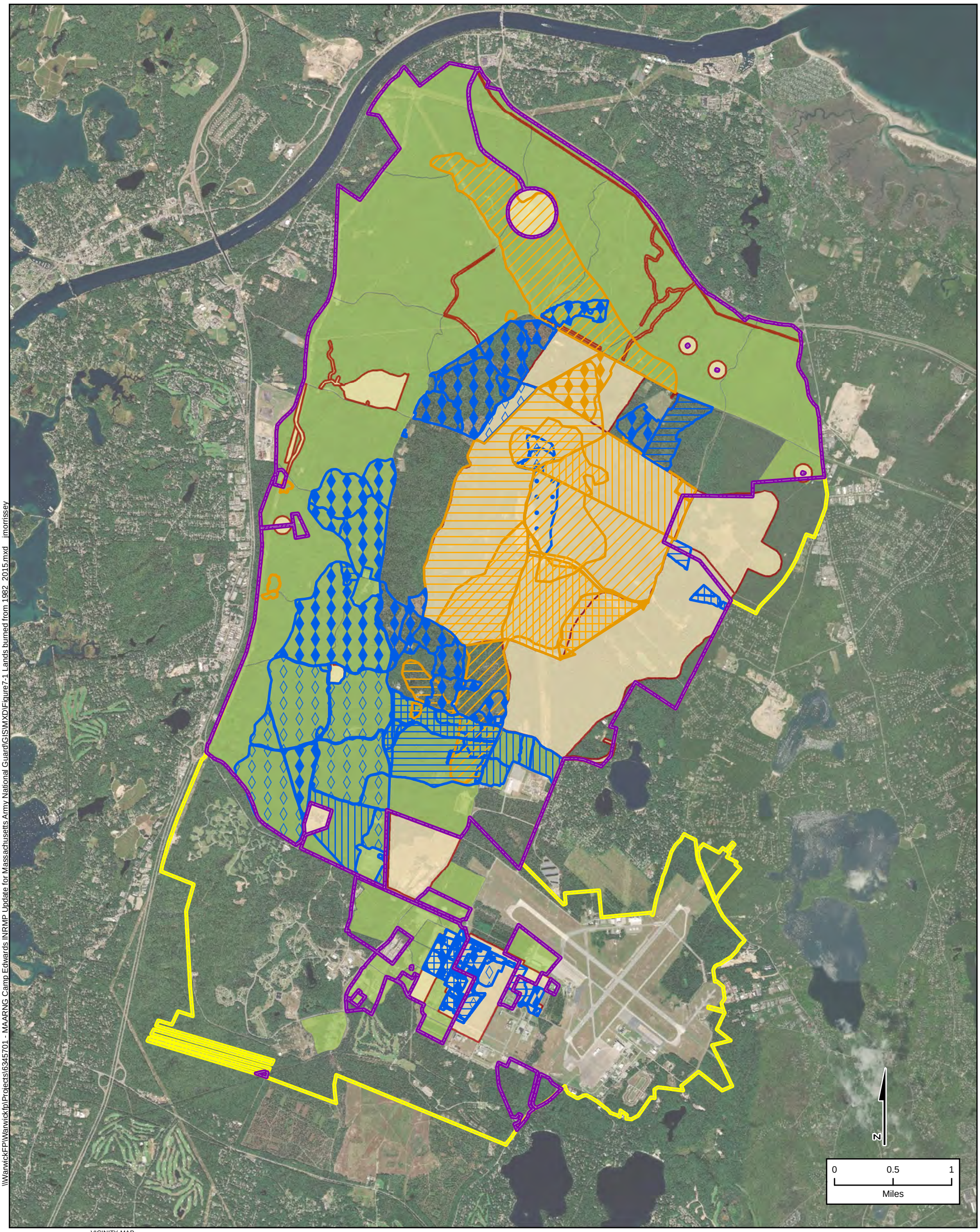

VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary
- Training Areas
- Primary Ordinance Hazard Areas

Burn History

- '15 - '19; Rx
- '10 - '14; Rx
- '05 - '09; Rx
- '00 - '04; Rx
- '90 - '94; Rx
- '15 - '19; Wild
- '10 - '14; Wild
- '05 - '09; Wild
- '00 - '04; Wild
- '90 - '94; Wild
- '85 - '89; Wild
- '80 - '84; Wild

Figure P-1
Lands burned from 1982-2015
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

\\WarwickFP\Warwickfp\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure7-1 Lands burned from 1982_2015.mxd jmorrissey

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B-12
B-11
C-13
C-14
B-10
C-15
RAW1
B-9
RAN1
C-16
RAW2
IA3
RAN2
B-8
RAN3
BA-5
RAW3
IA2
IA6
IA1
RAE1
B-7
IA5
A-6
RAE2
RAW4
IA4
IA8
IA7
RAE3
A-5
BA-4
RAW5
RAS1
RAS2
RAE4
A-0
A-3
A-4
BP1
BP2
BA-6
A-2
A-1
BA-1
BA-3
3600 Area
3500 Area
BA-2
1800 Area
1600 Area
1700 Area
2800 Area
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3400 Area
1400 Area
5200 Area
1300 Area
1000 Area
5500 Area
1200 Area
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N
0
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1
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\\WarwickFP\Warwickfp\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure7-2 Fire Management Unit Map.mxd jmorrissey

VICINITY MAP

Legend

- Installation Boundary
- Camp Edwards Boundary

Burn Units

- Managed Grassland
- Dudded - Impact Area
- Dudded - Experimental Ranges
- Off limits - M.B. Sportsmen Club
- Primary IA Buffer
- Secondary IA Buffer
- Other Burn Units
- Buildings

Figure P-2
Fire Management Units
Camp Edwards Training Site
Cape Cod, Massachusetts

Map Date: 5/14/2020
Source: ESRI, 2011
Projection: WGS_1984_UTM_Zone_19N

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APPENDIX Q – INTEGRATED PEST MANAGEMENT PROGRAM

DoDI 4150.7, *Pest Management Program*, is a DoD policy to establish and maintain safe, effective, and environmentally sound IPM programs to prevent or control pests and disease vectors that could adversely impact readiness or military operations by affecting the health of personnel or damaging structures, material, or property. The policy set Measures of Merit for pest management, which require each installation to develop an IPM Plan, reduce the amount of pesticide use on the installation, and certify all pesticide applicators. The IPM Plan for Camp Edwards is provided as Component Plan B.

