102IW INRMP
Otis ANGB

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Annual Review Documents

This page is used to certify annual review and coordination of this INRMP.

With the signatures below, this acknowledges that the annual review and coordination of the INRMP has occurred for the specified year.

Installation Supplement:

Pending approval - Incorporate when finalized

Document Control

The INRMP is updated not less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. In accordance with (IAW) the Sikes Act, AFI 32-7064, *Natural Resources Management*, and ANG procedures, the INRMP is required to be reviewed for operation and effect not less than every five years. Annual reviews and updates are accomplished by the ANG Readiness Center (ANGRC) Natural Resources Program Manager and/or the installation Natural Resources Manager (NRM). The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the ANGRC Natural Resources Program Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signature to the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed updates are then made to the document, at a minimum updating the work plans.

1. Executive Summary

Installation Supplement:

The Integrated Natural Resources Management Plan (INRMP) is the primary guidance document and tool of the Massachusetts Air National Guard (MAANG) for managing natural resources at Otis Air National Guard Base (ANGB), which is part of Joint Base Cape Cod (JBCC). Otis ANGB is composed of approximately 1,328 acres over two parcels, with 1,057 acres owned by the Commonwealth of Massachusetts and 272 acres owned by the US government. All facilities are ultimately under the command of the MAANG with the primary purpose to provide the US Air Force (USAF) with combat ready personnel and equipment for utilization during times of war or national emergency and to provide assistance to the State of Massachusetts for use during local and statewide disasters or emergencies. Otis ANGB, due to its geographic location and the nature of the facility, contains diverse habitats and species that require natural resources management. The natural resources management on Otis ANGB must be conducted in a way that provides for sustainable land use, complies with applicable environmental laws and regulations and real estate leases and licenses, and provides for no net loss in the capability to support the military mission. The INRMP provides a structure and plan to manage natural resources more effectively and ensure that MAANG facilities remain available to support the installation's military mission into the future.

This INRMP is an update of the 2007 INRMP, which was originally developed in 2002. It is required as a result of the presence of significant natural resources, including the likely presence of the proposed federally endangered northern long-eared bat (*Myotis septentrionalis*), presence of state listed species, and significant vegetation management, including potentially prescribed fire. The development of the 2002 INRMP, the revision in 2007, and this update was done in cooperation with the US Fish and Wildlife Service (USFWS) and the Massachusetts Division of Fish and Wildlife (MDFW). The details of the current and future review processes are described in the INRMP Implementation, Update, and Revision Process section of the INRMP.

The Sikes Act Improvement Act (SAIA) of 1997, 16 US Code (USC) § 670a et seq., as amended, requires federal military installations with significant natural resources to develop a long-range INRMP and implement cooperative agreements with other agencies. An INRMP is required by Department of Defense (DoD) and USAF Policy for the Otis ANGB because the MAANG conducts military training that requires conservation measures to manage federal and state listed species and vegetation. The INRMP is intended to be consistent with the SAIA. Specific goals identified by the INRMP are:

GOAL PM: Manage natural resources in a manner that is compatible with and supports the military mission while complying with applicable federal and state laws and USAF regulations and policies.

GOAL FW: Maintain fish and wildlife populations by providing healthy, diverse habitat types and corridors for wildlife movement between those habitats while minimizing potential impacts to the military mission.

GOAL OR: Provide opportunities for outdoor recreation to members of the public and the military while maintaining ecosystem integrity and function as well as the safety of the public and employees.

GOAL TE: Manage threatened and endangered listed species using an ecosystem approach, while supporting the military mission.

GOAL WA: Manage stormwater and soils to protect water quality and manage water resources, including wetlands, so they remain resilient and with no net loss of acreage or functions and values.

GOAL VE: Manage vegetation to promote native species using cost effective and sustainable methods, while also minimizing the risk of uncontrollable wildfires.

GOAL IN: Minimize impacts of invasive and pest species, by utilizing an integrated pest management approach while minimizing use of chemicals to manage those species.

These goals are supported in the INRMP by objectives and projects, as well as management strategies and specific actions to achieve these goals. Goals and objectives are listed in the Management Goals and Objectives section of the INRMP, and projects and activities are summarized the Management Goals and Objectives section. This INRMP provides a description of the installation and the military missions, the environment on the installation, and specific natural resource management designed for sustainable military training. The implementation of this INRMP will ensure the successful accomplishment of the military mission while promoting adaptive management that sustains ecosystem and biological integrity and provides for multiple uses of natural resources. It will also ensure that management efforts of the MAANG at this facility is consistent, integrated and with as little redundancy as possible.

2. Overview and Scope

This INRMP was developed to provide for effective management and protection of natural resources. It summarizes the natural resources present on the installation and outlines strategies to adequately manage those resources. Natural resources are valuable assets of ANG. They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of ANG adaptability in all environments. The ANG has stewardship responsibility over the physical lands on which installations are located to ensure all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of the ANG natural resources program is to sustain, restore and modernize natural infrastructure to ensure operational capability and no net loss in the capability of ANG lands to support the military mission of the installation. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation's mission. The INRMP is intended for use by all installation personnel. The Sikes Act is the legal driver for the INRMP.

2.1. Purpose and Scope

Installation Supplement:

The Integrated Natural Resources Management Plan (INRMP) is the primary guidance document and tool for managing natural resources by the 102nd Intelligence Wing (102 IW) of the Massachusetts Air National Guard (MAANG) at Otis Air National Guard Base (ANGB). Otis ANGB is composed of approximately 1,328 acres over six parcels, with five parcels owned by the Commonwealth of Massachusetts and one owned by the US government. Otis ANGB is located within the Joint Base Cape Cod (JBCC) (formerly known as Massachusetts Military Reservation [MMR]) or on the Upper Cape of Cape Cod. The management of Otis ANGB is conducted in a way that provides for sustainable, healthy ecosystems, complies with applicable environmental laws and regulations and real estate leases and licenses, and provides for no net loss in the capability of military installation lands to support the military mission of the installation. Installation commanders can use INRMPs to manage natural resources more effectively to ensure that installation lands remain available and in good condition to support the installation's military mission over the long term.

This INRMP is intended to be consistent with the Sikes Act Improvement Act (SAIA) of 1997, 16 US Code (USC) § 670a et seq., as amended and Air Force Instruction (AFI) 32-7064, *Integrated Natural Resources Management* as required by the Department of Defense (DoD) and National Guard Bureau (NGB) (see Authority section for more information). The ultimate goal of this INRMP, as well as its subsequent updates or revisions, is to ensure long-term capability for the MAANG, while managing for sustainable natural resources at Otis ANGB. This INRMP integrates all aspects of natural resources management with the rest of the MAANG's mission, and therefore becomes the primary tool for managing the ecosystem and habitat at each facility while ensuring the successful accomplishment of the military mission at the highest possible levels of efficiency. The INRMP is the guide for the management and stewardship of all natural resources present on Otis ANGB. A multiple-use approach will be implemented to allow for the presence of mission- oriented activities, as well as protecting environmental quality through the efficient management of natural resources.

This INRMP was developed originally in 2002 as a result of the presence of state listed endangered and threatened species, and significant vegetation management requirements. The INRMP is being updated as a result of a mission change. The MAANG no longer manages the airfield and no longer has a flying mission; however, the MAANG still manages for state listed species.

