



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.

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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

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.



Nightjar Surveys

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

- Barbour, H., T. Simmons, P. Swain, and H. Woolsey. 1999. *Our Irreplaceable Heritage: Protecting Biodiversity in Massachusetts*. Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife, and The Massachusetts Chapter of the Nature Conservancy
- Bird Studies Canada and U.S. North American Bird Conservation Initiative. 2008. *New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Implementation Plan*. Published by Bird Studies Canada on behalf of the North American Bird Conservation Initiative. Available [online]: <https://acjv.org/planning/bird-conservation-regions/bcr-30/>. Accessed on 22 September 2020.
- Burt, W.H. and R.P. Grossenheider. 1980. *A Field Guide to the Mammals of North America North of Mexico*. Peterson Field Guide Series. Houghton Mifflin Company, New York.
- Cleere, N. 1998. *Nightjars, a guide to nightjars, nighthawks and their relatives*. Yale Univ. Press, New Haven. 317 pp.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service Publication FWS/OBS-79/31. Washington, D. C.
- Foster, D.R. and G. Motzkin. 1999. *Historical Influences on the Landscape of Martha's Vineyard: Perspectives on the Management of the Manuel F. Correllus State Forest*. Harvard Forest Paper No. 23. Harvard University.
- Gravatt, D.A., W. Packer, S. Sutton, M. Bishop, and A. Bishop. 1999. *Delineation of Wetlands and Other Regulated Waters: Camp Edwards, MA*. U.S. Army Engineer Waterways Experiment Station.
- Graves, A., Cavanagh, P.M., Kelly, J., and M. Ciaranca. 2005. *Forest Resources Inventory, Camp Edwards Training Site, Barnstable County, Massachusetts*. July 1998, Updated September 2005.
- Jenkins, J. 1994. *A Floristic Survey of Camp Edwards, Barnstable County, Massachusetts*. White Creek Field School.
- Lovell, R.A. 1984. *Sandwich: A Cape Cod Town*. Sandwich Archives and Historical Center, Sandwich, Massachusetts.
- Mass.gov. 2019. *The Northern Long-Eared Bat*. Accessed on 27 November 2019.
- Massachusetts Army National Guard (MAARNG). 2009. *Camp Edwards Training Site*

Integrated Natural Resources Management Plan. Revised 2009.

- . 2013. *Final Environmental Assessment Addressing the Construction and Operation of a Unit Training Equipment Site and the Addition of Two New Buildings at the Regional Training Institute at Camp Edwards, Massachusetts*. April.
- . 2019a. *Draft Environmental Assessment for a Multi-Purpose Machine Gun (MPMG) Range at the Known Distance (KD) Range*. Camp Edwards. October.
- . 2019b. *Mitigation Strategy for Near Term Actions (2019~2026): Upcoming Projects – Brief Descriptions*. NR-ITAM.
- . 2019c. *Mitigation Strategy for Master Planning Actions at Joint Base Cape Cod (2019-2026)*. Special Military Reservation Commission. 10 April.
- Massachusetts Division of Fisheries and Wildlife (MassWildlife). 2019a. *Frances A. Crane Wildlife Management Area*. MassWildlife Lands User Guide. Available [online]: <http://gisprpxy.itd.state.ma.us/MassWildlifeLands/pdf/FRANCES%20A.%20CRANE%20WMA.pdf>. Accessed on 21 November 2019.
- . 2019b. *State-Listed Rare Species in the Vicinity of Camp Edwards*. 16 August.
- . 2020. *Eastern Hog-nosed Snake Heterodon platirhinos Latreille 1801*. Eastern Hog-nosed Snake Fact Sheet. Available [online]: <https://www.mass.gov/doc/eastern-hog-nosed-snake-0/download>. Accessed on 17 December 2020.
- Massachusetts National Guard. 2001. *Final Draft of Master Plan/Area-Wide Environmental Impact Report*.
- . 2018a. *Camp Edwards History*. Available [online]: <https://www.massnationalguard.org/index.php/history/camp-edwards-history.html#>. Accessed on 21 November 2019.
- . 2018b. *Camp Edwards*. Available [online]: <https://www.massnationalguard.org/index.php/about-us/installations/camp-edwards.html>. Accessed on 21 November 2019.
- . 2019a. *Final Annual State of the Reservation Report, Camp Edwards, Training Year 2018*. Environmental & Readiness Center. February.
- . 2019b. *Final Annual State of the Reservation Report, Training Year 2018*. February.
- McCumber, J. 2015. *Camp Edwards Bird Surveys (using EM Plots) Summary of Data Analysis: 1994 to 2013*. February.

- Mello, M.J. 2018. *Two-year Survey of Lepidoptera and other insects of conservation concern focusing on species listed in the Massachusetts Endangered Species Act at Camp Edwards, MA Army National Guard*. Report to Massachusetts Army National Guard Camp Edwards Training Site. Lloyd Center for Environmental Studies Report # 2018-1. March.
- Mello, M.J., M. Aliberti, S. Galusha, K. Gerber, F. Hohn, A. Lawrence, D. Luers, R. Nagel, T. Ruehli, and B. Stephenson. 1999. *Inventory of State-Listed Lepidoptera and Other Insects at Massachusetts Military Reservation*. Report to Massachusetts Army National Guard Camp Edwards Training Site. Lloyd Center for Environmental Studies Report # 99-2.
- Mitchell, J.C., A.R. Breisch, and K.A. Buhlmann. 2006. *Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States*. Partners in Amphibian and Reptile Conservation, Technical Publication HMG-3, Montgomery, Alabama. 108 pp.
- National Archives and Records Administration. 1977. *Executive Order 11990 – Protection of wetlands*. www.archives.gov/federal-register/codification/executive-order/11990.html. Accessed on 6 December 2019.
- PRISM Climate Group. 2020. Monthly Climate Normals (1981–2010) Barnstable County, MA. Available [online]: <http://www.prism.oregonstate.edu/explorer/> Accessed on 24 January 2020.
- Oxbow Associates, Inc. 2018. *Conservation and Management Plan: Camp Edwards Road Repairs and Clam Shrimp Relocation, Bourne, MA*. Prepared for MAARNG Military Division. 30 July.
- Renfrew, R. and J. Hill. 2015. *Migratory Connectivity of At-risk Grassland Birds*. Project 14-764. Vermont Center for Ecosystem Studies. DoD Legacy Resource Management Program.
- Rosenberg, K.V., J.A. Kennedy, R. Dettmers, R.P. Ford, D. Reynolds, J.D. Alexander, C.J. Beardmore, P.J. Blancher, R.E. Bogart, G.S. Butcher, A.F. Camfield, A. Couturier, D.W. Demarest, W.E. Easton, J.J. Giocomo, R.H. Keller, A.E. Mini, A.O. Panjabi, D.N. Pashley, T.D. Rich, J.M. Ruth, H. Stabins, J. Stanton, and T. Will. 2016. *Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States*. Partners in Flight Science Committee. Available [online]: <https://www.partnersinflight.org/wp-content/uploads/2016/07/pif-continental-plan-final-spread-7-27-16.pdf>. Accessed on 22 September 2020.
- Ruffner, C.M., and W. A. Patterson III. 2000. *Fire Management Plan for the Massachusetts Military Reservation, Sandwich, Massachusetts*. Department of Forestry and Wildlife

Management. University of Massachusetts at Amherst.

Sawyer, R.P. 1988. *From Pocasset to Cataumet: The Origins and Growth of a Massachusetts Seaside Community Based on the Files of Elmer W. Landers*. Bourne Historical Commission, Bourne, Massachusetts.

Sichmeller, T. and K. Hammond. 2017. *Northern Long-Eared Bat Survey Report for the Camp Edwards Training Site, Barnstable County, Massachusetts: June 14 – July 14, 2016*. Western EcoSystems and Technology, Inc. 8 March.

Soil Conservation Service. 1993. *Soil Survey of Barnstable County, Massachusetts*. U.S. Department of Agriculture in cooperation with Massachusetts Agricultural Experiment Station.

State of Massachusetts. 2019. *Shawme-Crowell State Forest*. Available [online]: <https://www.mass.gov/locations/shawme-crowell-state-forest>. Accessed on 21 November 2019.

Strahler, A.N. 1966. *A Geologist's View of Cape Cod*. Parnassus Imprints. Orleans, Massachusetts.

Swain, P.C. 2016. *Classification of Natural Communities of Massachusetts*. Version 2.0. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts. Available [online]: <https://www.mass.gov/service-details/terrestrial-palustrine-and-estuarine-community-types>. Accessed on 1 December 2019.

Tetra Tech. 2014. *Camp Edwards Northern Long-eared Bat Planning Level Survey*.

———. 2015. *2015 Northern Long-Eared Bat Survey, Camp Edwards Joint Base*. 20 November.

———. 2017. *2016 Northern Long-Eared Bat Supplemental Planning Level Surveys, Camp Edwards Joint Base Cape Cod, Massachusetts*. 4 January.

Town of Bourne. 2011. *Town of Bourne Unofficial Zoning Map*. October 25. Available [online]: https://www.townofbourne.com/sites/bournema/files/file/file/zoning_map_102511.pdf. Accessed on 21 November 2019.

Town of Sandwich. 2017. *Zoning Map, Town of Sandwich, Massachusetts*. November. Available [online]: <https://www.sandwichmass.org/DocumentCenter/View/3830/November-2017-Zoning-Map>. Accessed on 21 November 2019.

U.S. Army Corps of Engineers (USACE). 1987. *Corps of Engineers Wetland Delineation Manual*. Technical Report Y-87-1, U.S. Army Corps of Engineers Waterways

Experiment Station. Vicksburg, Mississippi.

———. 2000. *Environmental Assessment: Upper Cape Water Supply Project*. New England District, Concord, Massachusetts.

———. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*. Version 2.0 (J.S. Weakeley, R.W. Lichvar, C.V. Noble, and J.F. Berkowitz, eds.). ERDC/EL TR-12-1. USACE Wetlands Regulatory Assistance Program, Engineer Research and Development Center, Vicksburg, Mississippi. January.

———. 2020. The Navigable Waters Protection Rule: Definition of “Waters of the United States”. 85 *Federal Register* 77 (21 April 2020), pp. 22250-22342.

U.S. Army National Guard Bureau. 2000. All States Memo (Log Number P00-0039) Integrated Natural Resource Management Plans, Encl 4. Arlington, Virginia.

U.S. Department of Agriculture (USDA). 1932. *Shawme State Forest Map*. National Forest Service, State Forestry Conservation Work, Bourne and Sandwich, Massachusetts.

———. 2016. *What is an Invasive Species?* National Invasive Species Information Center. Available online at: <https://www.invasivespeciesinfo.gov/whatis.shtml>. Accessed on 6 December 2019.

U.S. Fish and Wildlife Service (USFWS). 2015a. Endangered and threatened wildlife and plants; 12-month finding on a petition to list the New England cottontail as an endangered or threatened species. 80 *Federal Register* 178 (15 September 2015), pp. 55286–55304.

———. 2015b. *Northern Long-Eared Bat (Myotis septentrionalis)*. April. Available [online]: <https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/NLEBFactSheet01April2015.pdf>. Accessed on 4 December 2019.

———. 2016. Endangered and threatened wildlife and plants; 4(d) rule for the northern long-eared bat. 81 *Federal Register* 9 (14 January 2016), pp. 1900–1922.

———. 2019a. Information for Planning and Consultation (IPaC). Barnstable County.

———. 2019b. *Northern Long-Eared Bat (Myotis Septentrionalis)*. Midwest Region Endangered Species. 17 May.

———. 2019c. *Species by County Report: Barnstable, Massachusetts*. Available [online]: <https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=25001>. Accessed on 4 December 2019.

- . 2020a. *IPaC Resources List for Camp Edwards Training Site*. Accessed on 21 September 2020. Available [online]: <https://ecos.fws.gov/ipac/>.
- . 2020b. *National Listing Workplan 5-Year Workplan (May 2019 Version)*. Accessed on 4 August 2020. Available [online]: <https://www.fws.gov/endangered/esa-library/pdf/5-Year%20Listing%20Workplan%20May%20Version.pdf>.
- U.S. Geological Survey (USGS). 2003. *Land Cover Trends: Atlantic Coastal Pine Barrens*. USGS Fact Sheet FS-092-03. July. Available [online]: <https://pubs.usgs.gov/fs/2003/0092/report.pdf>. Accessed on 1 December 2019.
- Veit, R.R. and W.R. Petersen. 1993. *Birds of Massachusetts*. Massachusetts Audubon Society, Lincoln, Massachusetts.
- Veit, M.F. 2019. *2019 Camp Edwards Survey for Anthophora walshii (Hymenoptera: Anthophila)*. Lawrence Academy, Groton, Massachusetts.
- White, R.P. and S.M. Melvin. 1985. *Rare Grassland Birds and Management Recommendations for Camp Edwards/Otis Air National Guard Base*. Report prepared for the Massachusetts National Guard.
- Wilkinson Ecological Design, Inc. 2018. *Vegetation Management Plan, Massachusetts Army National Guard, Camp Edwards*. 7 March.
- Wilson, K.A. and P.M. Cavanagh. 1996. *Call-Response Surveys for Monitoring Secretive Waterbirds on Camp Edwards Army National Guard Training Site*. Report EDW-LCTA-96-1.

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).

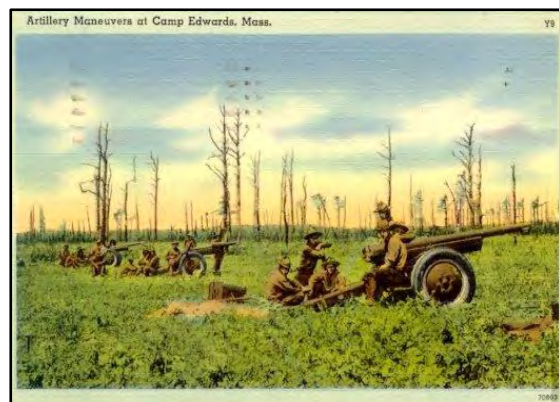
Initial construction on Camp Edwards occurred between 1935 and 1940 and consisted of 63 buildings and 2 runways (MANG 2018a). Construction ramped up between 1940 and 1941 with the threat of war and ahead of plans for a year-long training effort; during this time more than 1,300 buildings were constructed 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.

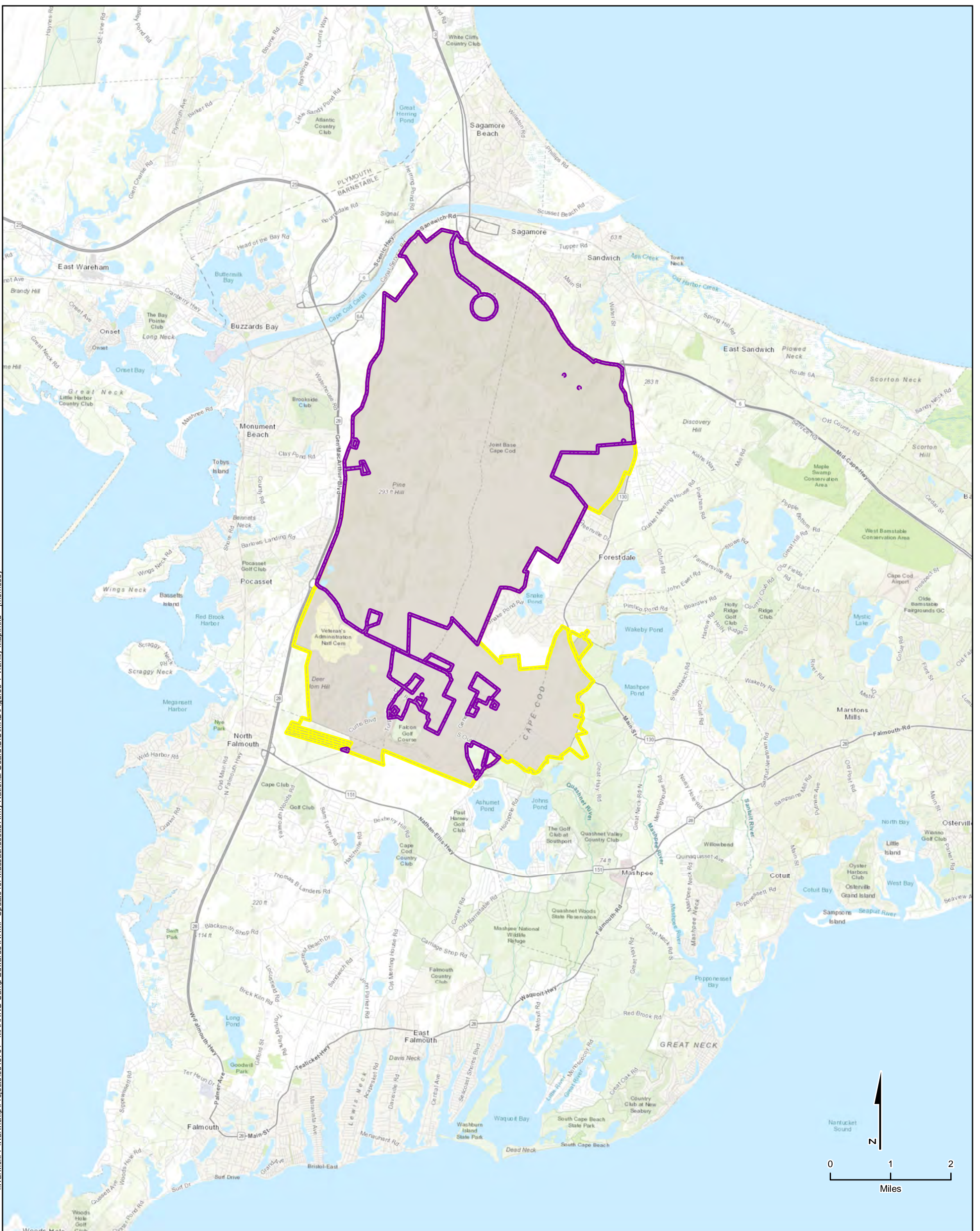
In May 1997, the U.S. Environmental Protection Agency (EPA), citing potential groundwater contamination from actual or potential releases emanating from the Training Ranges and Impact Area, delivered Administrative Order 1 to MAARNG. As a result, range use and other training on Camp Edwards was extremely 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.

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.



Early 1940s postcard depicting military activities at Camp Edwards

\\Warwick\FP\Warwick\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure3-1 Vicinity Map.mxd - jmorrissey



- Legend**
- Installation Boundary
 - Camp Edwards Boundary

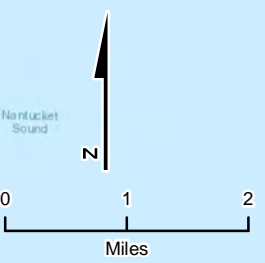
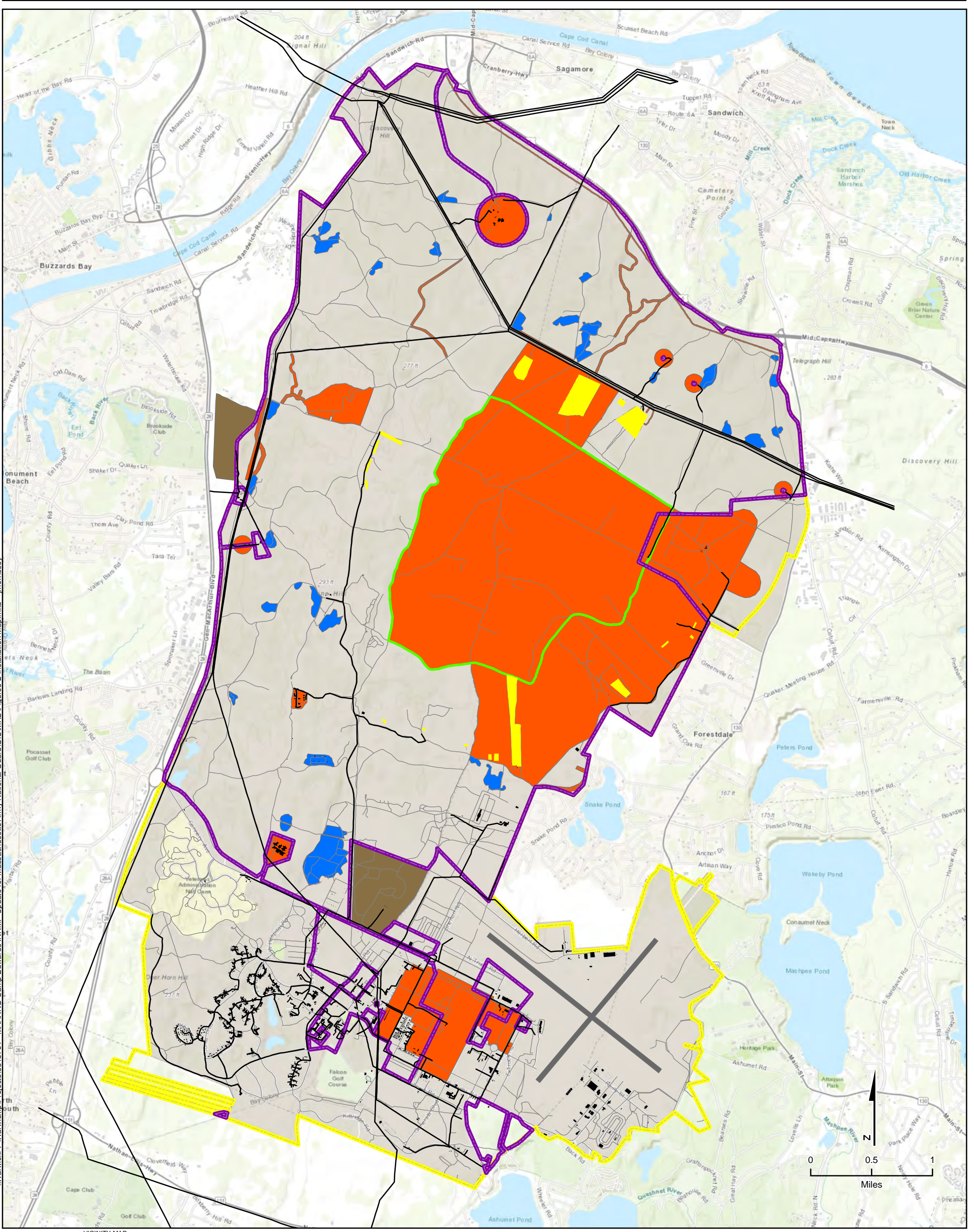


Figure C-1
Vicinity Map
Camp Edwards Training Site
Cape Cod, Massachusetts

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



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

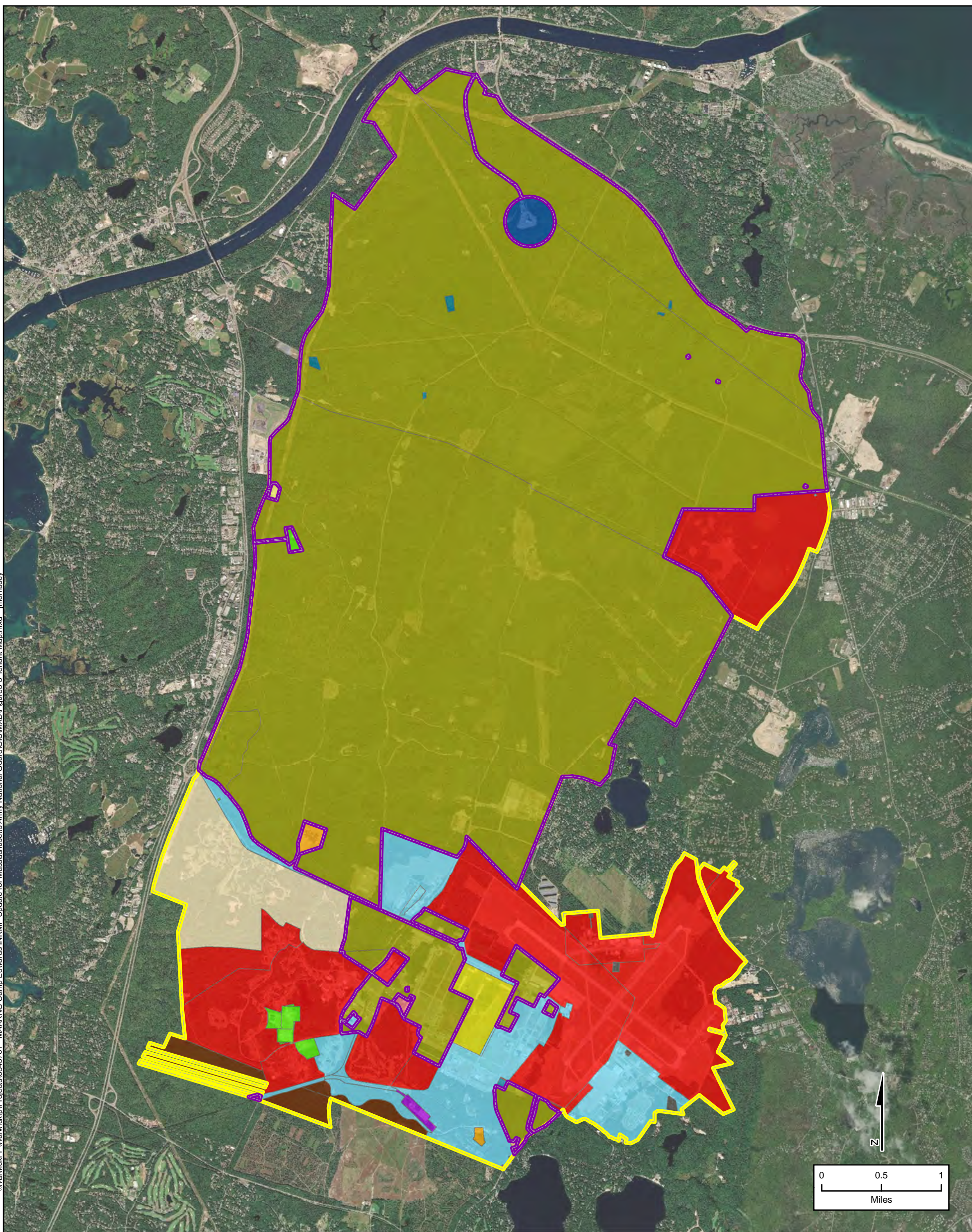
Figure C-2
Installation Map
 Camp Edwards Training Site
 Cape Cod, Massachusetts

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



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\\Warwick\FP\Warwick\p\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure3-3 Tenant_Map.mxd imorrissey



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 Maritime Academy
 - 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



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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
<p>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.</p> <p>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.</p>

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.

RECURRING AND NON-RECURRING CONSERVATION REQUIREMENTS

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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <i>Partners in Amphibian and Reptile Conservation Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States</i> (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 <i>Conservation and Management Plan for the Camp Edwards Road Repairs and Clam Shrimp Relocation</i> (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 <i>Conservation and Management Plan for the Multipurpose Machine Gun Range at Camp Edwards</i> . 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.

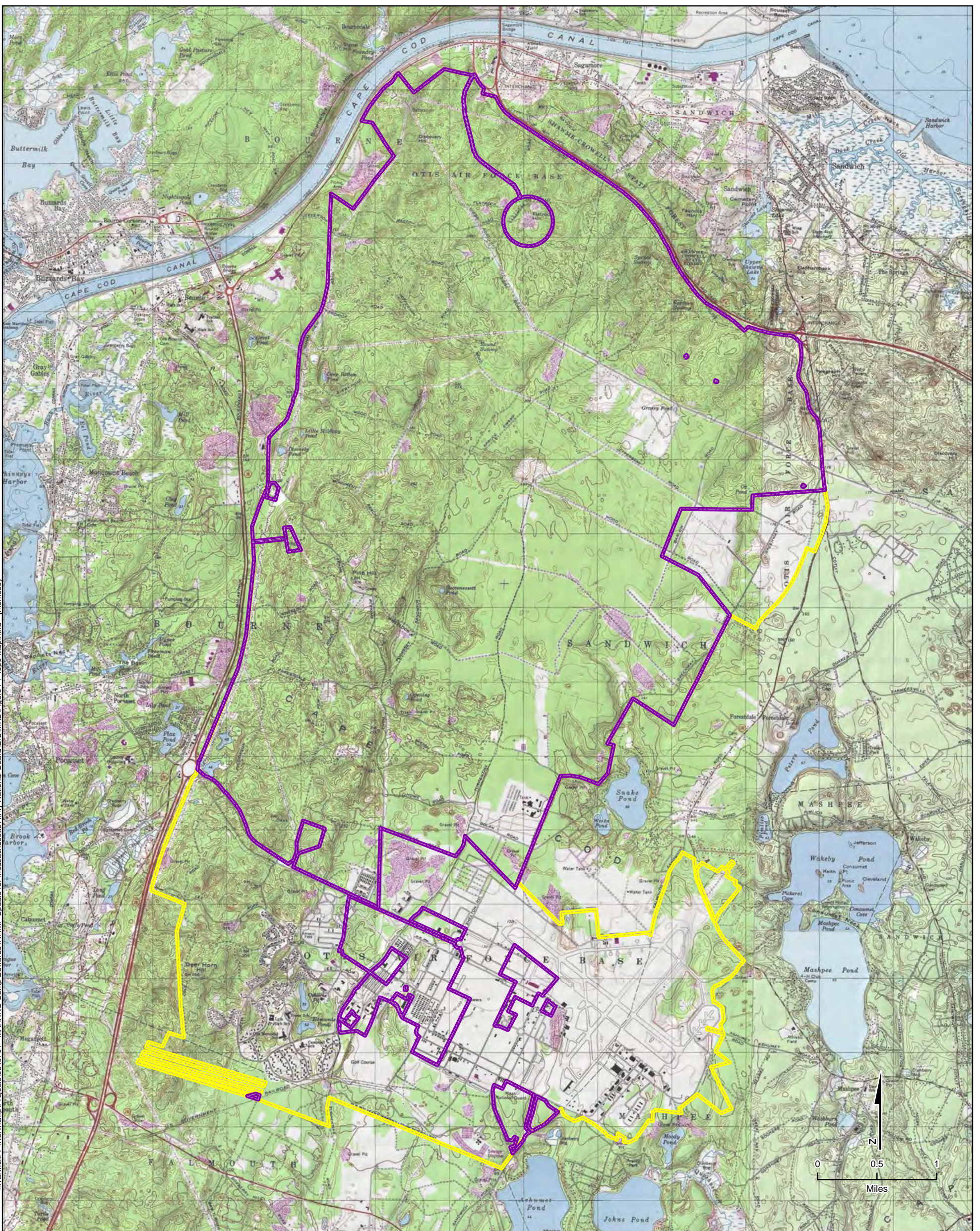
As the Laurentide Ice Sheet melted and retreated over the course of hundreds or thousands of years, rivers and streams of melt water deposited material from the moraines southward to the ocean. Much of the loam and clay washed into the Atlantic Ocean while the sand, gravel, and cobble was deposited closer 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.

\\Warwick\FP\Warwick\Projects\6345701 - MAARNG Camp Edwards INRIP Update for Massachusetts Army National Guard\GIS\MXD\Figure4-1 Topo Map.mxd - jmorisssey



- Legend**
- Installation Boundary
 - Camp Edwards Boundary

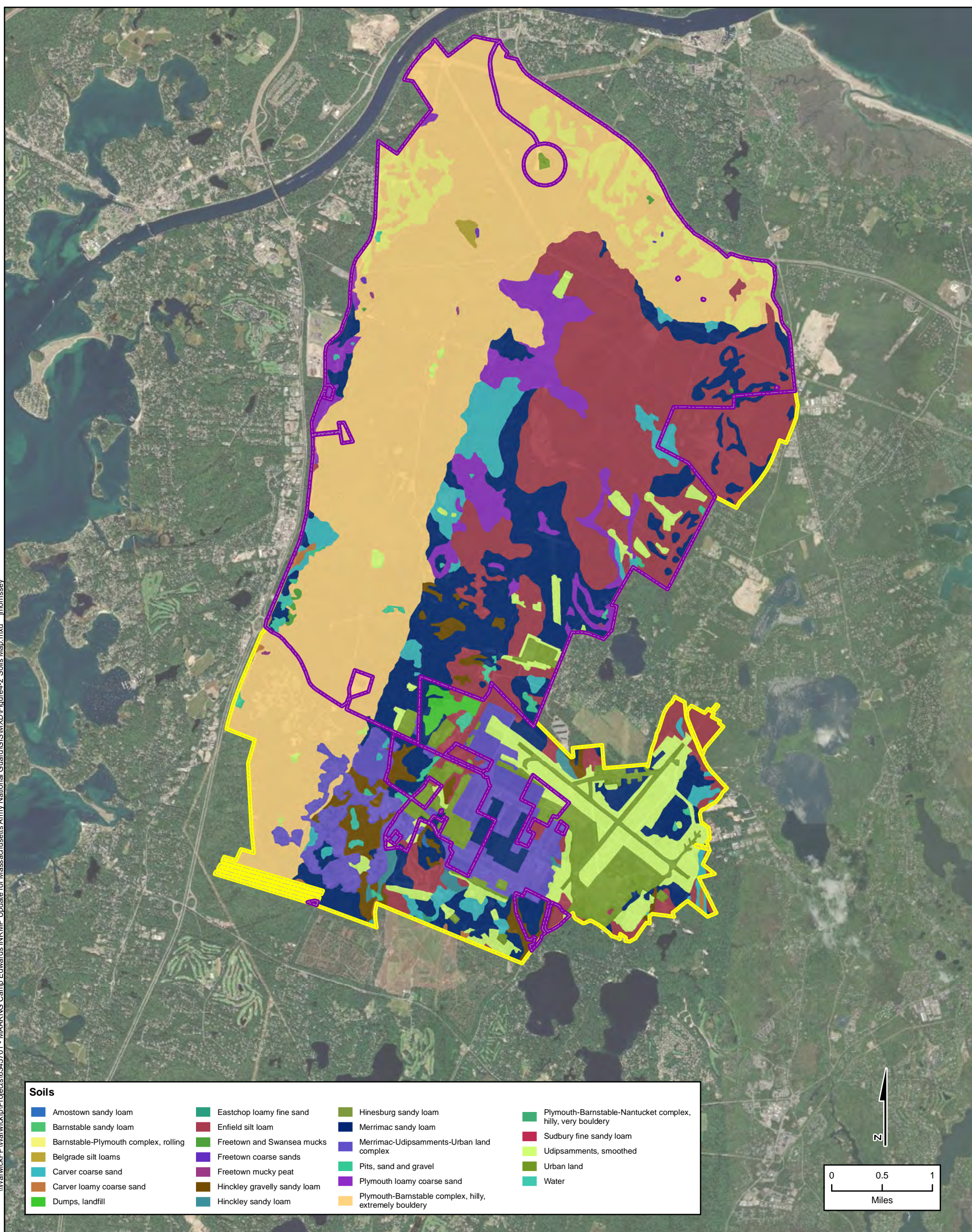
Figure E-1
Topographic Map
 Camp Edwards Training Site
 Cape Cod, Massachusetts

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



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\\Warwick\FP\Warwick\p\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure4-2 Soils Map.mxd _imorrissey



Legend
 Installation Boundary

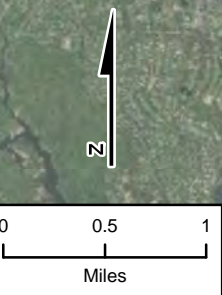


Figure E-2
 Soils Map
 Camp Edwards Training Site
 Cape Cod, Massachusetts

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



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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

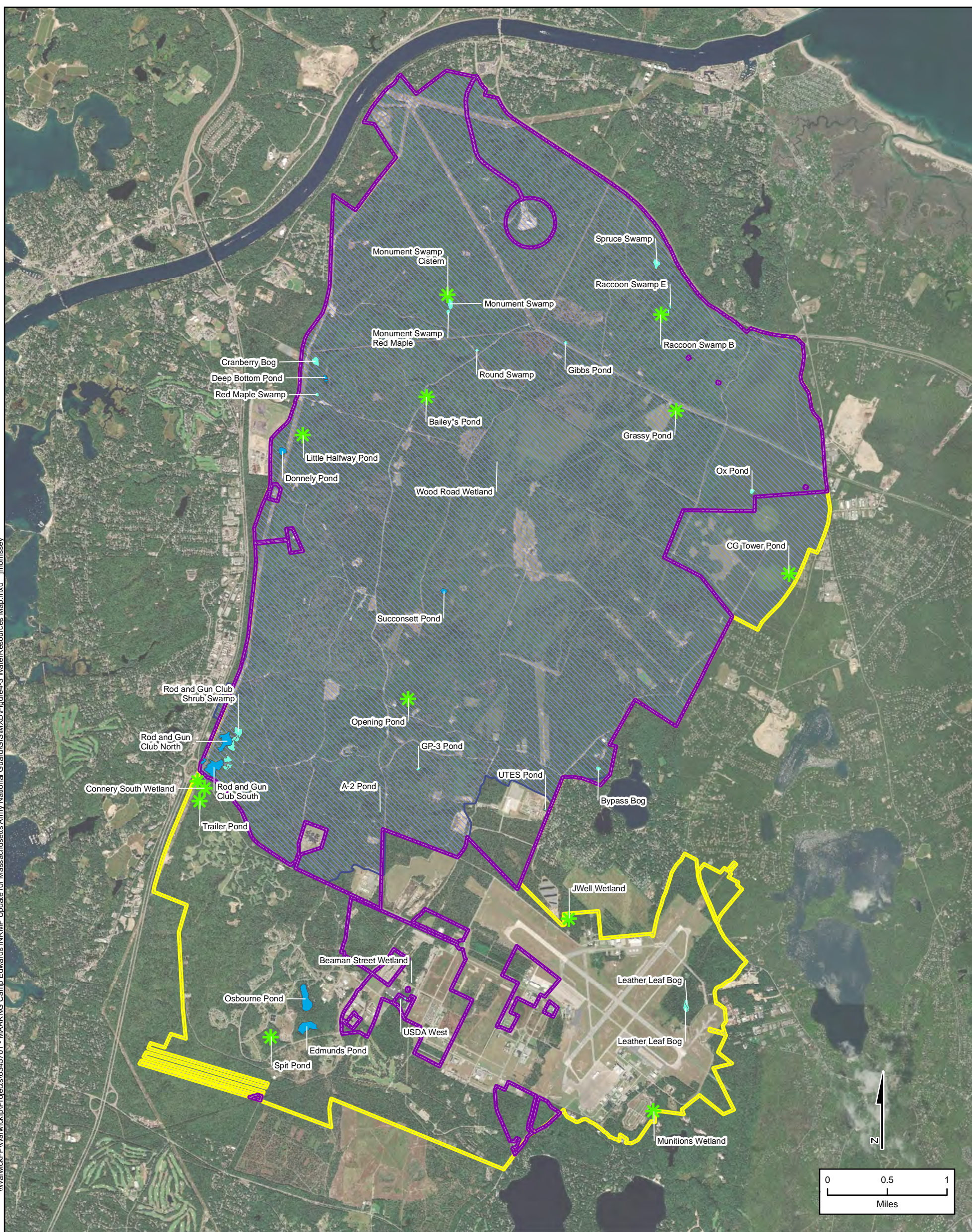
Surface water resources are sparse on Camp Edwards. Although there are 31 wetlands on the training site, they comprise only 69 of the 14,433 acres, or 0.39 percent, of land. No large lakes, rivers, or streams exist on the property, only small palustrine (i.e., marshy) wetlands and ponds (Gravatt et al. 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.

\\Warwick\FP\Warwick\p\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure4-3 WaterResources Map.mxd _imortissay



- 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
Donnelly 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 (<i>Quercus ilicifolia</i>) with essentially no pitch pine (<i>Pinus rigida</i>). Other common plants in the scrub oak barrens include black huckleberry (<i>Gaylussacia baccata</i>), blueberry (<i>Vaccinium</i> spp.), cat brier (<i>Smilax glauca</i>), and wintergreen (<i>Gaultheria procumbens</i>).
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 (<i>P. sylvestris</i>), white oak (<i>Q. alba</i>), and scarlet oak (<i>Q. coccinea</i>).
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 (<i>Schizachyrium scoparium</i>), Pennsylvania sedge (<i>Carex pensylvanica</i>), and poverty grass (<i>Danthonia spicata</i>), as well as goldenrods (<i>Solidago</i> and <i>Euthamia</i> spp.) and milkweeds (<i>Asclepias</i> 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

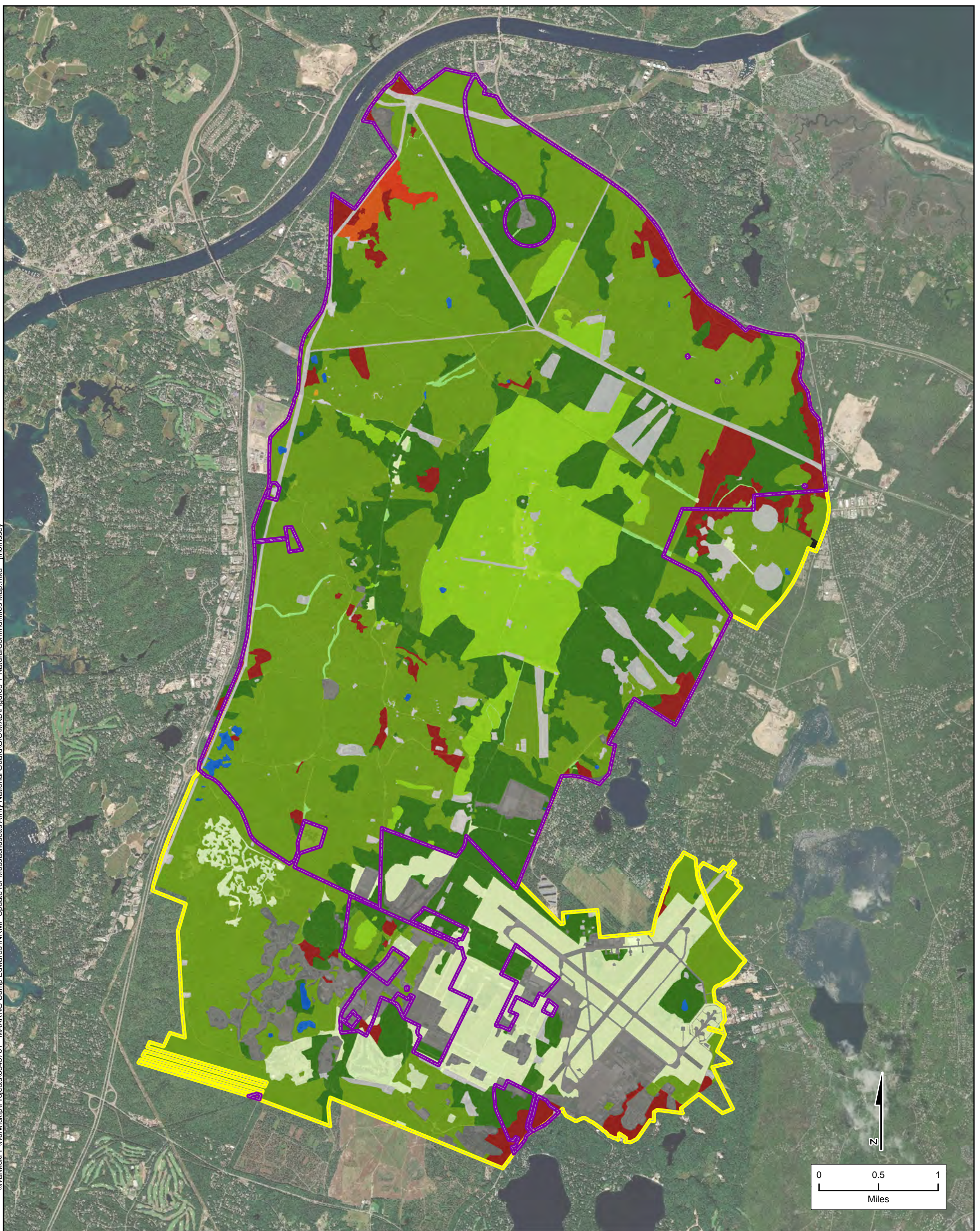
1.2.2.3 Pitch Pine – Scrub Oak Forest / Woodland

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.

\\Warwick\FP\Warwick\p\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figures-1 NaturalCommunities Map.mxd imorrissey



- 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*), reedtop (*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 serpentina*), 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 holbrookii*) 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**	<i>Myotis septentrionalis</i>	T
American chaffseed	<i>Schwalbea americana</i>	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		
<i>Myotis septentrionalis</i>	Northern Long Eared Bat	E
<i>Myotis lucifugus</i>	Little Brown Bat	E
<i>Myotis leibii</i>	Eastern Small-Footed Bat	E
<i>Perimyotis subflavus</i>	Tricolored Bat	E
Reptiles and Amphibians		
<i>Terrapene carolina</i>	Eastern Box Turtle	SC
<i>Heterodon platirhinos</i>	Eastern Hog-nosed Snake	SC
Birds		
<i>Bartramia longicauda</i>	Upland Sandpiper	E
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	T
<i>Circus cyaneus</i>	Northern Harrier	T
<i>Parula americana</i>	Northern Parula	T
<i>Sturnella magna</i>	Eastern Meadowlark	SC
<i>Pooecetes gramineus</i>	Vesper Sparrow	T
<i>Caprimulgus vociferus</i>	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		
<i>Enallagma carunculatum</i>	Tule Bluet	SC
<i>Enallagma recurvatum</i>	Pine Barrens Bluet	T
Moths		
<i>Acronicta albarufa</i>	Barrens Dagger Moth	T
<i>Hemileuca maia</i>	Barrens Buckmoth	SC
<i>Catocala herodias gerhardi</i>	Gerhard's Underwing Moth	SC
<i>Cicinnus melsheimeri</i>	Melsheimer's Sack Bearer	T
<i>Dargida rubripennis</i>	Pink Streak	T
<i>Papaipema sulphurata</i>	Water-Willow Borer Moth	T
<i>Cingilia catenaria</i>	Chain-dot Geometer	SC
<i>Abagrotis nefascia benjamini</i>	Coastal Heathland Cutworm	SC
<i>Metarranthis pilosaria</i>	Coastal Swamp Metarranthis	SC
<i>Papaipema</i> sp.	Ostrich Fern Borer	SC
<i>Zale lunifera</i>	Pine Barrens Zale	SC
<i>Psectraglaea carnosae</i>	Pink Sallow	SC
<i>Euchlaena madusaria</i>	Sandplain Euchlaena	SC
<i>Chaetagnaea cerata</i>	Waxed Sallow Moth	SC
<i>Cyenia inopinatus</i>	Unexpected Cyenia	T
<i>Lycia ypsilon</i>	Pine Barrens Lycia	T
<i>Speranza exonerata</i>	Pine Barrens Speranza	SC
<i>Sympistis riparia</i>	Dune Nocturnid Moth	SC
<i>Apamea inebriata</i>	Drunken Apamea	SC
Butterflies		
<i>Callophrys irus</i>	Frosted elfin	SC
Bees		
<i>Anthophora walshii</i>	Walsh's Anthora	E
Crustaceans		
<i>Eulimnadia agassizii</i>	Agassiz's Clam Shrimp	E
Plants		
<i>Triosteum perfoliatum</i>	Broad Tinker's Weed	E
<i>Ophioglossum pusillum</i>	Adder's Tongue Fern	T
<i>Eleocharis ovata</i>	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		
<i>Scaphiopus holbrooki</i>	Eastern Spadefoot ¹	T
Moths		
<i>Hemaris gracilis</i>	Slender Clearwing Sphinx ¹	SC
Beetles		
<i>Cicindela purpurea</i>	Purple Tiger Beetle ¹	SC
Plants		
<i>Agalinis acuta</i>	Sandplain gerardia ²	E
<i>Rhynchospora torreyana</i>	Torrey's Beak-Sedge ²	E
<i>Schwalbea Americana</i>	American Chaffseed ²	E
<i>Juncus debilis</i>	Weak Rush ²	E
<i>Malaxis bayardii</i>	Bayard's Green Adder's Mouth ²	E
<i>Scleria pauciflora</i>	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 gramineus*), 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

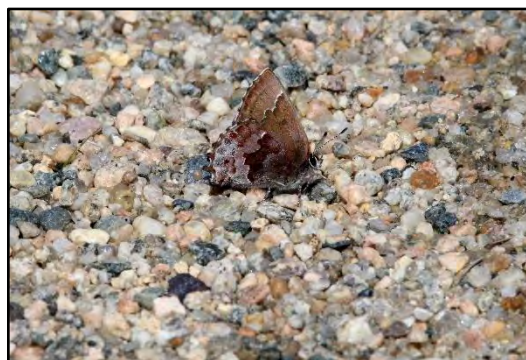
promote this species. This species is expected to benefit from the mitigation actions outlined in the CMP.

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

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.