1.1 EXISTING CONDITIONS

The Integrated Pest Management (IPM) Program for Camp Edwards is described in the IPM Plan for MAARNG, which was last updated in 2011 and is currently undergoing revisions (Component Plan B). The IPM Plan is a comprehensive document used to describe pest management activities performed by and for the MAARNG. The contents of the plan apply to all activities and individuals working, residing, or otherwise doing business on MAARNG installations, and are implemented to the maximum extent possible. Pest management operations are conducted in a manner respectful to the health and safety of personnel and the environment. The IPM Plan describes the organization's pest management requirements, outlines the resources necessary for surveillance and control, lists and the administrative, safety, and environmental requirements of the program. The program requires state-certified contract pest management technicians to control pests. Pests that are discussed in the plan include cockroaches and other crawling insects (e.g., crickets, earwigs, and ants), medically important pests such as ticks, mosquitoes, rodents, other vertebrate pests, and various plant pests. Without control, these pests could interfere with the military mission, damage real property, increase maintenance costs, and expose installation personnel to diseases.

1.1.1 Invasive Plant Species

Invasive, non-native species and noxious weeds have the capability to significantly impact native vegetation, change fuel loads and flammability, and outcompete native species. Management of undesirable species is necessary to maintain military training areas in usable condition. In addition, uncontrolled animal pests can become health hazards, which could threaten the military mission. Non-native invasive plant species are relatively uncommon throughout Camp Edwards. A roadside survey of the training area, conducted by the Senior Environment Corps, was conducted from 2003 to 2004, and a Vegetation Management Plan was developed for Camp Edwards in 2017 to catalog invasive species cover in areas that support rare plants (Wilkinson Ecological Design 2018). Non-native species are also cataloged through annual RTLA surveys, as well as other biological surveys completed on the installation.

Plans for removal of exotic or invasive species from Camp Edwards are coordinated with appropriate representatives from the NHESP to reduce risk to state-listed rare plant species. Prescribed fire and firebreak maintenance play an important role in control and management of invasive plant species on Camp Edwards. Invasive plant species documented on Camp Edwards that potentially pose a threat to native plant communities are described in Appendix F, Section 1.2. Management of invasive species at Camp Edwards includes the following activities:

- Herbicide, burning, and mechanical treatment to reduce the presence of invasive species as well as other accepted Best Management Practices (BMPs)

- Inventory and monitoring of non-native plants to ensure appropriate management actions are undertaken.

1.1.2 Integrated Pest Management Principles

Common pests at Camp Edwards include cockroaches, mosquitos, ants, moths, rodents, raccoons, feral cats, and birds such as starling and pigeons. The four basic principles described below are the emphasis of IPM and are indicative of the philosophy of the MAARNG. While any one of these methods may solve a pest problem, often several methods are used concurrently, particularly if long-term control is needed. For example, screens may be used to prevent mosquitoes from entering buildings, eliminating artificial breeding sites will control larval mosquito habitat, and pesticides may be used to kill adult mosquitoes. Screens will protect people inside but do little to keep people from being bitten outdoors. Larval control may eliminate mosquito breeding on the installation but will not prevent adult insects from flying to the installation from surrounding areas. Chemicals will kill most flying mosquitoes. Although chemical control is an integral part of IPM, non-chemical control is stressed. Chemical control is almost always a temporary measure and, in the long run, more expensive. Non-chemical control, which may initially be more expensive than chemicals, will usually be more cost effective in the long run. Non-chemical controls also have the added advantage of being nontoxic, thereby reducing potential risk to human health and the environment. Management of pests at Camp Edwards is completed in accordance with the IPM Plan and IPM principles. Actions include the following:

- Mechanical and Physical Control—altering the environment in which a pest lives or removing the pest from the environment. Examples include traps and barriers to entry.

- Cultural Control—this involves manipulating environmental conditions to suppress or eliminate pests, for example by using vegetation that would not support populations of defoliating insects.

- Biological Control—using predators, parasites, or disease to control pest populations. This requires review from MassWildlife prior to implementation. Examples of management include parasitic wasps to control gypsy moths.

- Chemical Control—Once considered the most effective control, management using chemicals has been reserved in recent years to be used only when other methods are not successful. When applied to plants, chemical control, especially when integrated with mechanical methods, may be the most effective and ecologically sound method of controlling invasive exotic species.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Native plant and animal communities have been adversely impacted by development and the introduction of non-native species. Non-native species are those plants or animal species that were not present during European settlement. Due to aggressive growth habits of many non-native species, the species have become invasive and outcompete the native plants and animals. "An invasive species is defined as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (EO 13112) (USDA 2016). Invasive species put native plants and animals at risk. Invasive plants, which can be both native and non-native, result in the loss of diversity within a local plant community.

The following goals apply to IPM projects listed for Camp Edwards in Appendix D, Table D-2.

IPM GOAL 1: CONTROL NON-NATIVE AND INVASIVE SPECIES THROUGHOUT THE INSTALLATION

- **IPM OBJECTIVE 1.1:** Ensure that the INRMP is consistent with and supports the principles of the Camp Edwards IPM Plan, and that the control of invasive and pest species is undertaken in a manner to maximize safety and minimize pesticide use.

- **IPM OBJECTIVE 1.2:** Ensure that the IPM Plan is current and addresses invasive species management issues at Camp Edwards.

- **IPM OBJECTIVE 1.3:** Conduct invasive species surveys to include nuisance and noxious species found on the base.

IPM GOAL 2: COORDINATE AND GUIDE FACILITIES PEST MANAGEMENT ACTIVITIES IN COMPLIANCE WITH THE IPM PLAN

- **IPM OBJECTIVE 2.1:** Ensure that the INRMP is consistent with and supports Camp Edwards facilities management needs relative to plant and animal pests.

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APPENDIX R – CULTURAL RESOURCES PROTECTION

1.1 EXISTING CONDITIONS

Camp Edwards has an ICRMP (Component Plan C), which guides management of cultural resources at the installation. The installation's ICRMP identifies goals and objectives for cultural resource management. The overall goal of the program includes planning and integration of cultural resource management with installation plans, projects, and programs and in support of military missions.

Past consultation has been completed with the two federally recognized tribes in eastern Massachusetts, the Wampanoag Tribe of Gay Head (Aquinnah) and the Wampanoag Tribe of Mashpee. These tribes are permitted to collect flora and fauna at Camp Edwards for cultural use. A 24 May 2016 letter from the Mashpee Wampanoag to Otis Air National Guard Base identifies the culturally significant natural resources checklist (Appendix C).