2.2. Management Philosophy

Installation Supplement:

The INRMP was developed using an interdisciplinary approach and information gathered from a variety of organizations. Information and guidance was solicited from a variety of federal, state, and local agencies and groups. A Task Force was formed, which included key MAANG personnel, other DoD personnel with an interest in natural resources on JBCC, and individuals from various agencies. Representatives from the following federal and state agencies comprised the Task Force in addition to MAANG: Massachusetts Army National Guard (MAARNG), US Air Force (USAF), US Coast Guard (USCG), US Fish and Wildlife Service (USFWS), Massachusetts Division of Fish and Wildlife (MDFW), and US Department of Agriculture – Wildlife Services (USDA-WS). The INRMP Task Force ensures that information concerning the natural resources on or in the vicinity of Otis ANGB is accurate and presented in accordance with local and regional management strategies, where feasible. This approach allows for insight into possible operational alternatives, which could result in reduced impacts on the natural resources on Otis ANGB and in surrounding areas. INRMP Task Force meeting minutes and correspondence with the agencies are documented on VEMO.

Participation on the INRMP Task Force by representatives from the USFWS and the MDFW satisfies the provisions of the SAIA as described in the Authority section. The INRMP Task Force is also the venue for achieving mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources, as well as for completing the annual reviews and 5- year reviews for operation and effect as described in the Annual INRMP Review and Update Requirements section.

The INRMP presents practicable alternatives and recommendations that allow for the protection and enhancement of natural resources and conservation of existing ecosystems, while minimizing impacts on the military mission at Otis ANGB. Consequently, the implementation of some of these recommendations may sacrifice improvement of the natural resources present on Otis ANGB in deference to the safety and efficiency of the military mission.

Enabling long-term use of Otis ANGB for military training is the primary purpose of natural resources management at Otis ANGB. The Otis ANGB INRMP is a military mission-driven plan, created with the paired goals:

- To allow for and support the conduct of military training at levels necessary to maintain a full readiness posture for national defense and civil missions; and,
- To provide for sustainable management of natural resources with an ecosystem focus, consistent with federal, state, and local regulations.

The MAANG embraces the concept of integrating holistic natural resource management with mission activities. The MAANG recognizes that on-going military training and associated mission activities can consume and potentially damage the natural resources on mission land, and that successful execution of their mission in perpetuity is dependent upon sustainable land use and the conservation of these natural resources. The MAANG is committed to the planned, deliberate management of natural resources, supporting the installation operational mission, meeting

or exceeding stewardship requirements, partnering in local and regional conservation initiatives, and enhancing the quality of life for its personnel and guests.

The MAANG recognizes that it is a steward of publicly-owned natural resources and, as compatible with the military mission, safety and security requirements, that it has a responsibility to provide access for the use and enjoyment of these resources in a manner consistent with the resources' ability to support such use. The MAANG also recognizes the responsibility to ensure that the natural resources entrusted to their care are sustained in a healthy condition for scientific research, education, and other compatible uses by future generations.

Ecosystem Management

Natural resources at Otis ANGB will be managed with an ecosystem management approach as directed by AFI 32-7064 and Department of Defense Instruction (DoDI) 4715.03. Ecosystem management may be defined as management to restore and maintain the health, sustainability, and biological diversity of ecosystems while supporting sustainable economies and communities. The goal of ecosystem management on military lands is to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. As described in DoDI 4715.03 and AFI 32-7064, ecosystem management will incorporate the following elements as described in the table of Elements and Principles of Ecosystem Management below.

Elements and Principles of Ecosystem Management	
DoDI 4715.03 Elements	
1	Avoid single-species management and implement an ecosystem-based multiple species management approach, insofar as that is consistent with the requirements of the ESA
2	Use an adaptive management approach to manage natural resources such as climate change
3	Evaluate and engage in the formation of locak or regional partnerships that benefit the goals and objectives of the INRMP
4	Use the best available scientific information in decision-making and adaptive management techniques in natural resource management
5	Foster long-term sustainability of ecosystem services
AFI 32-7064 Principles	
1	Maintain or restore native ecosystem types across their natural range where practical and consistent with the military mission
2	Maintain or restore ecological processes such as wildland fire and other disturbance regimes where practical and consistent with the military mission
3	Maintain or restore the hydrological processes in streams, floodplains, and wetlands when feasible
4	Use regional approaches to implement ecosystem management on an installation by collaboration with other DoD components as well as other federal, state and local agencies, and adjoining property owners
5	Provie for outdoor recreation, agricultural production, harvesting of forest products, and other practical utilization of the land and its resources, provided that such use does not inflict long-term ecosystem damage or negatively impact the USAF mission

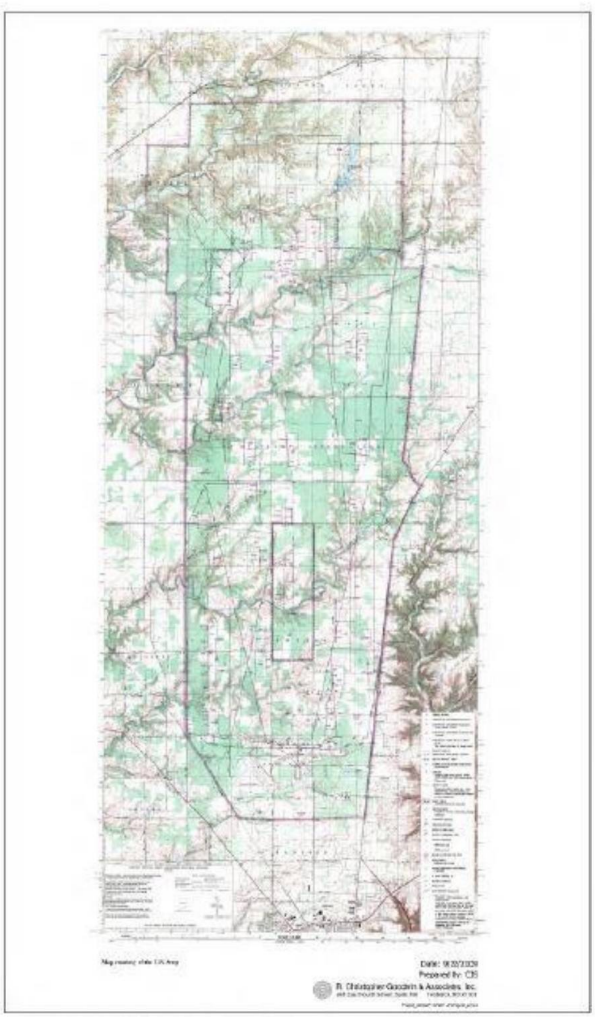
Biodiversity is the degree of variation of life within a given ecosystem, biome, or an entire planet. The DoD's challenge is to manage for biodiversity in a way that supports the military mission. The INRMP is identified by DoD as the primary vehicle for conserving biodiversity on military installations. Specific management practices identified in this INRMP have been developed to enhance and maintain biological diversity within the ecosystem at Otis ANGB. The outcome of biodiversity conversation on DoD-managed land includes the items in the table of Outcomes of Biodiversity Conservation below.