Frosted elfin (Callophrys irus)

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	<i>Myotis lucifugus</i>	Discretionary Status Review/PLPCH	Known to occur
Tricolored bat	<i>Perimyotis subflavus</i>	12M/PLPCH	Known to occur
Reptiles			
Spotted turtle	<i>Clemmys guttata</i>	12M/PLPCH	Known to occur
Invertebrates			
Monarch butterfly	<i>Danaus plexippus plexippus</i>	12M/PLPCH	Potential to occur
Regal fritillary	<i>Speyeria idalia</i>	12M/PLPCH	Potential to occur
Frosted elfin	<i>Callophrys irus</i>	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	<i>Haematopus palliatus</i>	Highest		X
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Moderate		X
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Not Ranked – Watch List Species	X	
Bobolink	<i>Dolichonyx oryzivorus</i>	Not Ranked – Watch List Species		X
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	High		X
Canada Warbler	<i>Cardellina canadensis</i>	Moderate		X
Clapper Rail	<i>Rallus crepitans</i>	High		X
Dunlin	<i>Calidris alpina arctica</i>	High		X
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	High		X
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	Not Ranked – Watch List Species		X
Gull-billed Tern	<i>Gelochelidon nilotica</i>	Highest		X
Kentucky Warbler	<i>Oporornis formosus</i>	High		X
Least Tern	<i>Sterna antillarum</i>	High		X
Lesser Yellowlegs	<i>Tringa flavipes</i>	Moderate		X
Long-eared Owl	<i>Asio otus</i>	Not Ranked – Watch List Species		X
Nelson's Sparrow	<i>Ammodramus nelsoni</i>	Not Ranked – Watch List Species		X
Prairie Warbler	<i>Setophaga discolor</i>	Highest	X	
Prothonotary Warbler	<i>Protonotaria citrea</i>	High		X
Purple Sandpiper	<i>Calidris maritima</i>	High		X
Red-throated Loon	<i>Gavia stellata</i>	Highest		X
Ruddy Turnstone	<i>Arenaria interpres morinella</i>	Highest		X
Rusty Blackbird	<i>Euphagus carolinus</i>	High		X
Seaside Sparrow	<i>Ammodramus maritimus</i>	Moderate		X
Semipalmated Sandpiper	<i>Calidris pusilla</i>	High		X
Short-billed Dowitcher	<i>Limnodromus griseus</i>	High		X
Snowy Owl	<i>Bubo scandiacus</i>	Not Ranked – Watch List Species		X
Whimbrel	<i>Numenius phaeopus</i>	Highest		X
Willet	<i>Tringa semipalmata</i>	High		X
Wood Thrush	<i>Hylocichla mustelina</i>	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 Massachusetts*: 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	Common Name	Scientific Name
Adder's-tongue fern	<i>Ophioglossum vulgatum</i>	Bluecurls	<i>Trichostema dichotomum</i>
Alfalfa	<i>Medicago sativa</i>	Bluegrass	<i>Poa</i> sp.
Alternate leaved dogwood	<i>Cornus alternifolia</i>	Bluejoint	<i>Calamagrostis canadensis</i>
American beech	<i>Fagus grandifolia</i>	Blue-stemmed goldenrod	<i>Solidago caesia</i>
American cow wheat	<i>Melampyrum lineare</i>	Bluets	<i>Houstonia caerulea</i>
American hazel	<i>Corylus americana</i>	Blunt spikerush	<i>Eleocharis obtusa</i>
American holly	<i>Ilex opaca</i>	Blunt-leaved sandwort	<i>Moehringia lateriflora</i>
American starflower	<i>Trientalis borealis</i>	Bluntscale-bulrush	<i>Scirpus smithii</i>
American willow-herb	<i>Epilobium ciliatum</i>	Bracken fern	<i>Pteridium aquilinum</i>
Apple	<i>Malus sylvestris</i>	Bracted plantain	<i>Plantago aristata</i>
Arrow-leaved tearthumb	<i>Polygonum sagittatum</i>	Bright-green spikerush	<i>Eleocharis olivacea</i>
Arrow-wood	<i>Viburnum recognitum</i>	Bristly sarsaparilla	<i>Aralia hispida</i>
Asparagus	<i>Asparagus officinalis</i>	Broad-leaf cattail	<i>Typha latifolia</i>
Aster	<i>Aster</i> spp.	Broad-leaf meadowsweet	<i>Spiraea alba</i> var. <i>latifolia</i>
Autumn bentgrass	<i>Agrostis perennans</i>	Brown knapweed	<i>Centaurea jacea</i>
Autumn olive	<i>Elaeagnus umbellata</i>	Brown-fruit rush	<i>Juncus pelocarpus</i>
Awl-aster	<i>Aster pilosus</i>	Brownish beakrush	<i>Rhynchospora capitellata</i>
Bachelor's buttons	<i>Centaurea cyanus</i>	Brownish sedge	<i>Carex brunnescens</i>
Barnyard-grass	<i>Echinochloa crusgalli</i>	Bulbous buttercup	<i>Ranunculus bulbosus</i>
Bayberry	<i>Myrica pensylvanica</i>	Bull thistle	<i>Cirsium vulgare</i>
Bayonet rush	<i>Juncus militaris</i>	Bur-reed	<i>Sparganium americanum</i>
Beach pinweed	<i>Lechea maritima</i>	Bushy bluestem	<i>Andropogon glomeratus</i>
Bead-grass	<i>Paspalum setaceum</i>	Butter-and-eggs	<i>Linaria vulgaris</i>
Beaked hazel-nut	<i>Corylus cornuta</i>	Butterflyweed	<i>Asclepias tuberosa</i>
Bearberry	<i>Arctostaphylos uva-ursi</i>	Buttonweed; Poorjoe	<i>Dioda teres</i>
Bedstraw	<i>Galium pilosum</i>	Canada bluegrass	<i>Poa compressa</i>
Beggar ticks	<i>Bidens fondosa</i>	Canada bunchberry	<i>Cornus canadensis</i>
Bellwort; Merrybells	<i>Uvularia sessilifolia</i>	Canada goldenrod	<i>Solidago canadensis</i>
Bentgrass	<i>Agrostis</i> sp.	Canada hawkweed	<i>Hieracium canadense</i>
Big-toothed aspen	<i>Populus grandidentata</i>	Canada mayflower	<i>Maianthemum canadense</i>
Bird-foot violet	<i>Viola pedata</i>	Canada rush	<i>Juncus canadensis</i>
Birdsfoot-trefoil	<i>Lotus corniculata</i>	Canada St. John's-wort	<i>Hypericum canadense</i>
Bittersweet nightshade	<i>Solanum dulcamara</i>	Carey's knotweed	<i>Polygonum careyi</i>
Black bindweed	<i>Polygonum convolvulus</i>	Carolina lovegrass	<i>Eragrostis pectinacea</i>
Black cherry; Wild cherry	<i>Prunus serotina</i>	Carpetweed	<i>Mollugo verticillata</i>
Black gum	<i>Nyssa sylvatica</i>	Cat brier	<i>Smilax glauca</i>
Black highbush blueberry	<i>Vaccinium atrococcum</i>	Catnip	<i>Nepeta cataria</i>
Black huckleberry	<i>Gaylussacia baccata</i>	Cat's ear	<i>Hypochoeris radicata</i>
Black locust	<i>Robinia pseudoacacia</i>	Cherries	<i>Prunus</i> spp.
Black medick	<i>Medicago lupulina</i>	Chicory	<i>Cichorium intybus</i>
Black Nightshade	<i>Solanum nigrum</i>	Choke cherry	<i>Prunus virginiana</i>
Black oak	<i>Quercus velutina</i>	Christmas fern	<i>Polystichum acrostichoides</i>
Black raspberry	<i>Rubus occidentalis</i>	Churchmouse three-awn	<i>Aristida dichotoma</i>
Black snakeroot	<i>Sanicula marilandica</i>	Cinnamon fern	<i>Osmunda cinnamomea</i>
Black swallowwort	<i>Cynachum nigrum</i>	Clasping dogbane	<i>Apocynum sibiricum</i>
Black willow	<i>Salix nigra</i>	Cleavers	<i>Galium aparine</i>
Blackberry	<i>Rubus alleghaniensis</i>	Climbing false buckwheat	<i>Polygonum scandens</i>
Black-eyed Susan	<i>Rudbeckia hirta</i>	Coastal mannagrass	<i>Glyceria obtusa</i>
Blue toadflax	<i>Linaria canadensis</i>	Colt's-foot	<i>Tussilago farfara</i>
Blueberry; cranberry	<i>Vaccinium</i> sp.	Common boneset	<i>Eupatorium perfoliatum</i>
		Common buckthorn	<i>Rhamnus cathartica</i>
		Common burdock	<i>Arcticum minus</i>
		Common cinquefoil	<i>Potentilla simplex</i>

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

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

Common Name

Petticoat climber, Purple lovegrass
 Pickerel weed; Tuckahoe
 Pignut hickory
 Pilewort; Fireweed
 Pin cherry
 Pinesap; False beechdrops
 Pink knotweed
 Pink ladies' slipper
 Pink tickseed
 Pinweed
 Pitch pine
 Plains snakecotton
 Pointed broom sedge
 Poison ivy
 Pokeweed
 Poor-man's pepper
 Poverty grass
 Poverty-grass
 Prairie cord-grass
 Prairie three-awn
 Prickly bog sedge
 Primrose-leaf violet
 Prince's pine
 Purple bladderwort
 Purple chokeberry
 Purple St. Johns-wort
 Purpletop
 Pussy-willow
 Quaking aspen
 Queen Anne's Lace
 Rabbit-foot clover
 Racemed milkwort
 Ragweed
 Rattlesnake mannagrass
 Rattlesnake weed
 Red baneberry
 Red cedar
 Red chokeberry
 Red clover
 Red fescue
 Red hickory
 Red maple
 Red pine
 Red raspberry
 Red spruce
 Red-stemmed dogwood
 Red-stemmed plantain
 Reed-grass
 Rhode Island bent
 Rhodora
 Rice cut-grass
 Ricegrass

Scientific Name

Eragrostis spectabilis
Pontederia cordata
Carya glabra
Erechtites hieracifolia
Prunus pensylvanica
Monotropa hypopithys
Polygonum pensylvanicum
Cypripedium acaule
Coreopsis rosea
Lechea spp.
Pinus rigida
Froelichia floridana
Carex scoparia
Toxicodendron radicans
Phytolacca americana
Lepidium virginicum
Danthonia spicata
Sporobolus vaginiflorus
Spartina pectinata
Aristata oligantha
Carex atlantica
Viola primulifolia
Chimaphila umbellata
Utricularia purpurea
Aronia x prunifolia
Triandenum virginicum
Tridens flavus
Salix discolor
Populus tremula
Daucus carota
Trifolium arvense
Polygala polygama
Ambrosia artemisiifolia
Glyceria canadensis
Hieracium venosum
Actaea rubra
Juniperus virginiana
Aronia arbutifolia
Trifolium pratense
Festuca rubra
Carya ovalis
Acer rubrum
Pinus resinosa
Rubus idaeus
Picea rubens
Cornus stolonifera
Plantago rugelii
Calamagrostis cinnoides
Agrostis capillaris
Rhododendron canadense
Leersia oryzoides
Oryzopsis pungens

Common Name

Robbin's spikerush
 Robin's plintain
 Rock polypody
 Rough barnyard-grass
 Rough cinquefoil
 Rough-fruited cinquefoil
 Rough-stemmed goldenrod
 Round leaved sundew
 Round-headed bush clover
 Roundleaf juneberry
 Round-leaved pyrola
 Roundseed panic grass
 Royal fern
 Rugosa rose
 Running pine
 Ryegrass
 Sage
 Sand cherry
 Sand jointweed
 Sand spurrey
 Sassafras
 Scarlet oak
 Scotch broom
 Scotch pine
 Scrub-oak
 Sedge
 Selfheal; Heal-all
 Sensitive fern
 Sessile-leaved horehound
 Shallow sedge
 Sheep fescue
 Sheep sorrel
 Sheep-laurel
 Shining sumac; Winged sumac
 Shinleaf
 Sickle-leaved golden aster
 Silky dogwood
 Silvery cinquefoil
 Silver-hairgrass
 Skunk cabbage
 Slender bush clover
 Slender fimbry
 Slender ladies' tresses
 Slender pondweed
 Slender wheatgrass
 Small-headed aster
 Small-leaved Linden
 Smooth brome-grass
 Smooth Winterberry
 Soapwort; Bouncing bet
 Southern sneezeweed
 Southern three-lobed bedstraw
 Southern yellow wood-sorrel

Scientific Name

Eleocharis robbinsii
Erigeron pulchellus
Polypodium virginianum
Echinochloa muricata
Potentilla norvegica
Potentilla recta
Solidago rugosa
Drosera rotundifolia
Lespedeza capitata
Amelanchier sanguinea
Pyrola rotundifolia
Dichanthelium sphaerocarpon
Osmunda regalis
Rosa rugosa
Lycopodium clavatum
Lolium perenne
Salvia officinalis
Prunus pumila
Polygonella articulata
Spergularia rubra
Sassafras albidum
Quercus coccinea
Cytisus scoparius
Pinus sylvestris
Quercus ilicifolia
Carex spp.
Prunella vulgaris
Onoclea sensibilis
Lycopus amplexans
Carex lurida
Festuca ovina
Rumex acetosella
Kalmia angustifolia
Rhus copallina
Pyrola elliptica
Heterotheca falcata
Cornus amomum
Potentilla argentea
Aira carophyllea
Symplocarpos foetidus
Lespedeza virginica
Fimbristylis autumnalis
Spiranthes lacera
Potamogeton pusillus
Elymus trachycaulus
Aster vimineus
Tilia cordata
Bromus inermis
Ilex laevigata
Saponaria officinalis
Helenium flexuosum
Galium tinctorium
Oxalis dillenii

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

Common Name

Yellow foxtail-grass
Yellow hedge-hyssop
Yellow nutsedge
Yellow stargrass
Yellow water-lily
Yellow-eyed grass
Yellowfruit sedge

Scientific Name

Setaria glauca
Gratiola aurea
Cyperus esculentus
Hypoxis hirsuta
Nuphar lutea
Xyris difformis
Carex annectens
Agropyron trachycaulum
Carex emmonsii
Carex longii
Carex rosea
Carex rugosperma
Cyperus filiculmis
Cyperus grayii
Dichantherium 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 zae
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 stigmata
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 virginensis
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
Argyrostroma anilis
Autographa ampla
Autographa precatationis
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

Callopietria cordata
Callopietria 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 relictata
Catocala similis
Catocala sordida
Catocala ultronia
Catocala unijuga
Cepphis armataria
Cerma cerintha
Cerura multiscrypta
Chaetagnathia cerata
Chaetagnathia sericea
Chaetagnathia tremula
Charadra deridens
Chlorochlamys chloroleucaria
Chloroclystis rectangularata
Chrysanympha formosa
Chytolita morbidalis
Chytornix palliatricula
Chytornix 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
Cyenia oregonensis
Cyenia 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 festivoidea
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
Euclidean 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
Protoarmia porcelaria
Protolampra brunneicollis
Protorthodes oviduca

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

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	<i>Lestes eurinus</i>
Atlantic Bluet	<i>Enallagma doubledayi</i>
Azure Bluet	<i>Enallagma aspersum</i>
Black Saddlebags	<i>Tramea lacerata</i>
Black-tipped Darner	<i>Aeshna tuberculifera</i>
Blue Corporal	<i>Libellula deplanata</i>
Blue Dasher	<i>Pachydiplax longipennis</i>
Calico Pennant	<i>Celithemis elisa</i>
Carolina Saddlebags	<i>Tramea carolina</i>
Citrine Forktail	<i>Ischnura hastata</i>
Comet Darner	<i>Anax longipes</i>
Common Baskettail	<i>Epitheca cynosura</i>
Common Green Darner	<i>Anax junius</i>
Common or Sweetflag Spreadwing	<i>Lestes disjunctus/forcipatus</i>
Common Sanddragon	<i>Progomphus obscurus</i>
Common Spreadwing	<i>Lestes disjunctus</i>
Common Whitetail	<i>Libellula lydia</i>
Dot-tailed Whiteface	<i>Leucorrhinia intacta</i>
Eastern Amberwing	<i>Perithemis tenera</i>
Eastern Forktail	<i>Ischnura verticalis</i>
Eastern Pondhawk	<i>Erythemis simplicicollis</i>
Elegant Spreadwing	<i>Lestes inaequalis</i>
Four-spotted Skimmer	<i>Libellula quadrimaculata</i>
Fragile Forktail	<i>Ischnura posita</i>
Fragile Forktail	<i>Ishnura posita</i>
Frosted Whiteface	<i>Leucorrhinia frigida</i>
Golden-winged Skimmer	<i>Libellula auripennis</i>
Goldenwings	<i>Libellula auripennis/needhami</i>
Great Blue Skimmer	<i>Libellula vibrans</i>
Green-striped Darner	<i>Aeshna verticalis</i>
Halloween Pennant	<i>Celithemis eponina</i>
Lancet Clubtail	<i>Gomphis exilis</i>
Lilypad Forktail	<i>Ischnura kellicotti</i>
Lyre-tipped Spreadwing	<i>Lestes unguiculatus</i>
Martha's Pennant	<i>Celithemis martha</i>
Mottled Darner	<i>Aeshna clepsydra</i>
New England Bluet	<i>Enallagma laterale</i>
Northern Bluet	<i>Enallagma cyathigerum</i>
Painted Skimmer	<i>Libellula semifasciata</i>
Petite Emerald	<i>Dorocordulia lepida</i>
Pond Damsel	<i>Coenagrionidae species</i>
Ruby Meadowhawk	<i>Sympetrum rubicundulum</i>

Common Name	Scientific Name
Scarlet Bluet	<i>Enallagma pictum</i>
Seaside Dragonlet	<i>Erythrodiplax berenice</i>
Sedge Sprite	<i>Nehalennia irene</i>
Shadow Darner	<i>Aeshna umbrosa</i>
Skimming Bluet	<i>Enallagma geminatum</i>
Skimming Bluet	<i>Enallagma signatum</i>
Slaty Skimmer	<i>Libellula incesta</i>
Slender Spreadwing	<i>Lestes rectangularis</i>
Spangled Skimmer	<i>Libellula cyanea</i>
Spatterdock Darner	<i>Aeshna mutata</i>
Sphagnum sprite	<i>Nehalennia gracilis</i>
Spotted Spreadwing	<i>Lestes congener</i>
Spot-winged Glider	<i>Pantala hymenaea</i>
Stream Cruiser	<i>Didymops transversa</i>
Swamp Spreadwing	<i>Lestes vigilax</i>
Sweetflag Spreadwing	<i>Lestes forcipatus</i>
Twelve-spotted Skimmer	<i>Libellula pulchella</i>
Twelve-spotted Skimmer	<i>Libellula pulchella</i>
Variable Dancer	<i>Argia fumipennis</i>
Vesper Bluet	<i>Enallagma vesperum</i>
Wandering Glider	<i>Pantala flavescens</i>
White Corporal	<i>Libellula exusta</i>
Widow Skimmer	<i>Libellula luctuosa</i>
Yellow-legged Meadowhawk	<i>Sympetrum vicinum</i>

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 mellifera

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

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

**MAMMAL SPECIES OF
CAMP EDWARDS, MA**

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

**REPTILE SPECIES OF
CAMP EDWARDS, MA**

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

AMPHIBIAN SPECIES OF
CAMP EDWARDS, MA

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

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.

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



Off-Limits Grassland Bird Area

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):

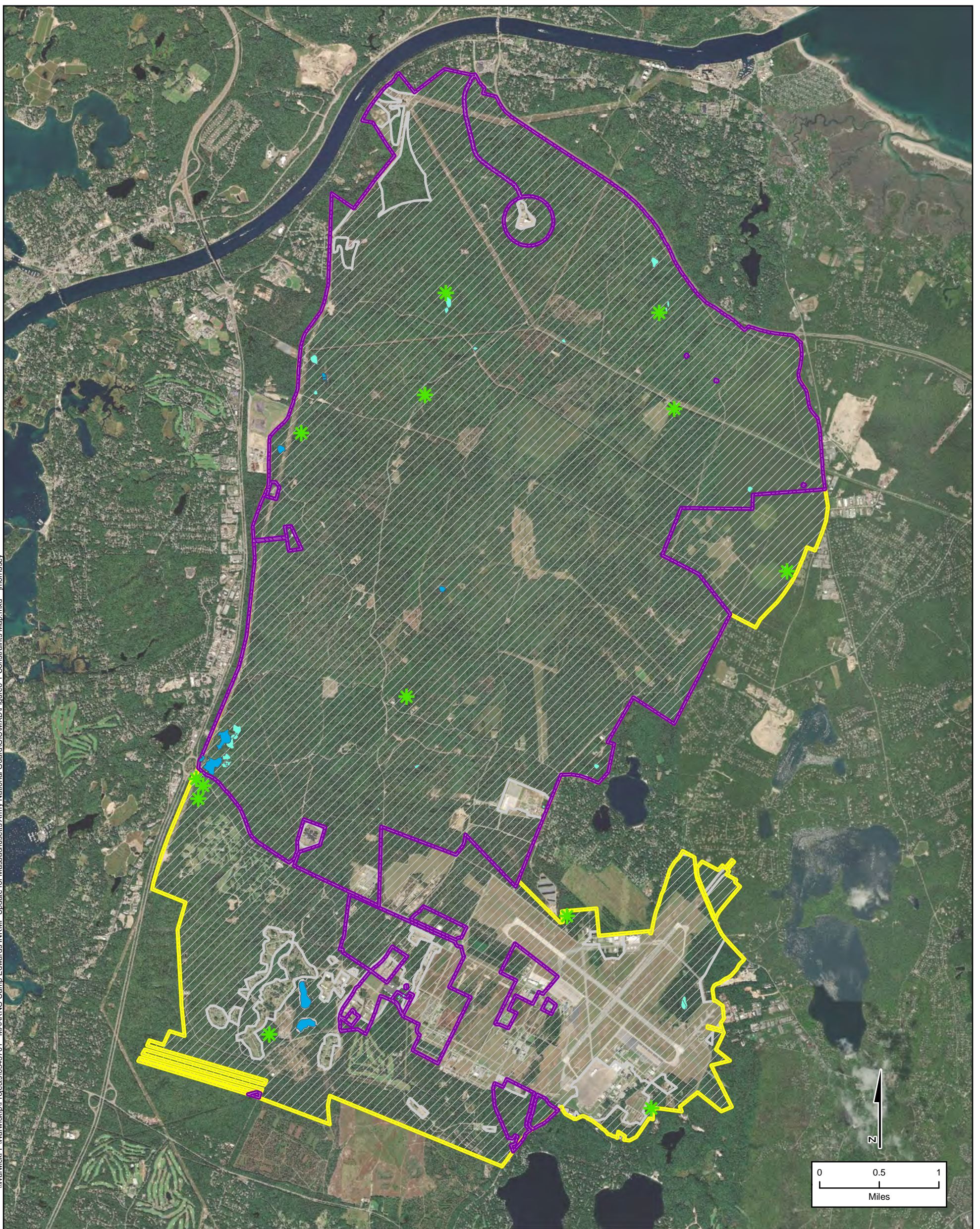
- Development of a Multipurpose Machine Gun Range at the existing Known Distance Range. The Known Distance range area is currently 36 acres of managed grassland, mitigation for the Tactical Training Base Landing Zone. The project includes a conversion of approximately 180 acres with target mounds, bullet 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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\\Warwick\FP\Warwick\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure6-1 Constraints Map.mxd imorrissey



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



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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.

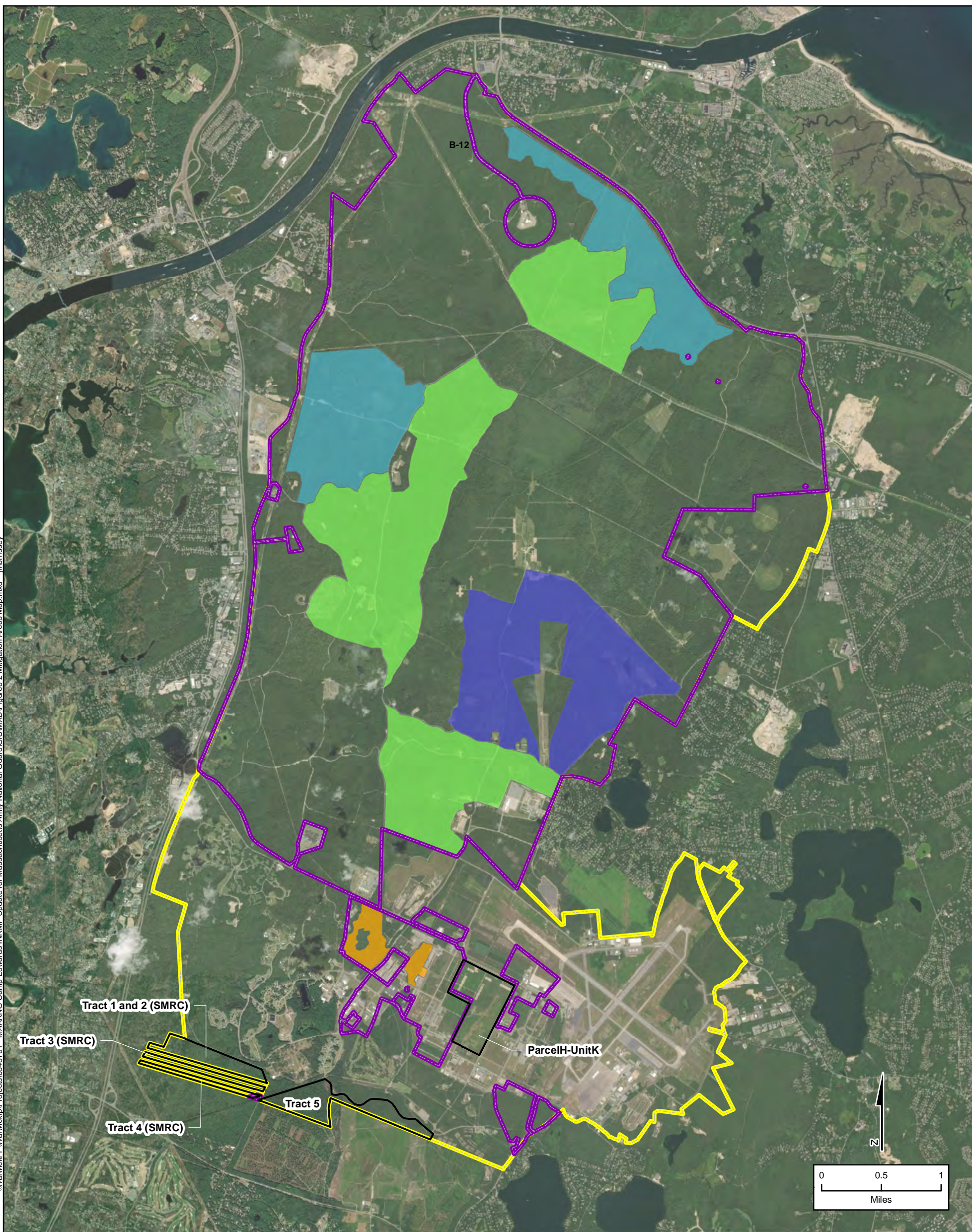
Projects identified in master planning are needed to support modernization efforts including construction, expansion, or redevelopment of multiple small arms ranges and modernization of cantonment infrastructure. However, the impacts of these activities to species and habitats protected under MESA requires 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.

\\Warwick\FP\Warwick\p\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure6-2 Mitigation Areas Map.mxd _imorrissey



- 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



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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 (RTLTA)—The RTLTA 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 RTLTA program evaluates relationships between land use and condition through the collection of physical and biological resource data. Some RTLTA projects are long term, while others are relatively short. The key to RTLTA 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 RTLTA 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 interspersed 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

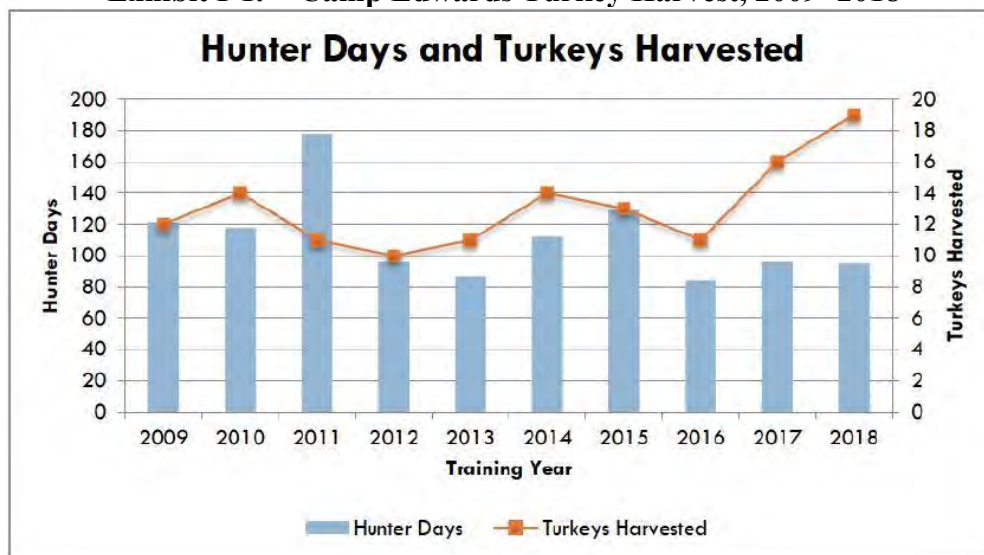
prescribed burning, and when necessary, mowing. Management of sandplain grasslands includes the implementation of the following measures:

- 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

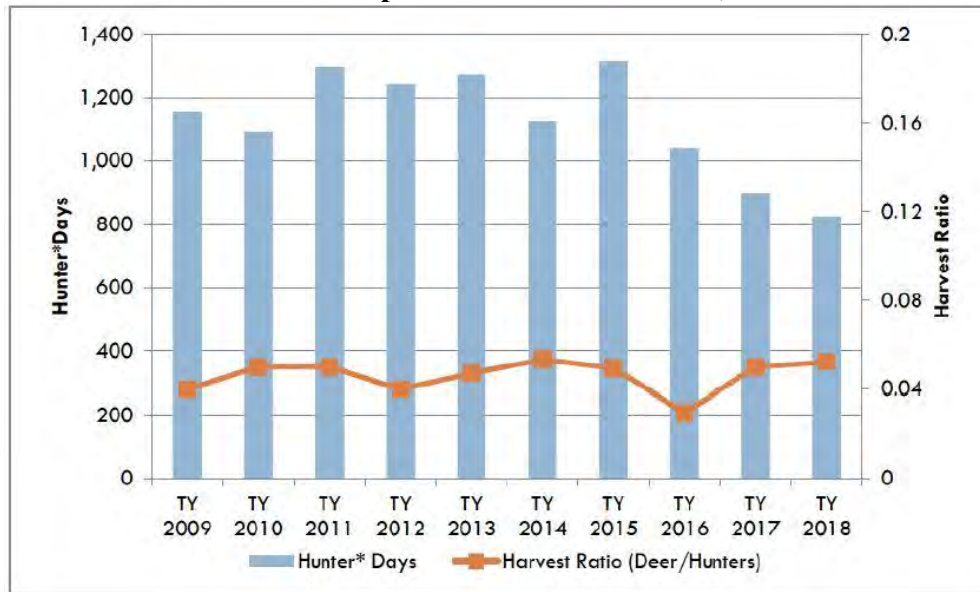
MassWildlife developed and implemented a wild turkey reintroduction program beginning in 1972. Between 1979 and 1996, 561 turkeys were released throughout the Commonwealth. MassWildlife successfully reintroduced wild turkey to the forests of Camp Edwards, one of the two locations on Cape Cod where turkeys 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 cover 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

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

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;

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(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

	<p>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.</p>
7.	<p><u>Prior to the start of Work</u>, 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. <u>Within three (3) days of the start of Work</u>, the Permit Holder shall send a letter or email to the Division stating the date upon which Work commenced.</p>
8.	<p><u>Within 30 Days of the Issuance of the Permit</u>, 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.</p>
9.	<p><u>At the completion of Work</u> 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.</p>
10.	<p>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</p>
11.	<p>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.</p>
12.	<p>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.</p>
13.	<p>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.</p>

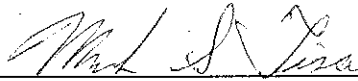
Special Conditions:

14.	<p><u>Authorized Construction and Uses:</u> 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</p>
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	shown/described in the Conservation and Management Permit Application.
15.	<u>Agassiz's Clam Shrimp Survey and Monitoring plan</u> : 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.	<u>Agassiz's Clam Shrimp Experimental Relocation and Monitoring plan</u> : 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.	<u>Construction Staff Education</u> : 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.	<p><u>Notice of Appeal Rights</u>: 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.</p> <p>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:</p> <p style="text-align: center;">Mark Tisa Director Division of Fisheries and Wildlife Field Headquarters One Rabbit Hill Road Westborough, MA 01581</p> <p>Any notice of claim for an adjudicatory hearing shall include the following information:</p> <ol style="list-style-type: none"> 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.

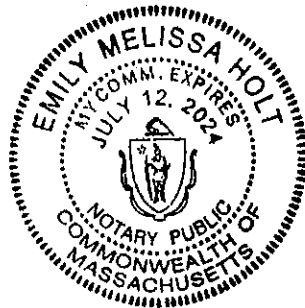


Emily Melissa Holt, Notary Public
My Commission expires: July 12, 2024

Conservation Permit 018-327.DFW

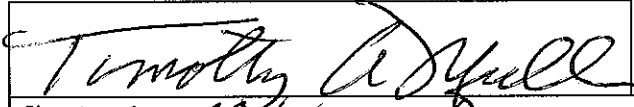
Issued this 8th day of November, 2018

Work must be completed by: 8 November 2023



**ACKNOWLEDGEMENT AND ACCEPTANCE OF ALL TERMS OF THIS
CONSERVATION PERMIT**

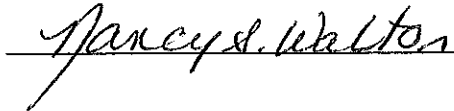
The undersigned below agrees that commencement of any work authorized by and described in this Conservation and Management Permit constitutes acknowledgement and acceptance of all terms of this Permit.


Signatory 1 Organization <u>Military Division, Comm of MA</u>

COMMONWEALTH OF MASSACHUSETTS

On this 16th day of November 2018, before me, the undersigned notary public, personally appeared Timothy A. Miller, 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



SEAL

My commission expires: 4/4/2025

MASSWILDLIFE

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



**DIVISION OF
FISHERIES & WILDLIFE**

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

MASSWILDLIFE

**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 (<i>Hemileuca maia</i>)	Special Concern
Barrens Dagger Moth (<i>Acrionicta albarufa</i>)	Threatened
Chain Dot Geometer (<i>Cingilia catenaria</i>)	Special Concern
Coastal Heathland Cutworm (<i>Abagrotis benjamini</i>)	Special Concern
Eastern Box Turtle (<i>Terrapene carolina</i>)	Special Concern

MASSWILDLIFE

Eastern Hognose Snake (<i>Heterodon platirhinos</i>)	Special Concern
Eastern Meadow Lark (<i>Sturnella magna</i>)	Special Concern
Eastern Whip-poor-will (<i>Antrostomus vociferus</i>)	Special Concern
Frosted Elfin (<i>Callophrys irus</i>)	Special Concern
Grasshopper Sparrow (<i>Ammodramus savannarum</i>)	Threatened
Heath Metarranthis (<i>Metarranthis pilosaria</i>)	Special Concern
Herodias Underwing Moth (<i>Catocala herodias</i>)	Special Concern
Melsheimer's Sack Bearer (<i>Cicinnus melsheimeri</i>)	Threatened
Northern Harrier (<i>Circus hudsonius</i>)	Threatened
Pine Barrens Speranza (<i>Speranza exonerata</i>)	Special Concern
Pine Barrens Zale (<i>Zale lunifera</i>)	Special Concern
Pink Sallow Moth (<i>Psectraglaea carnosa</i>)	Special Concern
Purple Tiger Beetle (<i>Cicindela purpurea</i>)	Special Concern
Scrub Euchlaena (<i>Euchlaena madusaria</i>)	Special Concern
Slender Clearwing Sphinx Moth (<i>Hemaris gracilis</i>)	Special Concern
The Pink Streak (<i>Dargida rubripennis</i>)	Threatened
Upland Sandpiper (<i>Bartramia longicauda</i>)	Endangered
Vesper Sparrow (<i>Pooecetes gramineus</i>)	Threatened
Waxed Sallow Moth (<i>Chaetoglaea cerata</i>)	Special Concern
Woolly Gray (<i>Lycia ypsilon</i>)	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 (<i>Phase 1: 142 Acres Phase 2: 65 Acres</i>)
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 statutes, 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.

	<p>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.</p>
GC 11.	<p>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).</p>
GC 12.	<p>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.</p>
GC 13.	<p>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.</p>
GC 14.	<p>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.</p>
GC 15.	<p>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.</p> <p>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</p>

	<p>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.</p>
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G. Special Conditions

SC 1.	<p><u>Work Authorized by the Permit:</u> 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.</p>
SC 2.	<p><u>Construction Phasing:</u> 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.</p>
SC 3.	<p><u>Permanent Protection of Habitat - Fee Transfers:</u> 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.</p> <p>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.</p> <ol style="list-style-type: none"> 1) Special Military Reserve Commission Parcels 1, 2, 3, 4 and 5 (totaling 261 acres), owned by the Commonwealth of Massachusetts). <p>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</p>

	<p>Department of Fish and Game, with a copy of the recorded deed submitted to the Division within five (5) business days of recordation.</p> <p>2) Massachusetts Military Division Parcel H of Unit K (totaling ±150 acres).</p>
SC 4.	<p><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).</p> <ol style="list-style-type: none"> 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 FCRA's 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 FCRA's 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. <p>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.</p> <p>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.</p> <p>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</p>

	<p>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.</p>
<p>SC 5.</p>	<p><u>Vegetation Management of MPMG Range, Fire Breaks, and Fuel Treatment Areas:</u> 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.</p> <p>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.</p>
<p>SC 6.</p>	<p><u>State-listed Species Monitoring and Research:</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 the monitoring and research studies listed below, as further detailed and described in the CMP Application (Section 5.3).</p> <ol style="list-style-type: none"> 1) Lepidoptera long-term monitoring, beginning in 2021 <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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.

	<p>4) Annual Grassland Bird Monitoring</p> <p>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.</p> <p>5) Monitoring of Invasive Species</p> <p>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.</p> <p>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.</p>
SC 7.	<p><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.</p>
SC 8.	<p><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.</p> <p>1) <i>Pine Barrens Mitigation Focal Areas.</i> 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.</p> <p>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.</p> <p>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.</p> <p>2) <i>Grassland Mitigation Focal Area (Parcel H Unit K).</i> 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.</p>

	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
SC 9.	<p><u>Long-Term Habitat Monitoring and Management of the Mitigation Focal Areas:</u> 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.</p> <p>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.</p> <p>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.</p> <p>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</p>

	<p>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.</p>
SC 10.	<p><u>State-listed Species Protection During Construction:</u> 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.</p> <p>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.</p>
SC 11.	<p><u>Annual Coordination:</u> 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.</p>
SC 12.	<p><u>Camp Edwards Integrated Natural Resources Management Plan (INRMP):</u> 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.</p>
SC 13.	<p><u>Joint Base Cape Cod Environmental Management Commission (EMC):</u> 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.</p>
SC 14.	<p><u>Construction Staff Education:</u> 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.</p>

SC 15.	<u>Amendment of Permit to Cover Other Portions of the Property</u> : 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.	<u>Rare Species Observations</u> : 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

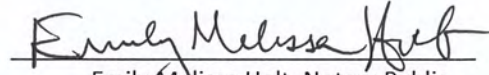
Any notice of claim for an adjudicatory hearing shall include the following information:

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

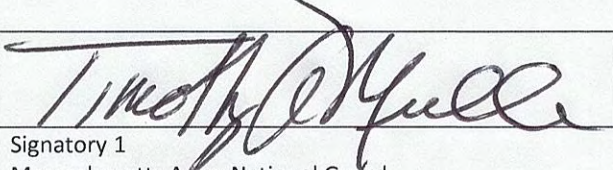
Issued September 29, 2020

Work must be completed by September 29, 2040



ACKNOWLEDGEMENT AND ACCEPTANCE OF ALL TERMS OF THIS CONSERVATION PERMIT

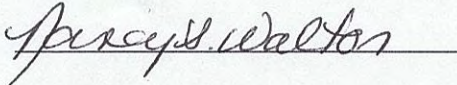
The undersigned below agrees that commencement of any work authorized by and described in this Conservation and Management Permit constitutes acknowledgement and acceptance of all terms of this Permit.


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. 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



SEAL



My commission expires: 4/4/2025

MASSWILDLIFE

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 well, 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 support 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 100-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

6.1 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 burns 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 contaminants 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.

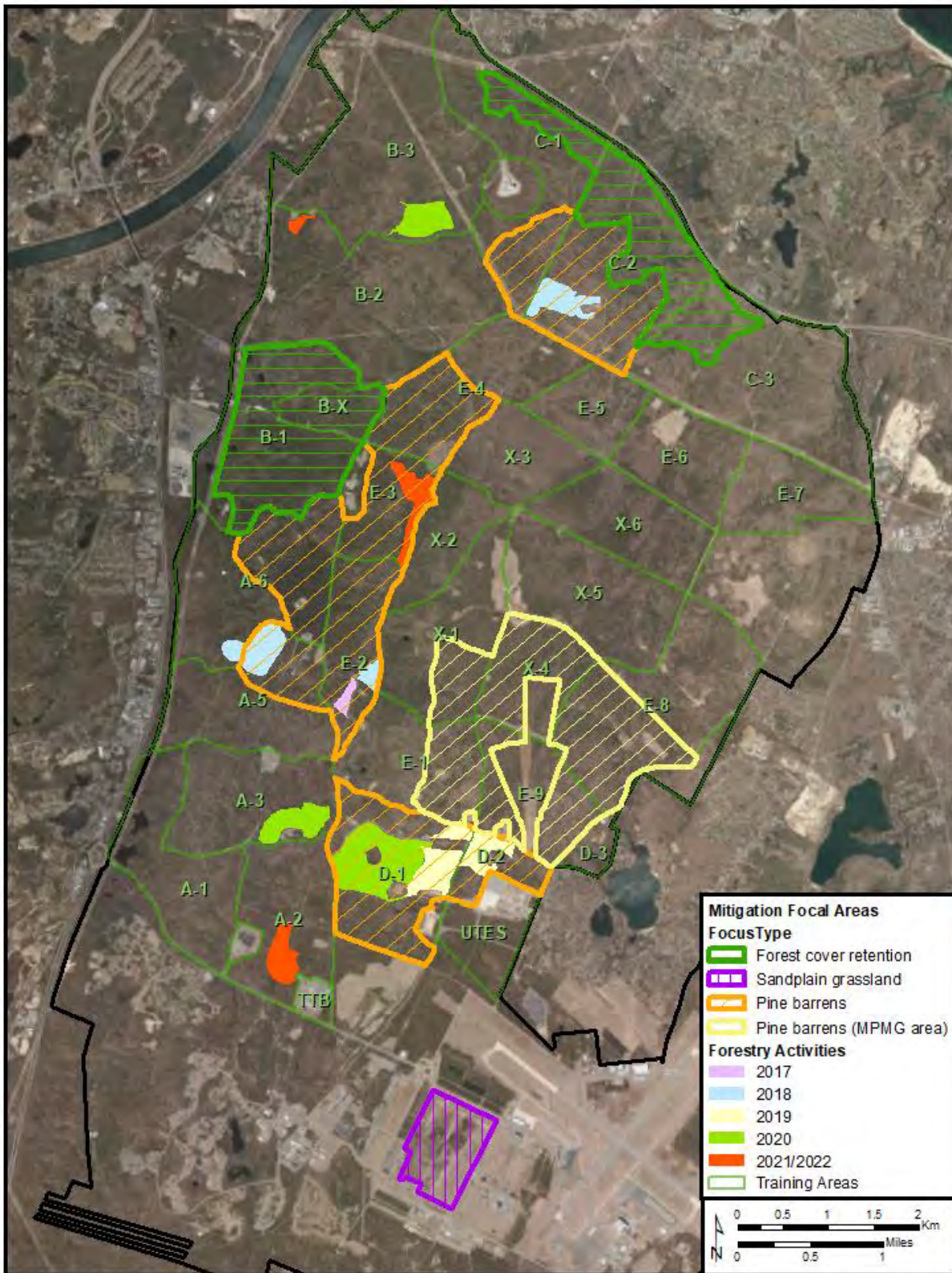
FM GOAL 1: MANAGE FOREST STANDS TO SUPPORT NATIVE SPECIES AND PROMOTE A DIVERSITY OF SUCCESSIONAL PITCH PINE – SCRUB OAK HABITATS.

- **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).

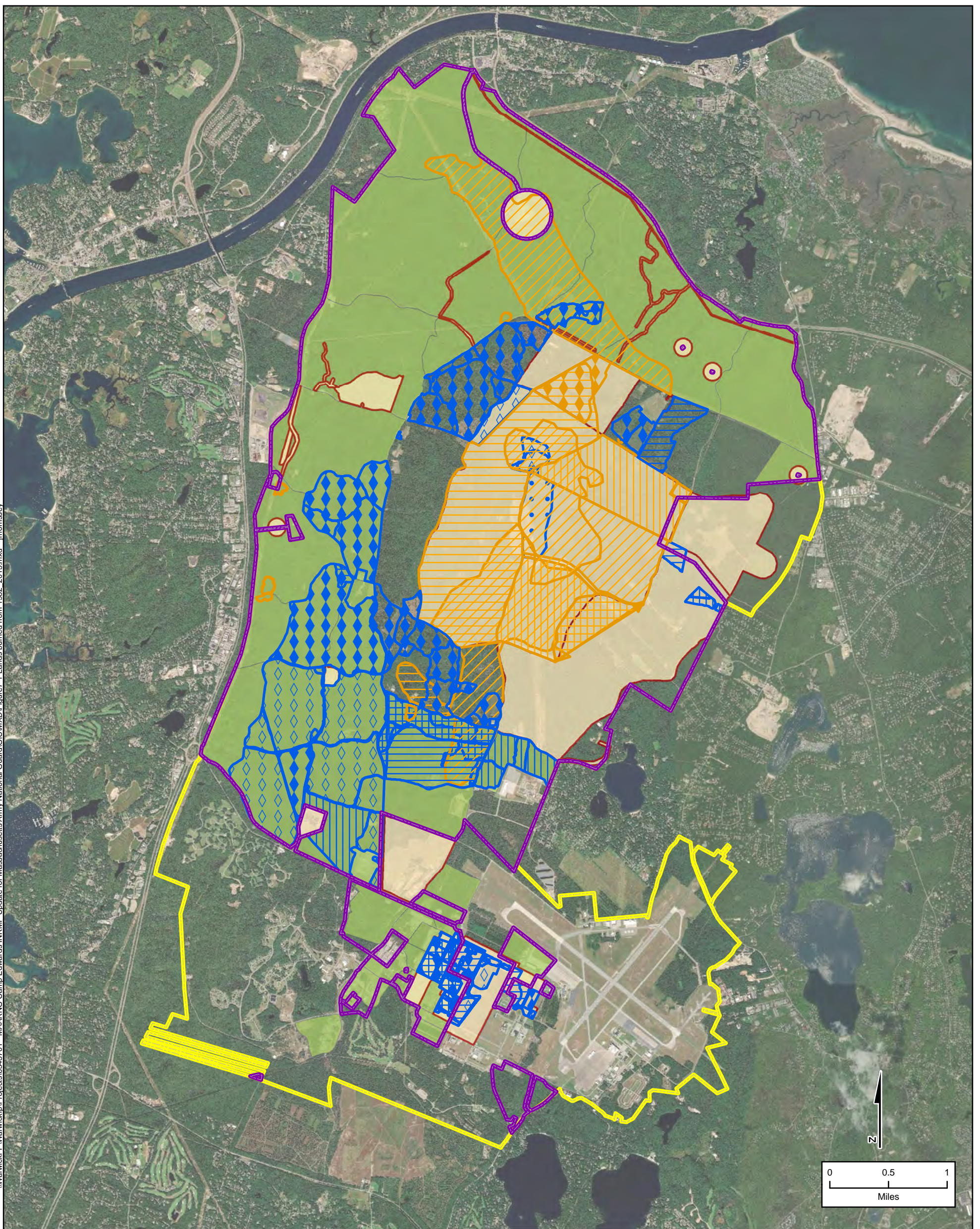
- **WFM OBJECTIVE 1.3:** Continue to develop collaborative working relationships with JBCC Fire Department, Camp Edwards, and the CFMO Fire and Emergency Services lead to ensure wildland fire preparedness.

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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\\Warwick\FP\Warwick\p\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure7-1 Lands burned from 1982-2015.mxd 2015.mxd jmorrissey



VICINITY MAP



Legend	Installation Boundary	'90 - '94; Rx
	Camp Edwards Boundary	'15 - '19; Wild
	Training Areas	'10 - '14; Wild
	Primary Ordinance Hazard Areas	'05 - '09; Wild
Burn History	'15 - '19; Rx	'00 - '04; Wild
	'10 - '14; Rx	'90 - '94; Wild
	'05 - '09; Rx	'85 - '89; Wild
	'00 - '04; Rx	'80 - '84; Wild

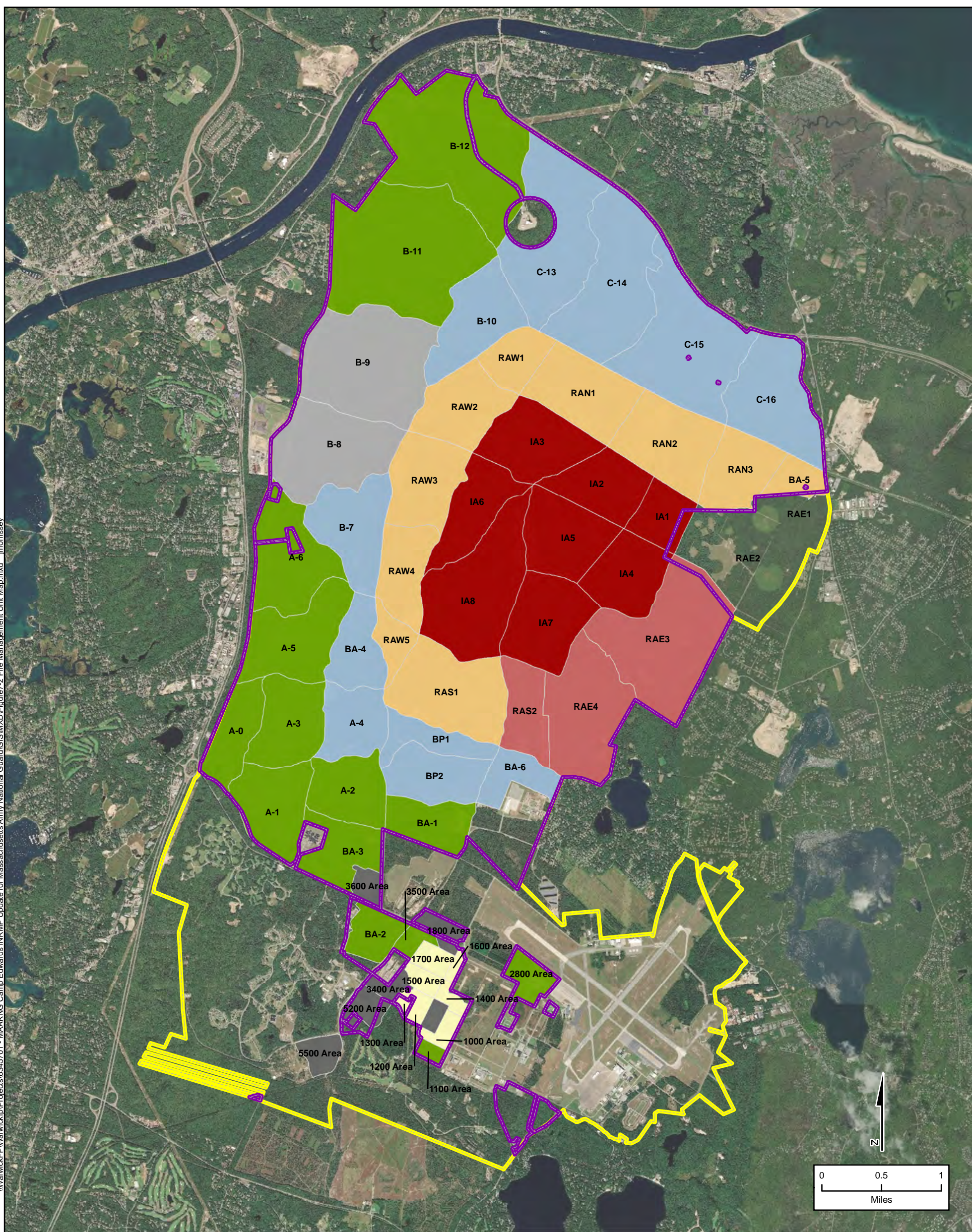
Figure P-1
Lands burned from 1982-2015
Camp Edwards Training Site
Cape Cod, Massachusetts

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



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\\Warwick\FP\Warwick\Projects\6345701 - MAARNG Camp Edwards INRMP Update for Massachusetts Army National Guard\GIS\MXD\Figure 7-2 Fire Management Unit Map.mxd_jmorrissey



- Legend**
- Installation Boundary
 - Camp Edwards Boundary
 - Off limits - M.B. Sportsmen Club
 - Primary IA Buffer
 - Secondary IA Buffer
 - Managed Grassland
 - Other Burn Units
 - Dudded - Impact Area
 - Dudded - Experimental Ranges
 - 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 it 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 to 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.

**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

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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.

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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 sacred 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.

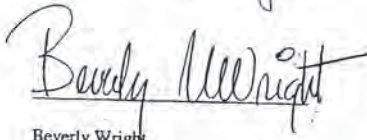
The Massachusetts Army National Guard and/or the Wampanoag Tribe of Gay Head-Aquinnah may terminate this Memorandum of Understanding by providing sixty- (60) working days notice to the other signatory party by Registered Mail. After such notification, but prior to the date of termination, both parties 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.

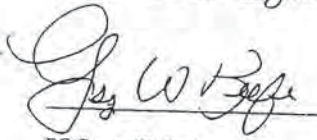
NOW THEREFORE, it is agreed that the MAARNG and the Wampanoag Tribe of Gay Head-Aquinnah will jointly cooperate to achieve the principles and purposes set forth in this Memorandum of Understanding.

Signed this 30th day of Aug, 2001.

Signed this 30th day of Aug, 2001



Beverly Wright
Chairperson
Wampanoag Tribe of Gay Head-Aquinnah



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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APPENDIX W-1.1 –FY21 ANNUAL REVIEW REPORT AND MEETING NOTES

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**CAMP EDWARDS ANNUAL INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
(INRMP) REVIEW**

**DRAFT MEETING MINUTES
CAMP EDWARDS TRAINING SITE
INRMP ANNUAL REVIEW FOR FY21**

Prepared by: EA Engineering, Science, and Technology, Inc., PBC (EA)
Date: Wednesday, 26 January 2022
Time: 1300 - 1500 hours

ATTENDEES:

Will Broberg	Scientist, EA
Joel Carlson	Wildland Fire Program Coordinator, Massachusetts Army National Guard MAARNG
Kathryn Cerny-Chipman	Scientist and Project Manager, EA
Robert Crevey	Land Rehabilitation and Maintenance Coordinator, MAARNG
Cynthia Corsair	Biologist, New England Field Office, US Fish and Wildlife Service (USFWS)
Annie Curtis	Wildlife Conservation Biologist, MAARNG
Keith Driscoll	Deputy Director, Environmental Management Program, MAARNG
Erin Hilley	Wetlands/Vegetation Conservation Biologist MAARNG
Katherine Ineson	Regional Military Lands Partnership Coordinator, USFWS North Atlantic – Appalachian Region
Nicole Madden	Field Crew Leader, Natural Resources Office, Camp Edwards
Jake McCumber	Natural Resource-Integrated Training Area Management (NR-ITAM) Program Manager, MAARNG
David Paulson	Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife (MassWildlife)
Leonard Pinaud	Environmental Officer, Environmental Management Commission (EMC)
Jason Zimmer	Southeast District Supervisor, MassWildlife

INVITED, BUT DID NOT ATTEND:

Paulo Baganha	Environmental Program Manager, MAARNG
James Doherty	Director of Facilities and Engineering, MAARNG Camp Edwards
MAJ Alexander McDonough	Plans and Training Officer, MAARNG Camp Edwards
Col. Matthew Porter	Commander and Base Operations Manager, MAARNG Camp Edwards
David Shannon	Construction and Facilities Management Officer, MAARNG

DISTRIBUTION: All invited

The Camp Edwards Integrated Natural Resources Management Plan (INRMP) Annual Review meeting was held via Microsoft Teams on 26 January 2022. An annual review meeting to review INRMP progress and upcoming goals is required by the Sikes Act and under 2019 Army guidance (*Army National Guard (ARNG) Installations and Environment (I&E) Directorate Policy for Integrated Natural Resource*

Management Plans). While the Sikes Act does not require that partners (U.S. Fish and Wildlife Service [USFWS] and Massachusetts Division of Fisheries and Wildlife [MassWildlife]) attend the meeting, it requires that they are invited. These meetings are a valuable opportunity for engagement between stakeholders, and MAARNG thanks everyone for attending and noted the good representation by agencies and installation stakeholders at the meeting.