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Cultural resource protection will be addressed through the Cultural Resources Management Program and the ICRMP. However, the natural resources of Camp Edwards are culturally important to our Tribal partners. Additionally, there is significant and mutual benefit to the partnership between MAARNG and the Mashpee Wampanoag Tribe.

The following goals apply to CR projects listed for Camp Edwards in Appendix D, Table D-2.

CR GOAL 1: ENSURE NATURAL RESOURCES PROJECTS SUPPORT A CULTURALLY RELEVANT AND SUSTAINABLE LANDSCAPE AND CULTURAL RESOURCES PROTECTION IS CONSIDERED IN PROJECT PLANNING.

- **CR OBJECTIVE 1.1:** Consistently incorporate cultural considerations into program management and project planning.

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APPENDIX S – PUBLIC OUTREACH

1.1 EXISTING CONDITIONS

Opportunities for public outreach are limited at Camp Edwards due to the high security of the installation. Environmental Awareness serves to educate the public and garner their support by effectively communicating the nature of the military mission at each installation and the level of natural resources management at the installation. Newspaper and digital media picture features enhance understanding of the natural resources and an easily accessible and understandable resource for the public. Specific examples of articles include natural communities on the installation (forests, wetlands, etc.), native species, and the importance of prescribed burning. Stories about activities at Camp Edwards have also been featured on social media outlets for the MAARNG. Camp Edwards personnel have participated in public outreach and community meetings and have provided guided tours on the installation with outside users, including school groups, boy scouts, and nonprofit organizations. Past management goals for public outreach have included:

- Providing an understanding of the Camp Edwards natural resources program to the training site and surrounding communities
- Providing general conservation education to the Camp Edwards community
- Supporting community and youth groups with educational tours
- Using available media effectively in public education.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

Maintaining a quality public outreach program is dependent on military mission, proper management of natural resources, and efficient program administration and oversight. The unique characteristics and needs of military operations make the evaluation criteria more specific and the spectrum of opportunities narrower. People and social uses/needs are an integral part of ecosystem management. The needs of the military mission determine the extent of public outreach activities allowed. Special consideration will be given to protecting critical areas from negative impacts due to public access or ecosystem management activities.

The following goals apply to PO projects listed for Camp Edwards in Appendix D, Table D-2.

PO GOAL 1: PROVIDE QUALITY PUBLIC OUTREACH EXPERIENCES, WHILE SUSTAINING ECOSYSTEM INTEGRITY. ENSURE THAT PUBLIC OUTREACH OPPORTUNITIES ARE NOT IN CONFLICT WITH MISSION PRIORITIES.

- **PO OBJECTIVE 1.1:** Engage the surrounding communities and the general public to provide information on and increase awareness of natural resource management activities at Camp Edwards.

- **PO OBJECTIVE 1.2:** Develop new opportunities for community outreach at Camp Edwards. Outreach programs that do not conflict with mission priority should be considered.

APPENDIX T – GEOGRAPHIC INFORMATION SYSTEM

1.1 EXISTING CONDITIONS

Geographic information systems (GIS) are an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. A simpler definition of GIS is a computer system capable of holding and using data describing places on the Earth's surface. GIS provides an analytical tool used not only for making maps but also for performing complex spatial analysis and modeling. GIS is critical to the management of natural resources and is used to integrate all natural and cultural resources data and graphically display the relationships between individual resource components.

MAARNG maintains a GIS database for Camp Edwards, JBCC, and other MAARNG facilities, and has personnel dedicated to GIS management. Standards have been implemented to educate users, improve communication, maintain consistency, ensure data compatibility, reduce duplication of efforts, and provide a medium to transfer the most current information. The GIS database is dynamic. The MAARNG is always obtaining and creating new layers, updating existing layers, accumulating additional data, and performing new and more complex analysis in GIS. GIS is now a significant part of facilitating the National Guard mission in environmental stewardship, facility management, and training.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

GIS is used to manage and catalog information acquired in natural resources research. Geospatial data can be useful in planning by spatially charting areas of environmental concern and providing a baseline for analyzing the potential impacts of any proposed natural resources management action. Managers can use GIS capabilities for watershed, wetlands, wildlife, and various other natural resource management applications.

The following goals apply to GIS projects listed for Camp Edwards in Appendix D, Table D-2.

GIS GOAL 1: CONTINUE TO USE GIS AT CAMP EDWARDS TO SUPPORT NATURAL RESOURCE MANAGEMENT.

- **PO OBJECTIVE 1.1:** Continue to update the Camp Edwards GIS database with data as it is collected. Update and digitize natural resources and infrastructure information to allow comprehensive GIS to be used as a natural resource management tool.

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APPENDIX U – CLIMATE CHANGE

1.1 EXISTING CONDITIONS

Climate change can happen on a local level that could impact the military mission. Changes in precipitation and temperature ranges could result in changes to the species of vegetation or wildlife habitat present at Camp Edwards that could impact training areas.

1.2 INRMP MANAGEMENT GOALS AND OBJECTIVES

MAARNG will consider existing information including regional plans, partnerships, or reports conducted by other entities that assess and/or implement climate change adaptation strategies. MAARNG will also determine any opportunities for collaboration with these efforts for ecosystem management objectives.

The following goals apply to CC projects listed for Camp Edwards in Appendix D, Table D-2.

CC GOAL 1: INCORPORATE CLIMATE CHANGE ADAPTATION STRATEGIES INTO NATURAL RESOURCE MANAGEMENT.

- **CC OBJECTIVE 1.1:** Implement climate change adaptation strategies to target installation-specific areas of concern including but not limited to increased storm severity, flooding, drought, fire, and species range shifts. Incorporate guidance from climate change experts as well as local and regional conservation/land management organizations.