Outcomes of Biodiversity Conservation	
Outcomes	
1	Maintain or restore remaining native ecosystem types across their natural range of variation
2	Maintain or reestablish viable populations of native species on an installation, when practical
3	Maintain ecological processes, such as disturbance regimes, hydrological processes, and nutrient cycles, to the extent practicable
4	Manage and monitor resources over sufficiently long time periods to allow for adaptive management and assessment of changing ecosystem dynamics

Ecosystem management includes biodiversity conservation and invasive species control as integral parts of ecosystem management. USAF installations should maintain or reestablish viable populations of all native species when practical and consistent with the military mission. USAF installations should also identify the presence of exotic and invasive species, and implement programs to control and/or eradicate those species. When feasible, USAF installations should develop joint control strategies with other federal, state, and local cooperating agencies and

adjacent landowners to increase the effectiveness of control measures and for the benefits illustrated in the graphic below. Ecosystem management should include developing and implementing management strategies oriented toward the conservation of those species and communities when practical and consistent with the military mission.

Why Conserve Biodiversity on Military Lands?



2.3. Authority

Installation Supplement:

Natural Resources Laws, Regulations & Policy

The SAIA requires federal military installations with significant natural resources to develop a long-range INRMP and implement cooperative agreements with other agencies.

The DoDI 4715.03, *Natural Resources Conservation Program*, dated 18 March 2011, identifies the DoD policies and procedures concerning natural resources management and INRMP reviews, public comment, and endangered species consultation. INRMPs are required to be jointly reviewed by the USFWS, state conservation agency, and military proponent for operation and effect on a regular basis, but not less often than every five years. Minor updates and continued implementation of an existing INRMP do not require an opportunity for public comment. Major revisions to an INRMP do require an opportunity for public review. The degree of endangered species consultation when updating or revising an INRMP depends upon the management strategies identified in the INRMP and the amount of past consultation. Most updates and revisions will not require formal consultation. Endangered Species Act (ESA) Section 7 consultation is required for INRMPs that contain management strategies that may affect federally listed species or designated critical habitat. The need for such consultation should become apparent during the review for operation and effect and implemented if necessary as part of a revision.

AFI 32-7064, *Integrated Natural Resources Management*, dated 17 September 2004, provides guidance on how the USAF implements the SAIA. This guidance addresses what an INRMP is, its purpose, who prepares it, the criteria for determining which installations require an INRMP, coordination requirements, reporting requirements, review requirements, ESA consultation requirements, public access policies, the requirement for no net loss of capability to support military training, and a few other topics. This is a general guidance document on the purpose, development, implementation, and update/revision of INRMPs. It requires INRMPs to be developed jointly with the USFWS and state conservation agency. It requires INRMPs to support the military mission and details the review process with emphasis on joint annual reviews and review for operation and effect no less than every five years. The guidance also indicates that the review for operation and effect will determine if a revision is required. A revision is not required if the cooperating agencies agree that an INRMP is meeting the intent of the Sikes Act. Instead, the INRMP can be updated as necessary and implementation continued.

In addition to these fundamental INRMP regulations and guidance, this INRMP has been prepared pursuant to applicable federal, state, local, and USAF laws, regulations and policies that pertain to natural resources management on military land, which are summarized in the Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP.

2.3.1. Responsibilities

General roles and responsibilities that are necessary to implement and support the natural resources program are identified in the Installation Supplement below. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

Installation Supplement:

The INRMP has been organized to ensure the implementation of year-round, cost-effective management activities and projects that meet the requirements of the MAANG. Various organizations within the MAANG that are responsible for the implementation of the INRMP are described in the following subsections.

Environmental, Safety, and Occupational Health Council

The ESOH Council will be responsible for the overall implementation of the INRMP. The ESOH Council consists of the key MAANG personnel from Otis ANGB and will assume an oversight role to ensure the effective implementation of this INRMP. The Commander chairs this organization and establishes subcommittees to focus on high-priority natural resources management issues.

Top and mid-level management representation, as well as representation from the Environmental Management Office and Operations, will provide the ESOH Council with the leadership and structure necessary for the successful implementation of this INRMP.

Commander—102 IW/CC

The Wing Commander of Otis ANGB (102 IW/CC) serves as the Chairman of the ESOH Council. The 102 IW/CC is the official signatory for the INRMP.

NGB/A7AM Natural Resources Manager

The Air National Guard Environmental Division NGB/A7AM Natural Resources Manager tracks DoD and USAF policies and approves funding for projects or studies identified as a priority in this INRMP. Deviation from the projects proposed in this INRMP will be independently reviewed by the NGB/A7AM Natural Resources Manager. The NGB/A7AM Natural Resources Manager acts as a technical point-of-contact on all natural resource-related activities.

Environmental Management Office—102 CES/CEV

The Environmental Management Office (102 CES/CEV) is responsible for ensuring that activities associated with the implementation of this INRMP adhere to applicable federal, state, local, and USAF environmental regulations and policies. Projects proposed in this INRMP are reviewed by the 102 CES/CEV and the NGB/A7AM Natural Resources Manager.

The 102 CES/CEV and Public Affairs Office (102 IW/PAO), in coordination with the NGB/A7AM Natural Resources Manager, are responsible for establishing and implementing a conservation education program to instruct MAANG personnel on the protection and enhancement of biological diversity. The 102 CES/CEV and NGB/A7AM Natural Resources Manager direct most of the ongoing natural resources management activities presented in this INRMP. However, several management activities (e.g., Bird/Wildlife Aircraft Strike Hazard [BASH]) fall under the responsibilities listed for other organizations. BASH activities at Otis ANGB must be coordinated with the Safety Office, NGB/A7AM BASH Program Manager and ASCC, as appropriate. The 102 CES/CEV acts as technical point-of-contact for all natural resource-related activities. Within 102 CES/CEV, at least one person should attend the Civil Engineer Corps Officers School (CECOS) DoD Natural Resources Compliance course.

Civil Engineering—102CES

The Civil Engineering Office (102 CES) is responsible for all facility construction and maintenance activities on Otis ANGB. In addition, this office will ensure that the habitat management protocols established in this INRMP for the conservation and enhancement of biodiversity are followed. MAANG has its own Operations and Maintenance Budget for Otis ANGB.

Wing Safety Office—102 IW/SE

The Otis ANGB Wing Safety Office (102 IW/SE) is responsible for implementing all activities presented in this INRMP that pertain to the BASH Program. The 102 IW/SE also ensures that bird/wildlife strikes resulting from aircraft assigned to transient units at Otis ANGB are accurately documented and reported to the USAF BASH Team, Kirtland Air Force Base (AFB), New Mexico. In addition, the 102 IW/SE participates in the Otis ANGB Bird Hazard Working Group (BHWG) which conducts meetings to evaluate and refine strategies for the reduction of BASH risk on Otis ANGB. The 102 IW/SE is responsible for coordinating with and providing required information on BASH activities with ASCC.

Staff Judge Advocate—102 IW/JA

The Staff Judge Advocate (102 IW/JA) is responsible for ensuring that the implementation of the management objectives contained within this INRMP meet all of the MAANG's regulatory and statutory requirements that pertain to natural resources management. The legal office will review any future natural resources management proposals and alert the 102 IW/CC and 102 CES/CEV should there be any regulatory conflicts or shortfalls. In addition, the legal office will keep these parties informed of any new statutes or regulations that might affect natural resources management on Otis ANGB.

Public Affairs—102 IW/PA

The 102 IW/PAO is responsible for the coordination of public access for events at Otis ANGB. The 102 IW/PAO serves as the point-of-contact to interface between the Commander and civilian groups interested in using Otis ANGB for environmental, educational, or other purposes.