The intent of the annual review meetings and process is to communicate the MAARNG INRMP implementation progress to the Sikes Act partners, including progress made in the last year and future plans for the coming year (FY22). The INRMP is intended to be a partnership document and provides the commitments of MAARNG to what they do in an adaptive management framework. Items in the INRMP change each year; some projects are incorporated and others do not get completed. Camp Edwards is unique in the level of engagement of both internal and external stakeholders. The notes from this meeting will be used to populate the Annual Review Template and develop a report for the Annual Review. Ahead of this meeting, participants were emailed supporting documents for meeting discussion. The focus is to review actions completed last year (FY21) and upcoming FY22 plans, and to discuss the questions from the Annual Review template. The discussions from the meeting on this template is summarized below.

MAARNG's ongoing efforts to conserve natural resources at Camp Edwards through the INRMP were acknowledged with Camp Edwards Receiving the FY20 conservation award from the National Guard Bureau (NGB). This was based on the success of partnerships, and continued collaboration with these partners is one of the highlights of this year. In FY21, MAARNG had good site visits with USFWS and MassWildlife, initiated new partnership efforts, and worked with partners to finish the FY20 INRMP Annual Review. In FY21, MAARNG also dealt with the ongoing impacts of the COVID-19 pandemic, but was able to overcome many of the challenges posed by this pandemic including a return to prescribed fire in FY21 after a hiatus in FY20.

MAARNG also dealt with backlash against the Multipurpose Machine Gun Range (MPMG) and Camp Edwards from Environmental groups and the media. However, this became an opportunity to reach a broader audience and provide outreach and education on their mission and regional conservation efforts and gave the public the ability to see how Camp Edwards is working together with partners in conservation. This included rare species management, pine barrens restoration, and prescribed fire. This outreach also allowed MAARNG to show how these efforts benefit the public (climate change, trees, etc.). MAARNG took on the challenge and communicated about conservation being done and why they are doing it. They reached a lot of the Upper Cape in this outreach.

REVIEW OF FY21 PROGRESS AND PLANNED FY22 PROJECT IMPLEMENTATION

Natural Resources Program Management – Camp Edwards had sufficient staff and funding in FY21. Major items under natural resources program management were focused on working through COVID-19 issues, program management, and environmental review. There is nothing major under this section to highlight as this section is mostly operational. It should be noted that although MAARNG did have good funding in FY21, they did not receive strong funding for FY22. Decreased funding is being seen across all facilities. Unfortunately this reduced funding has not freed up time of the staff members, but MAARNG is still planning to continue forward with the projects they intended to complete in the fiscal year despite the reduced funding. However some items will be moved around in the next few years.

Fish and Wildlife Management – This section of the Camp Edwards INRMP is focused on general ecosystem management and species that are not threatened or endangered (T&E). FY21 bird surveys produced impressive trends, including an exceptional year for whip-poor-wills. In FY21, MAARNG analyzed trend data for species of greatest conservation need (SOGCN). Jake plans to write up this analysis into a paper for better sharing of data and results. The analysis shows fairly impressive positive trends in

occupancy and abundance for species in the state wildlife action plan (SWAP). This is likely in response to expanded habitat restoration work undertaken at Camp Edwards. Field sparrows and prairie warblers are getting more abundant in training area and less in grasslands as restoration has started providing more available shrubland and pine barrens habitat.

Camp Edwards also updated and organized the species list for the installation to be taxonomically organized; this list will be appended to the annual review. The previous moth list had not been well put together, and as a result the number of moth species known from Camp Edwards was increased from 458 to 940 species. MAARNG also intentionally focused in FY21 on regional and nationwide projects with USFWS interest, including formal monitoring of monarchs and frosted elfin, and the spotted turtle legacy project. In FY22, MAARNG will predominantly focus on box turtles, annual monitoring efforts that are beneficial for public outreach, and analyzing real data on management actions. Updating the grassland monitoring and management strategy is also a top priority for FY22.

Outdoor Recreation and Public Access to Natural Resources – In FY21 MAARNG continued to maintain an active hunting program and also was able to provide some opportunities for wildlife and grassland viewing. Hunts continued successfully in FY21, including the youth, military, and paraplegic hunts, as well as the turkey hunt.

Due to COVID-19, Camp Edwards stopped grassland bird and other natural resources tours the last two years but will re-start tours again in the spring of 2022. MAARNG started doing public tours of Camp Edwards in August 2021. In this time, MAARNG held more than 15 base tours and hosted upwards of 200 people. Tours focused on the army training mission but also focused on conservation of training sites. People consistently noted a desire for more targeted wildlife field trips on the base, especially grassland bird tours.

Threatened and Endangered (T&E) Species Management (including CMPs) – MAARNG has one of two projects with the USFWS to evaluate all New England cottontail (NEC) data collected since 2009, but mostly from 2011 onward. These data are being combined with USFWS data and the University of Rhode Island (URI) is doing a meta-analysis on the dataset. This will be formalized into a report. MAARNG also undertook surveys for focal federally protected species and extensive box turtle work, including an intensive box turtle health assessment with University of Illinois wildlife epidemiology lab. All listed bat data was uploaded in FY21 into the nationwide database to allow for analysis. Long term monitoring of the Eastern box turtle will also continue through canine assisted searches in FY22.

Prior to this meeting, participants received the draft final report for mitigation actions covered in the Conservation and Management Permits (CMPs). This document covers a lot of actions undertaken as part of T&E species management, though MAARNG also completes actions outside of the mitigation areas and permits to support T&E species. The CMPs include the Agassiz's clam shrimp and everything under the range development. In FY21, MAARNG did extensive habitat work, including reinitiating prescribed burning in 2021. MAARNG completed 358 acres of habitat restoration this year, including large-scale pine barrens and sandplain grassland restoration which showed regionally significant ecological improvements, adding to landscape level heterogeneity and resilience. The summary table in the CMP report has more detailed numbers on habitat restoration by mitigation focal area, type of work, project level detail.

As part of the CMPs, MAARNG evaluated development projects from a master planning perspective and came up with large-scale mitigation plan for grassland habitat, pine barrens mosaic, and mature closed canopy forest habitat. In FY21, MAARNG completed a small expansion of Tango Range, which was a 3 acre project and the first one under this CMP. The annual CMP reports have been submitted to MassWildlife, and final closeout remains to be done. Facilities is wrapping up compliance with the permit for construction, and the CMP is still awaiting finalization of land transfer for the last parcel (Parcel H of

Unit K, a 150-acre grassland parcel in the cantonment area). This parcel has been transferred to MAARNG, and Jake is keeping on MAARNG to get it moved to MassWildlife, along with the license for them to manage the property under the CMP.

For the Agassiz's clam shrimp CMP, MAARNG completed work under 2018 permit, and took on the next step of developing an overall conservation plan for clam shrimp. This overall conservation plan was developed to allow for active and necessary road maintenance in support of a functional road network in training area, while still ensuring they were providing abundant habitat and net benefit for the species. MAARNG and MassWildlife formalized the amendment of the CMP permit in the summer of 2021; the first major permit under this amendment was for the impact area groundwater study program road repairs. Under this project, MAARNG filled 12 puddles and monitored puddles throughout season.

MAARNG's actions to support T&E species are intended to sustain rare species while ensuring functional training facilities. In FY22, Camp Edwards will do annual rare moth surveys using the moth monitoring protocol developed under the CMP and will support this study by also implementing a vegetation survey. This protocol has been established for the robust and long-term monitoring of rare moths. These surveys will allow them to tie current and post-management vegetation conditions to moth population trends. The first year of sampling will occur in 2022 and this contract is currently out to bid. MAARNG is working with MassWildlife on developing the project and have a list of qualified personnel for the surveys. In terms of habitat implementation, FY22 will be a slow year for mechanical work. MAARNG has been very active last few years in mechanical restoration, but are focusing in 2022 on bringing prescribed fire back on the landscape.

Water Resource Protection – Work completed in support of water resources at Camp Edwards largely involves coordinating continually with the EMC Environmental Officer (Len Pinaud) and the Impact Area Groundwater Study Program for support on Ch 47 groundwater reserve issues. One project that seems to be consistently passed to the next year is figuring out water withdrawal approvals for training. MAARNG made some progress on development of this project as part of the INRMP update, but the project hit the backburner in FY21 as the Natural Resources Office had to provide increased effort and focus on the MPMG. In FY22 MAARNG will need to revive this effort.

Wetland Protection – Erin Hilley completed lots of planning on wetlands protection in FY21. MAARNG identified a need to provide vernal pools throughout training site to support vernal pool species. This was highlighted with clam shrimp, though they prefer roadway puddles. In FY21, MAARNG contracted a plan to decide where to add new vernal pools to supplement roadway puddles in a manner that designs them in proximity to roads, soils, etc. so vernal pool development does not impact training access. This plan also highlighted zones where vernal pool development could be done without regulation. In FY22, MAARNG plans to start building two new vernal pools near existing vernal pool complexes. The implementation of the Clam Shrimp Protection and Road Repair Plan will also be a priority, along with the continued coordination and planning with the town to develop best management practices for activity in wetland buffer zones.

Grounds Maintenance and Forest Management – In FY21, MAARNG complete an extensive forestry project and removed 40 trees in the grassland as part of the chainsaw training. They were also able to get fire back into Training Area BA-7 in FY21 and completed 157 acres of mastication. MAARNG also did a 42-acre understory mastication in Training Area A4, near the NBC area. They expect it will become a good spot to support Chuck-will's-widows. They are continuing to work closely with grounds and maintenance on firebreaks and road maintenance. MAARNG initiated the development of standard operating procedures (SOPs) and standards in FY21 and will need to finish these standards in FY22. These standards are intended to increase consistency in planning; they will mostly be formalizing what Camp Edwards is already doing but make it easier to communicate and more consistent.

Wildland Fire Management – MAARNG held a fall training burn in FY21 (2020), and completed 4 burns totaling 115 acres in the spring on grassland, pitch pine, and scrub oak shrubland. They had great results with the four burns completed in FY21 even though the acreage of the burns were limited. Surveys following one grassland burn this summer recorded several moth species new for the county, all of which were species of conservation concern. Post-burn vegetation surveys found increased baptisia and blueberry, and they started finding *Asclepias tuberosa* with Unexpected *Cycnia* caterpillars (*Cycnia collar*) (a state-listed species), which was a new species in the area burned. Natural Resources also found a new state-listed plant species, *Spiranthes vernalis* in surveys. These species highlight the importance of burning at Camp Edwards. Another big effort in FY21 was updating the Integrated Wildland Fire Management Plan. Center for Environmental Management of Military Lands is currently developing this update in close coordination with Joel. MAARNG also established a Camp Edwards Wildland Fire Working Group, which includes State Headquarters, the Joint Base Cape Cod Fire Department, the Camp Edwards Natural Resources Office, Installation Commanders, etc. For FY22, MAARNG has set an ambitious target of 25 burn days with an average of 25 acres per day. Some of the burns in FY22 will be smaller, some will be bigger. A complete and comprehensive inventory and equipment kit configuration list is also a priority for FY22.

Integrated Pest Management – In FY21, MAARNG worked mainly on invasive plant management, particularly ongoing management of *Calamagrostis* including early detection of new patches in the cantonment and training areas. This is an aggressive grass that MAARNG is working to control; everyone on the Natural Resources staff has a good search image of this species and they try to spot it early and treat it when it is still manageable. MAARNG also contracted invasive shrub treatment in the grassland in FY21, which was half mitigation work. This treatment will be followed with prescribed fire in FY22. One of the biggest needs for FY21 is updating the Integrated Pest Management Plan (IPMP) and finalizing approvals of this document.

Cultural Resources – During FY21, MAARNG reinvigorated their relationship with the Wampanoag Tribe. MAARNG hosted a tour of the installation last month for Wampanoag Tribe natural resources staff and other participants. Participants from the Wampanoag Tribe and Camp Edwards Natural Resources staff left the tour enthusiastic and interested in keeping the momentum going. Coordination in December 2021 with the Tribe included discussions on mutually beneficial resource use. MAARNG will focus on continuing these discussions, along with avoidance/minimization measures onto future projects for culturally important natural resources. The work MAARNG is doing to support natural resources is consistent with meeting cultural landscape goals for Camp Edwards.

Public Outreach – Public Outreach was a huge effort for MAARNG in FY21, including news stories, meetings, and town halls. In FY21, this included things like a barrens buck moth tour for a naturalist club, and MAARNG is hoping to continue to increase these types of public outreach moving forward. Actions in FY21 included hiring a new public outreach coordinator and doing weekly tours. These tours were needed as the public did not have a good understanding of what was happening at Camp Edwards. Public outreach is critical to show the public about the natural resources management and training at Camp Edwards. In addition, external partners released outreach materials, including an excellent article about conservation targets from USFWS. This article looked at Sierra Range and the integration of what they do with training/mission and species conservation, and how this can work at a site like this.

The focus of FY22 will be to continue to produce public outreach materials, expand media engagement, and to publish long-term migratory bird results. There is also a need to develop a robust outreach campaign about wildland fire ahead of the release of the Integrated Wildland Fire Management Plan in FY22..

GIS – MAARNG keeps good spatial data for natural resources management. Currently the biggest project for GIS is working with USFWS doing planning level survey (PLS) mapping of natural communities on

base. This work will be completed in FY22 and will be fundamental dataset for natural resources management at Camp Edwards. MAARNG also continued standardizing the reference datasets to build a master database for habitat management efforts and facilities, which will also continue in FY22.

Climate Change – With the MPMG project and increased army emphasis on building climate change into INRMPs, climate change was more of a focus and topic of conversation in FY21 than in previous years. In FY21, Jake was a stakeholder for the development of the Cape Cod Commission Climate Action Plan, which is a good example of a regional climate change plan with reasonable measures for integration.

MAARNG is also working with Woodwell Climate Research on how landscape management relates to climate change, carbon sequestration, and climate resilience. A Climate Resilience Plan was contracted with Woodwell Climate Research Center, which will continue and be completed in FY22. Service-wide, the Army is completing assessments of every training installation, and Camp Edwards was one of five pilot installations to start this assessment. However, this assessment didn't connect with local people on installations. The assessment only considered climate change from a sea level rise perspective and did not account for fire, bark beetles, etc., and as a result was not highly useful to installation natural resources management.

ANNUAL REVIEW TEMPLATE QUESTIONS

The meeting participants discussed the questions on the INRMP Annual Review Template; these questions and draft responses were provided ahead of the meeting. MAARNG solicited thoughts and concerns from stakeholders, particularly focused on what components of the INRMP are working and not working, and input on what needs to be updated, fixed, changed, or addressed. The items provided ahead of the meeting are included below, and the discussion of these items during the meeting is provided in the italicized text.

INRMP Project Implementation

5) Are INRMP projects, including follow-up inventorying and monitoring work, properly identified, developed, and submitted for funding?

- Yes – all projects were submitted overall and funded in FY21, but funding has emerged as a challenge for FY22.
 - *INRMP projects in FY21 were funded at 96%, which was \$1.6 million. MAARNG spent all these funds in FY21. For a conservation program focused on 15,000 acres at Camp Edwards and on Camp Curtis Guild, this is a good number. In the transition to FY22, MAARNG is half funded. They have already gotten a little extra funding from other sources but even if they don't receive any additional funding MAARNG is still planning to meet project goals. However, a few projects may slide/carry over due to COVID-19 impacts. Overall, MAARNG is meeting annual objectives, such as bringing back prescribed fire, as an example. Core Monitoring and Research will continue despite lack of funding.*
 - *Dave Paulson of MassWildlife commended the Camp Edwards Natural Resources team for what they have been doing, and for working together with MassWildlife on MESA items. Seeing capacity they have built over last 5 years is really great for this important work. With the funding and some species being evaluated with USFWS, the northern long-eared bat status, little brown bat, and monarch, he asked if Camp Edwards see priorities shifting or additional funds being supplied to address these species as emerging concerns with expansion of activities on the base.*
 - *MAARNG has already built in regional survey plans, and not much additional work is need at the moment. If these bat species are listed, program impacts are a*

concern but none are driving a big additional cost. Jake hopes that the model for managing and studying the spotted turtle would work for other species. This includes DoD Legacy funded surveys on several installations in New England to supplement range-wide surveys elsewhere, and a regional protocol to support status assessment. Management-wise, the monarch butterfly and frosted-elfin are being benefitted by the work MAARNG is doing for other species, but this is not as much the case with bats. MAARNG is doing acoustic work, but removed mist-net surveys from the plan every 4 years, as success was poor. They can push for funding and prioritizing things that partners identify as a priority. This year for bat, they are contracting out the analysis of survey data since 2014 to analyze the best use of efforts for bat monitoring. Even in acoustic surveys they are only picking up bats on edge of base that are foraging but not roosting. There are lots of sites off-base. MAARNG paused acoustic surveys this year to focus on analyzing the data/reassessing next steps.

Mike Nelson is plugged in to USFWS for the frosted elfin and peripherally for the monarch. MassWildlife are doing a holistic approach, and continue to coordinate on opportunities. They could consider if there was a way to look at in-kind services on surveys, for example MAARNG could do flashlight surveys for frosted elfin caterpillars in exchange for support on focal rare plants where they cannot easily undertake this effort. There may be a way to figure out regional teams to do more surveys.

As native pollinators are a focus, there is a need for seed stock of what is native to New England. Camp Edwards could be a good place to collect seed stock to benefit native pollinators. Rob noted that he has been learning how to collect seed stock. They bought a seed harvester on the tractor and got it going. He is also in contact with Mike Whitmore from The Nature Conservancy for the sampling grassland network. There are good patches of vegetation on base where they could pinpoint source stock areas, and share equipment or figure out an in-kind service exchange. Pollinators will be a big focus going forward. NEC were tricky for public outreach because people think they are common. Recently people have been hearing about bees and there is public concern about them. The public is getting behind bees, even if they can't get behind moths. They had people who were very excited about Walsh's digger bee on tours.

Are there species they should be adding to the base? What pieces of the ecology are missing that can be added, what have they lost?

6) Has project funding been received, obligated, and expended?

- Project funding in FY21 was successfully received, obligated, and expended. MAARNG received 96% of their requested Natural Resources funding and obligated 100% (spent in completed or ongoing projects) in FY21.
- There is a funding shortage in FY22 across the National Guard G9 (facilities, including environmental programs). MAARNG has prioritized projects within funds received and is working to obtain additional funding for further priorities. Camp Edwards has received 53% of approved project funds for FY22.

7) What projects have been completed and do they meet expected objectives?

- Extensive details on projects completed and their relationship to the goals and objectives are outlined are within the project table.

- Overall, projects have resulted in extensive habitat restoration, increased species monitoring, increased public outreach, and have addressed planning level survey gaps. All projects have all been successful for meeting current objectives.
- *This was largely covered in the presentation provided by Jake at the beginning of the meeting and details on the status of projects is also on the implementation table provided prior to the meeting. MAARNG had a good year in FY21 for meeting INRMP project target and objectives and are in a good position for FY22. Even with reduced funding they are still able to respond to a lot of the emerging needs and INRMP project targets.*

8) What new projects are proposed?

- New projects for FY22 that are not currently in the INRMP project implementation table will be added as part of this annual review.
- A new project is needed for ongoing clam shrimp Conservation and Management Permit (CMP) implementation, which follows the completed project to develop the management plan and obtain a permit. This will be added as three separate projects:
 - Project for completing required monitoring and reporting
 - Project for submitting for approval an annual road maintenance workplan
 - Project for implementing puddle repair and conservation as needed.
- *The new projects to add are mostly ongoing annual actions, though some are more specific. The projects for the Agassiz's clam shrimp CMP are based on the annual rhythm of the work with the amended permit.*
- *If the partners in this meeting see things missing, they should let MAARNG know. The table is a living document that is updated to address changing management and resource needs.*

Federal/State ESA-Listed Species and Critical Habitat

4) Are conservation efforts effective?

- While MAARNG believes the conservation efforts and projects for ESA-listed species have been effective, the input of Sikes Act partners and other stakeholders is critical to consider.
- The conservation efforts and projects outlined on the table have been effective, and robust data collection and datasets shows we are seeing results.
- To continue to improve our understanding of the conservation effectiveness, MAARNG is increasing and targeting monitoring.
- Conservation actions in FY21 included
 - Ongoing, large scale pine barrens and sandplain grassland restoration and habitat management efforts and results show regionally significant ecological improvements adding to landscape level heterogeneity and resilience.
 - Continued implementation of the actions within the CMP and mitigation bank
 - Major efforts for eastern box turtles across multiple projects and partners
 - Completed annual monitoring and focal efforts for breeding birds, whip-poor-wills, monarch and frosted elfin butterflies, moths, rare plants, clam shrimp, Odonates, and other taxa
 - Long-term planning and public outreach for conservation actions.
- *In the big picture, MAARNG thinks their efforts have been effective, and the studies show this. Unsurprisingly there are a few species where there is greater concern, for example*

the health issues occurring with box turtles. MAARNG is helping support current research focused on figuring out the bot fly issues with box turtles. They supported a veterinary study, that is analyzing the data in FY22. There were also two graduate projects from UMASS Amherst looking at this issue.

There are also some hints of concerning trends for the NEC, but again MAARNG is investing in large-scale analysis with USFWS and URI to study NEC. Where concerns exist, MAARNG has implemented scientific studies and overall they are seeing that the expected response to management of vegetation for the species is occurring. Based on the science, it seems like efforts to support this species are working.

Cindy Corsair noted she was curious to hear more on the NEC management, including about pellet and collar data and GPS movement. MAARNG sent USFWS all the information and this should be a good dataset when combined with the study done by Eileen on NEC in Mashpee. They also talked to Dave Scarpitti about the pellet search, diet analysis, vegetation data, telemetry analysis and are pulling it all together to see what is the best tool to answer these questions, particularly about how the NEC population responds to management. For both NEC and bats, MAARNG realized they were at a point that they needed a larger scope analysis to better understand the current status of these species, not just annual data collection. They are waiting on results of these larger studies to see how to prioritize management and where to go from here. MAARNG is still doing acoustic surveys for bats and pellet surveys until they get results of these larger studies.

5) Does the INRMP provide conservation benefits necessary to preclude USFWS Critical Habitat designation?

- Yes – There is no critical habitat (CH) present or proposed for federally-listed species at Camp Edwards, and MAARNG does not expect designation. MAARNG is managing effectively for habitat and population resilience of listed species present.
- Nearly all of the base is already designated as Priority Habitat for state-listed species. Through the INRMP and CMP, MAARNG has the primary tools to do what is needed for both the mission and conservation without regulatory barriers
- *Avoiding CH designations on DoD installations is a major driver of INRMPs. Currently, there are no federally ESA-protected species that have CH identified at Camp Edwards. However, if species under status review or that are currently listed are given CH, it would seem that the extensive survey data and understanding of how these species use the base and how they are managed for could be sufficient to preclude CH designation. This decision would require partner input.*

Under the Massachusetts Endangered Species Act, all of Camp Edwards is priority habitat, but they have tools in place so that priority habitat is not limiting their ability to meet the mission through partnerships and beneficial offsets from conservation. This has been extremely successful and highlights that this model is working.

6) Are Species at Risk identified and are steps being undertaken to preclude listing?

Yes, something they have significantly improved with updated INRMP.

- Yes – the identification of at-risk species has been significantly improved with updated INRMP, and was provided by USFWS.
- In FY21, the following efforts were made in support of at-risk species:

- Took efforts to target tri-colored bat calls to aid in their status review and completed submission of all bat data to NABat to facilitate range-wide status review.
- Provided field staff to support a Legacy grant project regionally surveying spotted turtles
- Performed surveys in conjunction with the Monarch Larval Monitoring Project
- Implemented USFWS “Frosted Elfin Habitat and Butterfly Survey Protocol” at three locations
- Completed regional pellet search plots for NEC and initiated partnership effort to collaboratively analyze extensive data set for NEC ecology and management.
- *MAARNG captured species at risk in the last INRMP update. The management actions in the INRMP are covering these species effectively, and at-risk species get a lot of their management focus. Species at risk highlight MAARNG’s management and conservation priorities. MAARNG needs input from partners on whether they feel these species are sufficiently addressed in INRMP. For example, with NEC MAARNG questioned if there was enough in the INRMP that they could preclude listing based on conservation commitment, and as a result this section had to be beefed up. This is the kind of input they need from partners.*

Partnerships Effectiveness

5) *Has the INRMP review team (State ARNG, USFWS, ARNG I&E, and the State Wildlife Agency) been effective in ensuring the INRMP’s implementation?*

- Yes – MAARNG works in active partnership with USFWS, and frequently with MassWildlife on INRMP project implementation. Examples include work on the New England cottontail surveys, box turtle and natural community planning level surveys (PLS), odonate surveys, and the upcoming watchlist plant protocol.
- MAARNG meets annually with agencies to review the INRMP projects and progress.
- *Internally and externally, MAARNG has been working effectively to implement the INRMP and in targeting mutual needs. In terms of partnerships, MAARNG has very effective ones that are a real highlight of their natural resource management program. Five partnerships got impacted by COVID-19 and need attention and development in FY22.*

MAARNG is working to figure out a way to tap into partner agencies for support where they need it; not having to contract everything out would be great. For example, they would like to set up a 1-2 day Schwalbea study with partner agencies instead of contracting this work. MAARNG could do an in-kind service trade with partner agencies, and was wondering if this could help the agencies in addressing their needs. He would like to discuss this kind of opportunity moving forward in FY22.

6) *Are other partnerships needed to meet the INRMP goals?*

- No new fundamental partnerships are needed to accomplish INRMP goals. For prescribed fire, MAARNG and other stakeholders could all benefit from additional cooperation and collaboration. This collaboration will hopefully increase with additional emphasis and with further development/build-up of all programs.

7) Have other partnerships been effectively used to meet INRMP goals?

- Yes – MAARNG has several other effective partnership initiatives, including with the University of Massachusetts. MAARNG is also working to increase partnerships with additional universities and other partnerships, such as regional conservation initiatives.
- Past and current examples of effective partnerships include the CMPs, Woodwell Climate Research Center, and the Mashpee Wampanoag Tribe.
- *As discussed throughout this meeting there are several other partnerships, all have funding involved. MAARNG is coordinating with Woodwell Climate Research Center who is a beneficial partner to have. MAARNG is also working with UMASS Amherst and has multiple projects developing with USFWS, as well as work with SUNY ESF for NEC surveys. Using Camp Edwards as a site for university projects is an effective way to move forward, as long as they can manage their staff time. Since these university partnerships are relatively new for Camp Edwards, they are taking a lot of their staff time to set up and manage. Hopefully this effort will decrease as they become more experienced in managing these partnerships.*

8) Are internal stakeholders (training, facilities, etc.) effectively coordinating projects?

- Yes, internal stakeholders are relatively effectively coordinating projects, but there is still room for growth in this area. There is a need for earlier coordination, and a master plan for the base is needed to provide consistency and to provide a better long-term view on upcoming projects.
- MAARNG developed Clam Shrimp Conservation and Roadway Maintenance Plan in collaboration with MassWildlife to supplement and amend the original CMP, and a permit amendment was issued in July 2021. The plan establishes a Critical Road designation for certain roads which are intended to be frequently maintained and not intended for puddles. This plan was widely circulated to stakeholders at Camp Edwards, but two projects that were implemented without the prior coordination were identified in FY21. This highlights the need for improving coordination and planning early to avoid violations. Two meetings have been held since these incidents with all potential road/trail maintenance and repair stakeholders to identify roads and road sections in need of repair and planned for FY22 and allow for assessment of project mitigation needs.
- *Overall they were pretty effective at coordinating projects but there was a lot going on, and some things were able to slip through cracks. COVID-19 was very disruptive to their ability to hold coordination meetings. For the clam shrimp there were two road projects in FY21 that weren't coordinated prior to occurring. One had no puddles and no negative repercussions from a natural resources perspective, but it highlighted the need to reach more project proponents. On the second project a contractor on an approved project did extra grading to move trucks and graded over puddles where they had put clam shrimp as mitigation. In this case, they needed the managers of the project to communicate the requirements to in-house staff and contractors. As a result of this issue they had a corrective meetings and are now in a good place.*

Fish and Wildlife Management and Public Use

- 4) *Are public recreational opportunities such as hunting, fishing, and wildlife viewing available to soldiers and employees?*
- Yes – Camp Edwards has a significant hunting program for soldiers and employees, and has active programs and meetings. Some opportunities were limited in FY21 due to the COVID-19 pandemic.
 - *MAARNG has an active hunting program at Camp Edwards that provides lots of opportunities for recreation. This program is heavily used by the public. They also support grassland bird tours for the public. These recreational activities are all in good shape for FY22.*
- 5) *Are public recreational opportunities such as hunting, fishing, and wildlife viewing available to the public?*
- Yes – Camp Edwards has a significant hunting program and hosts occasional public wildlife viewing events, with some limitations in FY21 due to COVID-19 pandemic.
- 6) *Does the INRMP and site offer opportunities or facilities for disabled sportsmen?*
- Yes – Camp Edwards hosts an annual paraplegic sportsmen deer hunt (3-day event).

Team Adequacy

- 3) *Is the State ARNG's natural resources team adequately resourced to fully implement the INRMP?*
- MAARNG was sufficiently resourced in FY21 for the current conditions and for INRMP implementation.
 - MAARNG is lacking in funding for FY22 to fully implement INRMP. Due to this funding shortage, MAARNG has prioritized meeting the most critical needs, and is working to find/access additional funding sources.
 - *The heart of this question is if the program is able to meet needs to implement the INRMP. They have an exceptional team at Camp Edwards, but they always can get better. The team is adequately trained and try to be leaders and good partners in the conservation community. The same is the case with resources.*
- 4) *Is the State ARNG's natural resources team adequately trained to fully implement the INRMP?*
- Yes – The NR-ITAM team is adequately trained, but training is an ongoing and critical process and professional need. This is especially the case, as NR-ITAM program is developing rapidly and is addressing so many significant challenges.
 - MAARNG will continue to identify key training needs and make sure they are captured in the INRMP objectives and projects. Known training needs include continuing education and ongoing training that is required for certifications and qualifications (e.g. wildland fire, pesticides, etc.). MAARNG will also need to identify major training needs for capacity building.

APPENDIX W-1.2 –FY20 ANNUAL REVIEW REPORT AND MEETING NOTES

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**FINAL MEETING MINUTES
CAMP EDWARDS TRAINING SITE
FY20 INRMP ANNUAL REVIEW**

Prepared by: EA Engineering, Science, and Technology, Inc., PBC (EA)

Date: Friday, 12 February 2020

Time: 0900 to 1100 hours

ATTENDEES:

Joel Carlson	Wildland Fire Program Coordinator, Massachusetts Army National Guard MAARNG
Kathryn Cerny-Chipman	Scientist and Project Manager, EA
Robert Crevey	Land Rehabilitation and Maintenance Coordinator, MAARNG
Annie Curtis	Wildlife Conservation Biologist, MAARNG
James Doherty	Director of Facilities and Engineering, MAARNG Camp Edwards
Keith Driscoll	Deputy Environmental Program Manager, MAARNG
Erin Hilley	Wetlands/Vegetation Conservation Biologist MAARNG
Jake McCumber	Natural Resource-Integrated Training Area Management (NR-ITAM) Program Manager, MAARNG
MAJ Alexander McDonough	Plans and Training Officer, MAARNG Camp Edwards
Jessica Morrissey	Scientist, EA
David Paulson	Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife (MassWildlife)
Leonard Pinaud	Environmental Officer, Environmental Management Commission (EMC)
Col. Matthew Porter	Commander and Base Operations Manager, MAARNG Camp Edwards
Dan Savercool	Senior Biologist, EA
Jason Zimmer	Southeast District Supervisor, MassWildlife
David Shannon	Construction and Facilities Management Officer, MAARNG

INVITED, BUT DID NOT ATTEND:

Cynthia Corsair	Southern New England-New York Bight Coastal Program, US Fish and Wildlife Service (USFWS)
Paulo Baganha	Environmental Program Manager, MAARNG

DISTRIBUTION: All invited

The Camp Edwards Integrated Natural Resources Management Plan (INRMP) Annual Review meeting was held via Microsoft Teams. An annual review meeting to review INRMP progress and upcoming goals is required by the Sikes Act and under 2019 Army guidance (*Army National Guard (ARNG) Installations and Environment (I&E) Directorate Policy for Integrated Natural Resource Management Plans*). While the Sikes Act does not require that partners (U.S. Fish and Wildlife Service [USFWS] and Massachusetts Division of Fisheries and Wildlife [MassWildlife]) attend the meeting, it requires that they are invited. These meetings are a valuable opportunity for engagement between stakeholders, and MAARNG thanks everyone for attending.

The intent of the annual review meetings and process is to communicate MAARNG INRMP implementation progress with the Sikes Act partners, including progress made in the last year and future plans for the coming year (FY21). The Camp Edwards INRMP was finalized in December 2020, and all signatures have now been received. Mr. McCumber intends to distribute the final INRMP by posting it on the Camp Edwards website. He can also send out a Department of Defense (DoD) SAFE link to meeting participants with the signed INRMP if there are delays in posting the document on the website. MAARNG is moving on to updating the Camp Curtis Guild INRMP next.

The INRMP is intended to be a partnership document and provides the commitments of MAARNG to what they do in an adaptive management framework. Items in the INRMP change each year; some projects are incorporated and others do not get completed. Camp Edwards is unique in the level of engagement of both internal and external stakeholders. This meeting information will be used to populate the Annual Review Template and develop a report for the Annual Review. Meeting participants were emailed the supporting documents that will be discussed prior to the meeting. The focus is to review actions completed last year and upcoming FY21 plans, and to discuss the questions from the Annual Review template. The meeting participants discussed the questions on this template. This discussion is summarized below.

REVIEW OF FY20 PROGRESS AND PLANNED FY21 PROJECT IMPLEMENTATION

Natural Resources Program Management – MAARNG has focused on growing the NR-ITAM program and was able to hire two full time positions in FY20, a wetlands/vegetation conservation biologist and a wildland fire management coordinator. Having additional staff has necessitated figuring out new operations, especially in fire management. MAARNG would implement prescribed fire activities this coming year. Completing the INRMP update and environmental review of projects were also major efforts in FY20, particularly the multi-purpose machine gun (MPMG) range and permits to support this project. Addressing COVID-19 impacts was another significant management focus in the last year.

In FY21, natural resource management will be focused on many of these same issues. The MPMG range design and the Conservation and Management Permit (CMP) process is ongoing. MAARNG will also be working on the Camp Curtis Guild INRMP update and developing Standard Operating Procedures and best management practices (BMPs) for mowing and grounds maintenance in FY21.

Fish and Wildlife Management – This section of the Camp Edwards INRMP is focused on general ecosystem management and species that are not threatened or endangered (T&E). In FY20, MAARNG completed annual surveys for both birds and bats. Management activities also entailed

general ecosystem habitat improvements, including non-mitigation habitat restoration. These activities overlap with management objectives in other sections of the INRMP.

In FY21, MAARNG will be focused on a large effort funded under candidate species for the New England cottontail (NEC), working under the recovery plan. MAARNG is seeking out a partnership with USFWS to analyze several years of data, and analysis and reporting on this large volume of past NEC data is a high priority for both agencies. MAARNG will also be updating natural community maps for Camp Edwards and Camp Curtis Guild as planning level surveys using remote sensing and fieldwork under a contract. This is a critical need as the current habitat data does not provide a good representation of what is on the ground.

Recently, soldiers working at the trench lines north of Sierra Range in the northeast corner of Camp Edwards were checking for wildlife ahead of the Best Warrior competition. These soldiers were proactively checking for wildlife, a practice that NR-ITAM supports. The soldiers found a silver-haired bat hibernating in the recently-built wooden bunker at the command post for the trench complex. This command post is a half-buried wooden shed with no significant thermal inertia. Based on USFWS and Biodiversity Research Institute information, this is the first hibernation record of silver-haired bat in New England. Silver-haired bat acoustic calls were previously recorded in the winter, but this was the first visual documentation. This situation highlights the complexity of aligning natural resource management and the mission, for example, when structures are present for training that are good for wildlife, but the presence of wildlife limits training. The bat was found in training infrastructure, a resource that wouldn't be in the landscape if the training activities were not occurring. MAARNG has changed the location of the Best Warrior competition to avoid the bat, but in the long run they will need to come up with creative solutions to avoid conflict between wildlife and training.

MAARNG needs to proactively plan for similar situations so beneficial wildlife discoveries do not shut down training. Potential options to consider include bat boxes or other structures. This situation illustrates the type of management issues in which the INRMP is intended to be used to navigate potential conflicts between NR and training. Although the bat is not a protected species, Camp Edwards leadership and all of the ranks are committed to conservation. However, when there are unavoidable conflicts between conservation and mission-related actions, the mission cannot be limited by these resources. In this instance, the utility of the INRMP is to devise the conservation action to support the mission.

Mr. Paulson noted that the record of this bat should be published if it is unique, and commended the team and soldiers for their work. Ms. Curtis is putting together a contract for a bat specialist to conduct white-nose syndrome swabs, complete a more thorough search of the bunker, and review all the silver-haired bat calls previously recorded in the winter. These findings will be written up in a manuscript to publish.

Outdoor Recreation – Annual bird tours and the spring turkey hunt at Camp Edwards did not occur in FY20 due to COVID-19, but the deer hunting program did go forward with COVID-19 protocols in place. In FY21, MAARNG is hoping to hold the spring turkey hunt using the deer hunt COVID-19 protocols. Bird tours may be possible with smaller groups of ten individuals, but it has not yet been determined if these will move forward in FY21.

Threatened and Endangered Species Management (including CMPs) – The supplementary information sent to meeting participants prior to the meeting is mainly focused on T&E species management, including the CMPs. Box turtles have been a considerable management focus in

FY20 due to preconstruction survey needs. Past additional survey work included the 2019 AECOM dog-assisted surveys. MAARNG is continuing to track turtles from that survey effort. MAARNG has also been managing for parasites and pathogens that have been found on box turtles at Camp Edwards. In FY21, MAARNG anticipates continuing box turtle work and has been coordinating with MassWildlife on fire impacts to turtles and habitat management. Natural resource staff have been monitoring the northern long-eared bat (NLEB) with acoustic surveys and designing a long-term study for state-listed moths and butterflies to be completed under the CMP for the MPMG range where impacts are greatest. MAARNG is also continuing ongoing plant surveys and monitoring for T&E species in FY21.

Clam Shrimp CMP: The clam shrimp CMP has been completed and is almost closed out. MAARNG will complete an additional year of monitoring for the CMP due to severe drought in FY20. This will give them better idea of the success of mitigation sites. The final action on the CMP is final approval from the Judge Advocate General for MAARNG to send the signed permit to Barnstable county registry of deeds requesting closeout. However, additional planning for the clam shrimp and holistic management of this species is needed in the INRMP.

Master Plan CMP: The Master Plan for Range Development CMP was a major focus in FY20 and was finalized in September 2020. The CMP report provided to the meeting participants covers activities implemented in FY19/FY20 and planned for FY21. MAARNG has invested over \$800,000 for the CMP and mitigation in the last 2 years and anticipates an additional \$350,000 to \$400,000 in FY21. The mitigation bank structure of the CMP was implemented by MAARNG and MassWildlife as a proactive measure. The CMP was a critical component of Camp Edwards natural resources installation award from the National Guard Bureau. MAARNG is using this innovative program and the INRMP to chart a path forward for range development within an area that is highly regulated for natural resources.

Mr. McCumber shared a spreadsheet MAARNG uses to track all project work related to the mitigation bank and CMP activities that may be provided to the partners annually. The sheet includes monitoring projects and habitat improvement projects in focal areas as well as construction projects. The spreadsheet functions like a “checking account” balance sheet showing debits and credits that take into account mitigation ratios, and the planned budget for FY21. MAARNG also tracks treatment number (based on the criteria for initial or maintenance treatment), which applies to whether a treatment is directly addressing mitigation requirements for construction or perpetual maintenance requirements under the INRMP.

Mr. Paulson noted that since each year is adaptive, a check-in meeting for CMPs twice a year would be beneficial, one meeting for planning and a second meeting at the end of the year to discuss completed activities. A shared ArcGIS online map or file that georeferenced the table would also allow partners to track activities happening in a given year and over time. Mr. Paulson noted that the report provided what MassWildlife needs for the CMP FY20 end of the year reporting requirements, and that a quick summary document would also be sufficient. MassWildlife is willing to support an adaptive reporting system and would like to document, memorialize, and highlight successes so far; the text sent is a good example of this. Research and habitat management would be more of a report. Mr. McCumber noted that MAARNG is determining how this document fits within the State of the Reservation report and noted that it may replace the mitigation section that is currently in that document.

The CMP is a phased master plan, which is discrete over time. MassWildlife can issue MAARNG “tickets” of compliance as items are built out or completed. For example, once the range is built and protection measures are in place, they can close out the CMP. This “ticket” can be inserted into the INRMP and internal files for MAARNG. Mr. McCumber noted that this would be very helpful to demonstrate that projects are acceptable and are ready to move into perpetual maintenance as part of annual INRMP implementation. The first of these projects is Tango Range, which should be wrapped up in FY21. The turtle protection report for this project was sent to MassWildlife. The MPMG, small ranges, and gym facility are also under the Master Plan CMP, and more sites will be coming down the line. The MPMG project has faced some contention in public opinion. The CMP and mitigation have been discussed in this debate, but a review of the CMP and mitigation show they are holistically protective for state-listed species at Camp Edwards. MAJ McDonough highlighted his appreciation for the work done on this and encouraged NR-ITAM to contact his office for any higher-level support and compliance needs. Mr. McCumber noted that the project managers in Facilities and Engineering and the Construction and Facilities Management Office have been working well with NR-ITAM to meet pre-construction and construction requirements for the CMP.

Water Resource Protection – Camp Edwards is a fairly dry site, and management of water resources mainly involves regular coordination with the groundwater study and Mr. Pinaud on any water quality activities and the groundwater program. There are regular requests to train on water purification at Otis Ponds; this process will need to be sorted out with the Massachusetts Department of Environmental Quality water withdrawal program. MAARNG hopes to make progress on this request in FY21.

Wetland Protection – In FY20, Ms. Hilley joined NR-ITAM as a wetland/vegetation conservation biologist and has started on several projects. She has also been involved with road maintenance and coordinating with the Town of Bourne. MAARNG will be working with towns in FY21 to start developing BMPs for management in wetland buffers.

MAARNG is preparing a document for MassWildlife review about maintaining the road network to support training, groundwater remediation, and emergency response while still providing a puddle network for clam shrimp conservation. Proposed techniques include back dragging out puddles and spreading out the sediment containing clam shrimp cysts knowing that these sediments will wash into newly formed and settled puddles. The document also proposes defining the density of puddles in different zones of the base in conjunction with other efforts. MAARNG needs a primitive dirt road network with puddles, but these roads must be passable. Currently, the impact area boundary road is almost impassable due to clam shrimp puddles. MAARNG is hoping to implement measures as part of the INRMP to avoid the need for a new CMP for road maintenance. The INRMP would address puddles and include a clam shrimp management plan, with regular monitoring and reporting to MassWildlife.

Mr. McCumber proposed using the INRMP and a management plan for road maintenance, even if it included filling in puddles, as long as protective measures were in place. MassWildlife would support this as long as it was a holistic approach with BMPs in place for puddle impacts. Both agencies do not want to develop CMPs for small projects as CMPs every few years and would rather amend the existing clam shrimp CMP or develop a master plan to cover these. Clam shrimp are found in disturbed areas, such as the Crane Wildlife Management Area parking lot, and removing disturbance by road maintenance at Camp Edwards would be detrimental to the species.

While the goal should not be to fill all puddles, they can find a way to develop efficient maintenance.

Grounds Maintenance and Forest Management – This INRMP section typically covers reimbursable forestry, which does not occur at Camp Edwards. All forestry projects are mapped in the CMP report provided before the meeting, including projects outside mitigation areas. In FY20, MAARNG completed a large snag removal in the southern part of base (BA6/7), leaving snags for habitat but removing enough to get into the area with prescribed fire. In the past, these areas with very high snag density have been unsafe for burning or training due to fall hazards and prohibitive to burning due to smoke produced by the smoldering snags. The project involved mowing and spot mastication, which has restored frost-bottom habitats.

MAARNG has completed one new harvest in FY21 at Battle Position (BP) 20. They are rehabilitating the historic forest structure based on historic photographs and to support training; the project was designed with infantry training coordination and use in mind. Field sparrows and bluebirds started using the site almost immediately following the work, showing significant habitat gain. MAARNG also completed a 40-acre mastication on the southwest part of base (NBC area) and finished remaining snag treatments. In total, MAARNG completed 220 acres of snag treatment that will be followed up with fire. MAARNG is already developing the burn plans for prescribed fire maintenance in these areas.

The next large forestry project will be rehabilitation of training area BA3 near the tactical training base and the Barnstable County prison. The site was formerly a mature pine savannah but has quickly filled in with young pines and white oaks. It will be rehabilitated, incorporating an open habitat area that supports new artillery units to learn how to set up and occupy an area (not firing). The work will include native vegetation openings where units can set up their new model of Howitzer without firing live ammunition. Another project is a large frost-bottom and pine barrens restoration area in RAW3/E3. This area is a hazardous fuel area touching the impact area with a large kettle hole. The project will remove all trees around the kettle hole to restore the frost-bottom and moderately thin the surrounding woodland.

Wildland Fire – In FY20, MAARNG developed a firebreak assessment to analyze existing conditions and wildfire monitoring, to look at critical areas for hazard reduction, and to assess how to use tracers more safely on ranges. In FY21, MAARNG has formed the Camp Edwards Wildland Fire Working Group to, in part, address implementation of projects identified in the assessment. A main focus in FY21 will be updating the Integrated Wildland Fire Management Plan (IWFMP), which the Army has recently made into a plan with a 5-year review. The IWFMP for Camp Edwards is outdated, and MAARNG is contracting the update to address this critical current need. With the addition of Mr. Carlson as the Wildland Fire Program Coordinator, MAARNG will also be restructuring the program to reduce reliance on contracted fire services. MAARNG has identified 400 acres for potential prescribed burning in spring FY21, which is unlikely to be possible given current conditions, but several smaller units can be burned in-house while still following COVID-19 protocols.

Integrated Pest Management – The Integrated Pest Management Plan was another outdated plan under update. The internal draft has been completed and is ready for staffing and finalization. The biggest change in FY20 was the introduction of self-help allowances for armories and other departments, which are coordinated with the Director of Operational Logistics (DOL) for supply requests and tracked and reported by DOL. There is a need to catch potential management issues

early. Camp Edwards has also started using a biocontrol for spotted knapweed focused on management in battle positions.

Cultural Resources – Some natural resources at Camp Edwards are culturally sensitive/protective, and MAARNG coordinates with the Mashpee-Wampanoag tribe. Simple projects that would be meaningful for the Mashpee-Wampanoag could be implemented, including sweetgrass surveys and re-introduction of this species to wetlands on base if suitable. These projects would have a beneficial cultural impact with no regulatory or natural resource management concerns.

Public Outreach – MAARNG has produced media videos to support outreach on natural resources in addition to several public meetings. NR-ITAM assisted with a range qualification video in support of the Multipurpose Machine Gun Range project and public engagement describing range management and overall conservation and management programs. The video illustrates good examples of integrating training and natural resource management, and the natural resources portion highlighted restoration and management of a site that had been fully occupied in 2019 by hundreds of soldiers. MAARNG also held stakeholder meetings in FY20, including legislative and government meetings and Bourne public meetings.

GIS – Matt Penella has been entering natural resource data into a unified geodatabase so it is warehoused and spatially explicit. In FY21, MAARNG will be updating natural community and habitat maps.

Climate Change – Climate impact planning is integrated in the MPMG projects but will have an increasingly larger focus for natural resource management moving forward. MAARNG has established the fundamentals but needs to determine how to fit this work into a detailed climate resilience plan. Many of MAARNG's natural resource management (e.g. prescribed fire, fuel management) and ecosystem management actions are critical to climate resilience (e.g. fighting wildfire, pest outbreaks). This work protects surrounding communities, and the benefits should be more explicitly described in the INRMP.

The Cape Cod Commissions Climate Action Plan includes natural resources considerations, and Mr. McCumber was a development stakeholder for the plan. DoD is continuing to explicitly discuss climate change and develop tools to address climate change. The Army climate assessment tool is now required for inclusion within INRMPs. Mr. Zimmer noted that MassWildlife was receiving criticism about cutting trees several years ago, so he developed materials for the public on the value of habitat management and carbon storage. He offered to provide these materials to MAARNG. Mr. Zimmer also noted that the Simple Model for Climate Policy Assessment (SiMCP) may be another source of information. MAARNG lacks sufficient state and local data on restoration, so additional resources are useful. There is also a need to increase public understanding on the climate benefits of fire and forest management.

ANNUAL REVIEW TEMPLATE QUESTIONS

The meeting participants discussed the questions on the INRMP Annual Review Template; these questions and draft responses were provided ahead of the meeting. MAARNG solicited thoughts and concerns from stakeholders, particularly focused on what components of the INRMP are working and not working, and input on what needs to be updated, fixed, changed, or addressed.

INRMP Project Implementation Questions

9) *Are INRMP projects, including follow-up inventorying and monitoring work, properly identified, developed, and submitted for funding?*

Yes—all projects were identified, and all FY21 projects were submitted and approved. The meeting participants have no questions or comments on this question.

10) *Has project funding been received, obligated, and expended?*

Of the projects submitted for FY21, 85% were funded, compared to 82% in FY20. While this may seem low, it represents a high funding rate for many states and will fund most of the proposed work. The 82% funding level is \$1.2 million in work, which is about as much capacity as NR-ITAM can execute in a year. MAARNG received \$350,000 to \$400,000 for conservation, which was quite sufficient as conservation at the DoD level and National Guard Bureau (NGB) funding were decreased last year.

Mr. Pinaud asked for MAARNG to help him better understand how funding is appropriated for INRMP projects and the funding sources used. Mr. McCumber noted that VENQ is the code that identifies funding. Since the natural resources program at Camp Edwards is combined with ITAM, training lands funding is separate from funding for the INRMP and conservation actions. NR-ITAM received \$1.2 million in funding for conservation and \$350,000 for training lands management. Many projects share money between the two funding sources such as timber harvests. Within Conservation funding there are specific catalogs broken out by focal area to which projects are assigned (e.g. federally listed species, state-listed species, salaries, general INRMP implementation, ecosystem management, program administration, training funds, fire).

Funding is submitted in a database, undergoes local review by the Environmental Program for MAARNG, and then receives several levels of review at NGB. COL Porter noted that this would be a good topic to cover at a Sustainable Range Program meeting and offered to send Mr. Pinaud executional guidelines about how money is combined for symbiotic projects for facilities, training, and conservation. Mr. Driscoll also noted that MAARNG does not receive funding for projects not tied to a regulation, and thus everything in the program is tied to a federal, state, or local regulation. They must prove how the project is tied to the regulations to receive the money. In this case, signing/finalizing of CMP is a permit that must be complied with, which allows funding for these projects.

Mr. Paulson questioned if there were opportunities on grants and initiatives that were competitively funded, where MAARNG might partner with other agencies to leverage additional funds. MassWildlife would be interested in reviewing opportunities to partner if they arise to see where there might be a benefit. Additional funding sources exist, such as the Legacy grant program, which is focused on environmental conservation projects at the DoD level, and the Strategic Environmental Research and Development Program, which is a large source of grant funding typically put out as requests for proposals in focal resource areas. MAARNG has sought funding from these sources in the past but has not received funding. Currently NR-ITAM is not limited by funding but by the ability to find the time to manage these kinds of projects. MAARNG would like to identify regional partnerships for funding, for example, with local non-governmental organizations who would “own” the project, with MAARNG as a stakeholder and partner.