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APPENDIX V – AGENCY CONSULTATION

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DRAFT MEETING NOTES
CAMP EDWARDS TRAINING SITE
SIKES ACT PARTNERS MEETING AND SITE VISIT
FOR INRMP UPDATE

Prepared by: **EA Engineering, Science, and Technology, Inc., PBC (EA)**
Date: **Wednesday, October 23, 2019**
Time: **01000 to 1500 hours**

ATTENDEES:

Cindy Corsair	Biologist, USFWS	Present
David Paulson	Conservation Biologist, DFW	Present
Kathryn Cerny-Chipman	Project Task Leader, EA	Present
Chris Buelow	Senior Restoration Ecologist, MA NHESP	Present
Peter Hazelton	Chief Conservation Scientist, MA NHESP	Present
Annie Curtis	Conservation Biologist, Camp Edwards	Present
Sal DeCarli	Project Manager, EA	Present
Mike Jones	State Herpetologist, MA NHESP	Phone
Jake McCumber	NR-ITAM Program Manager, MAARNG	Present
Mike Nelson	Invertebrate Zoologist, MA NHESP	Phone

DISTRIBUTION: **Attendees**

The Sikes Act partners meeting for the Camp Edwards Integrated Natural Resources Management Plan (INRMP) Update was held at Camp Edwards to inform attendees of the INRMP update process, initiate a discussion of issues and projects within the INRMP, and provide attendees a tour of the installation, if desired. A presentation on the Integrated Training Area Management (ITAM) program and natural resources management at Camp Edwards was provided by Jake McCumber. Kathryn Cerny-Chipman provided a presentation on the INRMP regulatory process and format. MAARNG and EA led discussions on talking points and specific topics that MAARNG wished to cover at the meeting.

Natural Resources and ITAM Program: Camp Edwards is unique in that is remains as one of the few National Guard programs with natural resources and ITAM combined. This provides a benefit from training-focused land management and an emphasis on conservation projects that help to meet training area improvement goals. The natural resources program supports on-the-ground land management, environmental review, and permitting. ITAM includes monitoring of training impacts, and assessment of short-term and long-term training impacts on the landscape.

An INRMP update serves as a checkpoint to capture new items that need to be built into planning and review for the next five years. Because it requires signatories from the U.S. Fish and Wildlife Service (USFWS) and Massachusetts Division of Fisheries and Wildlife (DFW), the INRMP necessitates a strong partnership and collaboration with these agencies.

INRMP Authority and Process: Installations have a need maintain the military mission but must also manage natural resources under the Sikes Act. If these two things conflict, natural resources management defers to upholding the military mission. In the INRMP, the goal is to minimize or avoid

any adverse effects to the mission. The Sikes Act was developed in part to alleviate the potential for designated critical habitat occurring on Department of Defense (DoD) lands. The goal is to support these species without having a critical habitat designation on the installation. INRMPs include specific projects that are part of broader goals and objectives for the management needs of Camp Edwards.

Camp Edwards INRMP Update Needs and Goals: The current INRMP needs an updated structure and the incorporation of measurable objectives and future budget items developed by natural resources staff. These items are missing from the current INRMP. The INRMP also should strive to be an easily accessible and understandable document. Training needs should be described in the INRMP, with a timeline for when certain steps, such as permitting, need to occur. Not every step needs to be a 100 percent solution for the INRMP, but the INRMP can help to identify issues and concerns and address gaps. The INRMP serves as a guide for natural resources personnel to gain a sense of their future annual workload, but it is also a tool to identify issues early and begin planning processes to cover these issues when they arise.

The Sikes Act requires that MAARNG and the signatory agencies meet annually assess the goals and objectives to ensure they are representative of base/training operations, and natural resource concerns. Projects and annual agency review meetings must now be included in the INRMP for projects to be considered for funding. This annual meeting is required for funding of projects within the INRMP. The INRMP is developed with a 5-year outlook of projects for funding. This 5-year funding outlook is congruent with the USFWS National Listing Workplan, which is a list of planning efforts on a five-year outlook. This document update will be completed in May 2020, and the overlap of the timing of these documents provides opportunities to coordinate studies and conservation efforts.

Natural Resources and Listed Species: Camp Edwards is predominantly a pine barrens mosaic, with open grasslands and a pitch pine canopy, with oak canopy in some areas. There are also areas of pitch pine scrub oak and intact scrub oak shrubland; these are globally rare ecosystems. Sandplain grasslands at Camp Edwards are the most cost-intensive habitat to manage, but support several rare species, including the upland sandpiper and a rare bee species not known from other sites east of Ohio. Glacial frost bottoms at Camp Edwards also support state-listed and rare plant species. There are several listed species known to occur at Camp Edwards. Northern long-eared bats forage actively on the installation but rarely roost on-base. The main measure taken by MAARNG to protect this species is maintaining habitat by opening up understory conditions and reducing the tree stock. One hibernaculum is known from the groundwater treatment building, but it is not actively used. MAARNG consistently monitoring for bats, but feels there may be an opportunity to lessen the frequency of monitoring to allow for time and funding to be better used towards research on less well-understood species at Camp Edwards. DFW noted that the Massachusetts Department of Transportation is creating a statewide dataset of acoustic monitoring efforts, and MAARNG expressed an interest in contributing their existing data to the effort.

Changes in newly listed and potentially listed species may impact base operations. MAARNG currently works with natural resource agencies to actively manage for these species ahead of any potential listings. MAARNG is already managing for the meadowlark, bee species, and the hognose snake even though they are not currently listed. Hognose snakes may be susceptible to base training and operations impacts, but respond well to management if properly executed. Master planning efforts for this species include randomized sampling and a rapid assessment by density. Meeting attendees discussed that a pre-burn density assessment could inform future conservation by providing a measure of how many individuals were impacted by fire, but randomized surveys would be more objective. For all species, the goal is effective but achievable monitoring. USFWS noted that the American chaffseed appears as potentially occurring at Camp Edwards based on the USFWS Information Planning and Consultation (IPaC) website, and that sandplain gerardia is also a species that may need to be considered. MAARNG noted it would be good to do additional grassland monitoring.

Clam shrimp found in road puddles in parts of Camp Edwards. In a recent study this species was found in puddles at 17 properties offsite, and it is likely that this species may be more widely distributed than previously believed. Little was known previously about its distribution. Maintaining these road puddles for clam shrimp increases the risk of mortality for amphibians and the eastern box turtle, as they encourage these species to occur in roadways. The mortality of eastern box turtles is a concern at Camp Edwards due to their limited populations and slow life cycle. The installation is studying the development of clam shrimp mitigation puddles as an alternative. MAARNG would like to establish a procedure with DFW for determining the circumstances under which puddles can be filled to protect box turtles. DFW noted that clam shrimp have dropped from an S1 to an S3 species, and that MAARNG and DFW will need to revisit management. Population data are important for updating the species status. Additional discussion occurred about the potential to construct wetlands or vernal pools on base to attract species of concerns away from road edges and roadways by providing suitable habitat elsewhere.