Other Natural Resources Agencies

The USFWS and MDFW can provide technical assistance to the MAANG and are partners in the development and review of this INRMP. Specifically, these agencies will alert 102 CES/CEV whenever new species that have the potential for inhabiting Otis ANGB are added to the federal or state endangered species lists. In addition, these agencies should support MAANG personnel during scheduled wildlife and vegetation surveys as described in SAIA and related policies and agreements.

Cooperative Agreements

Intra- and inter-agency cooperation, coordination, and communication at the federal, state and local levels (e.g., USFWS and MDFW) are requisite to the success of the INRMP. The USFWS and MDFW review the INRMP and its implementation. Specialized expertise is required to adequately manage natural resources at the Otis ANGB. Technical assistance will be sought from federal and state agencies, universities, and special interest groups. Additional technical assistance is also available through the following two DoD initiatives.

- DoD Partners in Amphibian and Reptile Conservation (PARC) - initiative to support management of reptiles and amphibians on military installations. More information at http://www.dodnaturalresources.net/DoD-PARC.html.
- DoD Partners in Flight (PIF) – initiative to support management of birds on military installations. It is part of the international PIF partnership and facilitates connections between DoD entities and other PIF partners. More information at http://www.dodpif.org/.

In addition, the DoD and subcommand entities have Memoranda of Understanding (MOUs), Memoranda of Agreement (MOAs), and other cooperative agreements with other federal agencies, conservation and special interest groups, and various state agencies in order to provide assistance with natural resources management at installations across the US. Generally, these agreements allow installations and agencies or conservation and special interest groups to obtain mutual conservation objectives. The DoD agreements applicable to the Otis ANGB include:

- MOU between DoD and USFWS / Association of Fish & Wildlife Agencies for a Cooperative Integrated Natural Resource Management Program on Military Installations associated with the ecosystem-based management of fish, wildlife, and plant resources on military lands (2013).
- MOU between DoD and USFWS to promote the conservation of migratory birds (2011).
- MOU between the DoD and USEPA to form a working partnership to promote environmental stewardship by adopting integrated pest management strategies to reduce the potential risks to human health and the environment associated with pesticides (2012).
- MOA for Federal Neotropical Migratory Bird Conservation Committee ("Partners in Flight-Aves De Las Americas") among DoD, through each of the Military Services, and over 110 other federal and state agencies and non-governmental organizations (1991). In addition, the USAF signed an addendum to this MOA, thereby including itself in the agreement (1991).
- MOU between the DoD and Ducks Unlimited, Inc. to provide a foundation for cooperative development of selected wetlands and associated uplands in order to maintain and increase waterfowl populations and to fulfill the objectives of the North American Waterfowl Management Plan, within the context of DoD's environmental security and military missions (2006).
- MOU between DoD and NRCS to promote cooperative conservation where appropriate (2006).
- MOU with Watchable Wildlife Incorporated (2002).
- MOU between the DoD and Bat Conservation International (BCI) to identify, document and maintain bat populations and habitats on DoD installations (2011).
- Cooperative Agreement between DoD and The Nature Conservancy to work cooperatively in areas of mutual interest (2010).
- Interagency Agreement (2010) and MOU (2009) between USAF and US Forest Service (USFS) to enhance cooperation and improve public service, and management of natural and cultural resources on lands managed by the USAF and the USFS.

For a further list of cooperative agreements and MOUs please visit http://www.denix.osd.mil/nr/LegislationandPolicy/MOUsandMOAs.cfm for DoD list or http://www.afcee.af.mil/resources/conservation/natural/agreements/index.asp for USAF list.

2.3.2. Training

ANG EMs and other natural resources support personnel require specific education, training, and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to update and carry out certain actions required within this INRMP. Specific training and certification may be necessary to maintain a level of competence in relevant areas as installation needs change, or to fulfill a permitting requirement.

Installation Supplement:
No training table exists.

2.4. Integration with Other Plans

Installation Supplement:

By its nature, an INRMP is multidisciplinary and provides the summary for natural resources at a specific installation. As a result, information from an INRMP is incorporated into other plans and other plans help identify management priorities and potential impacts to natural resources. The INRMP is integrated with a number of MAANG plans including:

- Integrated Pest Management Plan (IPMP) for Otis ANGB – plan for management of pest species to minimize impact to mission, natural resources and the environment (MAANG 2010a).
- Integrated Cultural Resources Management Plan (ICRMP) for Otis ANGB – plan for management of cultural resources, including legal requirements, known cultural resources, processes and responsibilities (MAANG 2011a).
- Storm Water Pollution Prevention Plan (SWPPP) for Otis ANGB – plan for prevention and management of stormwater (MAANG 2010b).
- Spill Prevention and Counter Measure Plan (SPCCP) for Otis ANGB (MAANG 2012b).
- Draft Otis Air National Guard Base General Plan for Space Re-Utilization (MAANG 2012a).
- Environmental Performance Standards.

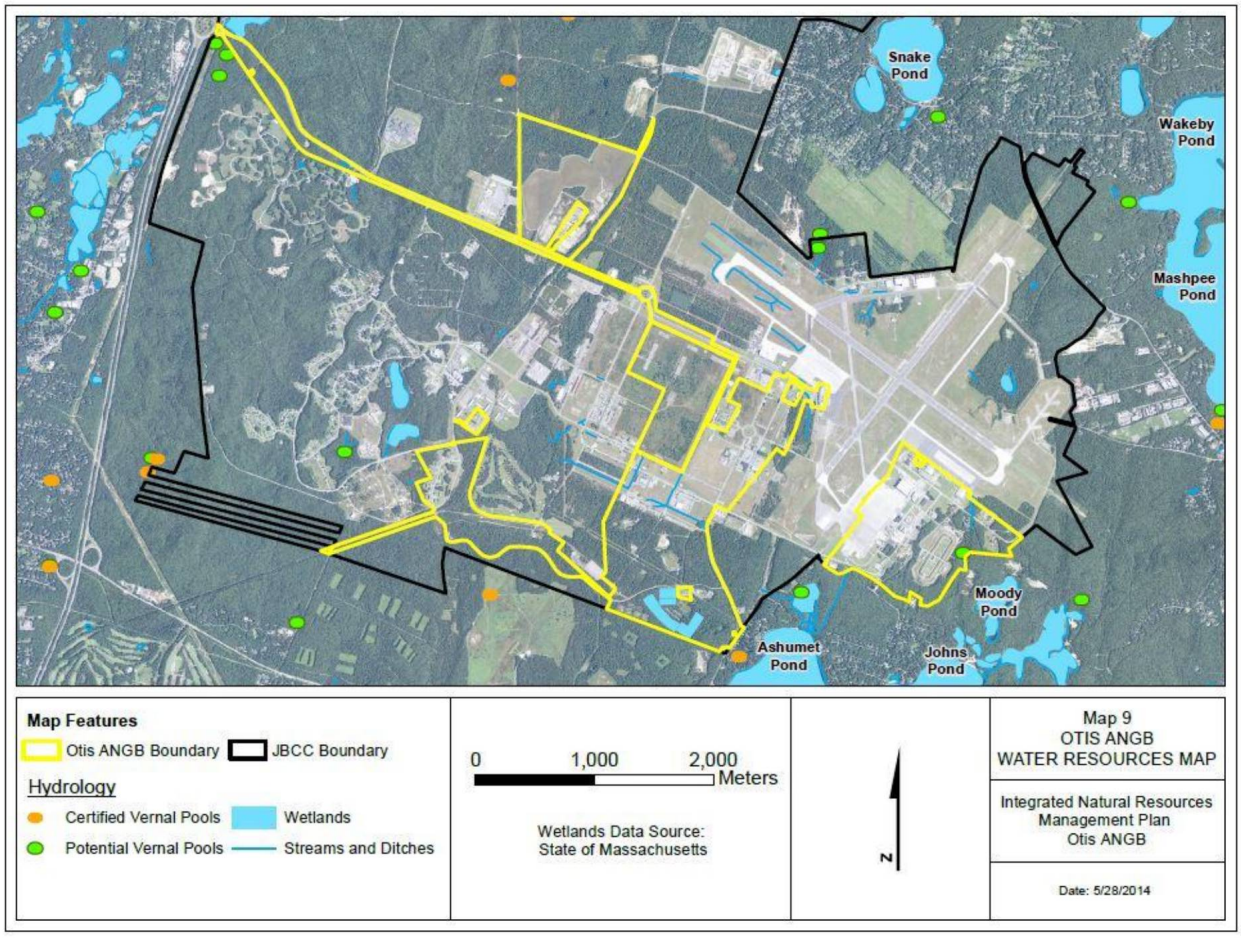
In addition, this INRMP is also integrated with INRMPs (or equivalent) for other portions of JBCC, including the ones maintained by the MAARNG, USAF, and USCG. See information below for more details on integrating with the other INRMPs on JBCC.