11) *What projects have been completed and do they meet expected objectives?*

NR-ITAM projects have met the expected objectives in FY20. For example, most projects in the INRMP are ongoing annual projects and are not discreet tasks that are completed. One fully completed project in FY20 was entering Camp Edwards bat data into the NA Bat database.

12) What new projects are proposed?

MAARNG is continuing to support ongoing projects in FY21 and adding new projects, such as a DoD Legacy project that includes range-wide spotted turtle surveys. DoD is working to be an early/engaged partner to try to preclude the need for listing of the spotted turtle under the Endangered Species Act (ESA) by better evaluating species. DoD is surveying populations on bases with the species to help determine if they are sufficiently persisting and sustained. This work will hopefully, at the very least, preclude the need for critical habitat designation on a base should the species become protected under the ESA. MAARNG is also adding a project for FY21 to better evaluate bird data to calculate trends.

Federal ESA Protected Species and Critical Habitat

For Camp Edwards, ESA also includes state-protected species; MAARNG noted that this is always the case with INRMPs and installations. This annual review section was discussed in regard to both federal and state protected species.

1) Are conservation efforts effective?

Yes, monitoring and collaboration have shown that conservation efforts are effective and that the INRMP, partnerships, and actions are conserving resources and habitat. For example, Mr. McCumber recently evaluated 1994–2014 and 2013–2020 data for bird species, which indicate that bird species of greatest conservation need are doing well at the installation. Most of these species are increasing significantly (e.g., scarlet tanagers, ruffed grouse) or are widespread and abundant (e.g., whip-poor-wills) at Camp Edwards. These species are responding positively to active habitat restoration, with many shrubland species observed in the grasslands moving into training areas. Monitoring for Walsh’s digger bee has shown more locations with this species. The slender clearwing moth, a rarer and less documented species, was identified at new sites during monitoring. Overall, monitoring provides a good indication that MAARNG is managing resources effectively, including training areas and other land uses such as the powerline right-of-way. Box turtles are an ongoing management challenge, and MAARNG is coordinating with other agencies to address this.

Mr. Paulson has not heard anything recently on the Legacy grant or work surrounding the frosted elfin and has not seen the DoD-led effort on this species. He stated that he would expect this to happen as the status assessment progresses for this species. Mr. McCumber noted that USFWS released a story a few years ago about bases protecting and managing this species. Camp Edwards is continuing to complete their own surveys and are implementing a range-wide protocol developed by USFWS. Mr. McCumber was not sure if there is a concerted DoD effort.

2) Does the INRMP provide conservation benefits necessary to preclude USFWS Critical Habitat designation?

No critical habitat has been proposed on Camp Edwards for federally protected species, but the NLEB is currently under status review for a potential change to an endangered listing. The current status of the NLEB as threatened allows for the 4(d) rule and does not introduce critical habitat, but this might change if it is listed as endangered and will require a Biological Evaluation. Cape Cod and islands would be focal areas for a critical habitat designation, but a lot is still unknown.

MAARNG's ongoing conservation efforts and monitoring data are in place to show the extent of NLEB use at Camp Edwards, which would hopefully help avoid a critical habitat designation on the base. MAARNG would need to do Section 7 consultation if this changes.

3) *Are Species at Risk identified and are steps being undertaken to preclude listing?*

Species at risk are identified in the INRMP, and the list from USFWS has been added to the most recent version of the INRMP. The Army Species At Risk (SAR) list is outdated and does not include any species found in Massachusetts. MAARNG will look at this list more effectively and intends to engage the Army in this updating so that species like NEC are captured.

Partnership 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?*

The biggest issues MAARNG faces are gaps in regional species distribution. There is a need for better regional studies and planning level surveys for rare species, including the clam shrimp and Walsh's digger bee, but both MAARNG and MassWildlife do not have the time or funds to lead. All indications are that these species are more common on the landscape than is currently known; for example, the discovery of clam shrimp at the Wildlife Management Areas.

Box turtles are an ongoing concern, particularly issues with bot fly larvae and respiratory disease. MAARNG cannot lead the effort to better assess regional threats or medical issues, but would like to be a supporting stakeholder.

2) *Are other partnerships needed to meet the INRMP goals?*

Currently, no identified additional partnerships are needed to meet the INRMP goals beyond those already discussed to address regional rare species data gaps.

3) *Have other partnerships been effectively used to meet INRMP goals?*

In general, other partnerships are used effectively and are reflected in projects in the INRMP. External coordination is going well.

4) *Are internal stakeholders (training, facilities, etc.) effectively coordinating projects?*

Overall, work and coordination with internal stakeholders on projects is good. Internal coordination is going well, and environmental review has significantly improved. The project managers are including environmental review early, addressing concerns, and ensuring issues such as box turtle protection being incorporated into design contracts. They are implementing protection measures in construction contracts, and continue to formalize and develop these measures.

Fish and Wildlife Management and Public Use

1) *Are public recreational opportunities such as hunting, fishing, and wildlife viewing available to soldiers and employees?*

Camp Edwards has a significant hunting program for soldiers and employees as outlined in the INRMP and has active programs and meetings. They just had the after-action review for the hunt, which went well.

2) *Are public recreational opportunities such as hunting, fishing, and wildlife viewing available to the public?*

The DoD stresses providing public recreation where possible. Camp Edwards has a hunting program and provides opportunities for wildlife viewing.

3) *Does the INRMP and site offer opportunities or facilities for disabled sportsmen?*

Yes, Camp Edwards hosts a 3-day paraplegic deer hunt for disabled sportsmen. This event was completed in FY20 with COVID-19 protocols in place.

Team Adequacy

1) *Is the State ARNG's natural resources team adequately resourced to fully implement the INRMP?*

Yes, the NR-ITAM team is sufficiently resourced, but there is an increasing demand for natural resources management. Active management and monitoring of natural resources requires ongoing funding and resources. NR-ITAM is adequately implementing the INRMP but will likely need to continue to grow.

2) *Is the State ARNG's natural resources team adequately trained to fully implement the INRMP?*

Yes, the NR-ITAM team is sufficiently trained, but a need always exists for more training funding to support ongoing learning, including continuing training for certifications and qualifications.

Final Remarks

Mr. Pinaud conveyed that the commissioners were very impressed with the soldiers' knowledge of environmental issues during the fall exercises, particularly how the soldiers set up on DEMO2 and the precautions they took to protect the environment. These kind of exercises, and the communication and knowledge they impart, are incredibly important.

Mr. Paulson thanked the MAARNG team for incorporating elements of the State Wildlife Action Plan for SAR and watch-listed species into the INRMP and management. He noted that these actions are important for conservation of these species. MassWildlife will be releasing a new priority habitat data layer based on a regulatory schedule, but he does not anticipate changes at Camp Edwards to this map. Development of BioMap3 is also in process. A spatial planning tool for installation use will be included and will be well represented in the map. Mr. Paulson also noted that MassWildlife is going through efforts with agency relevancy, retention, and engagement of community, and that the base plays a role in this; he offered thanks for their involvement.

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**APPENDIX W-2.1 –FY21 ANNUAL PROJECT IMPLEMENTATION PROGRESS
TABLE**

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Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

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	<i>Ongoing.</i> Funded for FY21 and FY22
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	<i>Ongoing.</i> Funded for FY21 and FY22
NRP – 1.1.3	Hire and annually fund the salary for a Wetlands and Vegetation Conservation Biologist.	2 (Medium)	X	X	X	X	X	<i>Ongoing.</i> Funded for FY21 and FY22
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	X			<i>Not Completed for FY21.</i> MAARNG was not able to make progress this year on this project and will re-evaluate current staffing needs based on current programmatic structure needs and capacity.
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	<i>Completed for FY21.</i> In FY21, hired four seasonal contract technicians For FY22 currently hiring four technicians. Each year, one is funded through ITAM.
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	<i>Partially Completed.</i> Completed for FY21, but formal implementation needs improvement and additional attention in FY22.
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	<i>Completed for FY21.</i> Continuing ongoing coordination and process in FY22.
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	<i>Completed for FY21.</i> Completed an intensive, process-based staffing survey from the National Guard Bureau (NGB) in July 2021, including over 30 different standard process flowcharts (e.g., T&E species consultation, INRMP project implementation, etc.).
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	<i>Completed for FY21.</i> Natural Resources personnel attended conferences virtually as possible including NMFWA and the NEC conference.
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	<i>Completed for FY21.</i>
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	<i>Completed for FY21.</i> All projects for FY21 and FY22 were approved in STEP.
NRP – 2.2.1	Annually complete Environmental Quality data calls from NGB according to the instructions for that year. Typical data calls include: <ul style="list-style-type: none"> • 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	<i>Completed for FY21.</i> MAARNG completed all Environmental Quality (EQ) data calls in October 2021.
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	<i>Ongoing.</i> Completed multiple data calls in FY21, including annual New England cottontail implementation, supplemental funding inquiries, etc.
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	<i>Completed for FY21.</i>
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	<i>Completed for FY21.</i> The annual internal stakeholder meeting to discuss INRMP progress in FY20 was held on 17 December 2020. The internal stakeholder review for FY21 was held on 10 December 2021.

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY21. The annual INRMP review meeting with external stakeholders to review FY20 INRMP progress was held on 21 February 2021.
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	Completed for FY21. The document summarizing the meetings and updates to the INRMP for FY20 was sent to external stakeholders for review on 11 March 2021 and finalized on 1 April 2021.
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	Completed for FY21. Natural Resources personnel attended meetings when they were held.
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	Completed for FY21. Natural Resources personnel participated in SRP as it was held.
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	Completed for FY21. Natural Resources personnel participated at CFMO meetings, but integration should be improved in FY22.
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	Completed for FY21. Natural Resources personnel completed extensive training throughout the year
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	Ongoing. Completed regular informal and formal coordination with proponents and stakeholders internally.
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	Ongoing. This is an ongoing regular practice.
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	Ongoing. This is an ongoing regular practice.
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	Ongoing. Project is ongoing, and MAARNG is currently developing a process for project reviews.
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	Ongoing. This is an ongoing regular practice needed for project reviews. Process has been improving with the implementation of memos for moderate projects.
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	Completed for FY21. Project was completed as needed in FY21.
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	Completed for FY21. Project was completed as needed in FY21.
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	Completed for FY21. Project was completed as needed in FY21.
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	Completed for FY21. Project was completed as needed in FY21.
NRP – 4.4.2	Purchase field equipment and other supplies necessary to carry out mitigation activities.	2 (Medium)		X	X	X	X	Completed for FY21. Project was funded in FY21 and completed as needed.
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	Completed for FY21. Project was completed as able within conditions and adjusted as needed within the bounds of the agreement and annual meetings.

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY21. Project was completed in FY21 for FY20; reporting and meeting are ongoing for FY21.
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	X			Ongoing. Major data synthesis is ongoing for highest priority taxa (e.g., bats, cottontails) through contracts, but this information needs to be formalized into written plan.
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		Ongoing. Highest priority large datasets are contracted for major data synthesis (bats and cottontails). An in-house assessment of bird data is ongoing, with prioritization of 2013-2021 dataset and SOGCN, which will be integrated with prior analysis of 1994-2013 dataset.
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	Ongoing. The Natural Resources Office contracted USFWS to analyze the NEC data collected on base along with their data collected in nearby Mashpee NWR. Provided support for spotted turtle surveys on base that will be conducted on nine military installations on the East Coast to inform conservation efforts for the species and provided past data collected at Camp Edwards from trapping efforts.
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	Upcoming for FY24. In FY21, specifically integrated this into the analysis contracts for bats and cottontails.
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	Upcoming for FY24.
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	X			Completed for FY21/Ongoing. Contracted USFWS to analyze NEC data. In FY21, contracted scope of work development for data analysis of a long term data set of bat acoustic data. Due to a change in funding in FY21, this project was not contracted, but is planned for FY22.
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	Completed for FY21. Volunteers completed survey for monarchs in grasslands. This was identified previously as a PLS need. Contracted PLS for box turtles based on discussion with MassWildlife. MAARNG has coordinated with MassWildlife but a lead for PLS is needed (box turtles and natural community surveys by USFWS).
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	C				Project Completed.
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	X			Ongoing. In FY21, started partnership with USFWS, with a contract end date end of FY22.
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	Not Completed in FY21/Ongoing. Completion was precluded by other priorities in FY21. The project was not funded in FY22 and the start of this project has been pushed to FY23. MAARNG is exploring an option for conducting surveys in-house with seasonal field techs and/or in collaboration with botanists from sister agencies in FY22. The preference is to discuss options for collaboration of both prioritization and implementation with staff, including taxa experts from Sikes Act partner agencies such as targeted surveys for high priority and/or listed species (e.g., Schwalbea).

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
FWM – 1.1.5	Continue implementation of general fauna surveys (i.e., non-listed, multi-species) including: <ul style="list-style-type: none"> 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 Additional bird surveys, as warranted Comprehensive reptile surveys, including snakes and spotted turtles, as warranted; and Comprehensive amphibian surveys, as warranted. 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	Completed as needed for FY21 and perennially ongoing. The following efforts implemented this project in FY21: <ul style="list-style-type: none"> Continued acoustic bat surveys in FY21 and completed a contract for database population with past data, acoustic analysis, and a plan for data analysis of the long term dataset. Completed annual breeding bird surveys (including grasslands) and annual whip-poor-will surveys. Whip-poor-will surveys were only done for Montague in FY21. Provided support for a Legacy project studying spotted turtles on Camp Edwards. Several telemetry projects and search efforts on Eastern box turtles were completed in FY21. Also coordinated efforts to work with universities to study Eastern box turtles on base were initiated in FY21. Snake boards were only checked occasionally and opportunistically in FY21. Implemented USFWS “Frosted Elfin Habitat and Butterfly Survey Protocol” at three locations. Assisted a graduate student studying Spingid moths on the site with extensive additional moth observation records. MassWildlife Biologist searched for state-listed odonates, in-house minor bioblitz for OdeOlympics. A volunteer completed Monarch surveys in the grasslands. Continued work on a study design for Lepidoptera trends on base. Expected completion in early FY22. MAARNG plans to prioritize odonates for FY22 and evaluate upland game birds for FY23. MAARNG is also considering upland game bird studies in FY22 for implementation in FY23, as ruffed grouse are increasingly being captured in the songbird surveys. This could also include Northern bobwhite surveys.
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	Completed for FY21/Ongoing. MAARNG worked to clean up species lists, correctly sorted by taxonomic group. As taxa are finished the lists will be appended to the INRMP with the annual review. Updates from FY21 have been appended to with this review.
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	X			Not Completed in FY21/Ongoing. MAARNG will start coordination with MAARNG for this project in FY22.
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	X		Not Completed in FY21/Ongoing. Project has been pushed back to FY23.
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		Completed for FY21/Ongoing. Over 80 bluebird boxes were constructed in FY21 and put up in April with assistance from Senior Environmental Corps. Wood duck boxes were also constructed and are pending installation.
FWM – 1.3.2	Calculate detection probabilities for birds to refine methods and to evaluate trends. Feed results into the study design for MPMG.	2 (Medium)		X	X	X		Not Completed for FY21/Ongoing. In FY21 MAARNG focused on trend analysis for SOGCN, not detection analysis. The detection analysis to be contracted in FY23.
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		X	X		Ongoing. MAARNG will consider using moth/vegetation protocol developed at sites for CMP and will determine monitoring objectives in FY22.
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	X	X	Not Completed for FY21/Ongoing. Project will be shifted to FY23-24.

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
FWM – 4.1.1	Provide funding for ongoing conservation and maintenance activities that support wildlife habitat restoration.	2 (Medium)	X	X	X	X	X	Completed for FY21/Ongoing. Completed as needed in FY21, including funding and completing frost bottom protection, nest boxes, restoration equipment and personnel time, etc. Upcoming needs in FY22 include materials for vernal pool creation and puddle hardening.
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	Completed for FY21/Ongoing. Completed as needed in FY21. Ordered materials for plant surveys and other equipment.
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	Ongoing.
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	Completed for FY21/Ongoing. A study design for Lepidoptera trends is nearing completion, and a project to analyze the NEC data was contracted in FY21. Data reporting for bats was contracted in FY21 and a long term analysis of the data is in contracting in FY22. Two graduate student projects are being coordinated for work on Camp Edwards focusing on Eastern box turtles, and an intern with DEP completed home range analyses on Eastern box turtle data from the 1990s in FY21. MAARNG also completed a detailed trend analysis for bird SOGCN and developed the annual whip-poor-will report with data analysis.
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 <i>Partners in Amphibian and Reptile Conservation Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States</i> (Mitchell, Breisch, and Buhlmann, 2006).	3 (Low)	X	X	X			Ongoing.
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	Completed for FY21. An after-action review meeting was conducted in January. A pre-hunt meeting with all the stakeholders was conducted in September.
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	Completed for FY21. MAARNG conducted continued coordination among parties on base to minimize impact on hunt from other activities and to provide for sufficient safety for necessary projects during the hunt. MAARNG also facilitated continued communication to address questions, complaints, etc. Information on protocols to address COVID-19 concerns were posted on the MassWildlife website.
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	Not Completed/Ongoing. Surveys were not conducted in fall 2020 or 2021 due to COVID-19 concerns.
OR – 1.2.1	Support recreational hunting at Camp Edwards.	2 (Medium)		X	X	X	X	Ongoing. Natural Resources staff continued to assist in staffing the check-in building for recreational hunting. The Conservation Biologist continued to organize logistics and communication between all partnering agencies.
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			Ongoing. This effort was undertaken in earnest for the 2019 hunting season with extensive advertisement and outreach. However, the 2020 and 2021 hunting seasons and NR Program were impacted by ongoing COVID-19 pandemic. The 2021 season had strong hunter participation, and increased outreach is hoped to restart in 2022 depending on pandemic conditions and check-in capacity.
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	Removed. Project will be removed due to lack of support from CE.
OR – 1.2.4	Investigate opportunities and benefits of providing an increased area for no drive hunting.	2 (Medium)	X	X			X	Not Completed/Ongoing. Project will be pushed to FY24. Project was precluded in FY21 based on staff time and politics.

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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	<i>Not Completed in FY21/Ongoing.</i> MAARNG did not conduct bird tours in FY21 due to the COVID-19 pandemic. MAARNG will be restarting grassland bird and wildlife tours in FY22 and there was a strong public interest during public base tours. Roughly 15 public tours were conducted at Camp Edwards, all including the Natural Resources Manager as co-leader, from August through December 2021, with large emphasis on conservation management and rare species. Additionally, multiple public presentations were given on the program or specific groups of rare species.
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	<i>Completed for FY21/Ongoing.</i> Three technicians were hired in FY21. In FY22 MAARNG will take a year off from acoustic monitoring to analyze the years of data and determine future monitoring needs.
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	<i>Completed for FY21/Ongoing.</i> Evaluating long term bat monitoring need and methods.
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	<i>Completed for FY21/Ongoing.</i> Contracted acoustic survey support for 2021 data and database entry in June of FY21. MAARNG also completed contracts for reports on 2020 data and the scope of work for a long term data set analysis project in June.
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)	C					<i>Project Completed.</i>
TE – 1.1.5	Identify key knowledge gaps from previous planning level surveys and monitoring efforts to prioritize future surveys.	2 (Medium)					X	<i>Ongoing.</i> In FY21, MAARNG completed a contract scope of work for a long term bat acoustic data set analysis project. Project is planned for contracting in FY22. Results should identify knowledge gaps.
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			<i>Ongoing.</i> In FY21, MAARNG completed a contract scope of work for a long term data set analysis project. Project is planned for contracting in FY22.
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	<i>Completed for FY21/Ongoing.</i> Surveys were completed in FY21 consistent with regional efforts.
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		<i>Ongoing.</i> In FY21, USFWS, working with the University of Rhode Island, was contracted to analyze the past NEC survey data.
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	<i>Completed for FY21/Ongoing.</i> In FY21, MAARNG implemented mitigation actions on 231 acres of active habitat restoration, including treatment of 157 acres of pine barren habitat which improved NEC habitat. Prescribed fire remained limited in FY21, but was reinvigorated after FY20 did not have prescribed burning due to weather and the pandemic. Planning for FY22 includes extensive prescribed burning to support NEC and other pine barrens species.
TE – 1.3.1	Purchase equipment for federally threatened and endangered species and priority species monitoring.	2 (Medium)	X	X	X	X		<i>Completed for FY21.</i> Completed as needed in FY21.
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	<i>Ongoing.</i> MAARNG initiated discussions with MassWildlife but there has been no other progress in FY21. Project will follow completion of natural communities PLS.

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY21. The following actions were taken in FY21: Efforts were made in FY21 to target tri-colored bat calls to aid in their status review. <ul style="list-style-type: none"> MAARNG provided field staff to support a Legacy grant project regionally surveying spotted turtles. Surveys were performed in conjunction with the Monarch Larval Monitoring Project. Implemented USFWS “Frosted Elfin Habitat and Butterfly Survey Protocol” at three locations. Regional pellet search plots for New England cottontail were completed in FY21.
TE – 2.1.1	Purchase equipment for state-listed threatened and endangered species monitoring.	2 (Medium)	X	X	X	X	X	Completed for FY21. Completed as needed. Purchased transmitters and receivers for radiotracking Eastern box turtles.
TE – 2.1.2	Hire seasonal technicians for annual bird, odonate, and lepidopteran surveys.	2 (Medium)	X	X	X	X	X	Completed for FY21/Ongoing. Completed FY21 hiring, hiring is ongoing for FY22.
TE – 2.1.3	Hire seasonal technicians for turtle, clam shrimp, and plant surveys.	2 (Medium)	X	X	X	X	X	Completed for FY21/Ongoing. Completed FY21 hiring, hiring is ongoing for FY22.
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	Completed for FY21. Addressed more specifically for related projects, but includes multiple prescribed burn units in grassland habitat in FY21, extensive pine barrens habitat mechanical restoration and some prescribed burning (including scrub oak shrubland Rx fire), and frost bottom protection and restoration.
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	X	X	X	X	Completed for FY21/Ongoing. Planning for conservation and management of state-listed species is an ongoing process of adaptive management, with partner engagement and ongoing surveys and monitoring. Initial efforts in FY21 focused on incorporating long-term monitoring and stakeholder reviews. Efforts overlapped those described in TE 1.3.2 and in FWM 1.1.4.
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		Ongoing. USFWS is recommending delisting the sandplain gerardia because it no longer meets the definition of a species. American chaffseed introduction at Camp Edwards will be evaluated after floristic inventories of grasslands (FWM 1.1.4) and related plant cover types.
TE – 2.2.2	Discuss and evaluate options for reintroduction of the SLS and WL plant species in newly restored grassland habitat at Camp Edwards. Assess costs, benefits, and potential agreements that would be required to implement reintroduction. It 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		Ongoing. MAARNG will initiate a discussion and evaluation for this project in FY23 after floristic surveys.
TE – 3.1.1	Enact the recommendations presented in the <i>Conservation and Management Plan for the Camp Edwards Road Repairs and Clam Shrimp Relocation</i> (Oxbow Associates, Inc. 2018) (Original CMP). This includes puddle replacement and monitoring. After collaboration with MassWildlife to develop a management plan to allow for regular road maintenance while also conserving Agassiz’s clam shrimp (TE-3.1.2), continue to carry out, annually, all activities and requirements set forth in the plan (CMP Amendment).	1 (High)	X	X	X	X	X	Completed for FY21/Ongoing. Implemented all requirements in the Original CMP in FY21, and the amended CMP for clam shrimp, effective July 14, 2021, will be appended to the INRMP and annual review. MAARNG will continue to carry out all activities and requirements in the CMP.
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)		C				Project Completed. Developed the Clam Shrimp Conservation and Roadway Maintenance Plan in collaboration with MassWildlife to supplement and amend the original CMP. Permit Amendment issued July 14, 2021.
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			Completed for FY21/Ongoing. MAARNG has the permit from September 2020 and a majority of real estate actions are completed except for finalization of parcel H of unit K, which is ongoing. Project is anticipated for completion in FY22.

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	<p>Completed for FY21. The following project activities occurred in FY21 and are documented in the CMP report:</p> <ul style="list-style-type: none"> • Due to delays in permitting for the MPMG Range, the NRO worked with Natural Heritage on an Addendum to the current plan to protect turtles during winter construction activities. The contractor completed required preconstruction surveys and implemented mitigation measures in the fall of 2021. • In FY20, preconstruction surveys were initiated, including fall 2019 and summer/fall 2020 efforts. However, due to the construction not being contracted the preconstruction surveys could not be completed. When the construction contract is awarded and silt fencing has been installed, additional surveys will be required by Natural Heritage. Continued delays through FY21 led to the continuation of preconstruction surveys and planning, review, and approval for a hibernation zone establishment for moving turtles outside the project area. Continued planning and coordination will be ongoing and will be adapted to the project timeline, which is still awaiting approval. • Construction period monitoring for Tango Range expansion was implemented by a contractor. Work was completed on this project in FY21, and the final report will be submitted to Natural Heritage in FY22. Coordinated on gym expansion project for future implementation. • Natural Resources staff talked with the state Herpetologist about priorities for box turtles and collaborated with University of Massachusetts on two graduate level projects focused on threats to Eastern box turtles. • Contractor performed canine-assisted searches for Eastern box turtles for long term monitoring. This project will continue in FY22. • Contracted the University of Illinois to perform health assessments and blood sampling on turtles to investigate potential causes or impacts from larval fly infestations in many turtles on base. • Technicians continued periodic monitoring of turtles for the long term monitoring component of the CMP.
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	X		<p>Completed for FY21/Ongoing. The sampling design contracted to WEST Inc. in FY20, continued development in FY21 and was completed in 2021. The study design includes vegetation sampling at a range of sites, and Lepidoptera sampling at a subset of sites. In FY21, the Natural Resources Office implemented the first year of vegetation, and expects to implement the first year of UV light trapping in FY22.</p>
TE – 3.2.4	Coordinate and hold annual meeting as required for oversight and coordination for implementation of mitigation actions in the <i>Conservation and Management Plan for the Multipurpose Machine Gun Range at Camp Edwards</i> . 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	<p>Completed for FY21. Completed concurrently with the INRMP review in FY21. Also hosted a MassWildlife-MAARNG tour in November 2021.</p>

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

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	Completed for FY21/Ongoing. MAARNG completed the following mitigation activities: <ul style="list-style-type: none"> Grassland: 47 acres prescribed fire; contracted 14 acre chemical treatment of invasive shrubs. Pine barrens: 164 acres of mechanical restoration and 20 acres of prescribed fire. Imbalance based on ongoing COVID impacts and using mechanical treatment to support following prescribed fire.
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	X	X			Not Completed in FY21/Ongoing. MAARNG is still developing this plan, partly based on challenges from a prolonged MPMG process and other impacts.
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)		C				Project Completed. Spreadsheet shared with MADFW annually along with detailed CMP and mitigation report.
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	X			Partially Completed for FY21/Ongoing. The stated FY21 priorities were completed (BA1/BA7 burn plan and RAW3 cutting plan), along with contracting the RAW3 implementation. The Rx fire priorities listed for FY20 that carried over to FY21 were again not able to be accomplished due to continued impacts on the fire program. These priorities are on the FY22 fire priorities list.
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			Not Completed for FY21/Ongoing. This objective is being shifted into FY22. FY21 met more general SGFA intent (TE 3.2.5). As mentioned above, weather and pandemic impacts impaired more aggressive prescribed burning however, basic annual targets were met overall.
TE – 3.2.10	Develop a compliance mechanism (help sheet, project tracker, etc.) to ensure internal compliance with CMP requirements including design phase, MADFW approvals, pre-construction, and during construction.	2 (Medium)		X	X			Partially Completed for FY21/Ongoing. Completed help sheet in FY21 and will continue working on a project tracker for compliance elements. Tango range, soil stockpile, MPMG, under CMP had effective compliance in FY21.
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	Completed for FY21/Ongoing.
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	X	X	X		Ongoing. Project was pushed to FY22/23 to allow a focus on other priorities.
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	X				Initiated in FY21/Ongoing. A vernal pool siting and design contract was implemented FY21 with anticipated completion in mid-FY22.
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		Completed for FY21/Ongoing. Developed and coordinated the CMP amendment for Agassiz’s clam shrimp. Final signatures were obtained in July 2021. “The purpose of this plan is to establish a long-term protocol that allows for adaptive road maintenance and repair of road puddles in the Camp Edwards Training Area while maintaining suitable and available puddle habitat for Agassiz’s clam shrimp.”
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	Ongoing. MAARNG had initial discussions with MADFW on their efforts for similar actions in FY21. Pushed coordination and planning with towns until FY22.

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	<i>Ongoing.</i> Project is completed only “as needed” and no plans required this support in FY21. NR staff did review and comment on remediation activities in the Rod and Gun Club Ponds complex.
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	<i>Ongoing/Upcoming in FY24.</i> This is a general topic of planning discussions. The primary effort is targeted for FY24, but will likely be accomplished prior to that.
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	<i>Ongoing.</i> There were no major equipment needs for NR-ITAM funding in FY21. NR-ITAM facilitated planning and funding requests to NGB for extensive heavy equipment and attachments for roads and grounds maintenance that will primarily support fuels and vegetation management.
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	X	X			<i>Not Completed/Ongoing.</i> Coordination and planning meetings were held through winter FY21, but the plan has not been finalized. MAARNG is re-engaging for completion during winter FY22.
GM – 1.1.3	Work with Camp Edwards Department of Facilities Engineering (DFE) 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	X			<i>Not Completed/Ongoing.</i> Project has been pushed to FY22/23 based on other priorities and staffing constraints.
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	<i>Completed for FY21/Ongoing.</i> Grassland maintenance was limited to chemical treatment and prescribed fire during FY21 based on habitat needs. In FY22, mowing will likely be limited to following herbicide treatments from fall 2021 and brush mowing north of Volpe area to combine with fire treatment for restoration of savannah conditions.
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	<i>Ongoing.</i> Project was ongoing and “as needed.” Approximately 40 trees were removed in the central grasslands during the MAARNG 179/180th Firefighter Detachment annual wildland fire safety refresher and chainsaw training coordinated by NR-ITAM and MA DCR.
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	<i>Partially Completed/Ongoing.</i> Work orders for roadway erosion are outstanding, partly due to road maintenance planning and permitting for clam shrimp. MAARNG plans to implement the Wheelock/Fredrikson repairs for winter FY22 after approval of annual maintenance plan by MassWildlife under clam shrimp CMP.
GM – 1.2.4	Implement erosion and sediment control plans	0 (Recurring)	X	X	X	X	X	<i>Completed for FY21/Ongoing.</i> This is a general BMP project and was implemented as needed for construction and maintenance (e.g. Tango Range).
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	<i>Completed for FY21.</i> For mitigation forestry in FY21, NR-ITAM completed the previously contracted snag and scrub oak mastication in BA-7 (157 acres) in January 2021 and contracted frost bottom restoration through whole-tree harvest in RAW3 (26 acres) for November 2021 (FY22) implementation.
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	<i>Completed for FY21.</i> Approximately 40 trees were removed in the central grasslands during the MAARNG 179/180th Firefighter Detachment annual wildland fire safety refresher and chainsaw training coordinated by NR-ITAM and MA DCR.

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
FM – 2.1.1	Continually develop and incorporate BMPs within project scopes and planning to streamline the implementation of forest management practices and timber harvests at Camp Edwards.	2 (Medium)	X		X	X		Ongoing. This project was focused on FY22 and FY23 to develop more specific BMPs based on lessons learned from forestry activities. However, BMPs have been consistently and routinely developed and incorporated into forestry actions, such as narrowed windows of execution, suitable equipment, material disposal, etc. Revising project wording to focus on incorporation of BMPs through time as adaptive management and refinement. We will develop a brief document summarizing the BMPs that have been incorporated into contracts and restoration work to ensure understanding and continuation/adaptation moving forward to including project timing, tools,
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		Completed for FY21. Vegetation and Lepidoptera monitoring protocols were developed to evaluate overall trends and response to forest and other habitat management. Additional monitoring needs will be considered in future years in addition to other long-term efforts that evaluate management effects (e.g., whip-poor-will, general bird monitoring).
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	Ongoing. Contracted initial phase of this effort in FY21 focused on climate resilience planning and identifying key knowledge gaps for the larger projects, overall planning, and understanding of the interface of carbon and climate change with regional conservation management, climate resilience, and community safety.
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	X	Completed for FY21/Ongoing. In September FY21, Colorado State’s Center for Environmental Management of Military Lands was contracted by MAARNG to update the Camp Edwards Integrated Wildland Fire Management Plan. The expected completion date is late 2022/early 2023.
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	Ongoing. The draft SOP for fire management planning sufficiency is being split into two by the MAARNG Wildland Fire Program Coordinator and is expected to be completed in mid-FY22.
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			Completed for FY21/Ongoing. MAARNG continues to support the new Wildland Fire Program Coordinator position.
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	Ongoing. As part of project WFM – 1.3.2, MAARNG participates in monthly meetings with Camp Edwards Wildland Fire Management stakeholders.
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			Completed for FY21/Ongoing. MAARNG participates in monthly meetings with stakeholders.
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	Ongoing. During FY21, strategically placed fuels management projects planned by the NR-ITAM Program and funded by the CFMO were initiated along Jefferson Road. Additional projects have been identified in the southeast and northwest corners of the Impact Area and its perimeter.
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	Ongoing. The fall wildland fire academy was not held in FY21 due to COVID concerns. Multiple smaller trainings such as S-131 Fire Fighter Type 1, Squad Boss and First Aid/CPR were held to meet onsite Camp Edwards programmatic needs and partner agency (DCR, DFW, & NHARNG) needs. The fall wildland fire academy was not funded in the FY22 budget.

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY21. A wildland refresher was completed in spring of FY21 as a virtual self-paced training followed with a prescribed burn.
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	Partially Completed for FY21/Ongoing. During FY21 a total of 4 prescribed burns were conducted, 2 within the pine barrens (training area) and 2 within the grasslands for a total of 115 acres. See WFM 2.3.3 for equipment maintenance and configuration. Fire implementation was limited due to program development, weather, and the COVID-19 pandemic, but program is building for a successful FY22.
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	Partially Completed for FY21/Ongoing. See WFM 2.2.1. Did not meet pine barrens target, but did meet grassland target for mitigation bank. Supplemented Rx fire with mechanical restoration in pine barrens setting up for follow-on maintenance with fire. Prescribed fire goals for FY22 are to increase the operational burn days to 25, with an average burn size of 25 acres, take advantage of a larger burn window, and burn approximately 600 to 1,000 acres.
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	Ongoing. The all-terrain utility vehicle and 100-gallon water tank are being maintained in an operational state. In the fall of FY21 a new 300-gallon skid unit was mounted to the F-350 flatbed to maintain the Type-6 as operational. A new non-standard wildland engine (mini-pumper) was delivered to Camp Edwards in the spring of FY21, however was damaged and taken out of service prior to NR-ITAM Program taking possession of the engine.
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		Partially Completed for FY21. In the spring of FY21 a vehicle tent was erected to protect the Type-6 Engine from the elements, however in the fall of FY22 a wind event destroyed the storage tent. Without a more permanent structure the Type-6 engine will be exposed to damage from the elements.
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	Completed for FY21/Ongoing. The NR-ITAM Wildland Fire Program Coordinator has initiated a comprehensive inventory and equipment/kit configuration that will be complete in FY22. This list provided substantial improvement and formalization in FY21.
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	Completed for FY21/Ongoing. Invasive plant management was contracted for high priority invasive shrub treatment in grassland habitat (Grassland Units) (GLU6 and GLU4a; 40 acres). <i>Calamagrostis epigeios</i> was targeted and treated in several small early invasions in the training area.
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		Completed for FY21/Ongoing. Completed basic program function and coordination with Department of Facilities Engineering. IPM requires integrated methods, which are applied in planning and facilities maintenance. Chemical applications for invasive plants used very targeted spot treatments to minimize product use.
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		Completed for FY21/Ongoing. Calamagrostis was the primary focus for early detection in FY21 and led to treatment of newly identified patches in the training area and cantonment.
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	X			Not Completed for FY21/Ongoing. Finalization of the document is still pending. The draft was completed by IPMC and is awaiting final staff review and approval. Completion should occur in early FY22.

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	<i>Upcoming for FY24.</i>
IPM – 1.3.1	Conduct baseline surveys to gauge the presence, locations, and abundance of invasive, nuisance, and noxious species.	2 (Medium)				X		<i>Upcoming for FY23.</i>
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	<i>Completed for FY21/Ongoing.</i> MAARNG needs to finalize the new IPMP, which includes assignment of the PMQAE. Coordination is ongoing and completed as needed between PMC and DFE.
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	<i>Completed for FY21.</i> Coordination and review were completed as needed and included requests from roads and grounds and range control for vegetation management needs.
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	<i>Completed for FY21.</i> Completed as noted above under IPM 2.1.2, in frequent coordination with stakeholders.
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	<i>Ongoing.</i> MAARNG annual coordination occurs through the Tribal Historic Preservation Office. The NRO did have a coordination call with the Mashpee Wampanoag Natural Resources Manager in early FY21 and coordination in December 2021 with new Natural Resources personnel for the tribe. Prioritization of more frequent coordination is mutually planned for FY22 and beyond.
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	<i>Ongoing.</i> MAARNG restarted discussion on this topic with the Mashpee Wampanoag Tribe in December 2021.
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	<i>Ongoing.</i> A Tribal tour was held in early FY22, which included discussion on this topic and plans for increased coordination moving forward.
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	<i>Completed for FY21.</i>
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	<i>Completed for FY21.</i> Minimization and avoidance measures were consistently incorporated to protect resources.
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	<i>Completed for FY21.</i> Coordination was completed as needed.
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	<i>Completed for FY21.</i> This project was a dominant feature of FY21 and consumed a large amount of time for the Natural Resource Manager developing briefings, videos, and documents along with tours, meetings, etc. Activities were both to provide outreach for the program and related to the MPMG and conservation.
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	<i>Completed for FY21.</i> Camp Edwards hired a new Public Outreach coordinator in FY21. Pending IWFMP development and coordination with the new outreach specialist, this program will hopefully be developed in FY23 for active engagement with communities.
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	<i>Ongoing.</i> Began weekly public tours focusing on combination of training and conservation.
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	<i>Ongoing.</i> Current emphasis is on publishing long-term monitoring results and then evaluating adding public engagement. Grassland bird tours will restart in FY22 with extensive interest received from the public.

Table W-1 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY21 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Ongoing. Working with the GIS program and contractors, NR-ITAM has started developing more robust geodatabase tools for data collection, maintenance, and analysis. Ongoing coordination with GIS ensures maintenance of existing data.
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	X			Ongoing. MAARNG contracted this project in FY21, and work is continuing as a partnership with USFWS. The project has a targeted completion date at the end of FY22.
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	Completed for FY21. MAARNG has undertaken ongoing efforts to standardize reference datasets and build master database for habitat management efforts and facilities (including firebreaks, etc.) maintenance. Efforts also ongoing with contracted work to build better reference databases for monitoring data, including GIS program support.
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	Ongoing. Climate change has been much more explicitly discussed in planning and outreach. MAARNG contracted a climate resilience plan with Woodwell Climate Research Center in FY21, with the project ongoing through FY22.

**APPENDIX W-2.2 –FY20 ANNUAL PROJECT IMPLEMENTATION PROGRESS
TABLE**

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Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

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	<i>Ongoing.</i> Funded for FY20 and FY21
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	<i>Completed for FY20.</i> Hired FY20 (August); funded for FY20 and FY21
NRP – 1.1.3	Hire and annually fund the salary for a Wetlands and Vegetation Conservation Biologist.	2 (Medium)	X	X	X	X	X	<i>Completed for FY20.</i> Hired FY20 (July); funded for FY20 and FY21
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				<i>Ongoing.</i> Effort was complicated by pandemic and other actions. No FY20 progress, and project implementation is more likely for FY23/24
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	<i>Ongoing.</i> In FY20 hiring of up to four technicians was initially planned but was reduced to one due to pandemic. For FY21, MAARNG is budgeted and approved for four technicians; one has been hired and other three are in hiring process for spring
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	<i>Completed for FY20.</i> Completed the State FY20 EPRSs for all full-time employees, including completion of discussions, forms, etc. for teleworking plans
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	<i>Ongoing.</i> MAARNG has established weekly meetings during pandemic
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	<i>Ongoing.</i> No workforce studies or data calls were required or conducted in FY20
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	<i>Completed for FY20.</i> FY20 funding was approved and provided. Fall and winter conferences/trainings were attended prior to pandemic, including the Northeast Bat Working Group, Northeast Forest Pest Council/Fire Compact joint meeting, and MACC Annual Conference
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	<i>Completed for FY20.</i> Project was completed as part of INRMP update process (November-March) and STEP submission (April-May). NGB has approved in the FY21 budget
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	<i>Completed for FY20.</i> Completed in May 2020 for FY21; all projects were approved by NGB. MAARNG has been funded at 85% for FY21
NRP – 2.2.1	Annually complete Environmental Quality data calls from NGB according to the instructions for that year. Typical data calls include: <ul style="list-style-type: none"> • 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	<i>Completed for FY20.</i> Completed data calls in September 2020
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	<i>Completed for FY20.</i> Completed as requested in FY20, including the following: <ul style="list-style-type: none"> • October 2019: wildland fire heavy equipment • February 2020: wildland fire legacy survey • March 2020: wildland fire program status
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	<i>Ongoing.</i> Project has been contracted and was ongoing in FY20; unfunded for FY21, but has been planned for support

Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY20. Project was completed as part of INRMP update process in FY20
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	Completed for FY20. Project was completed as part of INRMP update process in FY20
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	Ongoing. Project was completed sufficiently for FY20 with INRMP update. Currently facilitating FY21 completion (of the FY20 annual review)
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	Ongoing. Attended weekly meetings as held by CPED
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	Ongoing. Attended meetings as held
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	Completed for FY20. Representation was provided for EPM during FY20 but there is an ongoing need to continue integration of Natural Resources into CFMO meetings
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	Completed for FY20. Completed during FY20 through preceding projects (i.e. training, hiring, coordination)
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	Ongoing. Improved coordination with project managers in FY20 and improved integration of Natural Resources plans/compliance as needed
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	Completed for FY20. Extensive coordination through FY20 occurred concurrent with mitigation bank and Conservation Management Permit development. Several projects with significant impact minimization were incorporated. Others with extensive Natural Resources compliance elements were integrated into design and contracted services (e.g., T Range, MPMG Range, Track and Field). Natural Resources also advised DFE and Range Operations on potential projects at U Range, L Range, ISBC, T Range, S Range, MPMG Range, Eversource soil stockpiling locations, A Range, and others to develop BMPs, anticipate regulatory hurdles, and pursue overlap with natural resources objectives
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	Completed for FY20. Actions include: <ul style="list-style-type: none"> Numerous RECs reviewed and completed Intensive NEPA/MEPA processes for MPMG range and track/field projects CMP process and detailed review In addition, many construction, maintenance, and training projects noted above were coordinated and reviewed to avoid or reduce potential impacts
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	Completed for FY20. Completed as relevant for FY20 projects, in person and virtually. MAARNG is planning to develop a more formalized interdisciplinary review process for moderate to high complexity projects

Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY20. Provided NR review for several RECs, developed full Biological Assessment for the MPMG Range and associated projects, conducted informal Section 7 consultation, and received a concurrence letter. Reviewed several larger projects in CMP and facilitated documentation and/or contracting as needed
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	Completed for FY20. Consultation was completed as needed and described above in project NRP 4.2.6. A majority of projects were “no effect” due to seasonality, location, or other considerations and planning. One informal Section 7 consultation was completed in FY20 for the MPMG Range
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	Completed for FY20. MESA requirements were completed as needed for proposed projects. MAARNG completed major Conservation and Management Permits for state-listed species and established mitigation bank and framework (September 2020)
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	Ongoing. No FY20 projects required additional or detailed wetland assessment and scoping ensured avoidance where relevant (e.g., BA7 mechanical restoration). Projects were reviewed through RECs and meetings to evaluate any potential wetland concerns/impacts
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	Completed for FY20. The following permits were completed as necessary: <ul style="list-style-type: none"> • State wildlife collection permits • Smoke management permit (DEP) • Conservation and Management Permit MAARNG is also developing a mitigation tracker and is ahead of or on schedule for all elements
NRP – 4.4.2	Purchase field equipment and other supplies necessary to carry out mitigation activities.	2 (Medium)		X	X	X	X	Completed for FY20. All equipment and supplies were purchased as needed and planned for FY20
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	Completed for FY20. Implementation of mitigation actions was completed as needed and planned for FY20, including the CMP and mitigation bank (September 2020) and developing the mitigation tracker and reporting for FY19-FY20
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	Ongoing. Reporting of MANG projects and mitigation actions is being incorporated into the INRMP annual review for FY20
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				Ongoing. Currently this task is developing and will be a greater focus in FY21. Initial steps taken in FY20 include funding New England cottontail synthesis and bat survey synthesis and working with the DEP intern to look at past box turtle data
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		Ongoing. MAARNG successfully submitted for FY21 funding to undertake the NEC data synthesis. Initial work was also done by the DEP intern on box turtle older data in FY20. One ongoing need is to finalize a plan for past data work

Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY20. The following examples of collaborative activities occurred in FY20: <ul style="list-style-type: none"> The Environmental Management Commission intern evaluated some of the past and current box turtle telemetry data Alex Etkind completed his thesis through Harvard evaluating multiple New England cottontail datasets from Camp Edwards Based on partner input, significant effort is being put into uploading all past data into NABat (bat netting, acoustic, and roost data) and the Avian Knowledge Network. These are both federally sponsored systems. Entering this data will integrate Camp Edwards data into regional and nationwide datasets and provide internal data analysis and statistics
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	Not yet initiated. Project is not yet initiated and is planned for FY24
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	Not yet initiated. Project is not yet initiated and is planned for FY24
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				Ongoing. Funding for FY21 was submitted in May 2020, and both projects have been approved and funded by NGB
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	Completed for FY20. MAARNG coordinated with Natural Heritage extensively for the CMP, including discussions of monitoring. However, monitoring projects are not equivalent to planning level surveys (PLSs). MAARNG plans to conduct in-house PLSs for American chaffseed followed by a contracted survey within the next few years. MAARNG will need to identify a target year for each study and the potential to partner with MassWildlife. The monarch butterfly is a candidate species that may warrant a PLS effort. The most critical PLS need is large scale plant survey, but more focal surveys (e.g., Schwalbea) may be more realistic and useful
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					Ongoing. MAARNG identified natural communities mapping, state watchlist plant spp., and tri-colored bat as information gaps in FY20. Natural community mapping has been prioritized for FY21. Targeted tri-colored bat surveys were implemented in FY20. This survey and plant priorities will be integrated into INRMP (see FWM 1.2.1). The PLS plan still needs to be formalized and annually evaluated for needs and gaps in PLS inventory
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				Ongoing. In May FY20, MAARNG submitted for FY21 funding, which was approved and funded by NGB. MAARNG is scoping the project for FY21 completion
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	Ongoing. Plants of interest and those associated with sandplain grassland for FY21 inventories include American chaffseed, northern blazing star, common yellow flax, narrow-leaved bush-clover, few-flowered nutsedge, wild lupine, butterfly weed, clasping milkweed, nutall’s milkwort, grass-leaved ladies’-tresses, and broom crowberry

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
FWM – 1.1.5	Continue implementation of general fauna surveys (i.e., non-listed, multi-species) including: <ul style="list-style-type: none"> 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	Completed for FY20. The following progress was made in FY20: <ul style="list-style-type: none"> Continued acoustic bat surveys in FY20 and completed a contract for reports on past data in June FY20, as well as contracted database population with past data, acoustic analysis, and a plan for data analysis in September FY20 Completed annual breeding bird surveys (including grasslands), annual whip-poor-will surveys, and assisted state biologists with Whip-poor-will study Provided a letter of support for a Legacy project studying spotted turtles. This project will begin surveys of spotted turtles on base in FY21 Several telemetry projects on Eastern box turtles were completed in FY20 Snake boards were only checked occasionally and opportunistically in FY20 Performed limited diurnal surveys for Frosted Elfin. UV flashlight larval surveys successfully relocated a population not seen in over 20 years Assisted a graduate student studying Sphingid moths on the site. All lepidopteran projects were performed during active season (April-Oct 2020) Contracted a study design for Lepidoptera trends on base (August)
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	Ongoing. The slender clear wing (<i>Hemaris gracilis</i>), a state listed species, was found during UV flashlight surveys in June and needs to be added to the species list in the INRMP. In FY21, MAARNG plans to update all species lists to use taxonomic sorting and labels (e.g., order, family) and to complete a thorough update based on last several years of survey work
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				Ongoing. In March, MAARNG created a spreadsheet with all Watch List and state-listed flora with potential to be found at Camp Edwards, including phenology and likely habitats.
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			Not yet initiated. Project is not yet initiated and is planned for FY22
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		Ongoing. In February, MAARNG purchased materials for 78 bluebird/swallow boxes and used GIS to plan for proper box spacing. MAARNG also purchased materials for 4 Wood Duck boxes to be installed near wetlands and 4 rocket-style bat boxes to be installed on old range flag poles. MAARNG coordinated with Senior Environmental Corps for box construction in FY21, but it is currently not clear when boxes will be completed due to COVID-19
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					Not completed/Ongoing. Need to better assess what this project would entail and if it is necessary. Update project to evaluate any additional sandplain grassland monitoring needs to address management regimes, etc. for FY21/22
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			Ongoing. Based on Project FWM 3.1.1 and a needs assessment, this project may be reassessed and shifted to later years if needed
FWM – 4.1.1	Provide funding for ongoing conservation and maintenance activities that support wildlife habitat restoration.	2 (Medium)	X	X	X	X	X	Completed for FY20. Completed as needed. Several habitat projects were funded and completed through contracts and in-house actions for FY20, and MAARNG successfully submitted for FY21 funding
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	Completed for FY20. Equipment purchases were completed as needed FY20

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	<i>Ongoing.</i> This was a general effort, and consideration of general ecosystem and habitat was undertaken for focal habitat improvement
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	<i>Completed for FY20.</i> In FY20, a study design for Lepidoptera was contracted to determine the best methods to detect changes in the state listed species on base. A project to analyze the NEC data was unfunded in FY20, but funding has been made available in FY21. Data reporting for bats was contracted in FY20, and a long-term analysis of the data is being planned
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 <i>Partners in Amphibian and Reptile Conservation Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States</i> (Mitchell, Breisch, and Buhlmann, 2006).	3 (Low)	X	X	X			<i>Ongoing.</i> This process was initiated through coordination with Facilities Engineering in FY20, and MAARNG will be working on continuing development of a mowing plan with expected completion in FY21
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	<i>Completed for FY20.</i> An after-action review meeting was conducted in May with a smaller group than normal due to COVID-19. Several meetings were held with the primary planning team to plan for conducting the hunt with necessary control measures for COVID-19 transmission. A pre-hunt meeting with all the stakeholders was conducted in September
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	<i>Completed for FY20.</i> MAARNG conducted continued coordination among parties on base to minimize impact on hunt from other activities and to provide for sufficient safety for necessary projects during the hunt. MAARNG also facilitated continued communication to address questions, complaints, etc. Information on protocols to address COVID-19 concerns were posted on the MassWildlife website
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	<i>Ongoing.</i> MAARNG conducted hunter surveys in fall of 2019 and reported results in the State of the Reservation report. Surveys were not conducted in fall 2020 due to COVID-19 concerns
OR – 1.2.1	Support recreational hunting at Camp Edwards.	2 (Medium)		X	X	X	X	<i>Ongoing.</i> Natural Resources staff continued to assist in staffing the check-in building for recreational hunting. The Conservation Biologist continued to organize logistics and communication between all partnering agencies. MAARNG had to cancel the annual turkey hunt in FY20 due to a statewide shutdown for COVID-19
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			<i>Ongoing.</i> Due to efforts required to modify procedures for the hunt to address COVID-19 concerns, less effort was focused on advertising the hunt in FY20
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	<i>Not completed/Ongoing.</i> Base leadership is currently not in support of automating check-in hunting. As a result, this project may not be carried forward as planned and may be removed from the INRMP
OR – 1.2.4	Investigate opportunities and benefits of providing an increased area for no drive hunting.	2 (Medium)	X	X				<i>Ongoing.</i> The proportion of hunters that use the no deer drive hunting area continues to be larger than the proportion of huntable area that is designated as no deer driving. However, the proportion of hunters using the area was lower than the previous survey. This topic should be considered in the after-action review discussion for FY20
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	<i>Ongoing.</i> Expanding or increasing tours is a lower priority due to the logistical complications associated with COVID-19 and will be reassessed when COVID-19 concerns diminish
TE	Management of Threatened and Endangered Species and Habitats							

Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
TE – 1.1.1	Hire technicians to conduct annual acoustic bat monitoring.	1 (High)	X	X	X	X	X	Completed for FY20. Hired one technician for an April start. Although hiring of additional technicians were planned for FY20, COVID-19 made logistics difficult
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	Completed for FY20. MAARNG purchased annual license updates for Kaleidoscope Pro, and several backup hard drives, including an 8 TB backup hub intended as a master backup for all years of bat data. Field staff also attended several online trainings offered by Wildlife Acoustics
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	Completed for FY20. Contracted acoustic survey support for 2020 data, database entry, and the scope of work for a long-term data set analysis project in September. MAARNG also completed contracts for reports on late 2016-2019 data in June
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)	C					Fully completed. Project was completed in September 2020. All vetted bat data from 2014 to the end of 2019 was entered into NABat, a federal database, in order to support the ongoing USFWS three-species assessment. This is the same database used by MA DOT and MassWildlife
TE – 1.1.5	Identify key knowledge gaps from previous planning level surveys and monitoring efforts to prioritize future surveys.	2 (Medium)					X	Ongoing. Efforts were made to fine tune data collection for sites with clipping on bat call recordings. In addition, each report included recommendations for future surveys. This will be better addressed in the long-term data set analysis, with the capability of the monitoring to detect trends being evaluated
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			Ongoing. Contractor is currently working on a scope of work to get this report contracted in FY21 for FY22
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	Not completed/Ongoing. Pellet searches were not conducted in FY20, as the technician left the position during the winter. MAARNG plans to continue and re-initiate this work in FY21
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		Ongoing. MAARNG successfully submitted funding, and this project is funded/planned for FY21
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	Completed for FY20. In FY20, MAARNG conducted 41 acres of canopy thinning at BP-20 (May), 40 acres of oak coppice suppression at Wheelock Overlook (September), and 107 acres of snag and understory management in BA-6 and BA-7 (January). MAARNG also scoped and awarded 38 acres of midstory mastication at the NBC site to be executed in November and December of FY21
TE – 1.3.1	Purchase equipment for federally threatened and endangered species and priority species monitoring.	2 (Medium)	X	X	X	X		Completed for FY20. MAARNG purchased new solar panels, charge controllers, SD cards, backup hard drives, and batteries for acoustic bat monitoring, and UV flashlights for frosted elfin monitoring. Though funded through MILCON support, MAARNG also purchased a new UTV that will be used to support surveys for federally threatened and priority species
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	Not yet initiated. Project is not yet initiated. Was originally scheduled for FY21, but should shift to FY22 following completion of project FWM 1.1.4 in FY21

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY20. The following actions were taken in FY20: <ul style="list-style-type: none"> • Efforts were made in FY20 to target tri-colored bat calls to aid in their status review • MAARNG is collaborating with a Legacy grant project regionally surveying spotted turtles • All vetted bat data from 2014 to the end of 2019 were entered into NABat • Surveys were performed in conjunction with the Monarch Larval Monitoring Project • In addition to flight surveys, UV flashlight larval searches were added to our frosted elfin monitoring. MAARNG also plans to continue regional pellet search plots for New England cottontail in FY21
TE – 2.1.1	Purchase equipment for state-listed threatened and endangered species monitoring.	2 (Medium)	X	X	X	X	X	Completed for FY20. MAARNG purchased transmitters for tracking box turtles, new solar panels, charge controllers, SD cards, external hard drives, and batteries for acoustic bat monitoring, and UV flashlights for frosted elfin monitoring. Permanent signage for clam shrimp puddles were also purchased through MassCor. Though funded through MILCON support, MAARNG purchased a new UTV that will be used to support state-listed species surveys
TE – 2.1.2	Hire seasonal technicians for annual bird, odonate, and lepidopteran surveys.	2 (Medium)	X	X	X	X	X	Ongoing. An ornithologist was hired for bird surveys, and a graduate student from UMASS conducted lepidopteran surveys on base in FY20
TE – 2.1.3	Hire seasonal technicians for turtle, clam shrimp, and plant surveys.	2 (Medium)	X	X	X	X	X	Ongoing. One technician was hired for bat, clam shrimp, box turtle, and plant surveys. MAARNG planned to hire more technicians in FY20, but complications due to COVID-19 prevented additional hiring
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	Ongoing. This project is cross-linked with CMP mitigation and NEC habitat improvement, though specific actions may be funded separately for state-listed species habitat improvement beyond mitigation focal areas. No wildland fire was implemented in FY20 due to unsuitable fall conditions followed by COVID-19 issues and drought in 2020. Mechanical and chemical habitat improvement for state-listed species habitat improvement is listed in TE 1.2.3 and TE 3.2.5. Recommend rewording this project to specify state-listed species habitat improvement outside mitigation focal areas, which would include the BP20 harvest for FY20
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	X	X	X	X	Ongoing. Planning for conservation and management of state-listed species is an ongoing process of adaptive management with partner engagement and ongoing surveys and monitoring. Initial efforts in FY20 focused on development of the Conservation and Management Permit, which was finalized in September 2020, and incorporating long-term monitoring and stakeholder reviews
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		Not yet initiated. USFWS recommends delisting sandplain gerardia. MAARNG plans to conduct in-house PLSs for American chaffseed, followed by a contracted survey within the next few years (FWM 1.1.1). These surveys will inform chaffseed reintroduction options
TE – 3.1.1	Enact the recommendations presented in the <i>Conservation and Management Plan for the Camp Edwards Road Repairs and Clam Shrimp Relocation</i> (Oxbow Associates, Inc. 2018). This includes puddle replacement and monitoring.	1 (High)	X	X	X	X	X	Completed for FY20. MAARNG completed all habitat creation/improvement actions outlined in the CMP and completed the last year of required monitoring. MAARNG plans to continue the monitoring in FY21

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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				<i>Ongoing.</i> In September 2020, MAARNG began development of a clam shrimp protection and road repair plan to include in the INRMP. This project is currently on schedule to be completed in FY21, pending MassWildlife approval
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			<i>Completed for FY20.</i> Completed signatures in September 2020, and the SMRC parcel transfers were also completed in FY20. The transfer of Parcel H of Unit K is still in process
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	<i>Completed for FY20.</i> The following activities occurred in FY20: <ul style="list-style-type: none"> Contracted support for the Turtle Protection Plan for preconstruction surveys and during construction monitoring (July) In FY20, preconstruction surveys were initiated, including fall 2019 and summer/fall 2020 efforts. However, due to the construction not being contracted, the preconstruction surveys could not be completed. When the construction contract is awarded and silt fencing has been installed, additional surveys will be required by Natural Heritage. This is planned for spring/summer 2021, followed by surveys during construction The Turtle Protection Plan was adapted for Tango Range expansion and implemented by a contractor (September-October). The plan is also being adapted for the gym expansion project, for implementation in FY21 Natural Resources staff talked with the state herpetologist about priorities for box turtles
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		<i>Ongoing.</i> The Natural Resources Office contracted Western EcoSystems Technology Inc. to provide a robust analysis of sampling designs to make the most use of the monitoring data (July 2020). The Natural Resources Office plans to implement the sampling design in FY21. Natural Resources staff also met with the state invertebrate biologist to discuss a monitoring design for Lepidoptera
TE – 3.2.4	Coordinate and hold annual meeting as required for oversight and coordination for implementation of mitigation actions in the <i>Conservation and Management Plan for the Multipurpose Machine Gun Range at Camp Edwards</i> . 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	<i>Ongoing.</i> MAARNG is developing CMP annual meeting as a component of the INRMP annual review meeting. A reporting table, separate from the INRMP project table, is in development and will be ready for review during the INRMP annual review meeting
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	<i>Completed for FY20.</i> The following activities occurred in FY20: <ul style="list-style-type: none"> Conducted 40 acres of selective herbicide treatment at Wheelock Overlook mitigation area (September) Implemented 107 acres of snag mastication and mosaic understory mastication in the BA6/BA7 mitigation area (January) and contracted an additional 157 acres for FY21 implementation Completed approximately 80 acres of shrub and tree mastication and mowing in Parcel H of Unit K in October 2019. Work was completed by Camp Edwards Roads and Grounds No wildland fire was conducted in FY20 due to combined unsuitable weather in fall 2019 and COVID-19 issues and drought in 2020
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					<i>Not completed/Ongoing.</i> This project will be pushed back for implementation in FY21, and the basics of this plan are currently in development. More general plans will be discussed in FY20 review meeting

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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)		X				<i>Ongoing.</i> A mitigation tracking system is in development, and is currently on schedule
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				<i>Completed for FY20.</i> The following activities occurred in FY20: <ul style="list-style-type: none"> No wildland fire was implemented in FY20 due to unsuitable fall 2019 weather and 2020 pandemic and drought MAARNG contracted a forestry assessment of potential mitigation project at RAW 3. These assessments are a necessary first step for mechanical restoration No burn plans were developed due to complications with fire planning and other priorities. A burn plan for BA1/BA7/BA6 is prioritized for FY21 Conducted 107 acres of snag mowing and mosaic understory mastication to allow reintroducing prescribed fire in BA-6 and BA-7 (January). Contracted additional 157 acres for winter 2020/21 implementation. Completed approximately 80 acres of shrub and tree mastication and mowing in Parcel H of Unit K in October 2019. Work was completed by Camp Edwards Roads and Grounds
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			<i>Ongoing.</i> MAARNG will discuss priorities for FY21 grasslands implementation during the annual review meeting. MAARNG is currently planning approximately 30 acres of prescribed fire in the mitigation area. The burn day targets should be achievable, and plans are in development. Plans for the pine barrens focal areas of C13 and BA7 are less likely due to COVID-19 impacts in FY20 on timelines
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	<i>Completed for FY20.</i> Coordination was continued with the EMC Environmental Officer and with the Impact Area Groundwater Study Program in FY20. This includes general meetings and coordination regarding remediation actions, natural resources considerations, and facilitation of remediation activities to the extent practical
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	X	X			<i>Ongoing.</i> Project is being moved forward for FY21 and into FY22. MAARNG will collaborate with Bourne and Sandwich, and will review DEP water withdrawals regulations
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					<i>Ongoing.</i> Developed techniques for creating multiple temporary water features to enable turtle tracking at KD Range. The lessons learned from this have informed consideration of longer-term vernal pool creation in the future. MAARNG secured funding FY21 to contract a vernal pool creation project which is on schedule to be completed in FY21
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		<i>Completed for FY20.</i> In September 2020, MAARNG began development of a clam shrimp protection and road repair plan to be included in the INRMP. This is currently expected to be completed on schedule, pending MassWildlife approval, in FY21

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	<i>Not completed/Ongoing.</i> Project was not initiated in FY20, but MAARNG is on schedule to complete a wetland buffer BMP plan for Conservation review and approval in FY21. In addition, MAARNG is on schedule to develop a set of protocols to address the treatment of accidentally created wetland features in BPs/Bivouacs for Conservation consultation and approval in FY21
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	<i>Completed for FY20.</i> The Natural Resources Office supported permits for impacts to Waters of the U.S. as needed in FY20
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	<i>Not completed/Ongoing. Moving to the right given other priorities. Likely to be FY21 into FY22</i>
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	<i>Completed for FY20.</i> MAARNG funded and purchased a tractor with attachments for in-house management of grasslands, training area, firebreaks, and prescribed fire preparation. Also funded a seed collector for gathering local little bluestem seed for grassland restoration/improvement on base
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					<i>Ongoing.</i> Monthly meetings and document development are ongoing, identifying maintenance needs, methods, standards, and conservation measures. Expected completion by end of FY21
GM – 1.1.3	Work with Camp Edwards Department of Facilities Engineering (DFE) 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				<i>Ongoing.</i> Initiating as part of the mowing standards development
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	<i>Completed for FY2020.</i> Grassland mowing in FY2020 was consistent with the constraints listed in this project, and focused on restoration of mitigation parcel
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	<i>Completed for FY20.</i> MAARNG completed 80 acres of shrub/tree mowing and mastication in October 2020. This is to be followed with fire management in FY21
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	<i>Completed for FY20.</i> The Natural Resources Office coordinated with the DFE to fill areas of significant puddling and erosion along Cat Road (September). Also conducted in-house repairs of the maneuver trail within BP-20 (June)
GM – 1.2.4	Implement erosion and sediment control plans	0 (Recurring)	X	X	X	X	X	<i>Completed for FY20.</i> MAARNG addressed erosion and sediment control plans as needed in project planning and coordination, and implemented plans appropriately
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	<i>Completed for FY20.</i> MAARNG conducted 41 acres of canopy thinning at BP-20 (May), 40 acres of oak coppice suppression at Wheelock Overlook (September), and 107 acres of snag and understory management in BA-6 and BA-7 (January). MAARNG also scoped and awarded 38 acres of midstory mastication at the NBC site to be executed in November and December FY21
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	<i>Ongoing.</i> FY20 implementation of 82 acres mowing project, including brush and small trees in Parcel H of Unit K. Continuing in FY21 with minor chainsaw work

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Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
FM – 2.1.1	Develop BMPs to streamline the implementation of forest management practices and timber harvests at Camp Edwards.	2 (Medium)	X					<i>Ongoing.</i> A mastication project at the NBC site to assess the value of this management practice on the base was scoped and funded in FY20. MAARNG devised and executed a successful pilot project for mowing standing snags in BA-6 and BA-7 (January). However, BMP development was not completed, and will be shifted to late FY22 and FY23
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		<i>Ongoing.</i> In fall 2020, MAARNG developed draft post treatment assessment using contracted resources
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	<i>Ongoing.</i> This project is currently in development with Woodwell Climate Research Center and is supported by Congressman Keating. The project has been prioritized and moved earlier in planning due to partner interest and the MPMG project
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	<i>Ongoing.</i> This project was successfully funded for FY21, and the SOW is in draft for FY22
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	<i>Ongoing.</i> In April 2020, MAARNG contracted and completed a draft SOP for Wildland Fire Chemical Use (Foam and Ignition)
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			<i>Ongoing.</i> MAARNG continues to support the new Wildland Fire Coordinator position
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	<i>Ongoing.</i> As part of project WFM – 1.3.2, MAARNG participates in monthly meetings with stakeholders
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			<i>Ongoing.</i> MAARNG participates in monthly meetings with stakeholders
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	<i>Ongoing.</i> In August 2020, MAARNG completed the Camp Edwards Firebreak Assessment and established a Wildland Fire Working Group with NR-ITAM, Camp Edwards, CFMO, and Joint Base Cape Cod Fire Department. Initial project prioritization has already been completed for future CFMO funding based on the firebreak assessment
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	<i>Completed for FY20.</i> In November 2019, MAARNG hosted the RX-410 Smoke Management Techniques course, with 31 students and representing multiple agency participation
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	<i>Not completed/Ongoing.</i> Fire refresher trainings were not held in FY20 due to COVID-19
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	<i>Completed for FY20.</i> In August 2020, MAARNG contracted for a new Type 6 Skid Unit with equipment. In September 2020, the old Type 6 Skid was transferred to MassWildlife. No other wildland fire implemented in FY20 due to COVID-19, but planning in place for FY21 spring burn season
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	<i>Not completed/Ongoing.</i> COVID-19 issues and a late spring to early fall drought prevented prescribed burning in FY20. In February 2020, MAARNG contracted and completed a major update of the Cantonment Area Prescribed Burn Plan
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	<i>Ongoing.</i> MAARNG continues to inventory, evaluate needs, and maintain equipment. See project WFM – 2.2.1 for additional details

Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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		Ongoing. Project has been funded, and an order was placed for a vehicle and equipment storage tent/garage
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	Completed for FY20. In 2020, fitted a new fire cache trailer. The customization was completed with a contract. See projects WFM – 2.2.1 and WFM – 2.3.1 for additional details on FY20 progress
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	Completed for FY20. In-house invasive treatment was put on hold due to COVID-19. Invasive plant treatment in the northern Training Area was contracted in FY20 and was aimed at preventing the spread of invasive species from roadside areas into sensitive habitats or upcoming MILCON project sites where disturbance would make invasive plant species establishment easier. This work was completed in September 2020
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		Completed for FY20. The Natural Resources Office continued to advise and require mechanical vegetation control measures at Range Operations and TTB Kelly. When contracting herbicide work, MAARNG mandated highly targeted spray to minimize non-target impacts. MAARNG continued an assessment of pre-existing biocontrols for spotted knapweed and has documented two <i>Urophora</i> species to date. Once the assessment is complete, additional species may be introduced in order to achieve greater control of knapweed in the Cantonment grasslands without the need for herbicide
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		Completed for FY20. Several ongoing treatments fall into this category, including treatment for <i>Microstegium vimineum</i> and <i>Cynanchum louiseae</i> . A small population of an unknown <i>Prunus</i> tree species was discovered and treated in September. A sample was pressed for our herbarium, and local botanists were notified, including the state botanist
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				Completed for FY20. The IPMP draft was completed in FY20y, and the signature review process has been initiated
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	Ongoing. The IPMP plan was heavily reviewed in the process of creating the new draft version of the document
IPM – 1.3.1	Conduct baseline surveys to gauge the presence, locations, and abundance of invasive, nuisance, and noxious species.	2 (Medium)				X		Completed for FY20. Baseline surveys were performed at several sites throughout FY20
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	Ongoing. The IPMP coordinator consulted with and advised DFE on facilities pest management contracting throughout FY20
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	Completed for FY20. MAARNG advised the federal contracting representative from DFE to create an appropriate herbicide mix and application schedule for the new UTES facility
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	Ongoing. In FY20, Natural Resources staff discovered an inappropriate rodenticide being used around facilities and coordinated with DFE and the contractor to replace it with a less harmful alternative
CR	Cultural Resources Protection							

Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY20. MAARNG completed remote coordination with the Tribal Historic Preservation Officer and Natural Resources Manager and completed INRMP update engagement
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	Ongoing. No projects for FY20, but recent coordination discussing potential partnerships for sweet grass and other resources
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	Ongoing. Continually incorporated these goals in management projects. Once COVID-19 has diminished and it is safe to do so, MAARNG will coordinate a site visit
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	Ongoing. Natural Resources staff had regular discussions and revisited the list as needed
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	Completed for FY20. Minimization and avoidance measures were incorporated into FY20 project planning
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	Complete for FY20. Completed as needed; needs were minimal during FY20 due to limited burn attempts and other projects that typically involve public interface
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	Ongoing. Fostered several media engagements for Natural Resources & ITAM Program outreach, particularly focused around the MPMG project and how the NR-ITAM Program supports the mission and sustainable training development. Includes the following outreach video: https://www.youtube.com/watch?v=knkSmmMWEAk . Beginning in September 2020, MAARNG collaborated with Arnold Arboretum staff on their seed collection efforts to supplement their solar array pollinator meadow project at Weld Hill. This project will be publicly accessible and publicized
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	Not completed/Ongoing: This outreach campaign was not developed during FY20 due to COVID-19 issues and hiring of WFPC position. This project will be incorporated as concept into update of IWFMP and subsequent program development. Initial development will begin in FY21 and extend over a few years of building
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	Not completed/Ongoing: Hosting training activities and an open house was not feasible during FY20 due to COVID-19 issues and restrictions
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	Not completed/Ongoing: Events were canceled during FY20, and no new events are planned currently for FY21 due to COVID-19 issues, but public conservation engagement will continue to be considered. Ideally, MAARNG would partner with other agencies on this project
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	Completed for FY20. Maintenance was completed throughout FY20. Beyond maintenance, the Natural Resources Office was able to import old survey data into geodatabase format, making them searchable and applicable to upcoming projects
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				Ongoing. Submitted for funding FY21 in May 2020; funding was approved and funded by NGB, and the project is scoped for FY21 completion

Table W-2 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY20 Progress and Notes)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	Completed for FY20. Geodatabases for bats, herptiles, clam shrimp, rare plants, invasive plants, and road puddles were all maintained and updated in FY20. A Lepidoptera geodatabase was created including survey results dating back to 1996. Box turtle telemetry data from 1998 to 2004, and all incidental observations of herptiles on record, were added to the master herptile geodatabase
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	Ongoing. Climate change has become a significant focus. Projects are conceptually built into a climate resilience plan, which needs to be built. MAARNG is starting to build a more explicit evaluation and plan using the Army Climate Assessment Tool and new Climate Adaptation for DoD Natural Resource Managers Guide. Additionally, in FY21, engaged with Cape Cod Commission’s development of the Cape Cod Climate Action Plan. MAARNG needs to develop additional, specific projects for climate change planning in this objective, including incorporation of the above DoD resources and Cape Cod specific resilience considerations

Non-Project Natural Resources Work Completed in FY20:

Several measures not clearly defined in the INRMP but that are important to Natural Resources Management at Camp Edwards were undertaken in FY20. These measures should be captured as part of the INRMP annual review process and, if needed, incorporated as projects in the INRMP Implementation Table above.

Resource	Actions in FY20	Project Priorities and Changes
FWM - Snakes	<ul style="list-style-type: none"> Removal of FPs at B/CRNG for avoidance of snake mortality issues 	
FWM - Wildlife	<ul style="list-style-type: none"> Game camera surveys (predators, deer browse) 	
FWM – Birds		<ul style="list-style-type: none"> Add project FWM 1.3.2 – Calculate detection probabilities for birds to refine methods and to evaluate trends. Feed results into the study design for MPMG.
TE - Box Turtles	<ul style="list-style-type: none"> Natural Resources Office biologists have been coordinating with utility projects on their efforts to protect Eastern Box Turtles and plan around rare species In-house turtle searching and telemetry efforts focused on tracking turtles from C-14 and around the MPMG. The majority of these turtles were equipped with transmitters in fall 2019. Other turtles found in the area and in the areas surrounding Tango and Sierra Range (areas with future construction projects) were also outfitted with transmitters and tracked. At J and K Range, the tarps covering the STAPP system form puddles where turtles have been found in the past. These puddles were monitored for turtles, and several individuals were found in this area. The Natural Resources Office also attempted to replicate this created habitat for capture on the MPMG Range using black plastic and water filled from fire equipment. No turtles were captured using this method. Given knowledge of turtle use of the tarps at J and K Ranges, a technician searched the work area daily during the turtle active season as part of the STAPP system removal project. As turtles were monitored, an increasing number of Dipteran larval infestations were observed and monitored. Two turtles were found dead and taken for necropsy at Tufts Wildlife Clinic. Six turtles with radio transmitters were taken to Tufts due to significant fly larvae infestations and concerns for their survival. Two of those will overwinter at Tufts while the rest were healthy enough to be released shortly after treatment. Natural Resources Office staff are coordinating with the state herpetologist and the veterinarian at Tufts on this recently discovered threat to turtles on base. During the summer, a turtle mortality was discovered on Echo Range in one of the firing lanes. It is assumed that the turtle fell in the firing lane and was unable to escape. Given the heat in the summer and lack of shade, Range Control conducted twice daily checks of the lanes to prevent another mortality event. During monitoring, one turtle was discovered on the range and relocated to the east. With input from the Natural Resources Office, Range Control is creating ramps to install in each lane to provide a means of egress for turtles and preclude the need for monitoring during the turtle active season. 	
TE – Plants	<ul style="list-style-type: none"> Rare plant surveys and genetic study (purchase of deer exclusion materials?) Lupine translocation to satellite site 	
TE – Plants		<ul style="list-style-type: none"> Add project TE 2.2.2 - Discuss and evaluate options for reintroduction of the SLS and WL plant species in newly restored grassland habitat at Camp Edwards. Assess costs, benefits, and potential agreements that would be required to implement reintroduction. It is critical to ensure that any such reintroductions would not be in conflict with the training mission, fire management, and habitat restoration.
TE – CMPs		<ul style="list-style-type: none"> Add Project TE 3.2.10 - Develop a compliance mechanism (help sheet, project tracker, etc.) to ensure internal compliance with CMP requirements including design phase, MADFW approvals, pre-construction, and during construction.

APPENDIX W.3 – FY22 PROJECT IMPLEMENTATION TABLE

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Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

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	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: <ul style="list-style-type: none"> • 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	

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	
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	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		

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	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	C				<i>Project Completed.</i>
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	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: <ul style="list-style-type: none"> • 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 Additional bird surveys, as warranted • Comprehensive reptile surveys, including snakes and spotted turtles, as warranted; and • Comprehensive amphibian surveys, as warranted. • 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	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 – 1.3.2	Calculate detection probabilities for birds to refine methods and to evaluate trends. Feed results into the study design for MPMG.	2 (Medium)		X	X	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	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	

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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 <i>Partners in Amphibian and Reptile Conservation Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States</i> (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			X	
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)	C					Project Completed.
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	

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	X	X	X	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 – 2.2.2	Discuss and evaluate options for reintroduction of the SLS and WL plant species in newly restored grassland habitat at Camp Edwards. Assess costs, benefits, and potential agreements that would be required to implement reintroduction. It 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 <i>Conservation and Management Plan for the Camp Edwards Road Repairs and Clam Shrimp Relocation</i> (Oxbow Associates, Inc. 2018) (Original CMP). This includes puddle replacement and monitoring. After collaboration with MassWildlife to develop a management plan to allow for regular road maintenance while also conserving Agassiz’s clam shrimp (TE-3.1.2), continue to carry out, annually, all activities and requirements set forth in the plan (CMP Amendment).	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)		C				Project Completed.
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	X		

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
TE – 3.2.4	Coordinate and hold annual meeting as required for oversight and coordination for implementation of mitigation actions in the <i>Conservation and Management Plan for the Multipurpose Machine Gun Range at Camp Edwards</i> . 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	
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	X	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)		C				<i>Project Completed.</i>
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	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			
TE – 3.2.10	Develop a compliance mechanism (help sheet, project tracker, etc.) to ensure internal compliance with CMP requirements including design phase, MADFW approvals, pre-construction, and during construction.	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	X	X	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	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	

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	X	X			
GM – 1.1.3	Work with Camp Edwards Department of Facilities Engineering (DFE) 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	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	
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	Continually develop and incorporate BMPs within project scopes and planning to streamline the implementation of forest management practices and timber harvests at Camp Edwards.	2 (Medium)	X		X	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	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			

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	
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	
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	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							

Table W-3 Implementation Table. Summary of Camp Edwards Training Site Management Actions 2020-2024 (FY22 Version)

Project No.	Projects	Priority Level	Years Implemented					Notes (include actions and dates)
			2020	2021	2022	2023	2024	
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	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 W-4.1 – FY21 CMP MITIGATION ACTIONS REPORT

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Conservation and Management Permit Compliance and Mitigation Actions

Camp Edwards: Fiscal Year 2021

The Massachusetts Army National Guard maintains two Conservation and Management Permits (CMPs) under the Massachusetts Endangered Species Act (MESA, 321 CMR 10.00). The CMPs were developed within the framework of the Integrated Natural Resources Management Plan (INRMP) for Camp Edwards consistent with the Sikes Act and all implementing regulations for the MA Division of Fisheries and Wildlife (MADFW) and MA Army National Guard (MAARNG), including the Upper Cape Water Supply Reserve. The CMPs provide a collaborative and progressive path forward for training and operations at Camp Edwards while ensuring Net Benefit for state-listed species and their habitats at Joint Base Cape Cod (JBCC) directly through CMP associated actions as well as overall natural resources conservation and training lands management at JBCC.

The CMPs are held and administered by MAARNG and the MA Military Division and focus primarily on Camp Edwards' lands and operations. However, the "master plan" CMP was developed collaboratively with MA Air National Guard and includes both past mitigation commitments and implementation, as well as providing for potential future facilities actions for both services. This report includes updates and accomplishments for the FY2021 period covering October, 2020, through September, 2021. Reportable actions include facilities maintenance and development as provided by the permits, construction support actions, mitigation efforts, program administration, and planned activities for the coming fiscal year(s).



Acronyms and Definitions

This report uses many acronyms and abbreviations, as well as specific terms and titles. The majority are included here for clarity.

Acronym	Term
AgCS	Agassiz's Clam Shrimp (MESA fact sheet , NatureServe)
AmCS	American Clam Shrimp (MESA fact sheet , NatureServe)
CMP(s)	Conservation and Management Permit(s) (CMP overview)
CS	Clam Shrimp
CSCRMP	Clam Shrimp Conservation and Road Maintenance Plan
EBT	Eastern Box Turtle (MESA fact sheet)
EMC	Environmental Management Commission
EWPW	Eastern Whip-poor-will (MESA overview)
FCRA	Forest Canopy Reserve Area
FY(xx)	Fiscal Year (xx is two digit year); Federal FY: 01 October – 30 September
IAGWSP	Impact Area Groundwater Study Program (website)
INRMP	Integrated Natural Resources Management Plan (2021 INRMP)
JBCC	Joint Base Cape Cod (JBCC overview)
MA	Massachusetts
MAANG	Massachusetts Air National Guard (website)
MAARNG	Massachusetts Army National Guard (website)
MADFW	Massachusetts Division of Fisheries and Wildlife (website)
MANG	Massachusetts National Guard (joint) (website)
MEPA	Massachusetts Environmental Policy Act (website)
MESA	Massachusetts Endangered Species Act (MESA overview)
MPMG	Multi-Purpose Machine Gun (Range)
NEPA	National Environmental Policy Act (website)
NHESP	Natural Heritage and Endangered Species Program (website)
PBMFA	Pine Barrens Mitigation Focal Area
SGCN	Species of Greatest Conservation Need (State Wildlife Action Plan)
SMRC	Special Military Reservation Commission
UCWSR	Upper Cape Water Supply Reserve
UMass	University of Massachusetts
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet



The Pink Prominent Moth (*Hyparpax aurora*) is a stunning scrub oak (*Quercus ilicifolia*) associate that is rare throughout its range with very localized distribution in Massachusetts. This individual was observed during a MAARNG hosted Massachusetts Butterfly Club survey for Acadian Hairstreak Butterflies in Pine Barrens Mitigation Focal Area – North, with a high number of rare and state-listed species within a diverse barrens habitat mosaic, including powerline right-of-way, adjacent to a primary road and active soldier training features.

Agassiz's Clam Shrimp and Training Area Roads Conservation and Management Permit

Conservation Permit #: 018-327.DFW

NHESP Files #: 17-37184

Project: Road Repair and Clam Shrimp Relocation

Date: 08-NOV-2018; amended 14-JUL-2021

An initial CMP was developed in 2017 and 2018 to provide for localized road repair at Camp Edwards while providing for conservation of the Endangered Agassiz's Clam Shrimp (*Eulimnadia agassizii*, AgCS). Under that original permit two sites along Cat Road were repaired as *in situ* sites in Training Year (TY) 2020. Prior to that, in TY2019, one site was modified *in-situ* and five sites (Cat Road [3], Herbert Road [2]) were repaired and replaced through active construction or repair of vernal pool or road puddle sites and relocation of clam shrimp or sediment. Three years of monitoring, as required, were completed in TY 2020, but an additional year of monitoring was completed in TY21 due to the 2020 drought conditions and the focal conservation interest of the species for MAARNG.

Precipitation patterns were back to normal for the 2021 survey season. Natural Resources staff conducted repeated surveys following the standard approved protocol. In total, a subset of 12 puddles were surveyed. Four puddles were CMP mitigation puddles, five were puddles not surveyed previously, and five were known to support AgCS in previous years. From mid-May to October, puddles containing standing water were measured for area, depth, temperature and pH, and all aquatic life observed was recorded.



Agassiz's Clam Shrimp survey and active relocation efforts supporting critical road maintenance.

Clam shrimp were observed in seven of the twelve surveyed puddles, however, not all clam shrimp were identified to be AgCS. AgCS were encountered in five puddles with four puddles being new locations for AgCS records. American Clam Shrimp (*Limnadia lenticularis*, AmCS), a state-listed species of special concern, not previously confirmed on the base, were encountered in three puddles (two monitoring puddles contained both species). AmCS collected samples, along with AgCS, have been submitted to NHESP for verification of ID. Clam shrimp collected from one puddle were not able to be identified in the lab due to poor condition of the sample. This means that 50 percent of puddles surveyed in 2021 contained AgCS and/or AmCS, if we don't count the unknown clam shrimp species. This percent is up from 2019 and 2020 survey years in which approximately 30 percent of puddles surveyed contained AgCS. In 2018, the first year of monitoring, 25 puddles were surveyed and 80 percent of those contained clam shrimp. All data and results are provided separately to MassWildlife and observation reporting through Heritage Hub (<https://www.mass.gov/info-details/overview-of-the-heritage-hub>). Additional FY21 monitoring results worth noting are that two of the four CMP puddles modified *in-situ* in TY2019 and TY2020 contained clam shrimp, one on Cat road contained AgCS and one on Canal View Road contained AmCS. The seven positive observations were distributed throughout Camp Edwards, occurring in all five training area zones. Zones are discussed below as part of the CMP amendment.

The primary effort for AgCS, other than ongoing monitoring, was collaboratively developing an amendment to the existing permit to provide for holistic AgCS conservation and road maintenance within the training area. The presence of AgCS within some larger puddles precluded necessary repairs, which led to the development of the original permit, relocation efforts, and repair of select features. The next step with MassWildlife was to apply lessons from the original effort to development of an overarching road maintenance strategy that could provide for both a sustainable and usable road network and



Clam shrimp puddle signage is posted to protect known occupied sites – encourage driving and avoid filling.

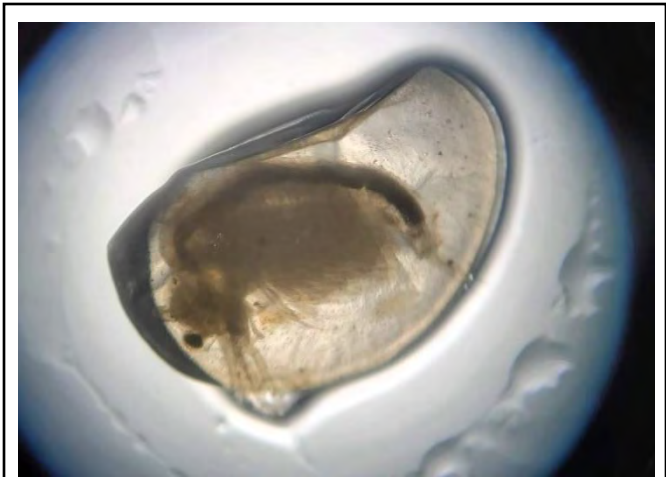
sustainable and healthy AgCS population throughout Camp Edwards. A well maintained road network is fundamental to supporting all operations on Camp Edwards, including ground-water monitoring, active remediation, natural resources management, and, critically, soldier training. A usable and maintained road network appears to also be critical to clam shrimp persistence as prolonged lack of maintenance quickly leads to exacerbation of puddles into unsuitable conditions for clam shrimp and eventually vegetation of the road bed and loss of roads and road puddles. Maintenance and use provides both roads and puddles.

Amendment of the original permit was completed in the summer of 2021. Both parties chose to amend the existing permit as it carries forward the framework of the original, including monitoring and Net Benefit through a combination of relocation and repair in place. The updated CMP establishes multiple categories of roads and establishes processes and standards for road puddle repair. Additionally, it establishes five zones of the northern training area for supporting a baseline number of puddles within each zone as primary habitat for ACS.

The priority action for FY21 was repair of the impact area perimeter roads (Jefferson, Barlow, Wheelock, and Crowell) and two key impact area access roads. These had become severely degraded and occasionally impassable, in large part due to prohibition on maintenance due to known ACS presence in puddles along the northern, western, and southern impact area boundary roads. These are key roads both for remediation activities and emergency response. The Clam Shrimp Conservation and Road Maintenance Plan (CSCRMP) establishes a Critical Road designation, which includes the existing paved roads, the impact area boundary and select access roads, and the primary access routes of Burgoyne and Gibbs Roads. These critical roads are intended to be frequently maintained and not intended for puddles, which will also serve to minimize box turtle risks on higher use roads. The impact area boundary repairs are ongoing currently through the Impact Area Groundwater Study Program (IAGWSP).

The permit amendment calls for an annual road maintenance and repair plan to be submitted to MassWildlife, which will include priority road and puddle repairs, current condition relative to repair standards in the CSCRMP, AgCS (and now AmCS) presence if documented, and impact on the zone puddle baseline. Additionally, the annual plan will outline mitigation requirements consistent with the described framework in the CSCRMP.

The CSCRMP and the Conservation and Management Permit were circulated through relevant stakeholders at Camp Edwards. However, two projects identified a need for more detailed training and internal communication. A troop labor road repair was implemented in September, 2021 on the western portion of Estey Road and southern portion of Fredrikson Road (Training Area A-3) without prior coordination. A previously developed engineering design was used and there were no existing puddles so no major issues occurred and no clam shrimp habitat was taken. However, it identified some communication and process gaps that have been addressed. Additionally, during the October/November road repairs implemented by IAGWSP, the working contractor graded a section of Wheelock Road without prior approval to facilitate material hauling. This section had received clam shrimp in three puddles as mitigation for the impact area boundary work and the puddles had been signed. Mitigation for this take is discussed in the annual road maintenance plan.



American Clam Shrimp from puddle 19a on July 9th, 2021. AgCS were successfully introduced to this puddle in 2019, though the introduction was incidental to repair and maintenance of the existing puddle to receive AgCS as mitigation. FY21 was the first year documenting AmCS.

While the planning, preparation, and mitigation portions of the conservation plan are working well there are still weaknesses in communication and coordination that are being addressed. Two meetings have been held since the grading incident that included all potential road/trail maintenance and repair stakeholders. During these meetings, stakeholders were also able to identify roads and road sections in need of repair and planned for FY22. With this, required and/or voluntary mitigation was assessed based on potential impacts to available and known clam shrimp habitat, as well as other wildlife, and worked into the FY22 annual road work plan. This plan has been submitted to MassWildlife for review, coordination, and approval. A plan to mitigate for the loss of clam shrimp habitat and clam shrimp

individuals from the Wheelock Road grading was also included in the work plan. It's the intent that these meetings involving all potential road/trail maintenance/repair stakeholders will occur on at least an annual basis for consensus on road work planning and clam shrimp habitat and mitigation requirements.



Agassiz's Clam Shrimp collected for identification confirmation of adults gathered for relocation to mitigation sites.

MA National Guard Master Development Plan Conservation and Management Permit

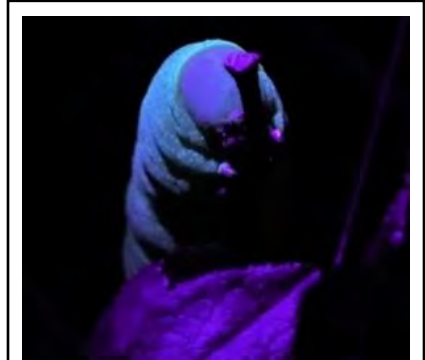
Conservation Permit #: 020-358.DFW

NHESP Files #: 18-37434

Project: Camp Edwards Multi-Purpose Machine Gun (MPMG) Range and Master Development Plan

Date: 29-SEP-2020

The Massachusetts Army National Guard received a Conservation and Management Permit in 2020 that established a master planning framework for projects implemented at Joint Base Cape Cod by both Air and Army National Guard. To support this master plan approach, a comprehensive mitigation plan was developed including establishing an on-site mitigation bank covering multiple habitats. The primary projects incorporated into the master planning mitigation strategy include MPMG Range at the current KD Range location, Infantry Squad Battle Course at the formerly used Infantry Battle Course location, expansion of Tango and Sierra ranges, Cantonment modernization including a running track and classroom buildings, and potential future solar development. The mitigation plan combines project design/impact minimization, take avoidance, land transfers, extensive habitat improvement, and long-term monitoring to provide for Net Benefit of a large number of state-listed species. It also establishes a framework for ongoing site development (including additional or modified projects) and land use planning while providing for proactive mitigation and demonstrable net benefit for state-listed species.



Slender Clearwing Moth larva feeding on Lowbush Blueberry. Detected and shown with ultraviolet light during rare caterpillar surveys at Sierra Range.



Grass-leaved Ladies'-tresses Orchid was newly documented for JBCC in the Grasslands Mitigation Focal Area in FY21.

The mitigation plan focuses on species guilds (pine barrens and sandplain grassland) for the majority of species with similar habitat condition needs and/or threats (e.g., loss of open canopy condition through forest closure). The Eastern Box Turtle (*Terrapene carolina*, EBT) is treated separately as it has differing needs and threats compared to the other species. Mitigation focal areas, tied to the guilds, have been identified to localize various mitigation actions for maximized benefit. Standards for mitigation have been developed for each type of guild and focal area to ensure sufficient conservation commitments are included in the plan and to provide assurances to MADFW for net benefit. For example, pine barrens mitigation will require 20% to 40% of habitat improvement work to be in the form of mechanical forestry, as the majority of the pine barrens guild species are threatened and declining due to tree encroachment and canopy closure where suitable and protected habitat exists. In addition to pine barrens and grassland focal areas, forest canopy retention areas are identified for box turtle hibernation and these areas are prioritized for maintenance of later successional forest condition and closed tree canopy.

Real Property Actions. Extensive land protection through real property actions was a fundamental component of the master CMP. One parcel (Special Military Reserve Commission [SMRC] Tract 5) that had already been transferred to MADFW was included in this agreement, as it had been transferred for a

project that did not occur and the transfer was specified as mitigation. Additionally, SMRC Tracts 1-4 were transferred to MADFW as mitigation through this agreement in 2020. Tracts 1-5 total 260 acres and are directly adjacent to Crane Wildlife Management area; these tracts represent a significant expansion to this public conservation area. Another parcel previously identified for mitigation land transfer was Parcel H of Unit K, which is 150 acres of former parade field in cantonment. This transfer was included within the master CMP agreement. The parcel was transferred to Military Division in 2020 and will be fully transferred to MADFW with anticipated completion in 2022. MANG will receive a license to maintain overall access and use to meet perpetual habitat conversion and long-term management requirements under the mitigation agreement. There are no new updates for FY21 regarding real property actions. The MANG State Quartermaster has been in regular communication with the MA Department of Fish and Game General Counsel to develop Care, Custody, and Control agreements for the transferred parcels and to complete the transfer of Parcel H of Unit K.

Construction Projects. Approval and construction of the flagship project – the MPMG Range – has been delayed and is pending resumption of the Environmental Management Commission process. However, the redevelopment of Tango Range, which was approved under the CMP in FY20, was completed at the end of FY21. Final reports are in development and near completion for Tango Range permit compliance. Additionally, the soil staging operation in partnership with Eversource was completed in FY21.



Restored scrub oak shrubland pocket within Pine Barrens Mitigation Focal Area West (Training Area E-4, OP10); Sept. 2021. The original restoration (Nov. 2017); preceded mitigation, but it is an excellent reference site.

Material from the redevelopment of the Bourne Switching station was accepted by Camp Edwards for clean fill material. The hauling and staging was permitted under the MAARNG CMP, including turtle protection provided by Eversource. The management of the turtle protection for the staged soil is being transferred to MAARNG in the late fall of 2021 and will persist until soil is used for the MPMG Range construction.

Mitigation Implementation. The framework of the CMP was erected to encourage early and abundant investment in monitoring and active mitigation efforts supporting the overall mitigation bank and evaluation of long-term monitoring results. MAARNG has consistently, effectively, and extensively managed for and monitored state-listed species, their habitats, and overall ecosystem health. CMP reportable and funded actions are a specific subset of MESA-related management, which itself is a subset within our overall natural resources management and ecosystem sustainability efforts. All of these efforts are guided by and captured within the Camp Edwards Integrated Natural Resources Management Plan (2021; https://www.massnationalguard.org/ERC/publications/Natural_Cultural/Final-INRMP-21.pdf) and frequent coordination with Sikes Act partner agencies (MADFW, US Fish and Wildlife Service), multiple other partner agencies, conservation collaboratives, universities, and others. CMP mitigation actions are implemented within mitigation focal areas (Pine Barrens, Sandplain Grassland, Forest Canopy Reserves). They also meet specified objectives of the CMP, associated plans, and interagency coordination (e.g., annual review meetings). The master development plan CMP effectively doubled the NR-ITAM project budget for active conservation efforts, including monitoring and habitat restoration and management.

Project Type	Sum of Contract Cost			Grand Total
	2019	2020	2021	
Mitigation: Administrative	\$6,020	\$45,169	\$11,262	\$62,451
Mitigation: Construction support		\$221,876		\$221,876
Mitigation: Monitoring	\$62,810	\$103,248	\$108,058	\$274,116
Mitigation: Other				
Mitigation: Initial treatment, fire	\$64,480			\$64,480
Mitigation: Initial treatment, mechanical	\$179,986	\$88,458	\$148,900	\$417,344
Mitigation: Maintenance treatment, other		\$55,950	\$8,000	\$63,950
Grand Total	\$313,295	\$514,701	\$276,220	\$1,104,216

Table 1. Contracted expenditure by federal fiscal year implementing the Master Plan CMP.

Project Type	Sum of Mitigation Acreage				Grand Total
	2019	2020	2021	2022	
Pine Barrens	520	401	184.4	-155	950.4
Construction: Pine Barrens		-6		-412	-418
Mitigation: Initial treatment, fire	448			40	488
Mitigation: Initial treatment, mechanical	72	106	164	27	369
Mitigation: Maintenance treatment, fire			20	190	210
Mitigation: Maintenance treatment, other		40			40
Mitigation: Real Property		261			261
Sandplain Grassland	42	80	47	168	173
Construction: Sandplain Grassland				-36	-36
Mitigation: Initial treatment, fire	42			40	82
Mitigation: Initial treatment, mechanical		80			80
Mitigation: Maintenance treatment, fire			47		47
Mitigation: Maintenance treatment, other				14	14
Mitigation: Real Property				150	150
Grand Total	562	481	231.4	13	1287

Table 2. Acreage totals for mitigation banking under the Master Plan CMP by federal fiscal year and project type. Maintenance actions meet the perpetual maintenance requirement. Negative numbers represent Take under MESA and draw against the “account” with a coefficient to account for mitigation ratios. Acres are frequently counted the year after funding where a project is planned and funded from one FY, but implemented during the following winter due to conservation best management practices.



Wheelock Overlook harvest area in PBFA West (Training Area A-5), Oct. 2021. The first mitigation project funded through the CMP has had strong results.



NR-ITAM personnel recording and applying radio-transmitters to two Eastern Box Turtles.

Mitigation investment for specific CMP implementation contracts and projects totaled \$276,220. The primary difference from the previous year’s higher investment was construction support for box turtles, which was contracted in 2020 to cover the entirety of the proposed Multi-Purpose Machine Gun (MPMG) Range construction. All requested funds for FY21 were received from National Guard Bureau to support proposed projects and all received funds were obligated within FY21. The breakdown by category of FY21 CMP expenditures is outlined in Table 1. This does not include staff time and salary nor does it include other state-listed species projects not directly associated with the CMP (e.g., bat monitoring, state-listed species habitat restoration outside the focal areas, etc.). An additional \$290,000 was spent on staff time and other state-listed species specific projects (i.e., where one or more state-listed species was

the primary objective rather than general ecosystem or program).

Several major mitigation efforts were completed, ongoing, and/or initiated in FY21, addressing all the above-listed components of the master CMP. The mitigation actions implemented during FY21 totaled 231 acres of active habitat restoration. Prescribed fire remained limited in FY21, but was reinvigorated after FY20 did not have prescribed burning due to weather and the pandemic. Multiple trainings and four burn days occurred at Camp Edwards in FY21. Three prescribed burns were fully or partially within mitigation areas, though the Sierra Range barrens habitat is associated with an earlier mitigation agreement, not the master development plan CMP and is not counted in this report. Extensive resource monitoring, including many in-house efforts, were completed or underway in FY21 in addition to active habitat management. Projects undertaken in FY21 as part of mitigation efforts are summarized below. Note that projects and efforts that are programmatic in nature or otherwise not specifically meeting requirements of the Permits are not included, but are reported in both the Annual State of the Reservation Report and Camp Edwards INRMP Annual Review.

- **Project Scoping, Design Minimization, and NHESP Review**

- **MPMG Range** – NHESP review and approval was completed in September 2020, preceded by completion of the MA Environmental Policy Act (MEPA) process in July 2020; followed by finalization of the National Environmental Policy Act (NEPA) process in April 2021. Project implementation is pending final approval from the Environmental Management Commission. Turtle protection plans were amended in coordination with MADFW to address the delayed implementation and develop a protective alternative for hibernating turtles.
- **Tango Range** – Construction and turtle protection actions were completed in September 2021. The preconstruction survey report was submitted in November 2020 and an interim, year-end report was submitted to NHESP in January 2021. The closeout report for turtle protection was submitted on 10-DEC-2021 and approved by NHESP on 14-DEC-2021. The closeout and compliance report for the overall construction is in development and will be submitted to MADFW consistent with permit requirements with anticipated delivery by the end of 2021.

- **Track and Field (1800 area)** – MADFW reviewed and approved final plans, turtle protection plan, and Net Benefit for the project design and consistency with the CMP January 12th, 2021. The project, including minimal land clearing and development of a track and field to support soldier fitness and training adjacent to the gymnasium, has been indefinitely put on hold pending funding. MEPA/MESA reviews and approvals are complete and notification will be made when funding is available to contract project implementation, including compliance with the CMP and turtle protection actions. Anticipated contracting is the middle of FY22.
- **ISBC Range** – Design consultation and internal review are ongoing. Anticipating environmental review of design in late FY22.

- **Species Protection**

- **MPMG Range** – Intensive year 3 of Eastern Box Turtle surveys implementing the approved turtle protection plan. The FY20 report was submitted in February 2021 to NHESP, and the FY21 report will be submitted in early 2022. Additional pre-construction surveys were added to the plan given the delayed construction implementation. The protection plan and actions were amended given the lack of turtle exclusion barrier, which is part of the construction contract and requires unexploded ordnance support. A movement barrier was installed, with approval, by in-house personnel to provide an area of good hibernation habitat (based on observed density of use) near the proposed project site. Additional pre-construction surveys were completed in the fall of 2021. As winter approaches, turtles within the limits of work will be relocated behind the barrier to allow for winter installation of the silt fence and tree removal.
- **Tango Range** – The preconstruction survey report was submitted in November 2020 and an interim, year-end report was submitted to NHESP in January 2021. In FY 2021, surveys during construction continued and oversight during silt fence removal was completed at the end of the project. The closeout report for turtle protection was submitted on 10-DEC-2021 and approved by NHESP on 14-DEC-2021.
- **Track and Field (1800 area)** – The turtle protection plan was developed and approved by NHESP during project design and design submission. No action has been taken as the project was put on hold pending funding. If funding becomes available turtle protection implementation will be part of the construction contract and confirmation will be made with NHESP of compliance with turtle protection and all other permit requirements.
- **Soil Stockpiling at Dig Site** - Eversource completed a turtle protection project at the Dig Site to enclose the site, survey for turtles, and monitor. The Dig Site is being used as a stockpiling site for clean, tested on-site soil that will be used on future construction projects on base. The monitoring, maintenance and reporting for this site has been taken over by the MAARNG in FY22.

- **Species Monitoring (CMP focused)**

- **Eastern Box Turtle (EBT)**
 - MAARNG NR-ITAM contracted the University of Illinois Wildlife Epidemiology Laboratory to implement an intensive box turtle health assessment. A total of 59 box turtles were sampled, the majority of which had physical assessments and blood samples taken multiple times through the summer to evaluate overall condition of the population and potential

influences leading to the prevalence of fly larvae, suspected sarcophagid, infestations and other potential health concerns. This project coordinated very closely with NR-ITAM, working from the same office, and others at Camp Edwards to gain efficiency from other ongoing turtle projects and opportunistic turtle observations from other site users. Oxbow Associates, working for on a turtle protection project for Eversource, tagged one turtle on Camp Edwards that was sampled and also escorted the veterinary student to sample 11 box turtles at their site in Sandwich. The veterinary student was also able to sample Spotted turtles captured during a Legacy funded project awarded to the Smithsonian. Sample analysis, data analysis, and reporting are ongoing. Updates from the field effort are available online from the veterinary student at: <https://vetmed.illinois.edu/wel/author/capecodturtles/>

- MAARNG applied radio transmitters and monitored previously transmitted turtles for an end of year total of 54 EBT during FY21 as part of the long-term box turtle monitoring requirement. This includes opportunistic turtle observations from a number of programs, including NR-ITAM, Camp Edwards Range Control, IAGWSP, other site users, soldiers within training units, and the following projects.
- Preconstruction surveys referenced above led to the discovery of 5 new EBT (4 at the MPMG and one near Tango Range) and one previously tagged turtle that had lost a transmitter. Radiotransmitters were applied to all 6 individuals. Two mortalities were documented, including one road mortality in a nearby training area and one mortality from unknown causes. The signals for two turtles cannot be located, but one of the turtles was last heard coming from the Impact Area. Radio failure can also cause the loss of signal. Preconstruction survey and monitoring will continue for MPMG Range.
- MAARNG NR-ITAM contracted a “planning level survey” effort targeted at providing baseline data on box turtle presence and approximate density in a variety of training areas and habitat conditions distributed throughout Camp Edwards. Seven (7) EBT were detected in FY21 as part of this effort and all individuals were outfitted with radio transmitters for long-term tracking.
- MAARNG, MADFW, and USFWS are coordinating with a graduate student at University of Massachusetts (UMass) Amherst’s Massachusetts Cooperative Fish and Wildlife Research Unit ([website](#)) who plans to monitor and investigate the population of transmitted turtles at Camp Edwards.

o **Breeding Bird Point-counts**

- Point-count surveys were conducted from 24 May through 24 June, 2021. Three surveys were conducted at each of 79 points throughout Camp Edwards, including 14 grassland (cantonment) points and 65 points in the northern training area. A total of 80 species were documented at point-count locations during the month of surveys.