Eastern box turtles at Camp Edwards may also face increased threats from fire, mowing, timber harvest, and understory mastication. These measures are needed to prevent habitat loss, and MAARNG is working to balance the needs of listed species and globally rare habitats. More study is needed of the relationship of fire intensity and turtle mortality. The challenges regarding this issue include uncertainty in population numbers, and balancing fire management for prevention of a higher intensity fire with turtle mortality during prescribed burns. Fire is necessary in this ecosystem, and there will be losses; however, MAARNG and DFW should work to find ways to reduce risk.

A recurring theme that was brought up by MAARNG and project partners was the need to analyze already collected data. For example, MAARNG has been collecting data on the New England cottontail, including pellet data and data from regional plots. However, the impacts (positive or negative) on this species and other species of concern on base are not fully understood. There have been restoration efforts and data collection but there is not a clear understanding on the interactions between restoration strategies, species interactions, and habitat use on base. Analysis of data would provide a good opportunity to understand species response to management, and to understand where additional surveys are needed. Species data are also useful for informing USFWS reintroduction efforts for species like the New England cottontail.

Additionally, some of the standard protocols that MAARNG has used to assess the presence or absence of species are not detailed enough to provide a clear enough picture of project success. The example of the box turtle was highlighted as an example of a species that needs to be more thoroughly assessed including proactive management, population monitoring, impact assessments, turtle sweep(s), and development of a standard operating procedure (SOP) for a regional rapid assessment method.

Other natural resource management matters discussed include game management; the impacts of deer on rare resources and the potential to use infrared or thermal sensing transects to understand deer populations; and potential ways to increase the diversity and numbers of the recreational hunting base at Camp Edwards. Lastly, the meeting attendees discussed other resources that may present a management concern, such as fish and damselflies, including the pine barrens bluet.

INRMP Goals: Some of the items or potential projects the meeting attendees discussed for inclusion in the INRMP include the following:

- Development of management standards for species of concern, including the clam shrimp and Eastern box turtle
- Coordination of study efforts between DFW and MAARNG and development of an SOP for box turtle population assessments

- Improvement of the range tunnel at Camp Edwards as bat hibernacula habitat
- Creation of vernal pools to assist with getting species of concern out of the roadways, and to provide a training benefit
- Developing a no-drive area to increase deer hunting by the public and on-base recreationalists
- Development of a whip-poor-will tour of Camp Edwards
- Surveys of grouse, quail, and woodcock for an understanding of game management
- Development of standards for resource management in wetland buffers, including best management practices and a pre-developed template.

Future Meetings: The INRMP process will include a meeting with stakeholders from other federal and state agencies and commissions. After this meeting, a future meeting will be scheduled and will include invitations to important local partners such as: Bourne Conservation Commission, Sandwich Conservation Commission, U.S. Air Force Environmental personnel, U.S. Coast Guard Environmental Personnel, representatives from the Environmental Management Commission, the Mashpee Wompanoag Tribe (general liaison and environmental representative), Jason Zimmer, and the Regional Department of Conservation and Recreation Forester.

Site Visit: Once the meeting concluded, attendees had the opportunity to tour the installation. Areas observed included natural features of interest, training areas, and areas where burning had been conducted as part of natural resource management.

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DRAFT MEETING NOTES
CAMP EDWARDS TRAINING SITE
SIKES ACT PARTNERS MEETING AND SITE VISIT
FOR INRMP UPDATE

Prepared by: **EA Engineering, Science, and Technology, Inc., PBC (EA)**
Date: **Thursday, November 14, 2019**
Time: **0930 to 1500 hours**

ATTENDEES:

Paulo Baganha	Environmental Program Manager, MAARNG	Present
Kathryn Cerny-Chipman	Project Task Leader, EA	Present
Annie Curtis	Conservation Biologist, Camp Edwards	Present
Sam Haines	Conservation Agent, Borne Conservation Commission	Present
Elizabeth Kirkpatrick	Environmental Program Manager, U.S. Coast Guard Base Cape Cod	Present
Steve Marinelli	Environmental Manager, Cape Cod Air Force Station	Present
Jake McCumber	NR-ITAM Program Manager, MAARNG	Present
Jessica Morrissey	GIS Specialist, EA	Present
Len Pinaud	Environmental Officer, EMC	Present
Josh Wrigley	Assistant Director of Natural Resources, Town of Sandwich	Present

DISTRIBUTION: **Attendees**

The Sikes Act partners meeting for the Camp Edwards Integrated Natural Resources Management Plan (INRMP) Update was held at Camp Edwards to inform attendees of the INRMP update process, initiate a discussion of issues and projects within the INRMP, and provide attendees a tour of the installation, if desired. A presentation on the Integrated Training Area Management (ITAM) program and natural resources management at Camp Edwards was provided by Jake McCumber. Kathryn Cerny-Chipman provided a presentation on the INRMP regulatory process and format. MAARNG and EA led discussions on talking points and specific topics that MAARNG wished to cover at the meeting.

Natural Resources and ITAM Program: Camp Edwards is unique in that is remains as one of the few National Guard programs with natural resources and ITAM combined. This provides a benefit from training-focused land management and an emphasis on conservation projects that help to meet training area improvement goals. The natural resources program supports on-the-ground land management, environmental review, and permitting. ITAM includes monitoring of training impacts, and assessment of short-term and long-term training impacts on the landscape.

An INRMP update serves as a checkpoint to capture new items that need to be built into planning and review for the next five years. Because it requires signatories from the U.S. Fish and Wildlife Service (USFWS) and Massachusetts Division of Fisheries and Wildlife (MassWildlife), the INRMP necessitates

a strong partnership and collaboration with these agencies. MAARNG held a separate stakeholder meeting with these agencies in October 2019.

Stakeholders were interested in the source of funding for the NR-ITAM program, which is funded in part by Army National Guard money allocated between states. Funding for installations by the state is based on planning. Mr. McCumber noted that often they are limited by manpower at Camp Edwards, not by funding.

INRMP Authority and Process: Installations have a need maintain the military mission but must also manage natural resources under the Sikes Act. If these two things conflict, natural resources management defers to upholding the military mission. In the INRMP, the goal is to minimize or avoid any adverse effects to the mission. The Sikes Act was developed in part to alleviate the potential for designated critical habitat occurring on Department of Defense (DoD) lands. The goal is to support these species without having a critical habitat designation on the installation. INRMPs include specific projects that are part of broader goals and objectives for the management needs of Camp Edwards.