Other Environmental Plans for JBCC

Joint Land Use Study (JLUS) for JBCC – This study provides recommendations regarding land use restrictions, land acquisition, water supply and wastewater infrastructure, transportation infrastructure, personal wireless communications facilities, base access, air safety, and noise to ensure the sustainability of the JBCC's tenants missions and the compatibility with community growth and development adjacent to JBCC (Cape Cod Commission 2005). In 2012, the DoD approved the pursuit of an update to the 2005 JLUS to reflect post-Base Realignment and Closure (BRAC) changes, current and future military plans, and projects in the communities surrounding the base. The Cape Cod Commission has been retained to produce the JLUS update, and work with the various JBCC entities and state and local representatives. A Draft Final Report was published in October 2013 (Cape Cod Commission 2013). More information on the JLUS program can be found in B.

Groundwater Protection Policy for JBCC (2011) – The MAANG is a signatory to this policy that applies to all operations, construction, and expansion within the JBCC protected areas (Groundwater Protection Areas, Zone II Areas, and Wellhead Protection Areas; see the Otis ANGB Water Resources Map below). This policy protects future and existing water supplies on JBCC, controls land use within protected areas, preserves and improves ecological integrity of fresh and marine resources, and prevents temporary and permanent contamination. This policy also defines permitted and prohibited uses within the protected areas.

Otis ANGB Water Resources Map



Massachusetts's CWCS

The State Wildlife Action Plan in Massachusetts is referred to as the Massachusetts Comprehensive Wildlife Conservation Strategy (MA CWCS). During the INRMP update process, the MAANG consulted the MA CSWS to ensure INRMP goals, objectives and strategies are consistent with Massachusetts' overall statewide and site specific plans. The MA CWCS is the strategic vision of the integrated conservation efforts needed to sustain the broad array of wildlife in the state. The purpose of the MA CWCS is to continue ongoing efforts to protect the biodiversity of the Commonwealth, build on past efforts (e.g., *BioMap and Living Waters*, the Fish Habitat Initiative, and Sustainable Forestry) to include the additional species and habitats identified as in greatest need of conservation and describe plans to develop new efforts within MDFW and their conservation partners to become more proactive and strategic in biodiversity protection in Massachusetts (MDFW 2006). For a copy of the MA CSWS contact the MDFW or go to http://www.mass.gov/eea/agencies/dfg/dfw/wildlife-habitat-conservation/ massachusetts-wildlife-conservation-strategy.html.

The MA CWCS is intended to meet the following objectives:

1. Better understand the species in greatest need of conservation (SGNC) and their habitats,
2. Identify potential threats and conservation actions to protect SGNC an d their habitats, and
3. Determine how to effectively and efficiently monitor these populations.

The primary threat to biodiversity and the conservation of SGNC and their habitats within Massachusetts has been the destruction and fragmentation of habitat due to residential, commercial and industrial development (MDFW 2006). Climate has also played a key role in shaping the habitat of Massachusetts since the last glacial period. As discussed in the Climate section, the climate of New England has changed measurably over the last half century with higher average annual temperatures and increased precipitation (New England Regional Assessment

Group [NERAG] 2001). Depending on the direction and speed of climate change in the coming years, these changes will favor some species and habitats and negatively impact others.

The MA CWCS identifies the following strategies to conserve biodiversity: (1) proactive habitat protection, (2) collection of biological information, (3) conservation planning, (4) environmental regulation, (5) habitat restoration and management, (6) coordination and partnerships, and (7) conservation/environmental education. However, MDFW identifies "proactive protection of SGNC habitats" has the highest priority.

MDFW identifies 22 habitat types ranging from large-scale habitats such as large unfragmented landscape mosaics; to medium-scale habitats like the state's large- and midsized rivers; to small- scale habitats such as vernal pools. The distribution, threats, and SGNC for each habitat type is included in the MA CWCS along with conservation strategies and monitoring requirements to conserve this habitat (MDFW 2006). Large-scale habitat types found on Otis ANGB are in association with the overall habitat types of JBCC (e.g., pitch pine-oak, upland forest, and large unfragmented landscape mosaic). Medium to small-scale habitats include grasslands, young forests/shrublands and a few ponds and wetlands.

The SGNC list for Massachusetts includes all federal and state listed animal species, globally rare species according to NatureServe, and other regionally rare or declining species identified by MDFW and its cooperators. After assessing all native wildlife species known to occur within Massachusetts, 257 SGNC were identified that are assigned to one or more of the 22 habitats (i.e., those essential to the species survival). The distribution, life history and key threat(s) to survival for each of these species is included in the MA CWCS. Numerous SGNC occur within or near Otis ANGB. Rare species management is discussed in the Management of Threatened and Endangered Species and Habitats section. For a complete list of Massachusetts SGNC, refer to the MA CWCS. Animal species known to occur within or in the vicinity of Otis ANGB are listed in the Camp Edwards Training Site INRMP.

Other Natural Resources Programs at JBCC

In addition to the MAANG, the USCG and two other DoD entities undertake natural resources management on JBCC. The MAARNG INRMP for Camp Edwards covers 14,374 acres and was originally developed in 2001 (MAARNG 2009a). The USAF has an INRMP for the Cape Cod Air Force Station that covers 87 acres in the northern part of JBCC that was originally developed in 1998 (USAF 2014). The USCG is finalizing a NRMP for the 3,586 acres on ASCC, which includes many areas formerly managed by the MAANG (USCG 2014). The NRMP is fundamentally similar to an INRMP, although the USCG is not subject to the Sikes Act. See the JBCC Parcel Map for a parcel map for all of JBCC.