Prairie Warbler is classified as a Species of Greatest Conservation Need and is locally relatively abundant and widespread at Camp Edwards, showing positive response to pine barrens habitat management.

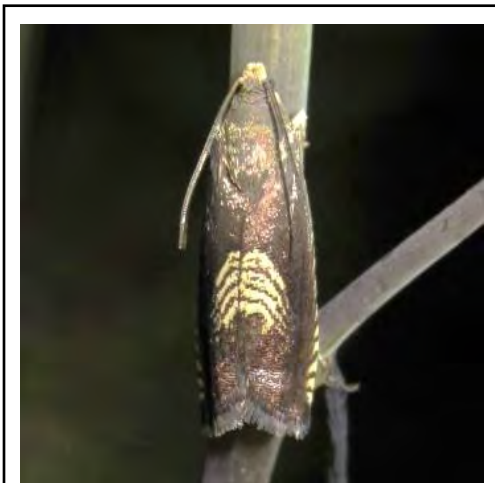
- Long-term trend analysis was completed for the newer point-count protocol covering data collected from 2013 through 2020. This standard point-count methodology allows for analyzing both abundance and occupancy whereas the 1994-2013 methodology primarily supports occupancy analysis. Trends in occupancy were compared for the different periods and show positive or stable trends for nearly all Species of Greatest Conservation Need (SGCN) as identified by the State Wildlife Action Plan. Scarlet Tanager (*Piranga olivacea*) and Brown Thrasher (*Toxostoma rufum*) are two useful habitat indicators species, both of which were documented with significant increases over the 1994-2013 period (+2.6% and +2.0% per year, respectively) despite regional/rangewide declines for each (from -2% to -9% per year). Scarlet Tanager averaged over 76% occupancy at Camp Edwards from 2013-2020 with increasing occupancy trend similar to the previous period and a significantly increasing per point count trend, compared to a mean of 40% occupancy for the prior survey period. Additionally, Brown Thrasher averaged over 60% occupancy with increasing, but not statistically significant trends for both occupancy and count, compared to a mean of roughly 23% occupancy for the prior survey period. Likewise, species such as Field Sparrow (*Spizella pusilla*) and Prairie Warbler (*Setophaga discolor*) are showing notable, though not yet statistically significant, increases in the northern training area in response to expanded habitat restoration while concurrently declining within primary grassland habitat as expected with reduction in shrub cover through habitat restoration. A full report on the monitoring data analysis will be developed in 2022 and provided to MADFW and others.

○ **Eastern Whip-poor-will (EWPW)**

- MAARNG NR-ITAM personnel conducted EWPW point-count transect surveys on 19 May, 2021. Three transects were conducted concurrently on one night covering 32 point-count locations throughout the northern training area. Whip-poor-wills were detected at all 32 locations for 100% occupancy. The mean per-point count was 4.3 birds, continuing a long-term stable to increasing trend from 2013 through 2021. Surveys are completed in coordination with MADFW and follow the Northeastern Nightjar Survey protocol. Additional, more opportunistic point-count surveys were conducted prior to the formal survey window and main survey night to provide greater confidence in results and these efforts provided consistent results. A full report on the effort has been sent to MADFW. Notably, in a 2021 publication ([online access](#)) researchers at Fort Drum Army Installation found that managed forest stands were preferred by EWPW reaching peak occupancy at a basal area of approximately 60 square feet per acre. This is very similar to the 80 square feet per acre or less target for southern pine beetle preparedness and shaded fuel break maintenance.

○ **Lepidoptera (Moths and Butterflies)**

- Pine Barrens Moths: Development of a statistically robust and comprehensive moth monitoring protocol continued through a contract from MAARNG NR-ITAM with Western EcoSystems Technology, Inc. (WEST). The protocol and



Grapholita tristrigana is a common barrens specialist moth at Camp Edwards with hostplant of Baptisia. It has a highly localized distribution in the eastern US.

supporting elements were completed and delivered at the end of November 2021. The initial round of vegetation surveys under the new protocol was completed during the summer of 2021. The overall protocol has a foundation of vegetation surveys that will evaluate change in structure and composition. In addition, protocols have been developed for nocturnal moth sampling and targeted diurnal sampling. The initial nocturnal UV trapping effort is anticipated during the summer of 2022.

- Frosted Elfin Butterfly and Slender Clearwing Moth: The Frosted Elfin Butterfly (*Callophrys irus*) is state-listed and being considered for federal listing. MAARNG NR-ITAM completed three formal surveys in May through July following the range-wide protocol developed by USFWS including a multi-step protocol covering vegetation, adults, and larvae. One of the survey units is within the Sandplain Grassland Mitigation Focal Area (Primary) while another is within the Sierra Range barrens habitat mitigation area (not part of the CMP mitigation). The third location is in the powerline right of way along Gibbs Road in Training Area C-13. Frosted Elfins were detected as adults at all three locations and appear to be expanding, especially in the grasslands sampling area. Follow-up larval surveys were completed with ultraviolet (UV) flashlights, which is particularly effective for Frosted Elfins, Slender Clearwing Moths (*Hemaris gracilis*), Barrens Buck Moth (*Hemileuca maia*) and other listed or otherwise rare Lepidoptera. Three nights of caterpillar surveys were completed in June and July 2021 covering the three sample sites with Frosted Elfins documented foraging on *Baptisia tinctoria* at all three. Slender Clearwing Moth was again documented with multiple individuals at the Sierra Range barrens habitat and new locations documented with a caterpillar at the northwestern elfin survey location and an adult photographed in the central grasslands of the SGMFA (Primary) for a total of four sites at Camp Edwards for this likely under-surveyed and secretive low blueberry specialist.
- General Moths: More opportunistic moth survey and documentation has continued forward from 2019. During FY21 a continued partnership with Teá Kesting-Handly, a graduate student from UMass Boston, led to multiple UV-light moth surveys with the two primary locations situated within mitigation focal areas SGMFA (Primary) and PBMFA (West). These efforts have led to documentation of several listed species and other species of significant conservation concern. Additionally, many informal diurnal photography efforts by Jake McCumber led to documentation of rare barrens associated species, including multiple new species documented for Barnstable County and one new species for the Commonwealth (*Ptycerata buskella*). Of particular management interest is documentation of many rare barrens habitat specialists that are poorly represented in New England or throughout their ranges. The growing suite of online identification aids and digital photography are significant facilitators allowing for better documentation, in particular, of microlepidoptera.

o **State- listed Plants**

- Frost bottom associates: The CMP does not have specific state-listed plant monitoring requirements, but does reference monitoring and reporting will be done. How best to monitor these plants, particularly Adder’s Tongue Fern (*Ophioglossum pusillum*) and Broad Tinker’s-weed (*Triosteum perfoliatum*), while minimizing disturbance is still a topic of mutual interest and discussion with MassWildlife. For FY21 broad-scale monitoring was not implemented. Effort focused on installation of a wooden “buck and pole” style fence around a frost bottom location for both species. It anecdotally appeared to eliminate

browsing by deer while having the benefit of being wooden and temporary fencing without soil impacts or digging.

- New listed species: A new MESA-listed species for JBCC was discovered in FY21 in two separate locations, both of which are within a mitigation focal area. Grass-leaved Ladies'-tresses Orchid is listed as Threatened in Massachusetts with similar threats as most other JBCC species, including development and habitat succession. This is a fairly expected species on-site and at the locations found. It is expected to respond positively to ongoing management efforts to expand and maintain suitable habitat. Location information is excluded here, but full reporting will be provided through Heritage Hub, MassWildlife's rare species reporting online database.

- **Habitat Management and Planning**

- **Planning** – A comprehensive prescribed burn plan was developed for Training Areas BA-7 and BA-1 within PBMFA-South. This facilitates prescribed burn treatment following the completed mastication work described below and the BA-7 prescribed burns completed in 2013 with strongly positive rare species response.

- **Pine Barrens Mechanical Restoration**

- Implementation was completed for the previously (FY20) contracted mechanical treatment in BA-7, which involved mowing dead trees across 157 acres to facilitate reentry with prescribed fire. This was a critical restoration step and included patchy mowing of shrub vegetation to introduce more heterogeneity in shrub layer structure.
- In-house scrub oak and other shrub mowing (7.4 acres) was ongoing in Training Area B-6 (PBMFA-South) as part of a small-scale and long term patch mowing to diversify age and structure composition in a good pitch pine – scrub oak area that is more challenging to burn and has needed maintenance after last having prescribed fire in 2009.
- A whole-tree harvest project was contracted in FY21 for winter implementation in Training Area E-3 (Burn Unit RAW3, PBMFA-West). Due to increased costs of implementation the project was scaled down to the highest priority 27 acres, which will expose an overgrown kettle hole depression and its "airshed" with intent of restoring frost bottom ecological function with scrub oak shrubland transitioning into pitch pine – scrub oak habitat at the transition from glacial moraine to the impact area. This is the highest priority type of restoration effort as it restores impact area type habitat in areas where habitat maintenance may be implemented and the project area will transition into the previously restored OP9/OP10 area (shown above).

- **Prescribed Burning**

- A grassland habitat maintenance burn of 47 acres was completed in subunit GLU04a within SGMFA-Primary (Parcel H of Unit K) as part of the ongoing restoration and maintenance of that



Grassland unit GLU04a two months after prescribed fire and 1.5 years after brush mowing. The area had a vigorous response of important host plants followed by flush of little bluestem. Many rare habitat specialists were documented post burn including the rare *Sitochroa dasconalis* and *Pococera baptisiella*.

150-acre parcel. The burn followed major restoration effort to remove trees from 2018, followed by brush mowing in 2021. Resprouting exotic shrubs were treated with herbicide in early FY22. This habitat area has been very effectively restored to functioning and diverse grassland and the burned area was the location for numerous rare moth observations this summer (*Baptisia* and heath specialists) along with an expansion area for both butterfly milkweed (*Asclepias tuberosa*) and one of its obligates – the state-listed Unexpected Cynia Moth (*Cynia inopinatus*).

- A pine barrens habitat maintenance prescribed burn of approximately 20 acres was conducted in Training Area E-3 (PBFA-West) in the OP-01 area on 14-APR-2021 as follow-up maintenance to the 2017 harvest and burn. The entire intended unit was not completed due to fire behavior more active than anticipated and the remainder of the unit will likely be completed in 2022. The partial burn provides good habitat heterogeneity and had excellent vegetative response– especially heath species.
- A pine barrens habitat management burn of 25 acres was conducted at the Sierra Range pine barrens mitigation zone, which is not part of this CMP, but is continuation of past completed mitigation commitment. This habitat burn was completed on 25-MAY-2021 and well met habitat objectives in a zone that has become high profile for habitat specialists such as the Slender Clearwing Moth and Frosted Elfin along with a high density of other listed species including Barrens Buckmoth and Eastern Whip-poor-will.



Sierra Range barrens habitat being treated with prescribed fire. This habitat area, its history, our management, and some of the species found there were highlighted by the US Fish and Wildlife Service Northeast Region in an April post titled Conservation Targets based on the successful restoration from open small arms range to focal conservation area with many rare species (<https://medium.com/usfishandwildlifeservicenortheast/conservation-targets-72a068e6b103>).

Fiscal Year 2022 Planning and Implementation

Army National Guard budgets have been substantially reduced in FY22, impacting facilities and environmental programs throughout the country. However, \$134,000 has been funded specifically for state-listed species conservation projects between dedicated mitigation under the master development plan CMP (\$57,000; MA175180002) and other state-listed species projects (\$77,000; MA175150003), much of which supports the mitigation implementation. Additionally, extra funds are anticipated as we get further into the fiscal year. Other monitoring and habitat restoration funding supports the mitigation implementation requirements. The robust and proactive structure of the master plan CMP was specifically developed to minimize or eliminate negative impacts from low funding years as extensive mitigation has been completed, as reported above, while minimal construction implementation has



Central-western portion of the Sandplain Grassland Mitigation Focal Area within a Frosted Elfin monitoring plot and following 2019 prescribed fire. This habitat supports high species diversity and this location had a new state record moth, *Ptycerata buskella*, documented June, 2021.

occurred under the Permit. As the initial mitigation requirements are met for actions such as major monitoring plan development and primary MILCON acreage requirements, the perpetual requirements funding will predominantly shift to the state-listed species funding tied to the CMP similar to the FY22 funding. Annual expenses after the first five or so years will decrease significantly as MAARNG shifts to focus on annual maintenance/management targets, resource monitoring, and data analysis.

Mechanical implementation of habitat mitigation is expected to be minimal for FY22 as extensive mechanical work has occurred over the last three years of implementation. Significant focus has

gone into planning for more active prescribed burning after challenges posed by COVID-19 and weather conditions. As mapped and described below numerous prescribed burn priorities are planned throughout the training site in various mitigation focal areas to continue restoration and maintenance of pine barrens and sandplain grassland mosaic conditions.

Monitoring and research efforts will be focal for FY22 with the first year of the long-term moth monitoring protocol and two developing box turtle research projects in partnership with UMass Amherst, MassWildlife, and US Fish and Wildlife Service.

- **Project Scoping, Design Minimization, and NHESP Review**

- **MPMG Range** – Completion of the Environmental Management Commission process will hopefully be completed during the winter of FY22 along with approval and contracting for construction. Submission and completion of all pre-Work required information and tasks will be completed as appropriate and able prior to construction.
- **Tango Range** – Final reporting is in development and preparation for submission to NHESP to close out the construction phase of the project and move into long-term maintenance and use.

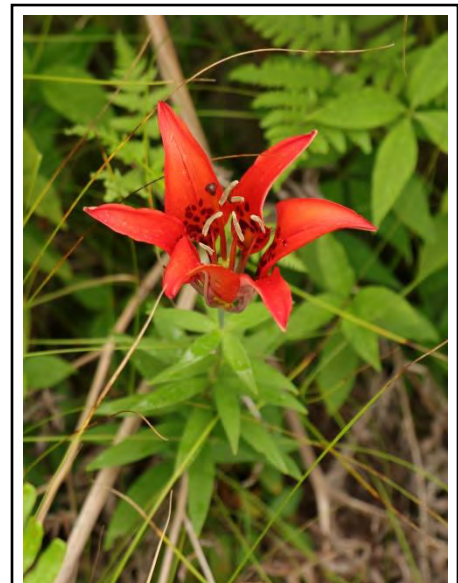
- **Track and Field (1800 area)** – Depending on funding the contracting of this project is anticipated during FY22. Contracting and implementation of the approved turtle protection plan and all other pre-Work requirements will be submitted for approval and completed as appropriate and able prior to construction.
- **ISBC Range** – Design consultation and internal review are ongoing with external reviews pending. It is anticipated that the CFMO will contract the turtle protection plan and other required support (e.g., permit compliance letter) given current funding if the project is slated to move forward in FY22 or FY23. Submission and completion of all pre-Work required information and tasks will be completed as appropriate and able prior to construction, to include approval and implementation of turtle protection, design review, etc.

- **Species Protection**

- **MPMG Range** – Resumption of turtle protection efforts including silt fence installation and construction support consistent with approved turtle protection plan.
- **Track and Field** – Initiation and compliance of turtle protection plan consistent with approval if construction project is funded and awarded.

- **Species Monitoring**

- **Eastern Box Turtles** – Ongoing in-house monitoring of box turtles found both opportunistically and during targeted surveys in 2019, 2020, and 2021 near future construction projects as well as those found during planning level surveys. Support for two graduate research projects, which will focus on efforts related to fly larval impacts and prescribed fire impacts. Review of health assessment results and continued coordination with university veterinarians.
- **Bird Surveys** – Cantonment and training area point count surveys and Eastern Whip-poor-will surveys.
- **Lepidoptera (Moths and Butterflies)** – Finalizing robust monitoring plan. Implementation of monitoring plan, including vegetation surveys, UV trap sampling, and pilot larval surveys for Barrens buckmoth, depending on resources.



The Wood Lily (Lilium philadelphicum) is not state-listed, but is an early successional habitat associate. It is a good indicator of barrens habitat condition at Camp Edwards and responds well to fire and restoration efforts.

- **Habitat Management and Planning (see map below)**

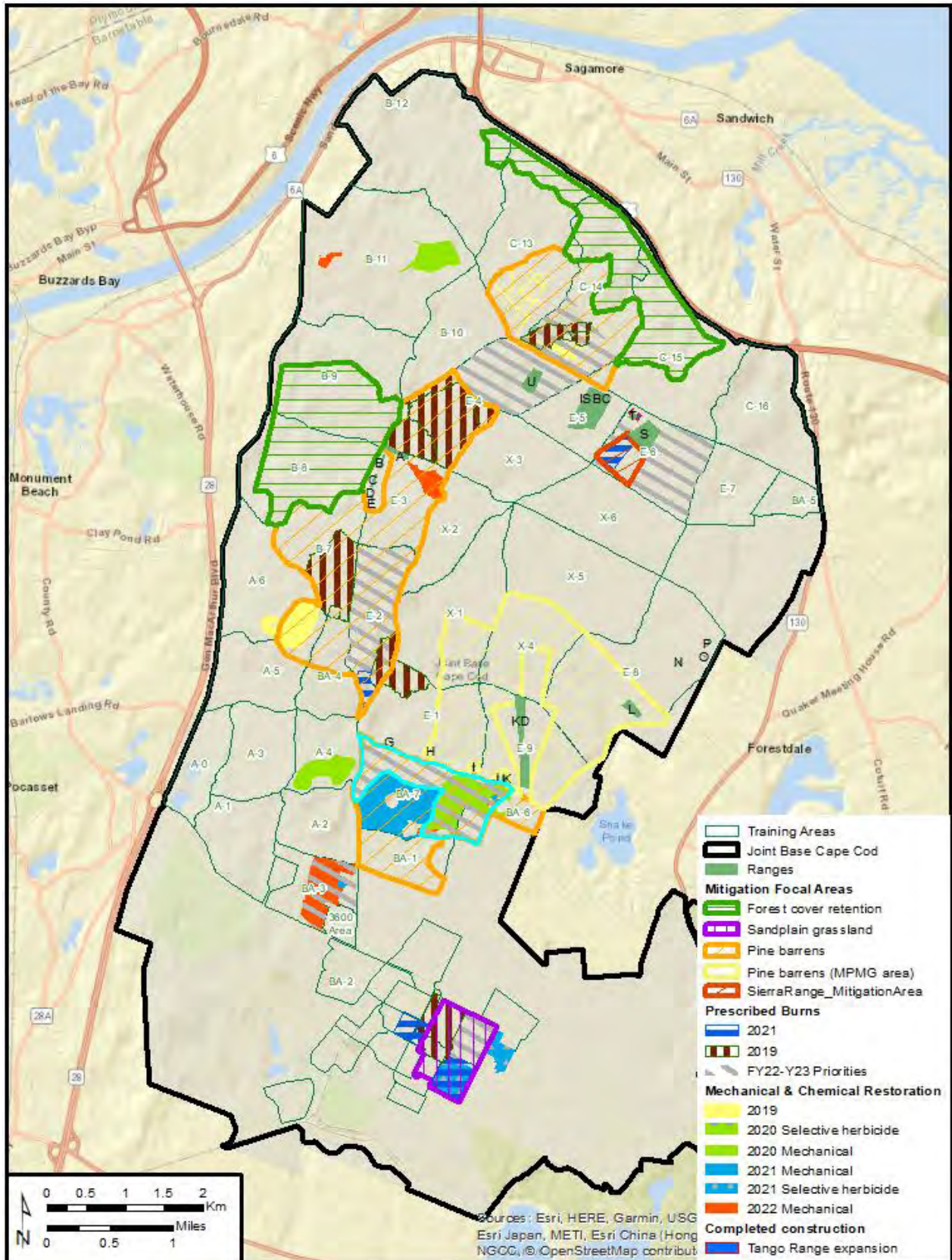
- **Prescribed Fire** – Priority prescribed burn areas for mitigation include:
 - PBMFA (North): up to approximately 170 acres of the southern portion of Training Area C-14 including previously harvested area and scrub oak shrubland
 - PBMFA (West): Training Area E-2 of which approximately 200 acres of pitch pine – scrub oak habitat is unburned in recent history and 61 acres is previously burned (2019).
 - PBMFA (South): Training Areas B-6 and B-7 maintenance fires for pitch pine – scrub oak and pitch pine – heath habitat up to approximately 260 acres.

- SGMFA (Primary): approximately 61 acres are prioritized for the more wooded northeastern portion of the mitigation area to facilitate slower conversion to savannah conditions suitable for frosted elfin and similar species while maintaining soil-disturbance sensitive plants.
- **Mechanical Restoration** –
 - Completion of the 27 acre RAW3 harvest contracted in FY21. As described above this project focuses on restoration of a large kettle hole frost bottom system and surrounding pitch pine – scrub oak savannah.
 - Long-term and small scale patch mowing of understory shrubs and small trees will continue in Training Area BA-6 to provide complex structural diversity in support of both training and habitat objectives. Approximately 7 acres will be mowed in FY22.
- **Rare species and mitigation outreach:** while outreach for rare species is not required or discussed in the CMP, other than contractor education, public outreach on rare species is important for long-term support of conservation efforts at Camp Edwards and elsewhere, including mitigation efforts.
 - **Camp Edwards Tours** – Base-wide tours of Camp Edwards have been well attended and popular with the public. Mission activities and habitat conservation are the primary foci, including extensive discussion of rare species, habitat needs, ongoing mitigation efforts under the CMP. These tours have garnered notable interest in listed fauna including listed moths and other early successional species. These tours, which were held from August through December, are expected to begin again in the spring and will continue to emphasize endangered species and habitat conservation.
 - **Grassland Bird Tours** – These annual tours were halted for two years due to the pandemic, but will start again in FY22 focusing on localized specialties of sandplain grassland habitat at Camp Edwards. These have long been productive outreach with the public and bird enthusiasts for both grasslands habitat conservation and military conservation.
 - **Public presentations** – MAARNG personnel have already given a presentation in FY22 focused on the Barrens Buck Moth to the Upper Cape Naturalist Club. Additional talks and field trips for this group and others (MA Butterfly Club, etc.) are planned for the year highlighting rare species and habitat restoration fundamental to the mitigation efforts of the Permit.



Jake McCumber presenting a tracked Eastern Box Turtle during a Camp Edwards public tour. This old male was opportunistically found on the firing line of Sierra Range during the tour and provided an excellent and popular educational opportunity.

All photos taken 2021 at Camp Edwards; MAARNG Natural Resources and Training Lands Program
Cover photos – Top: Barrens Buck Moth (*Hemileuca maia*) female. Bottom (from left): Grasshopper Sparrow (*Ammodramus savannarum*), Eastern Box Turtle (*Terrapene carolina*) with radio-transmitter, Frosted Elfin (*Callophrys irus*)



Map of Camp Edwards prescribed fires and mechanical pine barrens and training lands restoration projects from 2019 forward, including upcoming priorities. Designated mitigation areas are also shown.

Camp Edwards CMP Permit Compliance and Mitigation – Fiscal Year 2021

January 2022

APPENDIX W-4.2 – FY19/20 CMP MITIGATION ACTIONS REPORT

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Conservation and Management Permit Compliance and Mitigation Actions

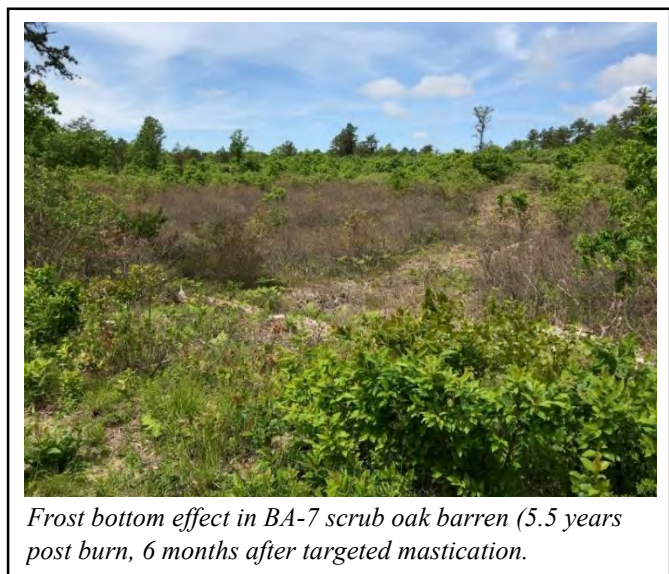
Camp Edwards: Fiscal Years 2019 & 2020

Outstanding and ongoing mitigation requirements for Camp Edwards and Joint Base Cape Cod (JBCC) are focused on formalized agreements with the MA Division of Fisheries and Wildlife (MADFW), Natural Heritage and Endangered Species Program (NHESP), under the Massachusetts Endangered Species Act (MESA). A holistic mitigation structure has been developed for the joint Massachusetts National Guard (MANG) elements to proactively implement mitigation and conservation for actions at JBCC. There are two formal and ongoing mitigation requirements Joint Base Cape Cod governed by respective Conservation and Management Permits (CMP). Both permits are held by MANG/Military Division with primary oversight and implementation by Massachusetts Army National Guard (MAARNG) and Camp Edwards. Grassland mitigation requirements for the 102nd Intelligence Wing, previously reported in the Annual State of the Reservation Report (SoTRR), have been subsumed within the overarching “master planning” mitigation bank discussed below and established in 2020.

Agassiz’s Clam Shrimp and Road Repairs CMP

The mitigation associated with the Agassiz’s Clam Shrimp (ACS) CMP are discussed more thoroughly in the Annual SoTRR, Section 3.3.4. In summary, two sites along Cat Road were repaired as *in situ* sites in Training Year (TY) 2020. This completed the habitat creation/improvement mitigation actions outlined in the CMP. The third of three years of monitoring required in the CMP was also completed in TY 2020. One additional year of monitoring is planned beyond the permit requirements in TY21, primarily due to the drought conditions of 2021 and conservation interest of MAARNG.

An early focus of TY2021 relative to ACS is developing a holistic road maintenance plan for Camp Edwards that accounts for ACS conservation and management. The condition of secondary and unimproved roads at Camp Edwards has severely degraded over the last few years, in large part due to repair prohibitions put in place with the discovery of widespread ACS. MAARNG’s intent, as discussed with MADFW, is to address this challenge through the INRMP and holistic planning that allows for perpetual ACS conservation while providing a framework for road repair that provides for suitable site use for military training, conservation management, unexploded ordnance remediation, and emergency response (e.g., EMS and wildfire response). A planning structure is in draft and will be provided to MADFW in early Calendar Year (CY) 2021.



Master Development Plan CMP

The MANG received a CMP (final signatures dated September 29, 2020) for construction of a Multipurpose Machine Gun Range (MPMG) and several other projects under a “master planning” framework proposed by MADFW. The primary projects incorporated into the master planning mitigation strategy include:

- MPMG Range at the current KD Range location
- Infantry Squad Battle Course at the formerly used Infantry Battle Course location
- Expansion of Tango and Sierra ranges
- Cantonment modernization, including the addition of a running track at the gym and classroom buildings in the 1300 area
- Potential for future solar development.

The mitigation plan combines project design/impact minimization, take avoidance, land transfers, extensive habitat improvement, and long-term monitoring to provide for net benefit of a large number of state-listed species. It also establishes a framework for ongoing site development (including additional or modified projects) and land use planning while providing for proactive mitigation and demonstrable net benefit for state-listed species.

The mitigation plan focuses on **species guilds** (pine barrens and sandplain grassland) for the majority of species with similar habitat condition needs and/or threats (e.g., loss of open canopy condition through forest closure). The eastern box turtle is treated separately as it has differing needs and threats compared to the other species. **Mitigation focal areas**, tied to the guilds, have been identified to localize various mitigation actions for maximized benefit. Standards for mitigation have been developed for each type of guild and focal area to ensure sufficient conservation commitments are included in the plan and to provide assurances to MADFW for net benefit. For example, pine barrens mitigation will require 20% to 40% of habitat improvement work to be in the form of mechanical forestry, as the majority of the pine barrens guild species are threatened and declining due to tree encroachment and canopy closure. In addition to pine barrens and grassland focal areas, **forest canopy retention areas** are identified for box turtle hibernation and these areas will be managed or left to maintain later successional forest condition and closed tree canopy.

Real Property Actions. Extensive land protection through real property actions was a fundamental component of the master CMP. One parcel (Special Military Reserve Commission [SMRC] Tract 5) that had already been transferred to MADFW was included in this agreement as it had been transferred for a project that did not occur and the transfer was specified as mitigation. Additionally, SMRC Tracts 1-4 were transferred to MADFW as mitigation through this agreement in 2020. Tracts 1-5 total 260 acres and are directly adjacent to Crane Wildlife Management area; these tracts represent a significant expansion to this public conservation area. Another parcel previously identified for mitigation land transfer, but not previously completed was Parcel H of Unit K, which is 150 acres of former parade field in cantonment. This transfer was included within the master CMP agreement. The parcel was transferred to Military Division in 2020 and will be fully transferred to MADFW with anticipated completion in 2021. MANG will receive a license to maintain overall access and use to meet perpetual habitat conversion and long-term management requirements under the mitigation agreement.

Mitigation Implementation. The Natural Resources Office budgeted for proactive mitigation implementation for the MPMG range. Early mitigation can better provide for net benefit by supplying improved or newly available habitat condition for impacted species prior to losses or impacts incurred through project development. A total of \$313,295 was spent specifically mitigation actions for the MPMG range and associated projects in 2019 (Table



First-year Eastern Whip-poor-will caught July 2020 as part of the ongoing migration study at the I Range barrens restoration area.

1). Contracted projects resulted in mitigation on a total of 563 acres, include the 52-acre timber harvest at Wheelock Overlook in Training Area A-5, eight days of prescribed burning (490 acres), and the development of a box turtle construction support and monitoring plan with an initial survey of the MPMG footprint, among other actions. Additional in-house efforts in TY 2019 for actions included in the CMP or to address state-listed species include bat surveys, grassland bird surveys, site-wide bird surveys, whip-poor-will surveys, and state-listed plant surveys (Table 2).

Sum of Contract Cost		Fiscal Year		
Project Type		2019	2020	Grand Total
Mitigation: Administrative		\$6,020.00	\$45,169.00	\$51,189.00
Mitigation: Construction support			\$221,876.00	\$221,876.00
Mitigation: Monitoring		\$62,810.00	\$103,247.82	\$166,057.82
Mitigation: Initial treatment, fire		\$64,479.50		\$64,479.50
Mitigation: Initial treatment, mechanical		\$179,985.94	\$88,458.00	\$268,443.94
Mitigation: Maintenance treatment, other			\$55,950.00	\$55,950.00
Grand Total		\$313,295.44	\$514,700.82	\$827,996.26

Table 1. Expenditure by federal fiscal year implementing the Master Plan CMP.

Sum of Mitigation Acreage		Fiscal Year				
Project Type		2019	2020	2021	2022	Grand Total
Pine Barrens		520	401	-163	72	830
Construction: Pine Barrens			-6	-412		-418
Mitigation: Initial treatment, fire		448		36		484
Mitigation: Initial treatment, mechanical		72	106	157	72	407
Mitigation: Maintenance treatment, fire				56		56
Mitigation: Maintenance treatment, other			40			40
Mitigation: Real Property			261			261
Sandplain Grassland		42	80	15		137
Construction: Sandplain Grassland				-36		-36
Mitigation: Initial treatment, fire		42				42
Mitigation: Initial treatment, mechanical			80			80
Mitigation: Maintenance treatment, fire				51		51
Mitigation: Real Property						
Grand Total		562	481	-148	72	967

Table 2. Acreage totals for mitigation banking under the Master Plan CMP by federal fiscal year and project type. Maintenance actions are implementing the perpetual maintenance and management requirement. Negative numbers represent Take under MESA and draw against the “account.”



Immature Eastern Box Turtle tracked during 2020 around J and K Ranges as part of long-term monitoring of turtles near the MPMG Range area.

Several major mitigation efforts were completed and/or initiated in TY20, addressing all the above-listed components of the master CMP. A total of \$514,700 was spent specifically on implementation of mitigation projects under the master plan CMP in TY2020, not including staff time, which was a significant investment for planning and project development/oversight. In addition to finalizing the Permit, 2020 was also the first year of approving a construction project under the Permit, though land clearing for the Tango Range expansion actually started in early FY21. Approval and construction of the flagship project – the MPMG Range – has been delayed due to the review of public comments received during the NEPA process.

The mitigation actions implemented during FY20 totaled 226 acres of habitat restoration in addition to the real property actions described above. No prescribed fire was implemented during FY20, primarily due to the impacts of the COVID-19 and

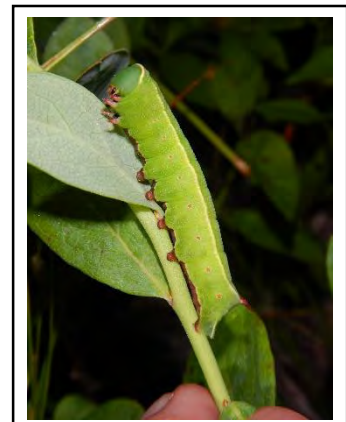
unsuitable weather during the fall of 2019. However, two new full-time positions were hired into the Natural Resources and ITAM Program, significantly expanding our internal experience and capabilities. Wildland fire actions have been focused on program development and planning. FY21 is planned for restarting wildland fire implementation, though likely significantly reduced as the pandemic effects will persist through at least spring burn season. Projects undertaken in FY19 and FY20 as part of mitigation efforts are summarized below.

- **Project Scoping, Design Minimization, and NHESP Review**
 - **MPMG Range** – Completion of design and project review with submission to NHESP for review and approval (April 2020). Completion and approval of turtle protection plan. Initial implementation of turtle protection surveys with extension required due to delayed construction.
 - **Tango Range** – Completion of design and project review with submission to NHESP for review and approval (September 2019). Pre-Work required submissions and approval, completion and approval of turtle protection plan, and completed pre-construction surveys (October 2020).
 - **Track and Field (1800 area)** – Completion of design and project review with submission to NHESP for review and approval (May 2020). Initial development of turtle protection plan. Project is planned for completion in January 2021.
 - **ISBC Range** – Design consultation and internal review.

- **Species Protection**
 - **MPMG Range** – Intensive year 2 of eastern box turtle surveys implementing approved turtle protection plan. Submission of interim report is pending.
 - **Tango Range** – Completion of initial eastern box turtle surveys and approval of submitted report to begin work on site. Site monitoring is ongoing.

- **Species Monitoring**
 - **Eastern Box Turtles** – Extensive in-house monitoring of box turtles found both opportunistically and during targeted surveys in 2019 and 2020 near future construction projects.

- **Bird Surveys** – Completion of cantonment and training area point count surveys and annual eastern whip-poor-will surveys.
- **Lepidoptera (Moths and Butterflies)** – Contracted scientific development of a monitoring plan to evaluate impacts of mitigation and range support habitat management efforts, including prescribed burning and mechanical fuels management. MAARNG and MADFW require a statistically sound, informative, and achievable monitoring protocol to evaluate impacts on listed moths and butterflies.



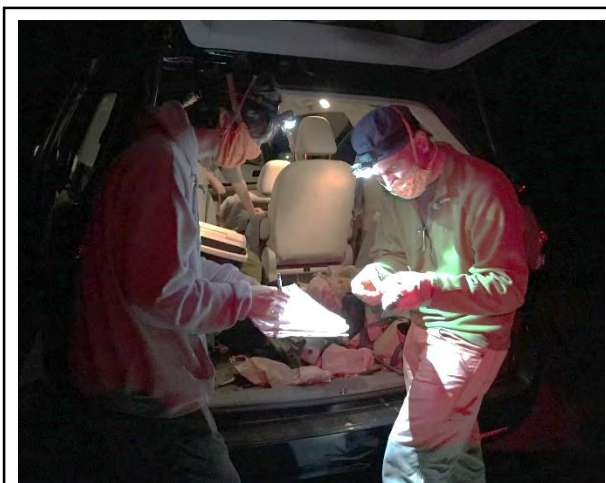
Larval Slender Clearwing Moth on lowbush blueberry found July 2020 at S Range barrens restoration area.

- **Habitat Management and Planning**

- **Forestry Assessment** – Completed a forestry assessment and harvest planning for burn unit RAW3 to restore pine barrens habitat conditions, including restoration of a large frost bottom feature.
- **Pine Barrens Restoration** – Contracted and completed phase 2 treatment at Wheelock Overlook site as recommended by MADFW. Targeted herbicide application was used across 50 acres to follow timber harvest and address tree oak coppicing that outcompetes other vegetation. Also contracted treatment in BA-7 mechanically mowing dead trees across 157 acres to facilitate reentry with prescribed fire. This is a critical step and includes spot mowing of shrub vegetation to introduce more heterogeneity in shrub layer structure.

Fiscal Year 2021 Planning and Implementation

While Department of Army Conservation budgets were significantly reduced in FY21, the mitigation and listed species projects for MAARNG were fully funded for Camp Edwards. The 85% funding level for MAARNG Natural Resources Conservation demonstrates the commitment of both MAARNG and National Guard Bureau to meeting our mitigation agreements. Explicit mitigation funding for FY21 totals \$282,000, and additional state-listed species funding totals an additional \$86,400. Finally, other monitoring and habitat restoration funding supports the mitigation implementation requirements. As the initial mitigation requirements are met for actions such as major monitoring plan development and primary MILCON acreage requirements, the perpetual requirements funding will predominantly shift to the state-listed species funding tied to the CMP. Annual expenses after the first five or so years will decrease significantly as MAARNG shifts to focus on annual maintenance/management targets, resource monitoring, and data analysis.



Processing an eastern whip-poor-will capture following COVID-19 procedures.

Based upon ongoing impacts of COVID-19 and restructuring of the wildland fire component of the program, prescribed burning implementation will continue to be significantly lower compared to FY2019. However, multiple prescribed burn units are prepared for spring 2021 and are likely to be implemented as smaller operational units (e.g., 20-50 acres) to allow for smaller crews, limited smoke production, etc. Mechanical management is ongoing for FY21, with some projects contracted during FY20 but held until fall/winter to minimize potential resource impacts (e.g., box turtles, nesting birds).

Additional mechanical restoration is being scoped for FY21 contracting and with implementation in the following fall. Another priority mitigation fund expense is a high probability of a cost extension to the contracted box turtle construction support for the MPMG Range, which has been

delayed due to public comments and agency response through the NEPA process. Project level emphasis is outlined below for proposed projects in FY21, as it was broken down above for FY20 accomplishments.

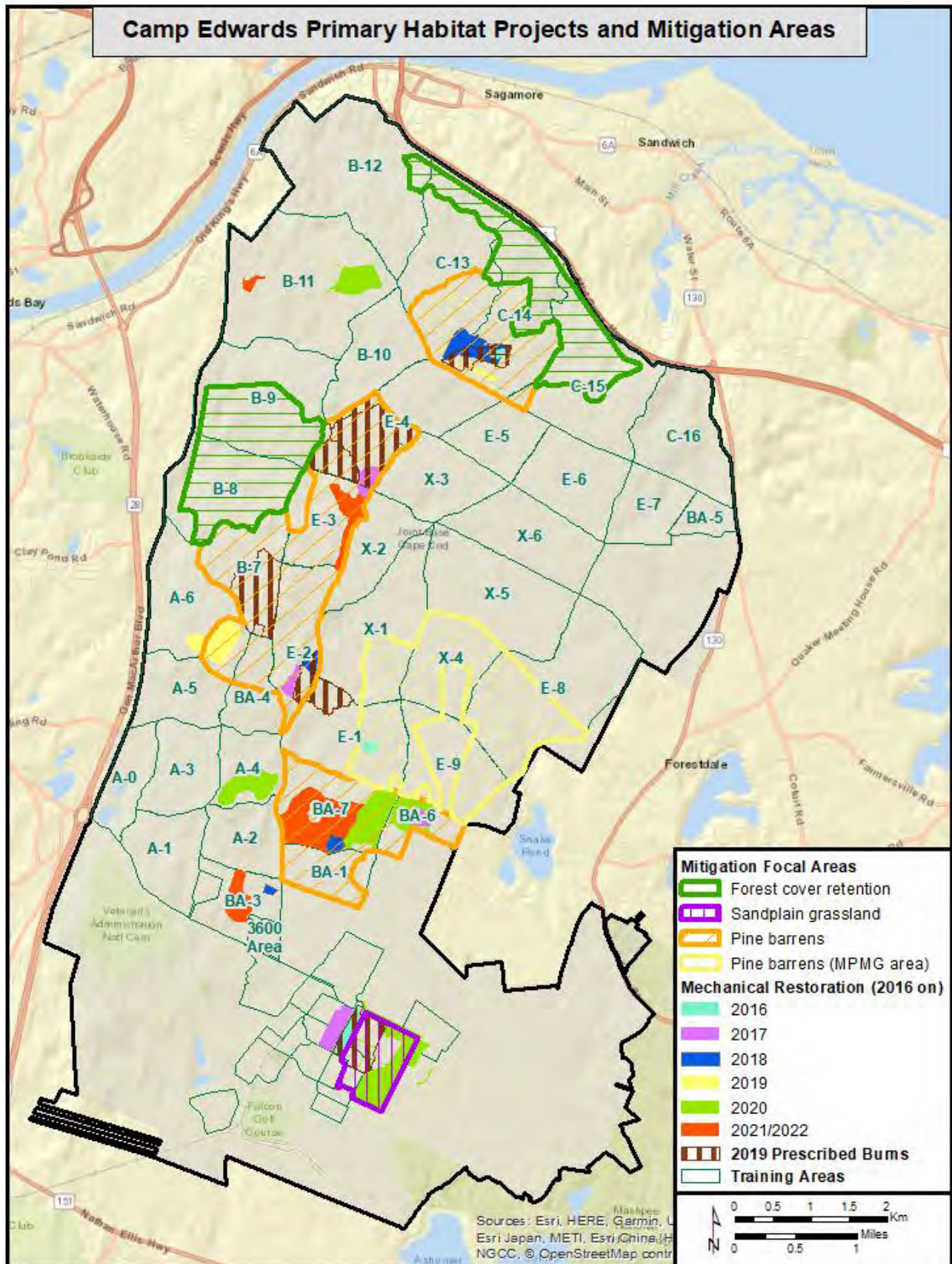
- **Project Scoping, Design Minimization, and NHESP Review**
 - **MPMG Range** – Finalization of NEPA process (anticipated early CY21) and construction initiation (potentially late summer 2021). Submission/completion of all pre-Work required information and tasks.
 - **Tango Range** – Compliance with all requirements through end of construction, and final submission consistent with Permit requirements.
 - **Track and Field (1800 area)** – Review/approval of turtle protection plan and other preliminary requirements (January 2021) and submission of all other required information prior to Work (March/April 2021).
 - **ISBC Range** – Design consultation and internal review. CFMO contract support of turtle protection plan and other required support/information.

- **Species Protection**
 - **MPMG Range** – Resumption of turtle protection efforts including silt fence installation (potentially late April or early May), rapid site clearance surveys based on previous level of effort, and construction support consistent with approved turtle protection plan.
 - **Tango Range** – Completion of turtle protection along with construction; submission of final report.
 - **Track and Field** – Initiation and compliance of turtle protection plan consistent with approval.

- **Species Monitoring**
 - **Eastern Box Turtles** – Ongoing in-house monitoring of box turtles found both opportunistically and during targeted surveys in 2019 and 2020 near future construction projects.
 - **Bird Surveys** – Cantonment and training area point count surveys and eastern Whip-poor-will surveys.
 - **Lepidoptera (Moths and Butterflies)** – Ongoing development of robust monitoring plan. Initial implementation of monitoring plan is likely, including vegetation surveys and nocturnal larval transects for target species.

- **Habitat Management and Planning**
 - **Burn Planning** – Complete a prescribed burn plan update for Southern Pine Barrens Focal Area (BA6, BA7, BA1) to support fire maintenance.
 - **Habitat Restoration and Maintenance** –
 - Contract implementation of BA-7 snag reduction and understory mastication (January/February 2021).
 - Complete contracting for RAW3 major pine barrens restoration including frost bottom release (approximately 72 acres).
 - Prescribed burning targets in mitigation areas of up to 166 acres, including RAW5/OP1 (79 acres, PBFA West), C-13/C-14 (36 acres, PBFA North), and GLU4A (51 acres, Parcel H of Unit K).





Map of Camp Edwards prescribed fires (2019 burns only for clarity) and six years of mechanical pine barrens and training lands restoration projects. Also shown are the recently designated mitigation areas.