Camp Edwards INRMP Update Needs and Goals: The current INRMP needs an updated structure and the incorporation of measurable objectives and future budget items developed by natural resources staff. These items are missing from the current INRMP. The INRMP also should strive to be an easily accessible and understandable document. Training needs should be described in the INRMP, with a timeline for when certain steps, such as permitting, need to occur. Not every step needs to be a 100 percent solution for the INRMP, but the INRMP can help to identify issues and concerns and address gaps. The INRMP serves as a guide for natural resources personnel to gain a sense of their future annual workload, but it is also a tool to identify issues early and begin planning processes to cover these issues when they arise.

The Sikes Act requires that MAARNG and the signatory agencies meet annually to assess the goals and objectives to ensure they are representative of base/training operations, and natural resource concerns. Projects and annual agency review meetings must now be included in the INRMP for projects to be considered for funding. This annual meeting is required for funding of projects within the INRMP. The INRMP is developed with a 5-year outlook of projects for funding.

Natural Resources and Listed Species: Camp Edwards is predominantly a pine barrens mosaic, with open grasslands and a pitch pine canopy, with oak canopy in some areas. There are also areas of pitch pine scrub oak and intact scrub oak shrubland; these are globally rare ecosystems. Sandplain grasslands at Camp Edwards are the most cost-intensive habitat to manage but support several rare species, including the upland sandpiper and a rare bee species not known from other sites east of Ohio. Glacial frost bottoms at Camp Edwards also support state-listed and rare plant species. There are several listed species known to occur at Camp Edwards. Northern long-eared bats forage actively on the installation but rarely roost on-base. The main measure taken by MAARNG to protect this species is maintaining habitat by opening up understory conditions and reducing the tree stock. One hibernaculum is known from the groundwater treatment building, but it is not actively used.

Clam shrimp found in road puddles in parts of Camp Edwards. In a recent study this species was found in puddles at 17 properties offsite, and it is likely that this species may be more widely distributed than previously believed. Little was known previously about its distribution. Maintaining these road puddles for clam shrimp increases the risk of mortality for amphibians and the eastern box turtle, as they encourage these species to occur in roadways. The mortality of eastern box turtles is a concern at Camp Edwards due to their limited populations and slow life cycle. The installation is studying the development of clam shrimp mitigation puddles as an alternative.

Eastern box turtles at Camp Edwards may also face increased threats from fire, mowing, timber harvest, and understory mastication. These measures are needed to prevent habitat loss, and MAARNG is working to balance the needs of listed species and globally rare habitats.

Camp Edwards has been working with MassWildlife for the last few years developing a mitigation bank to address impacts from upcoming projects on the installation. This includes conservation areas on the installation, as well as the transfer of lands to MassWildlife for conservation. Mr. McCumber expressed a desire to expand this program. Mr. Pinaud noted that reaching outside of Camp Edwards may require a third-party in the conservation transfer, which would have restrictions. Typically, the National Guard Bureau would purchase and transfer lands.

Water resources are scarce at Camp Edwards, but Mr. Haines noted that water resource protection is very important to the Town of Bourne. MAARNG is looking into future training exercises that would require water withdrawal for water purification training and wanted to learn from the stakeholders what would be required in terms of permitting and other regulatory issues. Stakeholders questioned if there are alternatives to this, and Mr. McCumber noted that the wash rack and fire holding tanks are used for this, but that ponds and natural training conditions are needed for the mission. They would need to determine BMPs and permitting associated with these potential projects. Mr. Pinaud mentioned the EMC would likely want to vet these projects before they are placed in the INRMP.

Other natural resource management matters discussed include herbicide concerns for invasive plant management, and development of future natural terrain training areas.

INRMP Goals: Some of the items or potential projects the meeting attendees discussed for inclusion in the INRMP include the following:

- Create more outreach to the community to inform them of burns. Post on town/fire station websites. Do poster board sessions at schools or libraries to inform the public.
- Development of management standards for species of concern, including the clam shrimp and Eastern box turtle
- Creation of vernal pools to assist with getting species of concern out of the roadways, and to provide a training benefit
- Work with Environmental Police Officers to clearly identify the enforcement needs of Camp Edwards. This could include tabletop exercises and trespass training.
- Development of standards for resource management in wetland buffers, including best management practices and a pre-developed template. This would include the potential for a blank approval for habitat management activities like prescribed burning that may occur in wetland buffers.
- Continue to develop a mitigation strategy at Camp Edwards for the conservation of rare habitats and species. Build this mitigation strategy into other natural resource projects. Mitigation actions could include:
    - The development of limited canopy areas for box turtles
    - The development of standardized monitoring requirements
- Increase public recreational access including the following examples of access:
    - Camping opportunities for boy scouts

- Training opportunities for local law enforcement and emergency services
- Developing a larger public hunting presence at Camp Edwards, as deer hunting is critical to habitat management. Mr. Haines said that Bourne would be happy to put out information on hunting at Camp Edwards if they have a flier
- Botany club tours.

Site Visit: Once the meeting concluded, attendees had the opportunity to tour the installation. Areas observed included natural features of interest, training areas, and areas where burning had been conducted as part of natural resource management.

MEMORANDUM OF UNDERSTANDING

between

The Wampanoag Tribe of Gay Head-Aquinnah

and

The Massachusetts Army National Guard

for

Cultural Resource Planning and Management

WHEREAS the Massachusetts Army National Guard (MAARNG) owns, uses and controls land for the purposes of federal military training and related activities and conducts training and support operations on lands other than those owned or controlled by the MAARNG in the State of Massachusetts, AND

WHEREAS the Massachusetts National Guard recognizes the status of the Wampanoag Tribe of Gay Head-Aquinnah (TRIBE) as a Sovereign Nation and a federally recognized Indian Tribe, AND

WHEREAS the MAARNG recognizes that it has an obligation pursuant to federal law, policy and executive orders to provide timely and meaningful opportunities for the tribes participation and input on MAARNG activities or determinations that impact, or may potentially impact, the Tribe, AND

WHEREAS the MAARNG and the Wampanoag Tribe of Gay Head-Aquinnah AGREE that the military training activities of the Massachusetts Army National Guard may from time to time affect cultural resources affiliated with the Wampanoag Tribe of Gay Head-Aquinnah, and its non-federally recognized sister Tribe, The Mashpee Wampanoag, including Traditional Cultural Properties, properties of traditional religious and cultural importance, sacred sites, human remains and associated cultural items, AND