All of these JBCC plans have a similar primary goal that includes supporting no net loss of military mission lands while supporting long-term sustainability of natural resources. Each of these plans also generally promote ecosystem management and ecological integrity and conflict prevention between the mission and natural resources, and include maintaining native wildlife and vegetation, maintaining listed species, and minimizing invasive species as primary goals. For all these plans, the protection of groundwater is also a key goal due to the history and current status of JBCC. In addition to these general goals, the JBCC plans also support each other in more specific ways, and together provide a more cohesive management approach for JBCC lands. For example, the MAARNG, USCG and MAANG have all identified grassland management as a significant element. A summary of the goals and objectives related to grassland management within the MAARNG and USCG plans is provided below. The USAF does not have any significant grasslands. Vegetation management on Otis ANGB is addressed in the Grounds Maintenance section and Goal VE in the Management Goals and Objectives section of this INRMP.

<u>MAARNG (Section 8.6.2 of the INRMP)</u>

GOAL 1. Maintain and restore grassland communities on Camp Edwards for the purposes of rare species protection, wildlife habitat, and, at times, military training.

Objective a. Monitor grassland communities using RTLA methods.
Objective b. Provide special protection and habitat management that leads to the recovery of state-listed rare species including upland sandpiper and grasshopper sparrows.
Objective c. Decrease the presence of aggressive exotic plants (e.g., knapweed, honeysuckle, autumn olive.) using mowing, prescribed burning, or mechanical removal.
Objective d. Increase the presence of native grassland vegetation.
Objective e. Prevent conflicts between training site operations and rare species management.
Objective f. Monitor effects of training activities on animal and plant populations dependent on the grassland communities.
Objective g. Maintain or improve grassland bird species richness, productivity, and survivorship.

GOAL 2. Use prescribed fire and at times mowing as the primary means of grassland management while protecting and conserving natural and cultural resources.

Objective a. Apply the Camp Edwards Training Site, Integrated Fire Management Plan (2006) to maintain certain areas of the grasslands on Camp Edwards, remove accumulated litter, and control exotic invasive species.
Objective b. Using mowing regimes when appropriate to create short grass areas needed for some grassland bird species (e.g. upland sandpipers)
Objective c. Minimize the threat to human safety when conducting prescribed burns in the grasslands within the cantonment area of Camp Edwards.
Objective d. Set a precedent for grassland management to provide guidance to other branches of the military that manage grasslands on the JBCC.

GOAL 3. Increase the acreage of grasslands on Camp Edwards as existing structures and facilities are demolished.

Objective a. Remove all structures associated with the facility. Objective b. Plant only native grass and tree species.
Objective c. Maintain grasslands using prescribed fire and mowing regimes.

<u>USCG (Section 4.6.2 of Draft Final NRMP, Grassland Objectives Only)</u>

GOAL VE: Manage vegetation to provide a variety of habitats to support the ASCC mission, minimize wildlife hazards and mortality, maintain native species, and enhance wildlife habitat

Objective VE2: Maintain airfield to minimize wildlife hazards and wildlife mortality, while providing wildlife habitat when feasible
Objective VE3: Maintain COMMSTA, roadsides, and other turf/lawn areas to minimize maintenance requirements and maximize benefits to wildlife when feasible
Objective VE4: Maintain golf course (outside of core golf areas) to provide wildlife habitat, while minimizing nuisance wildlife
Objective VE6: Monitor the results of habitat management efforts, appropriate to the management objectives and projects completed for a given area
Objective VE7: Maximize native plants and avoid invasive non-native plants in landscaping and revegetation projects
Objective VE8: Minimize chemical and maintenance inputs during grounds maintenance

As shown above, significant overlap occurs between the goals and objectives of the MAARNG, USCG and MAANG with respect to grassland management. This is similar for all management areas. The primary differences relate to variation in the mission or the available habitat for a given installation. The USCG manages the airfield and the MWR program, both of which generate additional and specific requirements. The MAARNG has significantly more forested areas to manage in comparison to the other entities, also maintains an active wildland fire program.

When possible, the MAANG, MAARNG, USAF, along with the USCG, will conduct a joint annual review of their respective plans and discuss projects for the upcoming year with USFWS and MDFW. While this may not always be possible given the many entities involved, it would benefit each party to work as a cohesive group/committee to manage these shared resources more efficiently and cost effectively.

Regional Planning

In addition to the JLUS study already mentioned in the Integration with Other Plans and Natural Resources Constraints to Missions and Mission Planning sections, a number of regional plans exist for Cape Cod, primarily hosted by the Cape Cod Commission. These plans include a Multi-Hazard Mitigation Plan, Ocean Management Plan, Transportation Plan, Policy Plan, Wastewater Management Plan, and Comprehensive Economic Development Strategy. Current regional plans are available at: http://www.capecodcommission.org/index.php?id=76.

National Environmental Protection Act Compliance

Environmental Impact Analysis Process

The Environmental Impact Analysis Process (EIAP) is the process by which federal agencies facilitate compliance with environmental regulations. The primary legislation affecting these agencies' decision-making process is the National Environmental Policy Act of 1969 (NEPA) (42 USC § 4321 et seq.). NEPA requires that federal agencies consider potential environmental consequences of proposed actions. The law's intent is to protect, restore, or enhance the environment through well-informed federal decisions. The Council on Environmental Quality (CEQ) was established under NEPA for the purpose of implementing and overseeing federal policies as they relate to this process.

The adoption of an INRMP can be considered a major federal action as defined by Section 1508.18 of the CEQ regulations. USAF policy requires an analysis of potential environmental impacts for the implementation of an INRMP, although a complete Environmental Assessment (EA) is not necessarily required, as individual actions and projects undergo their own NEPA analysis.

CEQ regulations require intergovernmental notifications prior to making any detailed statement of environmental impacts. Through the Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) process, the MAANG notifies relevant federal, state, and local agencies and allows them sufficient time to make known their environmental concerns specific to a Proposed Action. Comments and concerns submitted by these agencies during the IICEP process are subsequently incorporated into the analysis of potential environmental impacts. This coordination fulfills requirements under Executive Order (EO) 12372, Intergovernmental Review of Federal Programs, and AFI 32-7060, IICEP. Furthermore, public participation in decision making on new proposals is required. Consideration of the views and information of all interested persons promotes open communication and enables better decision-making. Agencies, organizations, and members of the public with a potential interest in the Proposed Action, including minority, low-income, disadvantaged, and Native American groups, are urged to participate. A record of public involvement, agency coordination, and Native American consultation associated with this NEPA analysis is provided on VEMO.

NEPA Analysis for INRMP Implementation

The EIAP for the implementation of this INRMP was conducted in accordance with NEPA, CEQ *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 Code of Federal Regulations [CFR] § 1500-1508), and 32 CFR Part 989. The EIAP and decision-making process for the Proposed Action (implementation of this MAANG INRMP) involves an examination of all environmental issues pertinent to the action proposed. The environmental impact analysis was originally conducted with the 2002 INRMP and reanalyzed in the 2007 INRMP, but have not been replicated here. The original Finding of No Significant Impact (FONSI) and analysis still stands for this updated INRMP. The reduction in acreage lessens the potential environmental impacts from this updated INRMP, but they are roughly of the same nature and magnitude.

NEPA Analysis for Specific Projects

The EIAP for the implementation of this MAANG INRMP does not include a NEPA analysis of effects for individual actions or projects. Individual actions or projects that have the potential to impact the environment will be analyzed separately. The initial step for any activity that might impact the environment by the MAANG is to complete USAF Form 813: Request for Environmental Impact Analysis. The form is prepared to aid in the development of the assessment, providing information on the proposed action and its alternatives, purpose, and potential environmental effects. This allows the proponent to identify potential environmental impacts early and facilitates making a determination about whether an EA or Environmental Impact Statement (EIS) might be required for a specific action. Some sections are prepared by the proponent and other sections are prepared by 102 CES/CEV.