APPENDIX W-5 – SPECIES LISTS TO BE INCORPORATED INTO INRMP

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MAMMALS

#	Class	Order	Family	Binomial	Common Name	ITIS#	G Rank	S Rank	State Status	Federal Status
1		Didelphimorphia	Didelphidae	Didelphis virginiana	Opossum	179921	G5	S5	Game	
2			Soricidae	Sorex cinereus	Masked shrew	179929	G5	S5		
3		Soricomorpha		Blarina brevicauda	Short-tailed shrew	179967	G5	S5		
4			Talpidae	Scalopus aquaticus	Eastern mole	179979	G5	S5		
5				Myotis lucifugus	Little brown bat	179988	G3	S2	E	
6				Myotis septentrionalis	Northern long-eared bat	180000	G1	S1	E	T
7				Eptesicus fuscus	Big brown bat	180008	G5	S4		
8		Chiroptera	Vespertilionidae	Lasionycteris noctivagans	Silver-haired bat	180014	G3	S2		
9				Lasiurus borealis	Red bat	180016	G3	S3		
10				Lasiurus cinereus	Hoary bat	180017	G3	S2		
11				Perimyotis subflavus	Tricolored bat	180025	G2	S1	E	
12		Lagomorpha	Leporidae	Sylvilagus floridanus	Eastern cottontail	180124	G5	Exotic	Game	
13				Sylvilagus transitionalis	New England cottontail	180127	G3	S2	Game	
14				Marmota monax	Woodchuck	180137	G5	S5		
15				Tamiasciurus hudsonicus	Red squirrel	180166	G5	S5		
16			Sciuridae	Glaucomys volans	Southern flying squirrel	180170	G5	S5		
17				Sciurus carolinensis	Gray squirrel	180175	G5	S5	Game	
18	Mammalia	Rodentia		Tamias striatus	Eastern chipmunk	180207	G5	S5		
19				Peromyscus leucopus	White-footed mouse	180278	G5	S5		
20			Cricetidae	Myodes gapperi	Southern red-backed vole	180294	G5	S5		
21				Microtus pennsylvanicus	Meadow vole	180297	G5	S5		
22				Ondatra zibethicus	Muskrat	180318	G5	S5		
23			Dipodidae	Zapus hudsonius	Meadow jumping mouse	180386	G5	S5		
24			Erethizontidae	Erethizon dorsatum	Porcupine	180393	G5	S5		
25				Lontra canadensis	River Otter	180549	G5	S4		
26				Mustela vison	Mink	180553	G5	S5		
27			Mustelidae	Mustela erminea	Short-tailed weasel	180555	G5	S5		
28				Mustela frenata	Long-tailed weasel	180556	G5	S5		
29				Martes pennanti	Fisher	180560	G5	S4		
30		Carnivora	Mephitidae	Mephitis mephitis	Striped skunk	180562	G5	S5		
31			Procyonidae	Procyon lotor	Raccoon	180575	G5	S5	Game	
32				Canis latrans	Coyote	180599	G5	S5	Game	
33			Canidae	Vulpes vulpes	Red fox	180604	G5	S5	Game	
34				Urocyon cinereoargenteus	Gray fox	180609	G5	S5	Game	
35			Felidae	Felis catus	Domestic cat	183798	NR	NR	Exotic	
36		Artiodactyla	Cervidae	Odocoileus virginianus	White-tailed deer	180699	G5	S5	Game	

HERPTILES

#	Class	Order	Family	Binomial	Common Name	ITIS #	G Rank	S Rank	State Status	Federal Status
1				Lithobates catesbeianus	American bullfrog	775084	G5	S5		
2				Lithobates clamitans	Green frog	775087	G5	S5		
3			Ranidae	Lithobates palustris	Pickerel frog	775107	G5	S5		
4		Anura		Lithobates sylvatica	Wood frog	775117	G5	S5		
5				Anaxyrus americanus	American toad	773511	G5	S5		
6	Amphibia		Bufo	Anaxyrus fowleri	Fowler's toad	773520	G5	S4		
7				Dryophytes versicolor	Gray treefrog	173503	G5	S5		
8			Hylidae	Pseudacris crucifer	Spring peeper	207303	G5	S5		
9				Ambystomatidae	Ambystoma maculatum	173590	G5	S5		
10		Caudata		Salamandridae	Notophthalmus viridescens	173615	G5	S5		
11				Plethodontidae	Plethodon cinereus	173649	G5	S5		
12				Chelydridae	Chelydra serpentina	173752	G5	S5		
13				Kinosternidae	Sternotherus odoratus	173758	G5	S4		
14	Chelonia	Testudines		Clemmys guttata	Spotted turtle	173771	G5	S4		
15			Emydidae	Terrapene carolina carolina	Eastern box turtle	173776	G5/T5	S3/NR	SC	
16				Chrysemys picta picta	Eastern painted turtle	173784	G5	S5		
17				Storeria occipitomaculata	Redbelly snake	174131	G5	S5		
18				Thamnophis saurita saurita	Eastern ribbon snake	174134	G5/T5	S4		
19				Thamnophis sirtalis sirtalis	Eastern garter snake	174137	G5/T5	S5/NR		
20				Diadophis punctatus edwardsii	Northern ring-necked snake	174158	G5/T5	S5/NR		
21	Reptilia	Squamata	Colubridae	Coluber constrictor	Black racer	174169	G5	S4		
22				Opheodrys vernalis	Smooth green snake	174173	G5	S5		
23				Lampropeltis triangulum	Milk snake	174187	G5	S5		
24				Heterodon platirhinus	Eastern hog-nosed snake	563935	G5	S4	T	

BIRDS

#	Class	Order	Family	Binomial	Common Name	ITIS#	G Rank	S Rank	Occurrence	State Status*	Federal Status			
1				<i>Branta canadensis</i>	Canada Goose	174999	G5	S5	R	Game				
2				<i>Cygnus olor</i>	Mute Swan	174985	G5	SNA	R	Game				
3				<i>Aix sponsa</i>	Wood Duck	175122	G5	S5B,S5M	R					
4				<i>Anas platyrhynchos</i>	Mallard	175063	G5	S5	R					
5				<i>Anas rubripes</i>	American Black Duck	175068	G5	S4B,S5N	R					
6				<i>Anas acuta</i>	Northern Pintail	175074	G5	S1B,S5M	M					
7		Anseriformes	Anatidae	<i>Anas crecca</i>	Green-winged Teal	175081	G5	S2B,S5M	W					
8					<i>Aythya collaris</i>	Ring-necked Duck	175128	G5	SXB,S5N	W				
9					<i>Aythya affinis</i>	Lesser Scaup	175134	G5	S5N	W				
10					<i>Melanitta deglandi</i>	White-winged Scoter	175167	G5	S5N	W(F)				
11					<i>Bucephala albeola</i>	Bufflehead	175145	G5	S5N	W				
12					<i>Bucephala clangula</i>	Common Goldeneye	175141	G5	S5N	W				
13					<i>Lophodytes cucullatus</i>	Hooded Merganser	175183	G5	S4B,S5N	W				
14					<i>Mergus merganser</i>	Common Merganser	175185	G5	S2B,S5N	W				
15					Odontophoridae	<i>Colinus virginianus</i>	Northern Bobwhite	175863	G4G5	S2	R	Game		
16				Galliformes	Phasianidae	<i>Meleagris gallopavo</i>	Wild Turkey	176136	G5	S5	R	Game		
17							<i>Bonasa umbellus</i>	Ruffed Grouse	175790	G5	S4	R	Game	
18							<i>Phasianus colchicus</i>	Ring-necked Pheasant	175905	G5	SNA	NA	Game	
19				Podicipediformes	Podicipedidae	<i>Podilymbus podiceps</i>	Pied-billed Grebe	174505	G5	S1B,S4N	W	E*		
20							<i>Podiceps grisegena</i>	Red-necked Grebe	174479	G5	S4N	E		
21		Columbiformes	Columbidae	<i>Columba livia</i>	Rock Pigeon	177071	G5	SNA	R					
22					<i>Zenaidura macroura</i>	Mourning Dove	177125	G5	S5	R				
23		Cuculiformes	Cuculidae	<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	177831	G5	S4B,S4N	B					
24					<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	177834	G5	S4B,S4N	B				
25				<i>Chordeiles minor</i>	Common Nighthawk	177979	G5	S2B,S5M	M					
26	Aves	Caprimulgiformes	Caprimulgidae	<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	177960	G5	S1N	B					
27					<i>Antrostomus vociferus</i>	Eastern Whip-poor-will	1077358	G5	S2S3B,S3N	B	SC			
28				Apodidae	<i>Chaetura pelagica</i>	Chimney Swift	178001	G4G5	S5	B				
29				Trochilidae	<i>Archilochus colubris</i>	Ruby-throated Hummingbird	178032	G5	S5B	B				
30				Gruiformes	Rallidae	<i>Fulica americana</i>	American Coot	176292	G5	SXB,S3N	E			
31					Charadriidae	<i>Charadrius vociferus</i>	Killdeer	176520	G5	S5B,S5N	R			
32						<i>Bartramia longicauda</i>	Upland Sandpiper	176610	G5	S1B,S1N	B	E		
33						<i>Numenius phaeopus</i>	Whimbrel	176599	G5	S3N	M			
34					Scolopacidae	<i>Calidris pusilla</i>	Semipalmated Sandpiper	176667	G5	S5N	M			
35						<i>Scolopax minor</i>	American Woodcock	176580	G5	S4B,S4N	R			
36						<i>Actitis macularius</i>	Spotted Sandpiper	726049	G5	S4B,S5N	M			
37				Charadriiformes		<i>Tringa solitaria</i>	Solitary Sandpiper	176615	G5	S4N	M			
38					Alcidae	<i>Uria lomvia</i>	Thick-billed Murre	176978	G5	S2N	E			
39						<i>Leucophaeus atricilla</i>	Laughing Gull	824079	G5	S2B	S(F)			
40			<i>Larus delawarensis</i>		Ring-billed Gull	176830	G5	S1B,S5N	R					
41			<i>Larus argentatus</i>		Herring Gull	176824	G5	S3S4B,S5N	R					
42			<i>Larus marinus</i>		Great Black-backed Gull	176815	G5	S3S4B,S5N	R					
43			<i>Sterna hirundo</i>		Common Tern	176888	G5	S3B,S4N	S(F)	SC*				
44		Gaviiformes	Gaviidae		<i>Gavia stellata</i>	Red-throated Loon	174474	G5	S4N	W(F)				
45					<i>Gavia immer</i>	Common Loon	174469	G5	S2B,S5N	M/W(F)	SC*			
46		Suliformes	Sulidae	<i>Morus bassanus</i>	Northern Gannet	174712	G5	S5N	E					
47			Phalacrocoracidae	<i>Phalacrocorax auritus</i>	Double-crested Cormorant	174717	G5	S3B,S5N	R					
48				<i>Ardea herodias</i>	Great Blue Heron	174773	G5	S4B,S5N	R					
49		Pelecaniformes	Ardeidae	<i>Ardea alba</i>	Great Egret	554135	G5	S2B,S4N	B					
50					<i>Butorides virescens</i>	Green Heron	174793	G5	S4B,S5M	B				
51					<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	174832	G5	S2B	M				
52		Cathartiformes	Cathartidae	<i>Cathartes aura</i>	Turkey Vulture	175265	G5	S4B,S5M	R					

BIRDS

#	Class	Order	Family	Binomial	Common Name	ITIS#	G Rank	S Rank	Occurrence	State Status*	Federal Status
53			Pandionidae	Pandion haliaetus	Osprey	175590	G5	S4B,S5M	B		
54				Circus hudsonius	Northern Harrier	175430	G5	S2B,S4N	R	T	
55				Accipiter striatus	Sharp-shinned Hawk	175304	G5	S2B,S5N	W		
56				Accipiter cooperii	Cooper's Hawk	175309	G5	S4B,S5N	R		
57				Accipiter gentilis	Northern Goshawk	175300	G5	S3	E		
58		Accipitriformes	Accipitridae	Haliaeetus leucocephalus	Bald Eagle	175420	G5	S2B,S3N	E	SC	
59				Buteo lineatus	Red-shouldered Hawk	175359	G5	S4B,S4N	B		
60				Buteo platypterus	Broad-winged Hawk	175365	G5	S5B,S5N	B		
61				Buteo jamaicensis	Red-tailed Hawk	175350	G5	S5B,S5N	R		
62				Buteo lagopus	Rough-legged Hawk	175373	G5	S3N	E		
63				Megascops asio	Eastern Screech-Owl	686658	G5	S5	R		
64				Bubo virginianus	Great Horned Owl	177884	G5	S5	R		
65		Strigiformes	Strigidae	Bubo scandiacus	Snowy Owl	686683	G4	S2S3N	W		
66				Asio otus	Long-eared Owl	177932	G5	S1B,S2N	E	SC	
67				Asio flammeus	Short-eared Owl	177935	G5	S1B,S3N	M/W	E	
68				Aegolius acadicus	Northern Saw-whet Owl	177942	G5	S3B,S5N	R		
69		Coraciiformes	Alcedinidae	Megaceryle alcyon	Belted Kingfisher	178106	G5	S5B,S5N	B		
70				Sphyrapicus varius	Yellow-bellied Sapsucker	178202	G5	S4B,S4N	M		
71				Melanerpes carolinus	Red-bellied Woodpecker	178195	G5	S4	R		
72		Piciformes	Picidae	Picoides pubescens	Downy Woodpecker	178259	G5	S5	R		
73				Picoides villosus	Hairy Woodpecker	178262	G5	S5	R		
74				Colaptes auratus	Northern Flicker	178154	G5	S5	R		
75				Falco sparverius	American Kestrel	175622	G5	S3	R		
76		Falconiformes	Falconidae	Falco columbarius	Merlin	175613	G5	S4N	R		
77				Falco peregrinus	Peregrine Falcon	175604	G4	S2B,S3N	M	SC*	
78	Aves			Contopus cooperi	Olive-sided Flycatcher	554221	G4	SHB,S2N	M		
79				Contopus virens	Eastern Wood-Pewee	178359	G5	S5B	B		
80				Empidonax virens	Acadian Flycatcher	178339	G5	S2B	B		
81			Tyrannidae	Empidonax alnorum	Alder Flycatcher	178340	G5	S4B	B		
82				Empidonax minimus	Least Flycatcher	178344	G5	S5B	B		
83				Sayornis phoebe	Eastern Phoebe	178329	G5	S5B	B		
84				Myiarchus crinitus	Great Crested Flycatcher	178309	G5	S5B	B		
85				Tyrannus tyrannus	Eastern Kingbird	178279	G5	S5B	B		
86				Vireo flavifrons	Yellow-throated Vireo	179009	G5	S4B	M		
87			Vireonidae	Vireo solitarius	Blue-headed Vireo	179010	G5	S4B,S5N	M		
88				Vireo olivaceus	Red-eyed Vireo	179021	G5	S5B	B		
89				Lanius ludovicianus	Loggerhead Shrike	178515	G4	SXB,S1N	E		
90			Laniidae	Lanius excubitor	Northern Shrike	178511	G5	S4N	W		
91		Passeriformes		Cyanocitta cristata	Blue Jay	179680	G5	S5	R		
92				Corvus brachyrhynchos	American Crow	179731	G5	S5	R		
93			Corvidae	Corvus ossifragus	Fish Crow	179737	G5	S4	R		
94				Corvus corax	Common Raven	179725	G5	S4	R		
95				Poecile atricapillus	Black-capped Chickadee	554382	G5	S5	R		
96			Paridae	Baeolophus bicolor	Tufted Titmouse	554138	G5	S5	R		
97			Alaudidae	Eremophila alpestris	Horned Lark	554256	G5	S3B,S4N	R		
98				Stelgidopteryx serripennis	Northern Rough-winged Swallow	178443	G5	S4B	B		
99				Progne subis	Purple Martin	178464	G5	S1	M		
100			Hirundinidae	Tachycineta bicolor	Tree Swallow	178431	G5	S5B	B		
101				Riparia riparia	Bank Swallow	178436	G5	S5	B		
102				Hirundo rustica	Barn Swallow	178448	G5	S5B	B		
103				Petrochelidon pyrrhonota	Cliff Swallow	178455	G5	S2	E		
104			Regulidae	Regulus calendula	Ruby-crowned Kinglet	179870	G5	SXB,S5N	M		

BIRDS

#	Class	Order	Family	Binomial	Common Name	ITIS#	G Rank	S Rank	Occurrence	State Status*	Federal Status
105			Regulidae	Regulus satrapa	Golden-crowned Kinglet	179865	G5	S2B,S5N	W		
106			Sittidae	Sitta canadensis	Red-breasted Nuthatch	178784	G5	S5	R		
107			Sittidae	Sitta carolinensis	White-breasted Nuthatch	178775	G5	S5	R		
108			Certhiidae	Certhia americana	Brown Creeper	178803	G5	S5	R		
109			Poliophtidae	Poliophtila caerulea	Blue-gray Gnatcatcher	179853	G5	S4B	M		
110			Troglodytidae	Troglodytes aedon	House Wren	178541	G5	S5B	B		
111			Troglodytidae	Troglodytes hiemalis	Winter Wren	916803	G5	S4B,S4N	W		
112				Thryothorus ludovicianus	Carolina Wren	178581	G5	S5	R		
113			Sturnidae	Sturnus vulgaris	European Starling	179637	G5	SNA	R		
114				Dumetella carolinensis	Gray Catbird	178625	G5	S5B,S2N	B		
115			Mimidae	Toxostoma rufum	Brown Thrasher	178627	G5	S4	R		
116				Mimus polyglottos	Northern Mockingbird	178620	G5	S5	R		
117				Sialia sialis	Eastern Bluebird	179801	G5	S3B,S4N	R		
118				Catharus fuscescens	Veery	179796	G5	S5B	B		
119			Turdidae	Catharus ustulatus	Swainson's Thrush	179788	G5	S2B,S5N	B		
120				Catharus guttatus	Hermit Thrush	179779	G5	S5B	B		
121				Hylocichla mustelina	Wood Thrush	179777	G4	S5B	B		
122				Turdus migratorius	American Robin	179759	G5	S5	R		
123			Bombycillidae	Bombycilla cedrorum	Cedar Waxwing	178532	G5	S5	R		
124			Passeridae	Passer domesticus	House Sparrow	179628	G5	SNA	R		
125			Motacillidae	Anthus rubescens	American Pipit	554127	G5	S4N	W		
126				Carpodacus mexicanus	House Finch	179191	G5	SNA	R		
127				Carpodacus purpureus	Purple Finch	179186	G5	S4	R		
128				Acanthis flammea	Common Redpoll	179241	G5	S4N	E		
129			Fringillidae	Loxia curvirostra	Red Crossbill	179259	G5	S1B,S4N	R/E		
130	Aves	Passeriformes		Loxia leucoptera	White-winged Crossbill	179268	G5	S1B,S4N	W/E		
131				Spinus pinus	Pine Siskin	179246	G5	S3B,S5N	N		
132				Spinus tristis	American Goldfinch	179249	G5	S5	R		
133			Calcariidae	Calcarius lapponicus	Lapland Longspur	179526	G5	S4N	M		
134				Plectrophenax nivalis	Snow Bunting	179532	G5	S5N	W		
135				Ammodramus savannarum	Grasshopper Sparrow	179333	G5	S3B	B	T	
136				Spizella passerina	Chipping Sparrow	179435	G5	S5B	R		
137				Spizella pallida	Clay-colored Sparrow	179439	G5	S2N	B		
138			Passerellidae	Spizella pusilla	Field Sparrow	179443	G5	S3S4	R		
139				Spizella arborea	American Tree Sparrow	179432	G5	S5N	W		
140				Passerella iliaca	Fox Sparrow	179464	G5	S4N	W		
141				Junco hyemalis	Dark-eyed Junco	179410	G5	S5	W		
142				Zonotrichia leucophrys	White-crowned Sparrow	179455	G5	S4N	W		
143				Zonotrichia albicollis	White-throated Sparrow	179462	G5	S5	W		
144				Poocetes gramineus	Vesper Sparrow	179366	G5	S1S2B,S3N	B	T	
145			Passerellidae	Passerculus sandwichensis	Savannah Sparrow	179314	G5	S4B,S5M	R		
146				Melospiza melodia	Song Sparrow	179492	G5	S5	R		
147				Melospiza georgiana	Swamp Sparrow	179488	G5	S5B,S5N	W		
148				Pipilo erythrophthalmus	Eastern Towhee	179276	G5	S4B	B		
149				Sturnella magna	Eastern Meadowlark	179034	G5	S3	R	SC	
150				Icterus spurius	Orchard Oriole	179064	G5	S3B	B		
151				Icterus galbula	Baltimore Oriole	179083	G5	S5B	B		
152			Icteridae	Agelaius phoeniceus	Red-winged Blackbird	179045	G5	S5	B		
153				Molothrus ater	Brown-headed Cowbird	179112	G5	S5	R		
154				Euphagus carolinus	Rusty Blackbird	179091	G4	S1?B,S3N	M		
155				Quiscalus quiscula	Common Grackle	179104	G5	S5	W		
156			Parulidae	Seiurus aurocapilla	Ovenbird	726205	G5	S5B	B		

BIRDS

#	Class	Order	Family	Binomial	Common Name	ITIS#	G Rank	S Rank	Occurrence	State Status*	Federal Status
157				Seiurus noveboracensis	Northern Waterthrush	178931	G5	S4B	M		
158				Vermivora pinus	Blue-winged Warbler	178853	G5	S3S4B	B		
159				Mniotilta varia	Black-and-white Warbler	178844	G5	S5B	B		
160				Vermivora peregrina	Tennessee Warbler	178855	G5	S4N	M		
161				Vermivora celata	Orange-crowned Warbler	178856	G5	S2N	M		
162				Vermivora ruficapilla	Nashville Warbler	178861	G5	S4B	M		
163				Geothlypis philadelphia	Mourning Warbler	950024	G5	S2B,S2N	M	SC*	
164				Geothlypis trichas	Common Yellowthroat	178944	G5	S5B	B		
165				Setophaga ruticilla	American Redstart	178979	G5	S5B	M		
166				Dendroica tigrina	Cape May Warbler	178887	G5	S3N	M		
167				Setophaga americana	Northern Parula	950033	G5	S1B,S4M	M	T*	
168			Parulidae	Dendroica magnolia	Magnolia Warbler	178886	G5	S4B,S5M	M		
169				Dendroica castanea	Bay-breasted Warbler	178912	G5	S5N	M		
170	Aves	Passeriformes		Dendroica fusca	Blackburnian Warbler	178904	G5	S4B	M		
171				Dendroica petechia	Yellow Warbler	178878	G5	S5B	B		
172				Dendroica pensylvanica	Chestnut-sided Warbler	178911	G5	S5B	M		
173				Setophaga striata	Blackpoll Warbler	950041	G5	S1B,S5M	M	SC*	
174				Dendroica caerulescens	Black-throated Blue Warbler	178888	G5	S4B	M		
175				Dendroica palmarum	Palm Warbler	178921	G5	S5N	W		
176				Dendroica pinus	Pine Warbler	178914	G5	S4B	R		
177				Dendroica coronata	Yellow-rumped Warbler	178891	G5	S5B,S5M,S3N	W		
178				Dendroica discolor	Prairie Warbler	178918	G5	S3S4B	B		
179				Dendroica virens	Black-throated Green Warbler	178898	G5	S5B	M		
180				Piranga olivacea	Scarlet Tanager	179883	G5	S5B	B		
181				Cardinalis cardinalis	Northern Cardinal	179124	G5	S5	R		
182			Cardinalidae	Pheucticus ludovicianus	Rose-breasted Grosbeak	179139	G5	S5B	M		
183				Passerina caerulea	Blue Grosbeak	726198	G5	S1N	B		
184				Passerina cyanea	Indigo Bunting	179150	G5	S4B	B		

*Several species of bird are listed specifically as breeders and not for wintering or migrant habitat/populations. (e.g., <https://www.mass.gov/doc/avian-record-acceptance-requirements/download>)

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
1	Eriocranioidea	Eriocraniidae	[Eriocraniinae]	Dyseriocrania griseocapitella	Chinquapin Leaf-miner Moth		3				
2			Tineidae (unplaced)	Xylesthia pruniramiella	Clemens' Bark Moth		317				
3		Tineidae	Acrolophinae	Acrolophus arcanela	Grass Tubeworm Moth		340				
4	Tineoidea			Acrolophus popeanella	Clemens' Grass Tubeworm Moth		373				
5			Tineinae	Monopis longella			418.1				
6		Psychidae	Psychinae	Psyche casta	Common Bagworm Moth		437				
7	Gracillarioidea	Gracillariidae	Parornichinae	Parornix obliterella			678				
8			Lithocolletinae	Phyllonorycter quercialbella			785				
9			Depressariinae	Semioscopis inornata			914				
10			Depressariidae	Machimia tentoriferella	Gold-striped Leaf-tier Moth		951				
11			(unplaced)	Psilocorsis quercicella	Oak Leaf-tier Moth		955				
12		Depressariidae		Antaeotricha schlaegeri	Schlaeger's Fruitworm Moth		1011				
13			Stenomatinae	Antaeotricha unipunctella			1013				
14				Antaeotricha leucillana	Pale Gray Bird-dropping Moth		1014				
15				Antaeotricha osseella			1015				
16		Oecophoridae	Oecophorinae	Epicallima argenticinctella	Orange-headed Epicallima Moth		1046				
17				Promalactis suzukiella	Suzuki's Promalactis Moth		1047.1				
18		Elachistidae	Elachistinae	Elachista irrorata			1100				
19		Autostichidae	Glyphidocerinae	Glyphidocera septentrionella			1142				
20		Blastobasidae	Blastobasinae	Blastobasis glandulella	Acorn Moth		1162				
21			Holcocerinae	Holcocera vellella			1206.1				
22		Coleophoridae		Coleophoridae sp.			1357				
23		Cosmopterigidae	Antequerinae	Euclementia bassettella	Kermes Scale Moth		1467				
24	Gelechioidea		Chrysopeleiinae	Walshia miscecolorella	Sweetclover Root Borer Moth		1615				
25			Anomologinae	Stereomita andropogonis			1725				
26				Aristotelia roseosuffusella			1761				
27				Coleotechnites florum	Coleotechnites Flower Moth		1809				
28				Exoteleia pinifoliella	Pine Needleminer Moth		1840				
29			Gelechiinae	Pubitelfhusa latifasciella			1857				
30				Telfhusa longifasciella			1858				
31				Gnorimoschema gallaesolidaginis	Goldenrod Gall Moth		1986				
32		Gelechiidae	Anomologinae	Ptycerata busckella			2044				
33			Gelechiinae	Chionodes abella			2055				
34				Aroga compositella	Six-spotted Aroga Moth		2187				
35			Anacampsininae	Battaristis vittella	Stripe-backed Moth		2229				
36				Anacampsis innocuella	Dark-headed Aspen Leafroller Moth		2237				
37				Dichomeris bipunctellus			2274				
38			Dichomeridinae	Dichomeris ventrellus			2287				
39				Dichomeris flavocostella	Cream-edged Dichomeris Moth		2295				
40		Attevidae	[Attevininae]	Atteva aurea	Ailanthus Webworm Moth		2401				
41	Yponomeutoidea	Yponomeutidae	Yponomeutinae	Zelleria retiniella			2431				
42		Argyresthiidae	[Argyresthiinae]	Argyresthia oreasella	Cherry Shoot Borer Moth		2467				
43		Sesiidae	Sesiinae	Synanthedon acerni	Maple Callus Borer Moth		2554				
44	Cossoidea	Cossidae	Cossinae	Prionoxystus robiniae	Carpenterworm Moth	117911	2693	G5	SNR		
45				Bactra verutana	Javelin Moth		2707				
46				Zomaria interruptolineana	Broken-line Zomaria Moth		2750				
47	Tortricoidea	Tortricidae	Olethreutinae	Apotomis albeolana			2763				
48				Orthotaenia undulana	Dusky Leafroller Moth		2770				
49				Phaecasiophora confixana	Macramé Moth		2771				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
50				Olethreutes comandranum			2777				
51				Olethreutes olivaceana	Olivaceous Olethreutes Moth		2778				
52				Olethreutes electrofuscum			2781				
53				Olethreutes diallacta			2783				
54				Olethreutes inornatana	Inornate Olethreutes Moth		2788				
55				Olethreutes merrickana			2803				
56				Olethreutes valdanum			2812				
57				Olethreutes permundana	Raspberry Leafroller Moth		2817				
58				Olethreutes appendiceum	Serviceberry Leafroller Moth		2821				
59				Olethreutes fasciatana			2823				
60				Olethreutes griseoalbana	Putty-patched Moth		2828				
61				Olethreutes astrologana	The Astronomer Moth		2837				
62				Celypha cespitana	Celypha Moth		2859				
63				Hedya separatana	Pink-washed Leafroller Moth		2860				
64				Evora hemidesma	Spirea Leaf-tier Moth		2866				
65				Rhyacionia rigidana	Pitch Pine Tip Moth		2868				
66				Rhyacionia adana	Adana Pine Tip Moth		2877				
67				Rhyacionia frustrana	Nantucket Pine Tip Moth		2882				
68				Retinia comstockiana	Pitch Twig Moth		2889				
69				Retinia gemistrigulana			2898				
70				Eucosma essexana	Essex Phaneta Moth		2910				
71				Eucosma ochrocephala	Pale-headed Phaneta Moth		2927				
72				Eucosma raracana	Reddish Phaneta Moth		2928				
73				Eucosma parmatana			2937				
74	Tortricoidea	Tortricidae	Olethreutinae	Eucosma kiscana			2982				
75				Eucosma olivaceana	Olivaceous Phaneta Moth		2998				
76				Pelochrista ridingsana	Snakeweed Borer Moth		3014				
77				Pelochrista argentifurcatana			3014.2				
78				Pelochrista argentialbana			3038				
79				Pelochrista albiguttana			3043				
80				Eucopina cocana	Shortleaf Pinecone Borer Moth		3072				
81				Eucopina tocullionana	White Pinecone Borer Moth		3074				
82				Pelochrista dorsisignatana	Triangle-backed Eucosma Moth		3116				
83				Pelochrista derelicta	Derelict Eucosma Moth		3120				
84				Pelochrista cataclystiana	Solidaga Pelochrista Moth		3142				
85				Epiblema boxcana			3171				
86				Epiblema strenuana	Ragweed Borer Moth		3172				
87				Epiblema abruptana	Abrupt Epiblema Moth		3173				
88				Epiblema tripartitana			3184				
89				Epiblema scudderiana	Goldenrod Gall Moth		3186				
90				Epiblema desertana			3190				
91				Epiblema otiosana	Bidens Borer Moth		3202				
92				Notocelia rosaecolana	Doubleday's Notocelia Moth		3208				
93				Sonia constrictana	Constricted Sonia Moth		3218				
94				Sonia paraplesiana	Hebrew Sonia Moth		3218.1				
95				Sonia canadana	Canadian Sonia Moth		3219				
96				Gypsonoma fasciolana			3223				
97				Gypsonoma substitutionis			3227				
98				Proteoteras aesculana	Maple Twig Borer Moth		3230				

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#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
99				<i>Pseudexentera oregonana</i>			3248				
100				<i>Pseudexentera spoliata</i>	Bare-patched Leafroller Moth		3251				
101				<i>Pseudexentera vaccinii</i>			3254.1				
102				<i>Pseudexentera hodsoni</i>			3257.1				
103				<i>Gretchena watchungana</i>			3261				
104				<i>Chimoptesis pennsylvaniana</i>	Filigreed Moth		3273				
105				<i>Epinotia momonana</i>			3312				
106				<i>Ancylis nubeculana</i>	Little Cloud Ancylys Moth		3354				
107			Olethreutinae	<i>Ancylis laciniana</i>			3366				
108				<i>Ancylis burgessiana</i>	Oak Leafroller Moth		3367				
109				<i>Ancylis n. sp. nr. comptana</i>			3374.1				
110				<i>Ancylis divisana</i>	Two-toned Ancylys Moth		3375				
111				<i>Ancylis albacostana</i>	White-edged Ancylys Moth		3387				
112				<i>Sereda tautana</i>	Speckled Sereda Moth		3425				
113				<i>Grapholita tristrigana</i>	Three-lined Grapholita Moth		3443				
114				<i>Cydia latiferreana</i>	Filbertworm Moth		3494				
115				<i>Gymnandrosoma punctidiscanum</i>	Dotted Ecdytolopha Moth		3495				
116				<i>Acleris curvalana</i>	Blueberry Leaf-tier Moth		3504				
117				<i>Acleris schalleriana</i>	Schaller's Acleris Moth		3527				
118				<i>Acleris fragariana</i>			3532				
119				<i>Acleris maculidorsana</i>	Stained-back Leafroller Moth		3543				
120				<i>Acleris minuta</i>	Yellowheaded Fireworm Moth		3545				
121				<i>Acleris busckana</i>			3558				
122				<i>Eulia ministrana</i>	Ferruginous Eulia Moth		3565				
123	Tortricoidea	Tortricidae		<i>Pandemis heparana</i>	Dark Fruit-tree Tortrix Moth		3592.1				
124				<i>Pandemis lamprosana</i>	Woodgrain Leafroller Moth		3593				
125				<i>Pandemis limitata</i>	Three-lined Leafroller Moth		3594				
126				<i>Argyrotaenia velutinana</i>	Red-banded Leafroller Moth		3597				
127				<i>Argyrotaenia tabulana</i>	Jack Pine Tube Moth		3603				
128				<i>Argyrotaenia quercifolia</i>	Yellow-winged Oak Leafroller Moth		3623				
129				<i>Argyrotaenia mariana</i>	Gray-banded Leafroller Moth		3625				
130				<i>Choristoneura obsoletana</i>			3631				
131				<i>Choristoneura fractivittana</i>	Broken-banded Leafroller Moth	117860	3632				
132			Tortricinae	<i>Choristoneura sp. nr. zapulata</i>			3634.1				
133				<i>Choristoneura rosaceana</i>	Oblique-banded Leafroller Moth		3635				
134				<i>Choristoneura conflictana</i>	Large Aspen Tortrix Moth		3637				
135				<i>Choristoneura pinus</i>	Jack Pine Budworm Moth	117864	3643				
136				<i>Archips semiferanus</i>	Oak Leafroller Moth		3653				
137				<i>Archips ferveridana</i>	Oak Webworm Moth	117883	3655				
138				<i>Syndemis afflictana</i>	Gray Leafroller Moth		3672				
139				<i>Clepsia peritana</i>	Garden Tortrix Moth		3688				
140				<i>Clepsia virescana</i>			3689				
141				<i>Sparganothis sulfureana</i>	Sparganothis Fruitworm Moth		3695				
142				<i>Sparganothis lycopodiana</i>			3697				
143				<i>Sparganothis xanthoides</i>	Mosaic Sparganothis Moth		3706				
144				<i>Sparganothis violaceana</i>			3710				
145				<i>Sparganothis unifasciana</i>	One-lined Sparganothis Moth		3711				
146				<i>Cenopsis reticulatana</i>	Reticulated Fruitworm Moth		3720				
147				<i>Cenopsis directana</i>	Chokecherry Leafroller Moth		3722				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status	
148	Tortricoidea	Tortricidae	Tortricinae	<i>Platynota flavedana</i>	Black-shaded Platynota Moth		3732					
149				<i>Platynota idaeusalis</i>	Tufted Apple Budmoth		3740					
150				<i>Amorbia humerosana</i>	White-line Leafroller Moth		3748					
151				Chlidanotinae	<i>Thaumato-grapha jonesi</i>	Psychedelic Jones Moth		3751				
152				Tortricinae	<i>Aethes argentiimitana</i>			3754.2				
153			<i>Eugnosta bimaculana</i>				3763					
154				Zygaenidae	Procridinae	<i>Pyromorpha dimidiata</i>	Orange-patched Smoky Moth		4639			
155				Megalopygidae	Megalopyginae	<i>Megalopyge crispata</i>	Black-waved Flannel Moth		4644			
156						<i>Tortricidia testacea</i>	Early Button Slug Moth		4652			
157						<i>Tortricidia flexuosa</i>	Abbreviated Button Slug Moth		4654			
158				<i>Packardia geminata</i>	Jeweled Tailed Slug Moth		4659					
159				<i>Lithacodes fiskeanus</i>			4663					
160	Zygaenoidea	Limacodidae	Limacodinae	<i>Lithacodes fasciola</i>	Yellow-shouldered Slug Moth		4665					
161				<i>Apoda y-inversum</i>	Yellow-collared Slug Moth		4667					
162				<i>Apoda biguttata</i>	Shagreened Slug Moth		4669					
163				<i>Prolimacodes badia</i>	Skiff Moth		4671					
164				<i>Isa textula</i>	Crowned Slug Moth		4681					
165				<i>Adoneta spinuloides</i>	Purple-crested Slug Moth		117614	4685				
166				<i>Euclea delphinii</i>	Spiny Oak-slug Moth		117619	4697				
167						<i>Scoparia biplagiialis</i>	Double-striped Scoparia Moth		4716			
168					Scopariinae	<i>Scoparia basalis</i>	Many-spotted Scoparia Moth		4719			
169						<i>Eudonia heterosalis</i>			4739			
170				<i>Elophila icciusalis</i>	Pondside Pyralid Moth		4748					
171				<i>Elophila gyralis</i>	Waterlily Borer Moth		4751					
172			Acentropinae	<i>Parapohnx maculalis</i>	Polymorphic Pondweed Moth	117715	4759					
173		<i>Parapohnx obscuralis</i>		Obscure Pondweed Moth	117716	4760						
174		<i>Parapohnx seminealis</i>		Floating-heart Waterlily Moth		4763						
175		<i>Parapohnx allionealis</i>		Watermilfoil Leafcutter Moth	117719	4764						
176		<i>Eoparargyractis plevie</i>				4787						
177					<i>Glaphyria sesquialis</i>	White-roped Glaphyria Moth		4870				
178			Glaphyriinae	<i>Aethiophysa invisalis</i>			4877					
179		<i>Xanthophysa psychialis</i>		Xanthophysa Moth		4879						
180		<i>Chalcoela iphitalis</i>		Sooty-winged Chalcoela Moth		4895						
181	Pyraloidea	Crambidae		<i>Ostrinia nubilalis</i>	European Corn Borer Moth	117738	4949					
182				<i>Perispasta caeculalis</i>	Titian Peale's Pyralid Moth	117740	4951					
183				<i>Anania tertialis</i>	Crowned Phlyctaenia Moth		4953					
184					Pyraustinae	<i>Hahncappsia marculenta</i>			4962			
185				<i>Hahncappsia pergivalis</i>			4968					
186				<i>Achyra rantalis</i>		Garden Webworm Moth		4975				
187				<i>Sitochroa dasconalis</i>			4986					
188						<i>Loxostege cereralis</i>	Alfalfa Webworm Moth		5017			
189						<i>Udea rubigalis</i>	Celery Leaf-tier Moth		5079			
190						<i>Nomophila nearctica</i>	Lucerne Moth		5156			
191			<i>Desmia funeralis</i>	Grape Leaf-folding Moth		5159						
192		Spilomelinae	<i>Desmia maculalis</i>			5160						
193			<i>Hymenia perspectalis</i>	Spotted Beet Webworm Moth		5169						
194			<i>Spoladea recurvalis</i>	Hawaiian Beet Webworm Moth		5170						
195			<i>Anageshna primordialis</i>	Yellow-spotted Webworm Moth		5176						
196			<i>Apogeshna stenialis</i>	Checkered Apogeshna Moth		5177						

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197				<i>Pantographa limata</i>	Basswood Leafroller Moth		5241				
198			Spilomelinae	<i>Diastictis ventralis</i>	White-spotted Brown Moth		5255				
199				<i>Herpetogramma aeglealis</i>	Serpentine Webworm Moth		5280				
200				<i>Crambus praefectellus</i>	Common Grass-veneer Moth		5355				
201				<i>Crambus leachellus</i>	Leach's Grass-veneer Moth		5357				
202				<i>Crambus albellus</i>	Small White Grass-veneer Moth		5361				
203				<i>Crambus agitatellus</i>	Double-banded Grass-veneer Moth		5362				
204				<i>Crambus saltuellus</i>	Pasture Grass-veneer Moth		5363				
205				<i>Crambus laqueatellus</i>	Eastern Grass-veneer Moth		5378				
206				<i>Neodactria caliginosellus</i>	Corn Root Webworm Moth		5381				
207				<i>Neodactria murellus</i>			5382				
208				<i>Chrysoteuchia topiarius</i>	Topiary Grass-veneer Moth		5391				
209				<i>Raphiptera argillaceellus</i>	Diminutive Grass-veneer Moth		5393				
210				<i>Platytes vobisne</i>			5394				
211		Crambidae		<i>Agriphila ruricolellus</i>	Lesser Vagabond Sod Webworm		5399				
212			Crambinae	<i>Agriphila vulgivagellus</i>	Vagabond Crambus Moth		5403				
213				<i>Pediasia trisecta</i>	Sod Webworm Moth		5413				
214				<i>Pediasia laciniellus</i>			5414				
215				<i>Microcrambus elegans</i>	Elegant Grass-veneer Moth	117823	5420				
216				<i>Fissicrambus mutabilis</i>	Changeable Grass-veneer Moth		5435				
217				<i>Thaumatopsis pectinifer</i>			5447				
218				<i>Parapediasia decorellus</i>	Graceful Grass-veneer Moth		5450				
219				<i>Parapediasia teterellus</i>	Bluegrass Webworm Moth		5451				
220				<i>Argyria nummulalis</i>			5460				
221	Pyraloidea			<i>Argyria rufisignella</i>	Mother-of-pearl Moth		5462				
222				<i>Urola nivalis</i>	Snowy Urola Moth	117815	5464				
223				<i>Argyria auratella</i>	Curve-lined Argyria Moth		5465				
224				<i>Argyria critica</i>	Straight-lined Argyria Moth		5466				
225				<i>Eoreuma densellus</i>	Wainscot Grass-veneer Moth		5492				
226				<i>Aglossa cuprina</i>	Grease Moth		5518				
227			Pyralinae	<i>Hypsopygia costalis</i>	Clover Hayworm Moth		5524				
228				<i>Hypsopygia binodulalis</i>	Pink-fringed Dolichomia Moth		5530				
229				<i>Hypsopygia olinalis</i>	Yellow-fringed Dolichomia Moth		5533				
230				<i>Arta statalis</i>	Posturing Arta Moth		5566				
231			Chrysauginae	<i>Condylolomia participalis</i>	Drab Condylolomia Moth		5571				
232				<i>Macalla zelleri</i>	Zeller's Macalla Moth		5579				
233				<i>Oneida lunulalis</i>	Orange-tufted Oneida Moth		5588				
234				<i>Pococera robustella</i>	Pine Webworm Moth		5595				
235			Epipaschiinae	<i>Pococera asperatella</i>	Maple Webworm Moth		5606				
236		Pyralidae		<i>Pococera expandens</i>	Striped Oak Webworm Moth		5608				
237				<i>Pococera baptisiella</i>			5619				
238			Galleriinae	<i>Aphomia sociella</i>	The Bee Moth		5629				
239				<i>Acrobasis indigenella</i>	Leaf Crumpler Moth		5651				
240				<i>Acrobasis coryliella</i>			5682				
241				<i>Acrobasis comptoniella</i>	Sweetfern Leaf Casebearer Moth		5691				
242			Phycitinae	<i>Tulsa finitella</i>			5809				
243				<i>Pyla fusca</i>	Speckled Black Pyla Moth		5829				
244				<i>Dioryctria disclusa</i>	Webbing Coneworm Moth		5847				
245				<i>Dioryctria zimmermani</i>	Zimmerman Pine Moth		5852				

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246				Eulogia ochrifrontella	Broad-banded Eulogia Moth		5999						
247				Ephestiodes infimella			6001						
248				Moodna ostrinella	Darker Moodna Moth		6005						
249	Pyraloidea	Pyrilidae	Phycitinae	Moodna pallidostrinella	Paler Moodna Moth		6005.1						
250				Bandera binotella			6024						
251				Cabnia myronella			6037						
252				Peoria bipartitella			6043						
253				Peoria approximella			Carmine Snout Moth		6053				
254							Geina tenuidactylus	Himmelman's Plume Moth		6092			
255	Pterophoroidea	Pterophoridae	Pterophorinae	Stenoptilia pallistriga			6145						
256					Thyatirinae	Pseudothyatira cymatophoroides	Tufted Thyatirid Moth		6237				
257	Drepanoidea	Drepanidae	Drepaninae	Drepana arcuata	Arched Hooktip Moth	189065	6251						
258				Oreta rosea	Rose Hooktip Moth	189061	6255						
259				Heliomata cycladata	Common Spring Moth	942176	6261						
260				Protitame virginalis	Virgin Moth	942635	6270						
261				Eumacaria madopata	Brown-bordered Geometer Moth	941950	6272	G5	S3S4				
262				Macaria pustularia	Lesser Maple Spanworm Moth	943055	6273						
263				Macaria argillacearia	Mousy Angle Moth		6282						
264				Macaria sulphurea	Sulphur Angle Moth		6283						
265				Macaria exonerata	Pine Barrens Speranza		6285.1	G3G4	S2S3	SC			
266				Macaria aemulataria	Common Angle Moth	942368	6326						
267				Macaria notata	Birch Angle Moth	942382	6330						
268				Macaria transitaria	Blurry Chocolate Angle Moth	942394	6339						
269				Macaria minorata	Minor Angle Moth	942380	6340						
270				Macaria bicolorata	Bicolored Angle Moth	942370	6341						
271				Macaria bisignata	Red-headed Inchworm Moth	942371	6342						
272				Macaria sexmaculata	Six-spotted Angle Moth	942390	6343						
273				Macaria pinistrobata	White Pine Angle Moth	942386	6347						
274				Macaria granitata	Granite Moth	942376	6352						
275				Macaria multilineata	Many-lined Angle Moth	942381	6353						
276	Geometroidea	Geometridae	Ennominae	Digrammia continuata	Curve-lined Angle Moth	941795	6362						
277				Digrammia ocellinata	Faint-spotted Angle Moth	941818	6386						
278				Orthofidonia tinctaria		942504	6428						
279				Ematurga amitaria	Cranberry Spanworm Moth	941863	6436						
280				Hypomecis umbrosaria	Umber Moth	942269	6439	G4	S2S3				
281				Glenoides texanaria	Texas Gray Moth	942170	6443	G5	SU				
282				Glena cribrataria	Dotted Gray Moth	942161	6449						
283				Glena cognataria	Blueberry Gray Moth	942160	6450	G4	S3S4				
284				Aethalura intertexta	Four-Barred Gray Moth	941658	6570						
285				Iridopsis vellivolata	Large Purplish Gray Moth	942313	6582						
286				Iridopsis ephyraria	Pale-winged Gray Moth	942302	6583						
287				Iridopsis humaria	Small Purplish Gray Moth	942305	6584						
288				Iridopsis larvaria	Bent-line Gray Moth	189279	6588						
289				Anavitrinella pampinaria	Common Gray Moth	189275	6590						
290				Cleora projecta	Projecta Gray Moth	941755	6595	G4	SU				
291				Ectropis crepuscularia	Small Engrailed Moth	189283	6597						
292				Protoboarmia porcelaria	Porcelain Gray Moth	189273	6598						
293				Epimecis hortaria	Tulip-tree Beauty Moth	941888	6599						
294				Melanolophia canadaria	Canadian Melanolophia Moth	942398	6620						

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
295				Melanolophia signataria	Signate Melanolophia Moth	942402	6621				
296				Eufidonia convergaria		189268	6637				
297				Eufidonia notataria	Powder Moth	941941	6638				
298				Eufidonia discospilata	Sharp-lined Powder Moth	189269	6639				
299				Biston betularia	Peppered Moth	117560	6640				
300				Lycia ypsilon	Woolly Gray Moth	942362	6652	G4	S1		T
301				Hypagyrtis unipunctata	One-spotted Variant Moth	942264	6654				
302				Hypagyrtis esther	Esther Moth	942263	6655				
303				Hypagyrtis piniata	Pine Measuringworm Moth	189271	6656				
304				Phigalia titea	Half-wing Moth	942572	6658				
305				Lomographa semiclarata	Bluish Spring Moth	189248	6666				
306				Lomographa vestaliata	White Spring Moth	189249	6667				
307				Lomographa glomeraria	Gray Spring Moth	189250	6668				
308				Cabera erythemaria	Yellow-dusted Cream Moth	189254	6677				
309				Ilexia intractata	Black-dotted Ruddy Moth	943007	6711	GNR	SU		
310				Lytrosis unitaria	Common Lytrosis Moth	942366	6720				
311				Euchlaena serrata	Saw-wing Moth	941936	6724				
312				Euchlaena muzaria	Muzaria Euchlaena Moth	941933	6725				
313				Euchlaena effecta	Effective Euchlaena Moth	941925	6728				
314				Euchlaena johnsonaria	Johnson's Euchlaena Moth	941927	6729				
315				Euchlaena madusaria	Scrub Euchlaena Moth	941928	6731	G5	S2S3		SC
316				Euchlaena marginaria	Ochre Euchlaena Moth	941930	6734				
317				Euchlaena irraria	Least-marked Euchlaena Moth	941926	6739				
318				Xanthotype urticaria	False Crocus Geometer Moth	942956	6740				
319	Geometroidea	Geometridae	Ennominae	Xanthotype sospeta	Crocus Geometer Moth	942955	6743				
320				Pero ancetaria	Hubner's Pero Moth	942537	6748				
321				Pero honestaria	Honest Pero Moth	189312	6753				
322				Pero morrisonaria	Morrison's Pero Moth	189313	6755				
323				Phaeoura quernaria	Oak Beauty Moth	942563	6763				
324				Campaea perlata	Pale Beauty Moth	189289	6796				
325				Ennomos magnaria	Maple Spanworm Moth	941868	6797				
326				Ennomos subsignaria	Elm Spanworm Moth	117566	6798				
327				Petrophora divisata	Common Petrophora Moth	942554	6803				
328				Petrophora subaequaria	Northern Petrophora Moth	942555	6804				
329				Tacparia zalissaria		942893	6805				
330				Tacparia atropunctata		942891	6806				
331				Tacparia detersata	Pale Alder Moth	942892	6807				
332				Homochlodes fritillaria	Pale Homochlodes Moth	189291	6812				
333				Gueneria similaria		942173	6815				
334				Metanema inatormaria	Pale Metanema Moth	189306	6819				
335				Metarranthis duaria	Ruddy Metarranthis Moth	189304	6822				
336				Metarranthis angularia	Angled Metarranthis Moth	942416	6823				
337				Metarranthis amyrisaria		942415	6824				
338				Metarranthis indeclinata	Pale Metarranthis Moth	942420	6825				
339				Metarranthis hypochraria	Common Metarranthis Moth	942419	6826				
340				Metarranthis refractaria	Refracted Metarranthis Moth	942425	6827				
341				Metarranthis n.sp.nr. lateritaria			6829.1				
342				Metarranthis pilosaria	Heath Metarranthis	942424	6830	G3G4	S2S3		SC
343				Metarranthis obfirmaria	Yellow-washed Metarranthis Moth	942423	6832				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
344				Cepphis armataria	Scallop Moth	941727	6835				
345				Plagodis pulveraria	American Barred Umber Moth	942594	6836				
346				Probole alienaria	Alien Probole Moth	942608	6837				
347				Probole amicaria	Friendly Probole Moth	942609	6838				
348				Probole nepiasaria	Heath Probole Moth	942610	6839				
349				Plagodis serinaria	Lemon Plagodis Moth	942595	6840				
350				Plagodis phlogosaria	Straight-lined Plagodis Moth	189293	6842				
351				Plagodis fervidaria	Fervid Plagodis Moth	942592	6843				
352				Plagodis alcoolaria	Hollow-spotted Plagodis Moth	942591	6844				
353				Caripeta piniata	Northern Pine Looper Moth	189318	6864				
354				Caripeta sp. nr. piniata			6864.1				
355				Besma endropiaria	Straw Besma Moth	941704	6884				
356			Ennominae	Besma quercivoraria	Oak Besma Moth	189321	6885				
357				Lambdina fiscellaria	Hemlock Looper Moth	117576	6888				
358				Lambdina pellucidaria	Yellow-headed Looper Moth	117580	6892				
359				Lambdina fervidaria	Curve-lined Looper Moth	942320	6894				
360				Cingilia catenaria	Chain-dotted Geometer Moth	117564	6898	G5	S2S3	SC	
361				Eusarca confusaria	Confused Eusarca Moth	942089	6941				
362				Tetracis crocallata	Yellow Slant-line Moth	942901	6963				
363				Tetracis cachexiata	White Slant-Line Moth	942900	6964				
364				Eugonobapta nivosaria	Snowy Geometer Moth	941942	6965				
365				Eutrapela clemataria	Curve-toothed Geometer Moth	942106	6966				
366				Patalene olyzonaria	Juniper Geometer Moth	942525	6974				
367				Prochoerodes lineola	Large Maple Spanworm Moth	942614	6982				
368	Geometroidea	Geometridae		Antepione thisoaria	Variable Antepione Moth	941678	6987				
369				Nematocampa resistaria	Horned Spanworm Moth	942435	7010				
370				Nemoria bistriaria	Red-fringed Emerald Moth	942442	7046				
371				Nemoria rubrifrontaria	Red-fronted Emerald Moth	942463	7047				
372				Nemoria mimosaria	White-Fringed Emerald Moth	942456	7048				
373			Geometrinae	Dichorda iridaria	Showy Emerald Moth	941786	7053				
374				Synchlora aerata	Wavy-lined Emerald Moth	942878	7058				
375				Chlorochlamys chloroleucaria	Blackberry Looper Moth	941744	7071				
376				Hethemia pistasciaria	Pistachio Emerald Moth	942191	7084				
377				Lobocleta ossularia	Drab Brown Wave Moth	942346	7094				
378				Idea dimidiata	Single-dotted Wave Moth	942274	7126				
379				Pleuroprucha insulsaria	Common Tan Wave Moth	942605	7132				
380			Sterrhinae	Cyclophora packardi	Packard's Wave Moth	941776	7136				
381				Cyclophora pendulinaria	Sweetfern Geometer Moth	189138	7139				
382				Scopula cacuminaria	Frosted Tan Wave Moth	942707	7157				
383				Scopula limboundata	Large Lace-border Moth	942713	7159				
384				Scopula junctaria	Simple Wave Moth	189132	7164				
385			Sterrhinae	Scopula inductata	Soft-lined Wave Moth	189134	7169				
386				Eulithis diversilineata	Lesser Grapevine Looper Moth	117570	7196				
387				Eulithis explanata	White Eulithis Moth	189075	7206				
388				Hydriomena renunciata	Renounced Hydriomena Moth	189194	7236				
389			Larentiinae	Hydriomena transfigurata	Transfigured Hydriomena Moth		7237				
390				Rheumaptera prunivorata	Ferguson's Scallop Shell Moth	942677	7292				
391				Rheumaptera hastata	Spear-Marked Black Moth	189232	7293				
392				Xanthorhoe lacustrata	Toothed Brown Carpet Moth	189197	7390				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status			
393				Euphyia intermediata	Sharp-angled Carpet Moth	941953	7399							
394				Orthonama obstipata	Gem Moth	189214	7414							
395				Costaconvexa centrostrigaria	Bent-line Carpet Moth	941769	7416							
396				Hydrelia condensata		942207	7420							
397				Eubaphe mendica	Beggar Moth	941917	7440							
398	Geometroidea	Geometridae	Larentiinae	Eupithecia palpata	Small Pine Looper Moth	189082	7449							
399				Eupithecia miserulata	Common Eupithecia Moth	942026	7474							
400				Pasiphila rectangulata	Green Pug Moth	942522	7625							
401				Cladara limitaria	Mottled Gray Carpet Moth	189147	7637							
402				Cladara anguilineata	Angle-lined Carpet Moth	941754	7638							
403				Cladara atroliturata	Scribbler Moth	189148	7639							
404				Lobophora nivigerata	Powdered Bigwing Moth	189151	7640							
405	Mimallonoidea	Mimallonidae	[Mimalloninae]	Lacosoma chiridota	Scalloped Sack-bearer Moth		7659							
406			Cicinnus melsheimeri	Melsheimer's Sack-bearer Moth			7662	G4	S2S3	T				
407	Bombycoidea	Apatelodidae	[Apatelodinae]	Apatelodes torrefacta	Spotted Apatelodes Moth		7663							
408			Macromphaliinae	Tolype vellea	Large Tolype Moth		7670							
409				Tolype laricis	Larch Tolype Moth		7673							
410	Lasiocampoidea	Lasiocampidae		Phyllodesma americana	Lappet Moth	117550	7687							
411				Lasiocampinae	Malacosoma disstria	Forest Tent Caterpillar Moth	117544	7698						
412					Malacosoma americana	Eastern Tent Caterpillar Moth		7701						
413				Dryocampa rubicunda	Rosy Maple Moth	936177	7715							
414			Ceratocampinae	Anisota stigma	Spiny Oakworm Moth	936154	7716	G5	S3					
415				Anisota virginensis	Pink-striped Oakworm Moth	936147	7723							
416		Saturniidae	Hemileucinae	Hemileuca maia	Buck Moth	936200	7730	G5	S2S3	SC				
417				Automeris io	Io Moth	936158	7746							
418					Antheraea polyphemus	Polyphemus Moth	189057	7757						
419				Saturniinae	Callosamia promethea	Promethea Moth	936189	7764						
420					Hyalophora cecropia	Cecropia Moth	936196	7767						
421	Bombycoidea			Dolba hyloeus	Pawpaw Sphinx Moth	936043	7784							
422				Sphinx gordius	Apple Sphinx Moth	188623	7810	G4G5	S2S4					
423			Sphinginae		Sphinx poecila	Northern Apple Sphinx Moth	936133	7810.1						
424					Sphinx drupiferarum	Wild Cherry Sphinx Moth	188624	7812	G3G5	SU				
425					Lapara coniferarum	Southern Pine Sphinx Moth	936081	7816	G5	S4				
426			Sphingidae		Lapara bombycoides	Northern Pine Sphinx Moth	936080	7817						
427						Smerinthus jamaicensis	Twin-spotted Sphinx Moth	188626	7821					
428					Smerinthinae	Paonias excaecata	Blind-eyed Sphinx Moth	936107	7824					
429						Paonias myops	Small-eyed Sphinx Moth	936108	7825					
430						Paonias astylus	Huckleberry Sphinx Moth	936106	7826					
431				Hemaris thysbe	Hummingbird Clearwing Moth	188633	7853							
432			Macroglossinae	Hemaris gracilis	Slender Clearwing Sphinx Moth	936069	7854	G3G4	S2S3	SC				
433				Hemaris diffinis	Snowberry Clearwing Moth	936068	7855							
434				Eumorpha pandorus	Pandorus Sphinx Moth	936062	7859							
435				Eumorpha achemon	Achemon Sphinx Moth	936056	7861							
436	Bombycoidea	Sphingidae	Macroglossinae	Sphecodina abbottii	Abbot's Sphinx Moth	936122	7870							
437						Amphion floridensis	Nessus Sphinx Moth	936022	7873					
438						Darapsa myron	Virginia Creeper Sphinx Moth	936039	7885					
439							Darapsa choerilus	Azalea Sphinx Moth	936038	7886				
440							Hyles lineata	White-lined Sphinx Moth	936075	7894				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status	
441			Pygaerinae	<i>Clostera albosigma</i>	Sigmoid Prominent Moth	936745	7895					
442				<i>Clostera strigosa</i>	Striped Chocolate-tip Moth	936751	7898					
443				<i>Datana ministra</i>	Yellow-necked Caterpillar Moth	117515	7902					
444			Phalerinae	<i>Datana drexelii</i>	Drexel's Datana Moth	936760	7904					
445				<i>Nadata gibbosa</i>	White-dotted Prominent Moth	189053	7915					
446			Notodontinae	<i>Paraeschra georgica</i>	Georgian Prominent Moth		7917					
447				<i>Peridea basitriens</i>	Oval-Based Prominent Moth	936846	7919					
448			Phalerinae	<i>Peridea angulosa</i>	Angulose Prominent Moth	936845	7920					
449				<i>Peridea ferruginea</i>	Chocolate Prominent Moth	936847	7921					
450				<i>Pheosia rimosa</i>	Black-rimmed Prominent Moth	936848	7922					
451			Notodontinae	<i>Notodonta scitipennis</i>	Finned-willow Prominent Moth	936828	7926					
452				<i>Gluphisia septentrionis</i>	Common Gluphisia Moth	936779	7931					
453				<i>Furcula borealis</i>	White Furcula Moth	936771	7936					
454			Cerurinae	<i>Furcula modesta</i>	Modest Furcula Moth	936773	7941	G4G5	SU			
455				<i>Tecmessa scitiscrupta</i>	Black-etched Prominent Moth		7942					
456		Notodontidae	Nystaleinae	<i>Symmerista albifrons</i>	White-headed Prominent Moth	936860	7951					
457				<i>Dasylophia anguina</i>	Black-spotted Prominent Moth	936753	7957					
458				<i>Macrocampa marthesia</i>	Mottled Prominent Moth	936822	7975					
459				<i>Heterocampa obliqua</i>	Oblique Heterocampa Moth	936794	7983					
460				<i>Heterocampa umbrata</i>	White-blotched Heterocampa Moth	936800	7990					
461				<i>Heterocampa guttivitta</i>	Saddled Prominent Moth	117517	7994					
462				<i>Heterocampa biundata</i>	Wavy-Lined Heterocampa Moth	936789	7995					
463				<i>Lochmaeus manteo</i>	Variable Oakleaf Caterpillar Moth	936820	7998					
464					<i>Schizura ipomaeae</i>	Morning-glory Prominent Moth		8005				
465	Noctuoidea			Heterocampinae	<i>Schizura badia</i>	Chestnut Schizura Moth	936856	8006				
466				<i>Schizura unicornis</i>	Unicorn Caterpillar Moth	117523	8007					
467				<i>Schizura apicalis</i>	Plaine Schizura Moth	936855	8009	G3G4	S1S2			
468				<i>Schizura concinna</i>	Red-humped Caterpillar Moth	117522	8010	G5	SU			
469				<i>Schizura leptinoides</i>	Black-blotched Schizura Moth	936859	8011					
470				<i>Oligocentria semirufescens</i>	Red-washed Prominent Moth	936843	8012					
471				<i>Oligocentria lignicolor</i>	White-streaked Prominent Moth	936838	8017					
472				<i>Hyperpax aurora</i>	Pink Prominent Moth	936805	8022	G5	SU			
473				<i>Crambidia pallida</i>	Pale Lichen Moth	938318	8045.1					
474				<i>Crambidia uniformis</i>	Uniform Lichen Moth	938321	8046					
475				<i>Cisthene packardii</i>	Packard's Lichen Moth	938217	8072	G5	SU			
476				<i>Hypoprepia fucosa</i>	Painted Lichen Moth	939128	8090					
477				<i>Haploa clymene</i>	Clymene Moth	938962	8107					
478				<i>Virbia laeta</i>	Joyful Holomelina Moth	940676	8114					
479				<i>Virbia opella</i>	Tawny Holomelina Moth	940680	8118					
480				<i>Virbia aurantiaca</i>	Orange Holomelina Moth	940670	8121					
481		Erebidae	Arctiinae	<i>Virbia ferruginosa</i>	Rusty Holomelina Moth	940673	8123					
482				<i>Pyrrharctia isabella</i>	Isabella Tiger Moth	117310	8129					
483				<i>Estigmene acrea</i>	Salt Marsh Moth	117299	8131					
484				<i>Spilosoma latipennis</i>	Pink-legged Tiger Moth	940314	8133					
485				<i>Spilosoma congrua</i>	Agreeable Tiger Moth	940311	8134					
486				<i>Spilosoma dubia</i>	Dubious Tiger Moth	940313	8136	G5	SU			
487				<i>Spilosoma virginica</i>	Virginian Tiger Moth	117312	8137					
488					<i>Hyphantria cunea</i>	Fall Webworm Moth	117304	8140				
489					<i>Hypercompe scribonia</i>	Giant Leopard Moth	939113	8146				