WHEREAS the MAARNG recognizes the Wampanoag Tribe of Gay Head-Aquinnah's, here after referred to as the Wampanoag Tribe, special expertise with respect to the cultural resources set forth in the foregoing paragraph, AND

WHEREAS the MAARNG seeks to work cooperatively with the Wampanoag Tribe in managing affiliated cultural resources on land under MAARNG's ownership and control and on lands other than those owned or controlled by MAARNG but used for training and support operations by MAARNG, and in meeting all legal requirements, polices, guidance applicable to conservation, protection and management of Tribal cultural resources; AND

WHEREAS the Wampanoag Tribe and MAARNG have consulted on a government-to-government basis and mutually agree on the principles set forth in this document, NOW, THEREFORE: the MAARNG and the Tribe agree that the following principles and procedures will guide conservation, protection and management of affiliated cultural resources on land under the ownership or control of the MAARNG and on other lands other than those owned or controlled by the MAARNG but used for training and support activities:

The MAARNG, in consultation with the Wampanoag Tribe, shall establish procedures for Such procedures will be incorporated into the MAARNG Integrated Cultural Resource Management Plan (ICRMP) and shall follow and adhere to the regulations and guidelines in regard to federally recognized Indian Tribes as published in AR 200-4 and DA-PAM 200-4 and all other applicable federal laws, polices, guidance and executive orders.

The MAARNG shall consult with the Wampanoag Tribe in development of the Massachusetts Army National Guard's Integrated Cultural Resources Management Plan (ICRMP). The Tribe shall have a timely and meaningful opportunity for review, comment and input at all phases of plan development that include issues pursuant to Wampanoag cultural resources, including scoping sessions, as well as, suggested levels and locations for surveys.

The MAARNG will not complete the ICRMP without first soliciting, considering, and responding to the written comments of the Wampanoag Tribe. The FINAL ICRMP shall, to the greatest extent practicable, reflect the mutual agreement of the MAARNG and the Wampanoag Tribe regarding management of affiliated cultural resources. During the course of ICRMP preparation and implementation, the following procedures will be followed to avoid conflicts over management of affiliated cultural resources:

The MAARNG shall require their contractor(s) TO provide a monthly report to the Wampanoag Tribe's Designated Historic Preservation Officer and the Tribal Chairperson, summarizing cultural resource management activities and other undertakings as may be applicable, to Traditional Cultural Properties or potential cultural properties locations and findings of such, both pre-historic and historic during the annual field survey period or when any undertakings or action takes place which may or will affect Traditional Cultural Properties, properties of traditional, religious, and cultural importance, sacred sites, human remains or associated cultural items.

The MAARNG will provide an annual report to the Wampanoag Tribe, but not limited to, dispositions, treatment, and curation, that includes the site locations and all other pertinent information on sites including, present and ongoing surveys conducted by their archaeology contractor.

The Wampanoag Tribe agrees to make A good faith effort to respond within thirty (30) days or less, where feasible and warranted, to requests for information from MAARNG for, consultation, or concurrence in relation to issues of Traditional Cultural Properties, sacred sites, burials or human remains.

The Wampanoag Tribe agrees to protect the confidentiality of site locations by limiting access to such information to the Wampanoag Tribe's Designated Historic Preservation Officer, Tribal Chairperson, and the Tribal Council. The MAARNG agrees to protect the confidentiality of site locations by limiting access to such information to only necessary National Guard operations, the SHPO, and the Wampanoag Tribe, to the greatest extent allowed by law.

The MAARNG recognizes that present and future surveys cannot identify all surface and sub-surface Traditional Cultural Properties, properties of traditional, religious and cultural importance, sacred sites, human remains and associated cultural items, and that such properties may be discovered through future cultural resource management activities or other training related ground disturbing activities. The Wampanoag Tribe agrees that the process created pursuant to this agreement shall be followed, and will not exceed thirty (30) days without further agreement of the parties.

If the MAARNG, at any time, unintentionally discovers, or seeks to intentionally excavate human remains, it will immediately notify the Wampanoag Tribe's Designated Historic Preservation Officer and Tribal Chairperson along with appropriate law enforcement and other local and state agencies, cease activities that could impact such remains, consulting with the Wampanoag Tribe on a government-to-government basis in recognition of the Sovereign status of the Wampanoag, and secure and safeguard the site. Activities in the vicinity of the site shall then cease until such time as the Wampanoag Tribe's Designated Historic Preservation Officer and National Guard Cultural Resource Officer can arrange for mutual inspection of the site and proper disposition.

The MAARNG shall at each site ensure that human remains and cultural items (i.e. associated and unassociated grave goods, sacred objects, and objects of cultural patrimony) are secured, treated and repatriated in accordance with the provisions of the Native American Graves Protection and Repatriation Act, its implementing regulations and Army Regulation 200-4 and DA-PAM 200-4.

The MAARNG agrees, for purposes of compliance with Section 106 of the National Historic Preservation Act, that the Wampanoag Tribe shall be included as a concurring party and signatory on all Memoranda of Agreement and Programmatic Agreements, or similar documents, for undertakings affecting Tribally affiliated Traditional Cultural Properties, properties of traditional, religious and cultural importance, sacred sites, human remains and associated cultural items. The MAARNG shall consult with the Wampanoag Tribe, on all no effect, beneficial effect, no adverse effect, and adverse effect determinations for undertakings with potential to impact Traditional Cultural Properties and sacred sites.

The parties to this agreement designate and mutually recognize and endorse the following points of contact for purposes of carrying out any communication and consultation necessary for implementation of the principles and processes of this agreement.

Matthew J. Vanderhoop
Tribal Historic Preservation Officer
Wampanoag Tribe of Gay Head-Aquinnah

Cultural Resource Management Officer
Massachusetts Army National Guard

The afore mentioned points of contact shall refer matters arising under this agreement to higher National Guard and Tribal Authority as the occasion and/or protocol demand. Should the MAARNG point of contact change, the MAARNG agrees that it shall contact the Wampanoag Tribe and inform the Tribal Chairperson regarding the appointment of a new point of contact. The Wampanoag Tribe agree that should their point of contact change, they shall inform the Massachusetts Army National Guard and the Adjutant General regarding the appointment of a new point of contact.

Flora and Fauna identified by species and locations must be included in any survey leading to or incorporated in development of an ICRMP. Such information shall be shared with the Wampanoag Tribe's Designated Historic Preservation Officer and the Tribal Chairperson and held confidential by the Massachusetts Army National Guard when such flora and fauna are of cultural importance to the tribe.

Although the DOD Secretary's Professional Qualifications and Standards do not apply to a federally recognized Indian tribe that has agreed to provide expertise, information or technical assistance regarding Traditional Cultural Properties and Sacred Sites, the Wampanoag Tribe agrees to this provision.

Consultation between the Massachusetts Army National Guard Cultural Resource Officer and the Wampanoag Tribe and their Designated Historic Preservation Officer shall be conducted to review no effect, beneficial effect, no adverse effect, and adverse effect determinations to a Traditional Cultural Property or Sacred Site or a nomination to the National Register of Historic Places. Such consultation shall give signatory authority to any Memorandum of Agreement or Programmatic Agreement as is referenced in AR 200-4 and DA-PAM 200-4. The Massachusetts Army National Guard AGREES that in all consultations, including review of individual undertakings pursuant to 36 CFR 800, the Tribe shall be invited to concur or not to concur in any Memorandum of Agreement, Programmatic Agreement or other pertinent documents that have the potential to affect Wampanoag Cultural Resources.

The Massachusetts Army National Guard ICRMP will be developed in a context, regarding Traditional Cultural Properties and Sacred Sites that reflect Tribal Cultural Values.

Nomination/eligibility to National Register of Historic Places.

While the Wampanoag Tribe Indians acknowledge that the only person delegated statutory authority to sign National Register of Historic Places nominations is the Deputy Assistant Secretary of the Army, the Tribe does, however, reserve the right, as it is expressed in the National Historic Preservation Act and Sections 60.11 and 60.12 of 36 CFR 60, to concur or not to concur in preparation of recommendations for nomination to the National Register of Historic Places in consultation with the MAARNG when such is related to, or in regard of, those elements which are Traditional Cultural Properties, Sacred Sites, or of Traditional Cultural Value to the tribe, and further reserves the right of appeal as referenced in 36 CFR 60.

Nominations to the National Register of Historic Places on Traditional Cultural Properties and Sacred Sites can only be submitted if mutually agreed upon by both the MAARNG and the Wampanoag Tribe.

It is neither the intent, nor is in the interest of the Wampanoag Tribe of Gay Head-Aquinnah, to act as representatives of any other federally recognized Indian tribe without their express authorization in writing. It is understood that this document may be employed in whole or in part, MADE into separate agreements made by other federally recognized Indian tribes and the Massachusetts Army National Guard and/or the other elements of the Department of Defense or any other federal agency.

MAARNG agrees that Traditional Cultural Properties will be defined by the Wampanoag Tribe and include but are not limited to:

Any pre-historic or historic site location and its components, which relate, or may relate to the Wampanoag Tribe and their ancestral kin groups, clans, or tribes.

Artifacts with surface or sub-surface locations.

Man-made or natural features including dwellings, mounds and other earth works.

Certain trees, shrubs, and plants.

Certain stones, minerals, and fossils.

Animal parts either terrestrial or marine.

MAARNG AGREES THAT Sacred Sites can only be designated on a case by case basis by the Wampanoag Tribe Designated Historic Preservation Officer and with the concurrence of the Wampanoag Tribal Chairperson and Tribal Council, as they may relate to the Wampanoag Tribe.

MAARNG agrees that Executive Order 13007 expresses in general the parameters of sacred sites and expresses the accommodations that must be made for access, use and protection of such scared sites.

The parties agree that this Memorandum of Understanding shall take effect on the date it is signed by the Adjutant General of the Massachusetts Army National Guard and the Chairperson of the Wampanoag Tribe as properly witnessed and shall remain in effect until 01 January 2010 unless properly terminated by either party. This Memorandum of Understanding may be extended and/or amended past that date by accord of both parties.

If at any time during implementation of this Memorandum of Understanding, either party raises an objection, both agree to appropriate consideration and consultation intended to resolve the objection.

The Massachusetts Army National Guard and/or the Wampanoag Tribe of Gay Head-Aquinnah may terminate this Memorandum of Understanding by providing sixty- (60) working days notice to the other signatory party by Registered Mail. After such notification, but prior to the date of termination, both parties shall within ten (10) working days of notification, set a mutual date to consult and seek a satisfactory solution that would avoid termination.

Nothing in this agreement prohibits or reduces either party's right to full lawful remedy or recourse for failure to comply with any and all terms agreed to herein.

NOW THEREFORE, it is agreed that the MAARNG and the Wampanoag Tribe of Gay Head-Aquinnah will jointly cooperate to achieve the principles and purposes set forth in this Memorandum of Understanding.

Signed this 20th day of Aug 2001.

Beverly Wright
Chairperson
Wampanoag Tribe of Gay Head-Aquinnah

Signed this 30th day of Aug, 2001

BG George W. Keefe
The Adjutant General
Massachusetts Army National Guard

Witnesses:

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APPENDIX W – ANNUAL REVIEWS

Annual Review Template

Attendees			
Name	Agency	Phone	Email
Invited but Did Not Attend			

INRMP Project Implementation

1) Are INRMP projects, including follow-up inventorying and monitoring work, properly identified, developed, and submitted for funding?
2) Has project funding been received, obligated, and expended?
3) What projects have been completed and do they meet expected objectives?
4) What new projects are proposed?

Federal ESA Listed Species and Critical Habitat

1) Are conservation efforts effective?
2) Does the INRMP provide conservation benefits necessary to preclude USFWS Critical Habitat designation?
3) Are Species at Risk identified and are steps being undertaken to preclude listing?

Partnerships Effectiveness

1) Has the INRMP review team (State ARNG, USFWS, ARNG I&E, and the State Wildlife Agency) been effective in ensuring the INRMP's implementation?
2) Are other partnerships needed to meet the INRMP goals?
3) Have other partnerships been effectively used to meet INRMP goals?
4) Are internal stakeholders (training, facilities, etc.) effectively coordinating projects?

Fish and Wildlife Management and Public Use

1) Are public recreational opportunities such as hunting, fishing, and wildlife viewing available to soldiers and employees?
2) Are public recreational opportunities such as hunting, fishing, and wildlife viewing available to the public?
3) Does the INRMP and site offer opportunities or facilities for disabled sportsmen?

Team Adequacy

1) Is the State ARNG's natural resources team adequately resourced to fully implement the INRMP?
2) Is the State ARNG's natural resources team adequately trained to fully implement the INRMP?

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