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#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
490				<i>Phragmatobia fuliginosa</i>	Ruby Tiger Moth	188651	8156				
491				<i>Phragmatobia lineata</i>	Lined Ruby Tiger Moth	939859	8157				
492				<i>Phragmatobia assimilans</i>	Large Ruby Tiger Moth	939858	8158				
493				<i>Apantesis phalerata</i>	Harnessed Tiger Moth	937871	8169	G5	SU		
494				<i>Apantesis nais</i>	Nais Tiger Moth	937870	8171	G5	SU		
495				<i>Apantesis carlotta</i>	Carlotta's Tiger Moth	937869	8171.1	G5	SU		
496				<i>Apantesis figurata</i>	Figured Tiger Moth		8188				
497				<i>Apantesis parthenice</i>	Parthenice Tiger Moth	188654	8196				
498			Arctiinae	<i>Apantesis virgo</i>	Virgin Tiger Moth	188653	8197				
499				<i>Halysidota tessellaris</i>	Banded Tussock Moth	938961	8203				
500				<i>Lophocampa caryae</i>	Hickory Tussock Moth	117307	8211				
501				<i>Cycnia collaris</i>	Collared Cycnia	938382	8229	G4	S2	T	
502				<i>Cycnia tenera</i>	Delicate Cycnia Moth	938385	8230				
503				<i>Cycnia oregonensis</i>	Oregon Cycnia Moth	938384	8231				
504				<i>Euchaetes egle</i>	Milkweed Tussock Moth	938578	8238				
505				<i>Ctenucha virginica</i>	Virginia Ctenucha Moth	188644	8262				
506				<i>Cisseps fulvicollis</i>	Yellow-collared Scape Moth	938199	8267				
507				<i>Dasychira vagans</i>	Variable Tussock Moth		8294				
508				<i>Dasychira basiflava</i>	Yellow-based Tussock Moth	938401	8296				
509				<i>Dasychira cinnamomea</i>	Cinnamon Tussock Moth	938402	8300				
510			Lymantriinae	<i>Dasychira obliquata</i>	Streaked Tussock Moth	938411	8302				
511				<i>Dasychira pinicola</i>	Pine Tussock Moth	938412	8305	G4	S4		
512				<i>Orgyia definita</i>	Definite Tussock Moth	939670	8314				
513				<i>Orgyia leucostigma</i>	White-marked Tussock Moth	709251	8316				
514	Noctuoidea	Erebidae		<i>Lymantria dispar</i>	Gypsy Moth	709249	8318				
515				<i>Idia americalis</i>	American Idia Moth	939153	8322				
516				<i>Idia aemula</i>	Common Idia Moth	939152	8323				
517				<i>Idia sp. nr. concisa</i>			8323.1				
518				<i>Idia rotundalis</i>	Rotund Idia Moth	939165	8326				
519				<i>Idia forbesii</i>		939156	8327				
520				<i>Idia julia</i>		939159	8328				
521				<i>Idia diminuendis</i>	Orange-spotted Idia Moth	939155	8329				
522				<i>Idia scobialis</i>	Smoky Idia Moth	939166	8330				
523				<i>Idia lubricalis</i>	Glossy Black Idia Moth	939161	8334				
524				<i>Phalaenophana pyramusalis</i>	Dark-banded Owlet Moth	939833	8338				
525				<i>Zanclognatha lituralis</i>	Lettered Zanclognatha Moth	940742	8340				
526			Herminiinae	<i>Zanclognatha theralis</i>		940750	8341	G4	S2S3		
527				<i>Zanclognatha laevigata</i>	Variable Zanclognatha Moth	940741	8345				
528				<i>Zanclognatha obscuripennis</i>	Dark Zanclognatha Moth	940747	8347				
529				<i>Zanclognatha protumnusalis</i>		940749	8349				
530				<i>Zanclognatha dentata</i>		941097	8349.1				
531				<i>Zanclognatha cruralis</i>	Early Zanclognatha Moth	940739	8351				
532				<i>Zanclognatha marcidilinea</i>	Yellowish Zanclognatha Moth	940744	8352				
533				<i>Zanclognatha jacchusalis</i>	Wavy-lined Zanclognatha Moth	940740	8353				
534				<i>Chytolita morbidalis</i>	Morbid Owlet Moth	938192	8355				
535				<i>Macrochilo absorptalis</i>	Slant-lined Owlet Moth	939435	8357				
536				<i>Macrochilo litophora</i>	Brown-lined Owlet Moth	939438	8358				
537				<i>Macrochilo orciferalis</i>	Bronzy Macrochilo Moth	939440	8360				
538				<i>Phalaenostola metonalis</i>	Pale Phalaenostola Moth	939837	8362				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
539				Phalaenostola larentioides	Black-banded Owlet Moth	939836	8364				
540				Tetanolita mynesalis	Smoky Tetanolita Moth	940590	8366				
541				Bleptina caradrinalis	Bent-winged Owlet Moth	937992	8370				
542				Renia salusalis		940121	8378				
543				Renia factiosalis	Sociable Renia Moth	940113	8379				
544				Renia nemoralis	Chocolate Renia Moth	940118	8380	G4		S1S2	
545			Herminiinae	Renia discoloralis	Discolored Renia Moth	940112	8381				
546				Renia flavipunctalis	Yellow-spotted Renia Moth	940114	8384.1				
547				Renia adspersigillus	Speckled Renia Moth	940111	8386				
548				Renia sobrialis	Sober Renia Moth	940122	8387				
549				Lascoria ambigualis	Ambiguous Moth	939251	8393				
550				Palthis angulalis	Dark-spotted Palthis Moth	189038	8397				
551				Redectis vitrea	White-spotted Redectis Moth	940108	8401				
552			Hypeninae	Colobochyla interpuncta	Yellow-lined Owlet Moth	938242	8411				
553				Melanomma auricinctaria	Gold-lined Melanomma Moth	939482	8412				
554				Hyphenodes fractilinea	Broken-line Hyphenodes Moth	939102	8421				
555			Hyphenodinae	Dyspyralis illocata	Visitation Moth	938496	8426				
556				Dyspyralis puncticosta	Spot-edged Dyspyralis Moth	938499	8427				
557				Dyspyralis nigellus		938497	8428				
558				Hypena manalis	Flowing-line Bomolocha Moth	939088	8441				
559				Hypena baltimoralis	Baltimore Bomolocha Moth	939077	8442				
560			Hypheninae	Hypena palparia	Mottled Bomolocha Moth	939091	8444				
561				Hypena madefactalis	Gray-edged Bomolocha Moth	939087	8447				
562				Hypena scabra	Green Cloverworm Moth	939094	8465				
563	Noctuoidea	Erebidae	Boletobiinae	Spargaloma sexpunctata	Six-spotted Gray Moth	940307	8479				
564			Pangraptinae	Pangrapta decoralis	Decorated Owlet Moth	939746	8490				
565				Ledaea perditalis	Lost Owlet Moth	939298	8491				
566				Metalectra discalis	Common Fungus Moth	939513	8499				
567			Boletobiinae	Metalectra quadrisignata	Four-spotted Fungus Moth	939517	8500				
568				Metalectra richardsi	Richards' Fungus Moth	939518	8505	G4		SU	
569			Scolecocampinae	Gabara subnivosella		938857	8522				
570			Eulepidotinae	Phyprosopus callitrichoides	Curve-lined Owlet Moth	939862	8525				
571			Calpinae	Calyptra canadensis	Canadian Owlet Moth	938038	8536				
572				Rusicada privata	Hibiscus-leaf Caterpillar Moth		8547				
573			Scoliopteryginae	Scoliopteryx libatrix	Herald Moth	189022	8555				
574				Anticarsia gemmatalis	Velvetbean Caterpillar Moth	117365	8574				
575			Eulepidotinae	Panopoda rufimargo	Red-lined Panopoda Moth	939750	8587				
576				Panopoda carneicosta	Brown Panopoda Moth	939747	8588				
577				Phoberia atomaris	Common Oak Moth	939841	8591				
578				Drasteria graphica	Graphic Moth	938469	8618				
579				Drasteria occulta	Occult Drasteria Moth	938478	8619	G4		SNR	
580				Zale lunata	Lunate Zale Moth	940714	8689				
581				Zale aeruginosa	Green-dusted Zale Moth	940697	8694				
582			Erebinae	Zale minerea	Colorful Zale Moth	940718	8697				
583				Zale obliqua	Oblique Zale Moth	940719	8699	G5		S4	
584				Zale submediana		940730	8702	G4		S4	
585				Zale duplicata	Pine False Looper Moth	940706	8703				
586				Zale helata	Brown-spotted Zale Moth	940711	8704				
587				Zale metatoides	Washed-out Zale Moth	940717	8707				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
588				Zale curema	Northeastern Pine Zale	940704	8709	G4	S4		
589				Zale lunifera	Pine Barrens Zale	940715	8713	G3G4	S2S3	SC	
590				Zale intenta		941085	8713.1				
591				Zale unilineata	One-lined Zale Moth	940733	8716				
592				Zale horrida	Horrid Zale Moth	940712	8717				
593				Euparthenos nubilus	Locust Underwing Moth	938620	8719				
594				Allotria elonympha	False Underwing Moth	937695	8721				
595				Parallelia bistriaris	Maple Looper Moth	939807	8727				
596				Euclidia cuspeida	Toothed Somberwing Moth	938590	8731				
597				Caenurgia chloropha	Vetch Looper Moth	938024	8733				
598				Caenurgina crassiuscula	Clover Looper Moth	117378	8738				
599				Caenurgina erechtea	Forage Looper Moth	938028	8739				
600				Mocis latipes	Small Mocis Moth	939546	8743				
601				Mocis texana	Texas Mocis Moth	939548	8745				
602				Argyrostromis anilis	Short-lined Chocolate Moth	937888	8764				
603				Catocala muliercula	Little Wife Underwing Moth	938131	8774	G5	S2S4		
604				Catocala antinympha	Sweetfern Underwing Moth	938073	8775	G5	SNR		
605				Catocala badia	Bay Underwing Moth	938075	8777	G4	S4		
606				Catocala badia badia	Bay Underwing Moth	941260	8777.1				
607	Erebidae		Erebinae	Catocala palaeogama	Oldwife Underwing Moth	938138	8795	G5	SNR		
608				Catocala ilia	Ilia Underwing Moth	189015	8801	G5	SNR		
609				Catocala umbrosa	Umber Underwing Moth	938155	8801.1	G5	SU		
610				Catocala relictata	White Underwing Moth	189016	8803	G5	SNR		
611				Catocala unijuga	Once-married Underwing Moth	189017	8805	G5	SNR		
612	Noctuoidea			Catocala sordida	Sordid Underwing Moth	938150	8846	G5	SNR		
613				Catocala gracilis	Graceful Underwing Moth	938100	8847	G5	SNR		
614				Catocala andromedae	Andromeda Underwing Moth	938071	8849	G5	SNR		
615				Catocala herodias	Herodias Underwing Moth	938106	8850	G3	S2S3	SC	
616				Catocala coccinata	Scarlet Underwing Moth	938086	8851	G5	SNR		
617				Catocala ultronia	Ultronia Underwing Moth	938154	8857	G5	SNR		
618				Catocala grynea	Woody Underwing Moth	938103	8864	G5	SNR		
619				Catocala praeclara	Praeclara Underwing Moth	938141	8865	G5	SNR		
620				Catocala similis	Similar Underwing Moth	938149	8873	G5	SNR		
621				Catocala micronympha	Little Nymph Underwing Moth	938127	8876	G5	SNR		
622				Catocala amica	Girlfriend Underwing Moth	938069	8878	G5	SNR		
623				Catocala lineella	Little Lined Underwing Moth	938118	8878.1	G5	SNR		
624				Catocala sp. nr. lineella			8878.2				
625				Catocala sp. nr. jair			8879.2				
626				Chrysodeixis includens	Soybean Looper Moth	938187	8890				
627				Diachrysis aereoides	Dark-spotted Looper Moth	938419	8896				
628				Pseudeva purpurigera	Straight-lined Looper Moth	189011	8899				
629				Chrysanympa formosa	Formosa Looper Moth	189013	8904				
630	Noctuidae		Plusiinae	Autographa precatonnis	Common Looper Moth	937936	8908				
631				Autographa ampla	Large Looper Moth	188688	8923				
632				Anagrapha falcifera	Celery Looper Moth	117363	8924				
633				Syngrapha octoscripta	Dusky Silver Y Moth	189001	8926				
634				Marathyssa inficita	Dark Marathyssa Moth	939452	8955				
635	Euteliidae		Euteliinae	Marathyssa basalis	Light Marathyssa Moth	939451	8956				
636				Paectes oculatrix	Eyed Paectes Moth	939741	8957				

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#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
637		Euteliidae	Euteliinae	Paectes pygmaea	Pygmy Paectes Moth	939742	8959				
638	Paectes abrostoloides			Large Paectes Moth	939732	8962					
639	Risobiinae		Baileya ophthalmica	Eyed Baileya Moth	937970	8970					
640	Chloephorinae		Nycteola frigidana	Frigid Owlet Moth	188980	8975					
641		Nolidae	Nolinae	Meganola minuscula	Confused Meganola Moth	939474	8983				
642	Meganola phylla			Coastal Plain Meganola Moth	939475	8983.1					
643	Meganola spodia			Ashy Meganola Moth	939476	8983.2					
644	Nola pustulata			Sharp-blotched Nola Moth	939637	8989					
645	Nola clethrae			Sweet Pepperbush Nola Moth	939632	8996					
646		Erebidae	Boletobiinae	Oruza albocostaliata	White Edge Moth	939710	9025				
647	Hyperstrotia villificans			White-lined Graylet Moth	939121	9038					
648	Hyperstrotia flaviguttata			Yellow-spotted Graylet Moth	939117	9039					
649	Hyperstrotia secta		Black-patched Graylet Moth	939120	9040						
650	Marimatha nigrofimbria		Black-bordered Lemon Moth	939456	9044	G5	SU				
651	Deltote bellacula		Bog Lithacodia Moth	938417	9046						
652	Eustrotiinae		Protodeltote muscosula	Large Mossy Lithacodia Moth	939968	9047					
653			Protodeltote albidula	Pale Glyph Moth	939967	9048					
654	Maliattha synochitis		Black-dotted Lithacodia Moth	939446	9049						
655	Noctuiinae		Pseudeustrotia carneola	Pink-barred Lithacodia Moth	940044	9053					
656	Condicinae	Homophoberia apicosa	Black Wedge-spot Moth	117501	9057						
657	Acronictinae	Cerma cerintha	Tufted Bird-dropping Moth	938169	9062						
658	Condicinae	Leuconycta diphteroides	Green Leuconycta Moth	939344	9065						
659	Acontiinae	Ponometia candefacta	Olive-shaded Bird-dropping Moth	939922	9090						
660	Bagisarinae	Bagisara rectifascia	Straight Lined Mallow Moth	937961	9169	G4	S2S3				
661	Noctuoidea	Noctuidae	Pantheinae	Panthea furcilla	Eastern Panthea Moth	939752	9182				
662	Colocasia propinquilinea			Closebanded Yellowhorn Moth	938244	9185					
663	Charadra deridens			Laughter Moth	938182	9189					
664	Raphiinae		Raphia frater	Brother Moth	188730	9193					
665	Acronicta rubricoma		Ruddy Dagger Moth		9199						
666	Acronicta americana		American Dagger Moth	117343	9200						
667	Acronicta innotata		Unmarked Dagger Moth	188666	9207						
668	Acronicta tritona		Triton Dagger Moth	937648	9211						
669	Acronicta albarufa		Barrens Dagger Moth	937591	9216	G3G4	S2S3	T			
670	Acronicta superans		Splendid Dagger Moth	188669	9226						
671	Acronicta hasta	Speared Dagger Moth	937611	9229							
672	Acronicta lobeliae	Greater Oak Dagger Moth	937623	9238							
673	Acronicta ovata	Ovate Dagger Moth	937630	9243							
674	Acronicta modica	Medium Dagger Moth	937626	9244							
675	Acronictinae	Acronicta haesitata	Hesitant Dagger Moth	937609	9245						
676		Acronicta tristis		937647	9247						
677		Acronicta increta	Southern Oak Dagger Moth	937616	9249						
678		Acronicta inclara	Unclear Dagger Moth	937615	9250						
679		Acronicta retardata	Retarded Dagger Moth	937636	9251						
680		Acronicta afflicta	Afflicted Dagger Moth	937590	9254						
681		Acronicta sperata		937640	9258						
682		Acronicta noctivaga	Night-Wandering Dagger Moth	937628	9259						
683		Acronicta longa	Long-winged Dagger Moth	188673	9264						
684		Acronicta lithospila	Streaked Dagger Moth	937622	9266						
685	Acronicta oblinita	Smearred Dagger Moth	117345	9272							

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#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
686				Acronicta fallax	Green Marvel Moth		9281				
687			Acronictinae	Polygrammate hebraeicum	Hebrew Moth	939914	9285				
688				Harrisimemna trisignata	Harris's Three-spot Moth	117494	9286				
689			Agaristinae	Eudryas unio	Pearly Wood-nymph Moth	938607	9299				
690				Apamea verbascoides		188681	9326				
691				Apamea inebriata	Drunk Apamea Moth	937836	9327	G3G4	S2S3	SC	
692				Apamea cariosa		937823	9329				
693				Apamea vulgaris	Common Apamea Moth	937864	9332				
694				Apamea lignicolora	Wood-colored Apamea Moth	937839	9333				
695				Apamea amputatrix	Yellow-headed Cutworm Moth	117367	9348				
696				Apamea inordinata		937838	9353				
697				Apamea impulsa		188685	9360				
698				Apamea unanimitis	Small Clouded Brindle Moth	937862	9362.2				
699				Apamea sordens	Bordered Apamea Moth	937859	9364				
700				Apamea dubitans	Doubtful Apamea Moth	937831	9367				
701				Apamea helva	Yellow Three-Spot Moth	937835	9373				
702				Apamea burgessi		937822	9378	G4	S4		
703				Apamea devastator	Glassy Cutworm Moth	117368	9382				
704				Laterologia ophiogramma	Double Lobed Moth	939297	9385.1				
705				Apamea lintneri	Sand Wainscot Moth	937840	9395	G4	SU		
706				Oligia modica	Black-banded Brocade Moth	117430	9404				
707				Mesapamea fractilinea	Broken-lined Brocade Moth	939505	9406				
708				Neologia exhausta	Exhausted Brocade Moth	939595	9408	GNR	SU		
709				Oligia strigilis	Marbled Minor Moth	939662	9415.1				
710	Noctuoidea	Noctuidae		Platypolia mactata	Adorable Brocade Moth	939889	9419				
711				Fishia illocata	Wandering Brocade Moth	938842	9420				
712			Noctuinae	Meropleon diversicolor	Multicolored Sedgeminer Moth	939501	9427				
713				Parastichtis suspecta		939819	9431				
714				Xylomoia chagnoni		940692	9433				
715				Photedes enervata		939854	9441				
716				Rhizedra lutosa	Large Wainscot Moth	940136	9447.2				
717				Helotropha reniformis	Reniform Celaena Moth	117506	9453				
718				Loscopia velata	Veiled Ear Moth	939419	9454				
719				Amphipoea interoceanica	Interoceanic Ear Moth	937710	9456				
720				Amphipoea americana	American Ear Moth	188943	9457				
721				Papaipema sulphurata	Water-willow Stem Borer Moth	939798	9467	G2	S2	T	
722				Papaipema pterisii	Bracken Borer Moth	188719	9480				
723				Papaipema inquaesita	Sensitive Fern Borer Moth	939778	9483	G5	SNR		
724				Papaipema baptisiae	Wild Indigo Stem Borer Moth	939765	9485	G4G5	SNR		
725				Achatodes zaeae	Elder Shoot Borer Moth	117339	9520				
726				Iodopepla u-album	White-eyed Borer Moth	939171	9522	G5	SU		
727				Euplexia benesimilis	American Angle Shades Moth	188947	9545				
728				Phlogophora iris	Olive Angle Shades Moth	188949	9546				
729				Phlogophora periculosa	Brown Angle Shades Moth	188950	9547				
730				Ipimorpha pleonectusa	Even-lined Sallow Moth	188940	9555				
731				Chytonix palliatricula	Cloaked Marvel Moth	938193	9556				
732				Chytonix sensilis	Barrens Chytonix Moth	938195	9557	G4	S1S3		
733				Dypterygia rozmani	American Bird's-wing Moth	938495	9560				
734				Hyppa xylinoides	Common Hyppa Moth	188961	9578				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
735				Nedra ramosula	Gray Half-spot Moth	188957	9582				
736			Noctuinae	Phosphila turbulenta	Turbulent Phosphila Moth	939850	9618				
737				Phosphila miselioides	Spotted Phosphila Moth	939849	9619				
738				Fagitana littera	Marsh Fern Moth	938814	9629	G4	S2S4		
739			Eriopinae	Callopietria mollissima	Pink-shaded Fern Moth	938036	9631				
740				Callopietria cordata	Silver-spotted Fern Moth	938033	9633				
741			Noctuinae	Magusa divaricata	Orbed Narrow-wing Moth	939443	9637.1				
742			Amphipyriinae	Amphipyra pyramidoides	Copper Underwing Moth	188954	9638				
743				Proxenus miranda	Miranda Moth	940008	9647				
744			Noctuinae	Athetis tarda	Slowpoke Moth	937926	9650				
745				Caradrina meralis	Rare Sand Quaker Moth	938050	9654	G5	S1S2		
746				Balsa malana	Many-dotted Appleworm Moth	937972	9662				
747			Balsinae	Balsa tristigella	Three-lined Balsa Moth	937973	9663				
748				Balsa labecula	White-blotched Balsa Moth	937971	9664				
749				Spodoptera frugiperda	Fall Armyworm Moth	117472	9666				
750				Spodoptera ornithogalli	Yellow-striped Armyworm Moth	117474	9669				
751				Elaphria versicolor	Variegated Midget Moth	188966	9678				
752			Noctuinae	Elaphria chalconia	Chalcedony Midget Moth	938522	9679				
753				Elaphria festivoides	Festive Midget Moth	188967	9681				
754				Elaphria alapallida	Pale-winged Midget Moth	938521	9681.1				
755				Galgula partita	Wedgling Moth	938858	9688				
756				Condica videns	White-dotted Groundling Moth	938273	9690				
757				Condica mobilis	Mobile Groundling Moth	938262	9693				
758			Condicinae	Condica vecors	Dusky Groundling Moth	938272	9696				
759	Noctuioidea	Noctuidae		Condica sutor	Cobbler Moth	938269	9699				
760				Condica cupentia	Spotched Groundling Moth	938255	9713				
761			Noctuinae	Cosmia calami	American Dun-bar Moth	938303	9815				
762			Erebinae	Amolita fessa	Feeble Grass Moth	937703	9818				
763				Amolita roseola		937706	9821	G5	SU		
764				Lithophane disposita	Dashed Gray Pinion Moth	939366	9892				
765				Lithophane antennata	Ashen Pinion Moth	117409	9910				
766				Lithophane grotei	Grote's Pinion Moth	939370	9915				
767				Eupsilia vinulenta	Straight-Toothed Sallow Moth	938632	9933				
768				Xystocheilus rufago	Red-winged Sallow Moth	940696	9942				
769				Metaxaglaea inulta	Unsated Sallow Moth	939523	9943				
770				Metaxaglaea viatica	Roadside Sallow Moth	939525	9944				
771				Metaxaglaea semitaria	Footpath Sallow Moth	939524	9945				
772				Epiglaea decliva	Sloping Sallow Moth	938550	9946				
773				Epiglaea apiata	Pointed Sallow Moth	188912	9947				
774			Noctuinae	Chaetaglaea cerata	Waxed Sallow Moth	938172	9948	G3G4	S1S3	SC	
775				Chaetaglaea tremula	Barrens Chaetaglaea	938175	9949	G5	S4		
776				Chaetaglaea rhonda			9949.1				
777				Chaetaglaea sericea	Silky Sallow Moth	938174	9950				
778				Psectraglaea carnosa	Pink Sallow Moth	940022	9951	G3	S2S3	SC	
779				Eucirroedia pampina	Scalloped Sallow Moth	938588	9952				
780				Sunira bicolorago	Bicolored Sallow Moth	188918	9957				
781				Anathix ralla	Dotted Sallow Moth	937744	9961				
782				Xanthia tatago	Pink-banded Sallow Moth	940686	9965				
783				Xylotype capax	Barrens Xylotype	940695	9979	G4	S4		

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#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
784			Noctuinae	<i>Sutyna privata</i>		188910	9989				
785				<i>Feralia jocosa</i>	Joker Moth	188886	10005				
786				<i>Feralia major</i>	Major Sallow Moth	938836	10007				
787			Amphipyriinae	<i>Psaphida rolandi</i>	Roland's Sallow Moth	940019	10014				
788				<i>Psaphida styracis</i>	Fawn Sallow Moth	940020	10016				
789				<i>Psaphida resumens</i>	Figure-Eight Sallow Moth	940018	10019				
790			Oncocnemidinae	<i>Sympistis dentata</i>	Blueberry Sallow Moth	940410	10055	G5	S3S4		
791				<i>Sympistis riparia</i>	Dune Sympistis	940502	10135	G4	S2S3	SC	
792				<i>Cucullia speyeri</i>	Speyer's Hooded Owlet Moth	938374	10190	G4	S3S4		
793			Cuculliinae	<i>Cucullia asteroides</i>	Asteroid Moth	188873	10200				
794				<i>Cucullia convexipennis</i>	Brown-hooded Owlet Moth	938352	10202				
795				<i>Sideridis rosea</i>	Rosewing Moth	940296	10265	G5	SNR		
796				<i>Sideridis congermana</i>	German Cousin Moth	940293	10266	GNR	SNR		
797				<i>Sideridis maryx</i>	Maroonwing Moth	188847	10268	G4	S2S4		
798				<i>Orthodes detracta</i>	Disparaged Arches Moth	939682	10288				
799				<i>Morrisonia latex</i>	Fluid Arches Moth	939551	10291				
800				<i>Lacanobia atlantica</i>	Atlantic Arches Moth	939186	10297				
801				<i>Lacanobia subjuncta</i>	Speckled Cutworm Moth	939190	10299				
802				<i>Lacanobia grandis</i>	Grand Arches Moth	939187	10300				
803				<i>Spiramater lutra</i>	Otter Spiramater Moth	940318	10301				
804				<i>Trichordestra legitima</i>	Striped Garden Caterpillar Moth	117481	10304				
805				<i>Lacinipolia meditata</i>	Thinker Moth	939221	10368				
806				<i>Lacinipolia anguina</i>	Snaky Arches Moth	188706	10372				
807				<i>Lacinipolia vicina</i>		939247	10394				
808	Noctuoidea	Noctuidae		<i>Lacinipolia renigera</i>	Bristly Cutworm Moth	117407	10397				
809				<i>Dargida diffusa</i>	Wheat Head Armyworm Moth	938392	10431				
810				<i>Dargida rubripennis</i>	Pink Streak Moth	938396	10434	G3G4	S1S2	T	
811				<i>Mythimna oxygala</i>	Lesser Wainscot Moth	939563	10436				
812				<i>Mythimna unipuncta</i>	Armyworm Moth	939565	10438				
813			Noctuinae	<i>Leucania extincta</i>		939313	10439				
814				<i>Leucania linita</i>		939324	10440				
815				<i>Leucania amygdalina</i>			10440.1				
816				<i>Leucania phragmitidicola</i>	Phragmites Wainscot Moth	939329	10444				
817				<i>Leucania linda</i>	Linda Wainscot Moth	939323	10445				
818				<i>Leucania multilinea</i>	Many-lined Wainscot Moth	939326	10446				
819				<i>Leucania lapidaria</i>		939322	10446.1				
820				<i>Leucania commoides</i>		188863	10447				
821				<i>Leucania insueta</i>		188864	10449				
822				<i>Leucania adjuta</i>	Adjutant Wainscot Moth	939308	10456				
823				<i>Leucania inermis</i>	Unarmed Wainscot Moth	939320	10459				
824				<i>Leucania ursula</i>	Ursula Wainscot Moth	939336	10461				
825				<i>Leucania pseudargyria</i>	False Wainscot Moth	939331	10462				
826				<i>Orthosia rubescens</i>	Ruby Quaker Moth	939705	10487				
827				<i>Orthosia revicta</i>	Subdued Quaker Moth	188858	10490				
828				<i>Orthosia alurina</i>	Gray Quaker Moth		10491				
829				<i>Orthosia hibisci</i>	Speckled Green Fruitworm Moth	188859	10495				
830				<i>Crocigrapha normani</i>	Norman's Quaker Moth	938324	10501				
831				<i>Orthimella fidelis</i>	Intractable Quaker Moth		10502				
832				<i>Egira alternans</i>	Alternate Woodling Moth	938505	10517				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
833				<i>Achatia distincta</i>	Distinct Quaker Moth	937578	10518				
834				<i>Morrisonia mucens</i>		939552	10519	G4G5	S1S3		
835				<i>Morrisonia evicta</i>	Bicolored Woodgrain Moth	939550	10520				
836				<i>Morrisonia confusa</i>	Confused Woodgrain Moth	939549	10521				
837				<i>Nephelodes minians</i>	Bronzed Cutworm Moth	117421	10524				
838				<i>Homorthodes furfurata</i>	Northern Scurfy Quaker Moth	939045	10532				
839				<i>Homorthodes lindseyi</i>	Southern Scurfy Quaker Moth	939048	10532.1				
840				<i>Protorthodes oviduca</i>	Ruddy Quaker Moth	188851	10563				
841				<i>Ulolonche culea</i>	Sheathed Quaker Moth	940659	10567				
842				<i>Ulolonche modesta</i>		940664	10569				
843				<i>Orthodes majuscula</i>	Rustic Quaker Moth	939685	10585				
844				<i>Orthodes cynica</i>	Cynical Quaker Moth	939680	10587				
845				<i>Tricholita signata</i>	Signate Quaker Moth	940622	10627				
846				<i>Agrotis vetusta</i>	Old Man Dart Moth	937680	10641				
847				<i>Agrotis gladiaria</i>	Swordsman Dart Moth	117351	10648				
848				<i>Agrotis venerabilis</i>	Venerable Dart Moth	188676	10651				
849				<i>Agrotis stigmosa</i>		937677	10658				
850				<i>Agrotis volubilis</i>	Voluble Dart Moth	188678	10659				
851				<i>Agrotis ipsilon</i>	Ipsilon Dart Moth	117352	10663				
852				<i>Feltia manifesta</i>		938825	10666	G4	S3S4		
853				<i>Feltia jaculifera</i>	Dingy Cutworm Moth	938824	10670				
854				<i>Feltia subgothica</i>	Subgothic Dart Moth	938829	10674				
855				<i>Feltia tricosia</i>	Confused Dart Moth	938831	10675				
856				<i>Feltia herilis</i>	Master's Dart Moth	938822	10676				
857	Noctuoidea	Noctuidae	Noctuinae	<i>Feltia geniculata</i>	Knee-joint Dart Moth	938821	10680				
858				<i>Eucptocnemis fimbriaris</i>	Fringed Dart Moth	938598	10694	G4	SU		
859				<i>Euxoa messoria</i>	Reaper Dart Moth	117387	10705				
860				<i>Euxoa pleuritica</i>	Fawn Brown Dart Moth	188697	10727	G4	S2S3		
861				<i>Euxoa velleripennis</i>	Fleece-winged Dart Moth	938804	10803				
862				<i>Euxoa tessellata</i>	Tessellate Dart Moth	117390	10805				
863				<i>Euxoa violaris</i>	Violet Dart Moth	938807	10810	G4	S3S4		
864				<i>Euxoa bostoniensis</i>	Boston Dart Moth	938666	10812				
865				<i>Euxoa obeliscoides</i>	Obelisk Dart Moth	938749	10817				
866				<i>Euxoa detersa</i>	Rubbed Dart Moth	188693	10838				
867				<i>Euxoa perpolita</i>	Polished Dart Moth	188694	10865	GNR	SNR		
868				<i>Striacosta albicosta</i>	Western Bean Cutworm Moth	940352	10878	GNR	SU		
869				<i>Ochropleura implecta</i>	Flame-shouldered Dart Moth	771402	10891				
870				<i>Anicla forbesi</i>		937763	10902				
871				<i>Anicla illapsa</i>	Snowy Dart Moth	937764	10903				
872				<i>Anicla infecta</i>	Green Cutworm Moth	937765	10911				
873				<i>Peridroma saucia</i>	Variegated Cutworm Moth	117454	10915				
874				<i>Actebia fennica</i>	Finland Dart Moth	117347	10924				
875				<i>Spaelotis clandestina</i>	Clandestine Dart Moth	771426	10926				
876				<i>Eurois occulta</i>	Great Brocade Moth	188732	10929				
877				<i>Xestia c-nigrum</i>	Lesser Black-letter Dart Moth	771442	10942				
878				<i>Xestia dolosa</i>	Greater Black-letter Dart Moth	771446	10942.1				
879				<i>Xestia normanianus</i>	Norman's Dart Moth	771465	10943				
880				<i>Xestia smithii</i>	Smith's Dart Moth	771473	10944				
881				<i>Pseudohermonassa bicarnea</i>	Pink-spotted Dart Moth	771417	10950				

Moths: Order Lepidoptera (minus Papilionoidea)

#	Superfamily	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status
882				Agnorisma badinodis	Pale-banded Dart Moth	771375	10955				
883				Xestia elimata	Southern Variable Dart Moth	771447	10967				
884				Xestia praevia	Praevia Dart Moth	771470	10968.1				
885				Xestia dilucida	Dull Reddish Dart Moth	771445	10969				
886				Cerastis fishii		771381	10997	G4	S3S4		
887				Aplectoides condita		188792	10999	G5	S3S4		
888				Anaplectoides prasina	Green Arches Moth	188795	11000				
889			Noctuinae	Noctua pronuba	Large Yellow Underwing Moth	771401	11003.1				
890				Protolampra brunneicollis	Brown-collared Dart Moth	771416	11006				
891				Eueretagrotis attentus	Attentive Dart Moth	771390	11009	G5	SU		
892				Lycophotia phyllophora	Lycophotia Moth	771399	11010				
893	Noctuoidea	Noctuidae		Abagrotis nefascia		771359	11024				
894				Abagrotis benjamini	Coastal Heathland Cutworm		11024.1	G3	S3	SC	
895				Abagrotis alternata	Greater Red Dart Moth	188804	11029				
896				Abagrotis cupida	Cupid Dart Moth	771343	11043				
897				Abagrotis brunneipennis	A Noctuid Moth	771341	11044	G4	S2S4		
898				Derrima stellata	Pink Star Moth	938418	11055	G4	S2S4		
899				Helicoverpa zea	Corn Earworm Moth	117398	11068				
900				Schinia spinosae	Spinose Flower Moth	940251	11104	G4	S2S3		
901			Heliothinae	Schinia septentrionalis	Northern Flower Moth	940244	11110	G3G4	SU		
902				Schinia arcigera	Arcigera Flower Moth	940153	11128				
903				Schinia rivulosa	Ragweed Flower Moth	940234	11135				
904				Schinia trifascia	Three-lined Flower Moth	940257	11149	G5	S3S4		

Butterflies: Order Lepidoptera, Superfamily Papilionoidea

#	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status	
1		Eudaminae	<i>Epargyreus clarus</i>	Silver-spotted Skipper	117282	3870	G5	S5			
2			<i>Thorybes bathyllus</i>	Southern Cloudywing	706829	3909	G5	S4			
3		Pyrginae	<i>Erynnis icelus</i>	Dreamy Duskywing	706743	3945	G5	S5			
4			<i>Erynnis brizo</i>	Sleepy Duskywing	706740	3946	G5	S4			
5			<i>Erynnis juvenalis</i>	Juvenal's Duskywing	706744	3947	G5	S5			
6			<i>Erynnis horatius</i>	Horace's Duskywing	706742	3952	G5	S4			
7			<i>Erynnis baptisiae</i>	Wild Indigo Duskywing	706739	3959	G5	S5			
8			<i>Ancyloxypha numitor</i>	Least Skipper	706668	4004	G5	S5			
9			<i>Thymelicus lineola</i>	European Skipper	188609	4012	G5	SNA			
10	Hesperiidae		<i>Polites peckius</i>	Peck's Skipper	706650	4036	G5	S5			
11			<i>Polites themistocles</i>	Tawny-edged Skipper	706655	4041	G5	S5			
12			<i>Polites origenes</i>	Crossline Skipper	706649	4042	G5?	S4			
13			<i>Polites mystic</i>	Long Dash	706648	4043	G5	S5			
14			Hesperiinae	<i>Wallengrenia egeremet</i>	Northern Broken-Dash	706664	4047	G5	S5		
15			<i>Pompeius verna</i>	Little Glassywing	706657	4048	G5	S4			
16			<i>Anatrytone logan</i>	Delaware Skipper	707256	4051	G5	S4			
17			<i>Poanes hobomok</i>	Hobomok Skipper	706637	4059	G5	S5			
18			<i>Poanes zabulon</i>	Zabulon Skipper	706643	4060	G5	S1S2			
19			<i>Euphyes vestris</i>	Dun Skipper	706613	4078	G5	S5			
20			<i>Atrytonopsis hianna</i>	Dusted Skipper	706596	4080	G4G5	S4			
21			<i>Papilio polyxenes</i>	Black Swallowtail	188543	4159	G5	SNR			
22	Papilionidae	Papilioninae	<i>Papilio glaucus</i>	Eastern Tiger Swallowtail	188547	4176	G5	S5			
23				<i>Papilio troilus</i>	Spicebush Swallowtail	777719	4181	G5	S5		
24		Pierinae	<i>Pieris rapae</i>	Cabbage White	188541	4197	G5	SNA			
25	Pieridae		<i>Colias philodice</i>	Clouded Sulphur	188529	4209	G5	S5			
26			Coliadinae	<i>Colias eurytheme</i>	Orange Sulphur	188528	4210	G5	S5		
27			<i>Phoebis sennae</i>	Cloudless Sulphur	777750	4228	G5	SNA			
28		Lycaeninae	<i>Lycaena phlaeas</i>	American Copper	777788	4251	G5	S5			
29			<i>Satyrrium titus</i>	Coral Hairstreak	777817	4275	G5	S4			
30			<i>Satyrrium acadica</i>	Acadian Hairstreak	777814	4278	G5	S4			
31			<i>Satyrrium edwardsii</i>	Edwards' Hairstreak	777818	4281	G4	S4			
32	Lycaenidae		<i>Satyrrium calanus</i>	Banded Hairstreak	777819	4282	G5	S5			
33			Theclinae	<i>Satyrrium liparops</i>	Striped Hairstreak	777822	4285	G5	S5		
34			<i>Callophrys gryneus</i>	Juniper Hairstreak	777841	4318	G5	S4			
35			<i>Callophrys augustinus</i>	Brown Elfin	188501	4322	G5	S5			
36			<i>Callophrys polios</i>	Hoary Elfin	777850	4324	G5	S3			
37			<i>Callophrys irus</i>	Frosted Elfin	777851	4325	G2G3	S2S3	SC	Review	

Butterflies: Order Lepidoptera, Superfamily Papilionoidea

#	Family	Subfamily	Binomial name	Common Name	ITIS TSN	Hodges#	G Rank	S Rank	State Status	Federal Status	
38	Lycaenidae	Theclinae	<i>Callophrys henrici</i>	Henry's Elfin	777852	4326	G5	S4			
39			<i>Callophrys niphon</i>	Eastern Pine Elfin	188504	4328	G5	S5			
40			<i>Satyrium favonius</i>	Oak Hairstreak	777826	4331	G4G5	S3S4			
41			<i>Strymon melinus</i>	Gray Hairstreak	117263	4336	G5	S5			
42		Polyommatainae	<i>Cupido comyntas</i>	Eastern Tailed-Blue	777889	4361	G5	S5			
43			<i>Celastrina ladon</i>	Spring Azure	777893	4363	G4G5	S5			
44			<i>Celastrina neglecta</i>	Summer Azure	777896	4363.7	G5	SNR			
45		Nymphalidae	Nymphalinae	<i>Polygonia interrogationis</i>	Question Mark	778041	4420	G5	S5		
46				<i>Nymphalis antiopa</i>	Mourning Cloak	188597	4432	G5	S5		
47				<i>Vanessa virginiensis</i>	American Lady	188600	4434	G5	S5		
48	<i>Vanessa cardui</i>			Painted Lady	188601	4435	G5	S5			
49	<i>Vanessa atalanta</i>			Red Admiral	188599	4437	G5	S5			
50	<i>Junonia coenia</i>			Common Buckeye	778049	4440	G5	S5			
51	Heliconiinae			<i>Euptoieta claudia</i>	Variegated Fritillary	777981	4447	G5	SNA		
52		<i>Boloria selene</i>	Silver-bordered Fritillary	188567	4464	G5	S5				
53	Nymphalidae	Nymphalinae	<i>Phyciodes tharos</i>	Pearl Crescent	188584	4481	G5	S5			
54			<i>Euphydryas phaeton</i>	Baltimore Checkerspot	778057	4516	G4	S4			
55		Limenitidinae	<i>Limenitis arthemis</i>	Red-spotted Admiral	188603	4522	G5	S5			
56	<i>Limenitis archippus</i>		Viceroy	777969	4523	G5	S5				
57	Satyrinae	<i>Lethe anthedon</i>	Northern Pearly Eye	778106	4568.1	G5	S5				
58		<i>Lethe eurydice</i>	Eyed Brown	778108	4568.3	G5	S4				
59		<i>Lethe appalachia</i>	Appalachian Brown	778109	4569	G4	S4				
60		<i>Megisto cymela</i>	Little Wood Satyr	778120	4578	G5	S5				
61		<i>Coenonympha tullia</i>	Common Ringlet	778111	4582	G5	S5				
62		<i>Cercyonis pegala</i>	Common Wood-Nymph	778122	4587	G5	S5				
63		Danainae	<i>Danaus plexippus</i>	Monarch	117273	4614	G4	S5			

Odonates

#	Suborder	Family	Binomial	Common Name	ITIS number	G Rank	S Rank	State Status	Federal Status
1			<i>Aeshna clepsydra</i>	Mottled Darner	592654	G4G5	S4		
2			<i>Aeshna tuberculifera</i>	Black-tipped Darner	185980	G5	S4		
3			<i>Aeshna umbrosa</i>	Shadow Darner	101605	G5	S5		
4		Aeshnidae	<i>Aeshna verticalis</i>	Green-striped Darner	101607	G5	S4S5		
5			<i>Anax junius</i>	Common Green Darner	101598	G5	S5		
6			<i>Anax longipes</i>	Comet Darner	101599	G5	S2S3		
7			<i>Rhionaeschna mutata</i>	Spatterdock Darner	722026	G4	S3		
8			<i>Dorocordulia lepida</i>	Petite Emerald	101855	G5	S3S4		
9		Corduliidae	<i>Epitheca cynosura</i>	Common Baskettail	185986	G5	S5		
10			<i>Epitheca princeps</i>	Prince Baskettail	185985	G5	S5		
11			<i>Phanogomphus exilis</i>	Lancet Clubtail	101679	G5	S5		
12		Gomphidae	<i>Progomphus obscurus</i>	Common Sanddragon	101720	G5	S3S4		
13			<i>Celithemis elisa</i>	Calico Pennant	101843	G5	S5		
14			<i>Celithemis eponina</i>	Halloween Pennant	101844	G5	S5		
15			<i>Celithemis fasciata</i>	Banded Pennant	101845	G5	S4		
16			<i>Celithemis martha</i>	Martha's Pennant	101849	G4	S3S4		
17			<i>Erythemis simplicicollis</i>	Eastern Pondhawk	101866	G5	S5		
18			<i>Erythrodiplax berenice</i>	Seaside Dragonlet	101873	G5	S4		
19	Anisoptera		<i>Ladona deplanata</i>	Blue Corporal	101882	G5	S3S4		
20	(Dragonflies)		<i>Ladona exusta</i>	White Corporal	101883	G5	S4S5		
21			<i>Leucorrhinia frigida</i>	Frosted Whiteface	101890	G5	S5		
22			<i>Leucorrhinia intacta</i>	Dot-tailed Whiteface	101888	G5	S5		
23			<i>Libellula auripennis</i>	Golden-winged Skimmer	101901	G5	S3		
24			<i>Libellula cyanea</i>	Spangled Skimmer	101899	G5	S5		
25			<i>Libellula incesta</i>	Slaty Skimmer	101900	G5	S5		
26		Libellulidae	<i>Libellula luctuosa</i>	Widow Skimmer	101894	G5	S5		
27			<i>Libellula pulchella</i>	Twelve-spotted Skimmer	101895	G5	S5		
28			<i>Libellula quadrimaculata</i>	Four-Spotted Chaser	101896	G5	S5		
29			<i>Libellula semifasciata</i>	Painted Skimmer	101903	G5	S4		
30			<i>Libellula vibrans</i>	Great Blue Skimmer	101904	G5	SNA		
31			<i>Pachydiplax longipennis</i>	Blue Dasher	101799	G5	S5		
32			<i>Pantala flavescens</i>	Wandering Glider	101801	G5	S5		
33			<i>Pantala hymenaea</i>	Spot-winged Glider	101802	G5	S5		
34			<i>Perithemis tenera</i>	Eastern Amberwing	101804	G5	S5		
35			<i>Plathemis lydia</i>	Common Whitetail	101809	G5	S5		
36			<i>Sympetrum rubicundulum</i>	Ruby Meadowhawk	101983	G5	S5		
37			<i>Sympetrum vicinum</i>	Autumn Meadowhawk	101979	G5	S5		
38			<i>Tramea carolina</i>	Carolina Saddlebags	101820	G5	S4		

Odonates

#	Suborder	Family	Binomial	Common Name	ITIS number	G Rank	S Rank	State Status	Federal Status
39	Anisoptera (Dragonflies)	Libellulidae	<i>Tramea lacerata</i>	Black Saddlebags	101822	G5	S5		
40		Macromiidae	<i>Didymops transversa</i>	Stream Cruiser	101852	G5	S5		
41			<i>Macromia illinoiensis</i>	Swift River Cruiser	101921	G5	S5		
42			<i>Argia fumipennis</i>	Variable Dancer	102143	G5	S5		
44			<i>Enallagma annexum</i>	Northern Bluet	722162	G5	S4		
45			<i>Enallagma aspersum</i>	Azure Bluet	102126	G5	S5		
46			<i>Enallagma doubledayi</i>	Atlantic Bluet	102109	G5	S3S4		
47			<i>Enallagma geminatum</i>	Skimming Bluet	102113	G5	S5		
48			<i>Enallagma laterale</i>	New England Bluet	102130	G3G4	S3		
49		Coenagrionidae	<i>Enallagma recurvatum</i>	Pine Barrens Bluet	592490	G3	S2S3	T	
50			<i>Enallagma signatum</i>	Orange Bluet	102115	G5	S5		
51			<i>Ischnura hastata</i>	Citrine Forktail	206632	G5	S3		
52	Zygoptera (Damselflies)		<i>Ischnura kellicotti</i>	Lilypad Forktail	102081	G5	S4		
53			<i>Ischnura posita</i>	Fragile Forktail	102082	G5	S5		
54			<i>Ischnura verticalis</i>	Eastern Forktail	102079	G5	S5		
55			<i>Nehalennia gracilis</i>	Sphagnum Sprite	102138	G5	S4S5		
56			<i>Nehalennia irene</i>	Sedge Sprite	102137	G5	S5		
57				<i>Lestes congener</i>	Spotted Spreadwing	102062	G5	S5	
58			<i>Lestes disjunctus</i>	Northern Spreadwing	102063	G5	S5		
59			<i>Lestes eurinus</i>	Amber-winged Spreadwing	102073	G5	S4		
60		Lestidae	<i>Lestes forcipatus</i>	Sweetflag Spreadwing	102067	G5	S4		
61			<i>Lestes rectangularis</i>	Slender Spreadwing	102071	G5	S5		
62			<i>Lestes unguiculatus</i>	Lyre-tipped Spreadwing	102068	G5	S2S3		
63			<i>Lestes vigilax</i>	Swamp Spreadwing	102072	G5	S5		

Key notes

- 1 The G-rank and S-rank designations and color scheme follow NatureServe (see image at right).
- 2 Federal (ESA) and State (MESA) status:
E: Endangered
T: Threatened
SC: Special Concern
- 3 Bird occurrence
R: resident (year-round)
B: breeding on-site
S: summer occurrence, non-breeding
W: primarily winter
M: migrant
E: Erratic (irregular and/or rare)
(F): flyover individuals only

State/Provincial Conservation Status