If the action is not covered by a categorical exclusion, then an EA is prepared to determine if there are potential significant impacts. If potential significant impacts are identified, either while completing USAF Form 813 or during the EA, then an EIS is prepared. The majority of natural resources management actions are covered by categorical exclusions.

Other Consultation Requirements

The MAANG has multiple natural resources consultation requirements in addition to the INRMP development and review requirements as identified in the Sikes Act (see Authority section). Federally listed species management requires ESA Section 7 consultation with the USFWS. State listed species management, as well as game species management, requires consultation with MDFW. Actions that fall under the jurisdiction of Section 401 of the Clean Water Act (CWA) necessitate permitting from US Environmental Protection Agency (USEPA) and/or Massachusetts Department of Environment (MDEP), while Section 404 actions necessitate permitting from the US Army Corps of Engineers (USACE), New England District.

In addition to natural resources consultation requirements, there are National Historic Preservation Act (NHPA) and tribal consultation requirements. A general summary of the cultural resources and consultation requirements are presented in the *Final Integrated Cultural Resources Management Plan for Otis Air National Guard Base* (MAANG 2011a).

3. Installation Overview

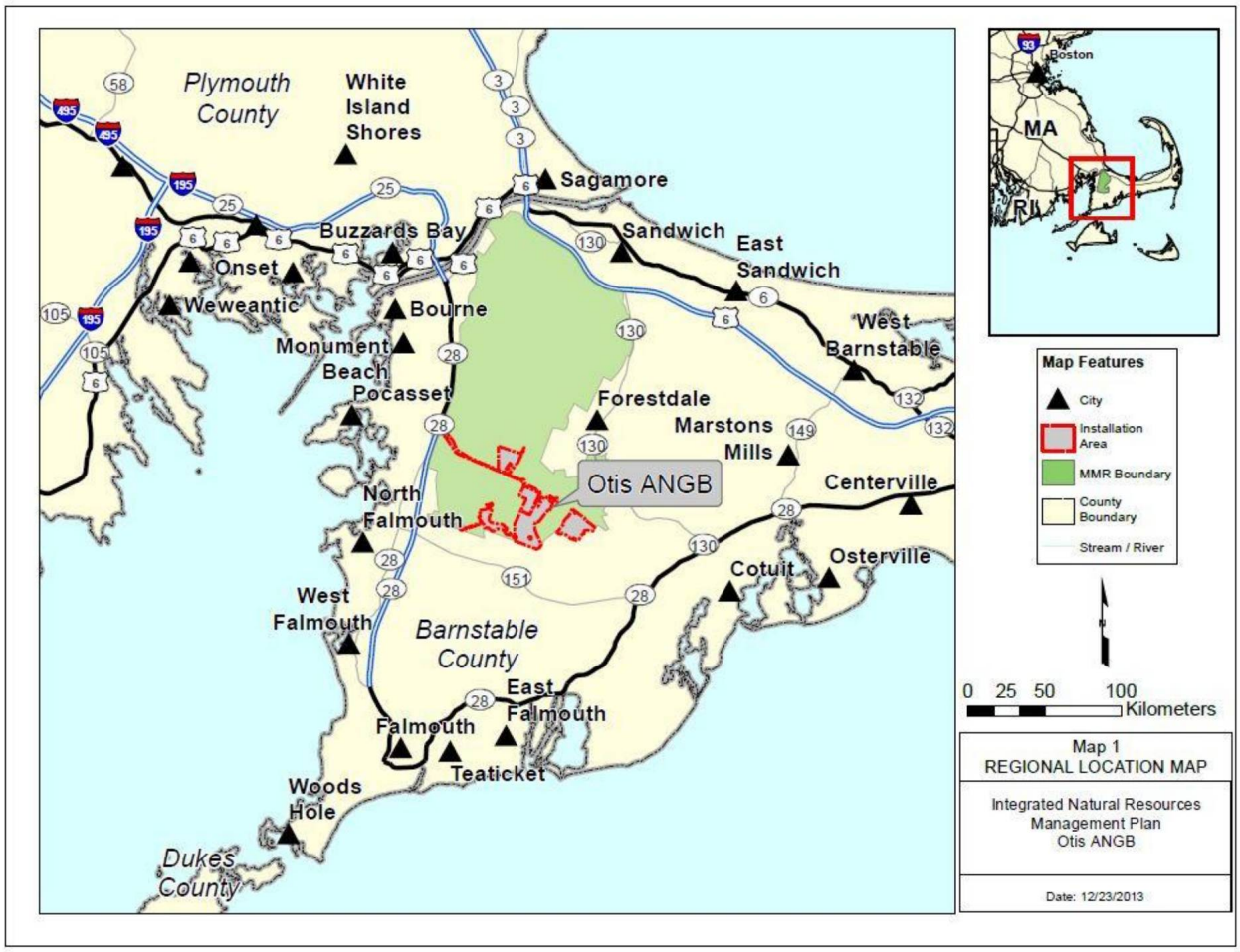
3.1. Location and Area

Installation Supplement:

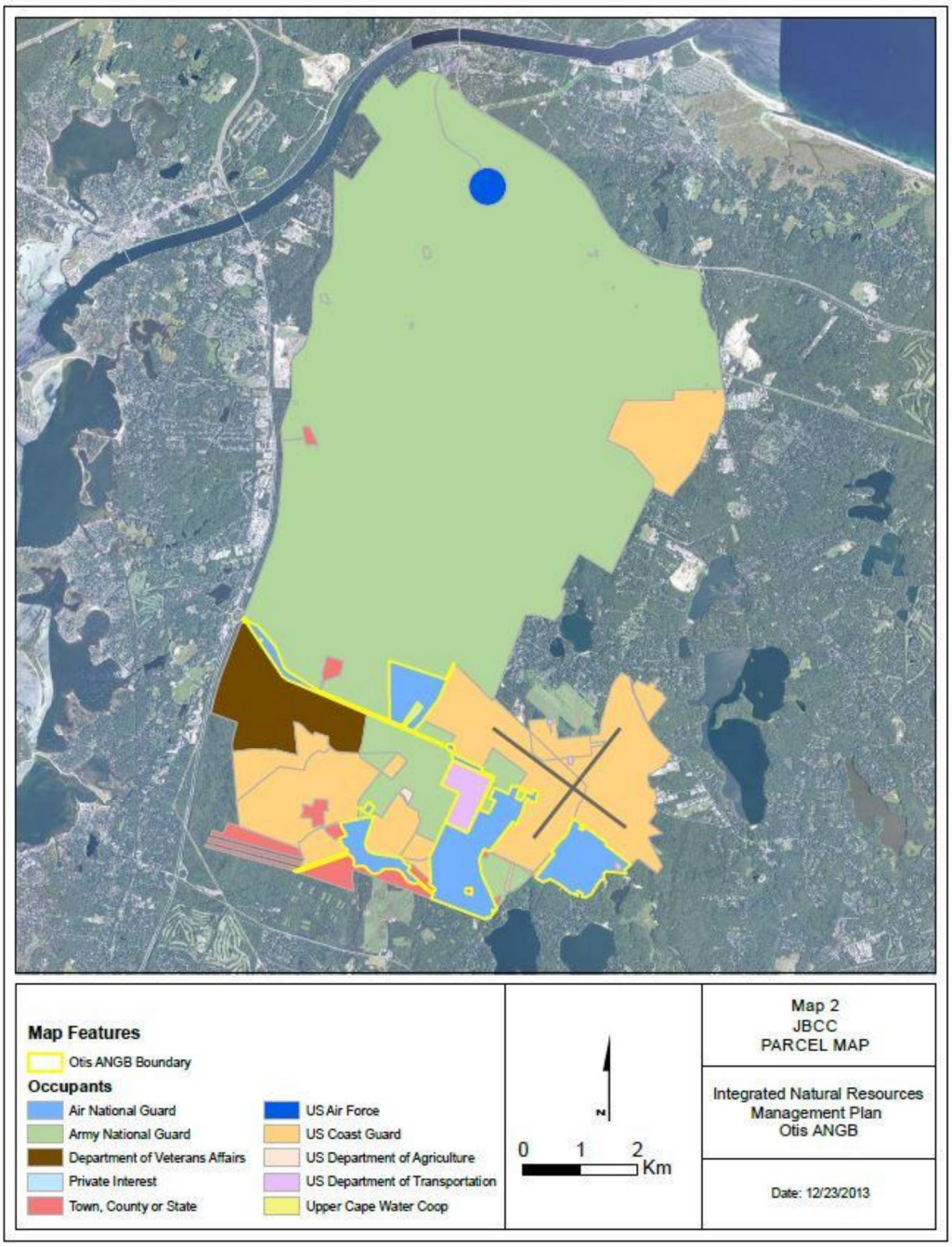
Otis ANGB Parcels

Otis ANGB is located in Barnstable County on the JBCC in the Upper Cape region of Cape Cod, Massachusetts, approximately 50 miles southeast of Boston, Massachusetts and east of Providence, Rhode Island (see the Regional Location Map). An overview of the facility is presented in the JBCC Parcel Map. Aerial imagery is presented in the Otis ANGB Real Property Map.

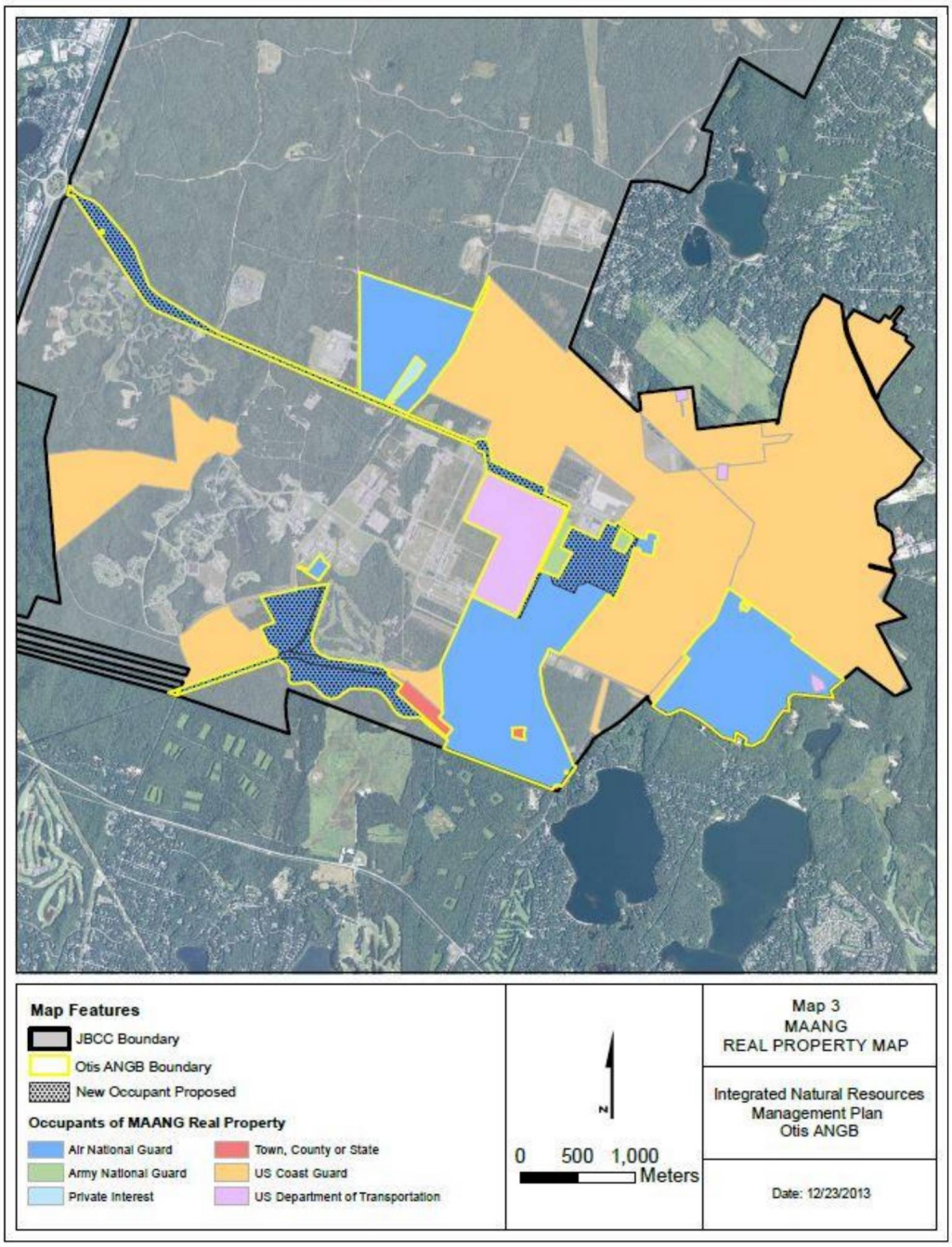
Regional Location Map



JBCC Parcel Map



Otis ANGB Real Property Map



Otis ANGB occupies approximately 1,328.5 acres in the southern portion of the approximately 21,000 acres that comprise JBCC, which was formerly known as the MMR. Otis ANGB includes 271.5 acres of property owned by the US Government and 1,057 acres leased from the Commonwealth of Massachusetts. There are an additional 1,910 acres that are technically licensed to the MAANG but another agency has the permit and actually undertakes the management on them. Most of this was acreage the MAANG managed in 2007 but no longer manages. In addition, there are a few areas totaling 323 acres that have been proposed for transfer to the MAARNG, but that transfer has not happened yet. The 14,433 acres primarily in the northern portion, known as Camp Edwards, are used as a training facility for the MAARNG. The USCG has an active base of 3,586 acres within JBCC, which now includes the airfield previously managed by the MAANG. *There are a number of parcels that the MAANG still holds the real property license for but which are now managed by other entities. Most of these parcels will eventually transfer in entirety to the new agency but this may take some time. In the meantime, MAANG no longer has any management authority over the parcel.* See the table of the Summary of JBCC Parcels Licensed to and/or Managed by MAANG below for a summary of the parcels, their size, ownership and management and the JBCC Parcel Map for a graphical depiction of these parcels.

Summary of JBCC Parcels Licensed to and/or Managed by MAANG

Parcel ID	Acreage	Licensed to	Managed By		
			2007	2014	Future[d]
Federal					
Air Station Cape Cod	104.5	ANG, Permit to USCG	USCG	USCG	USCG

Airfield	808.9	ANG, Permit to USCG	MAANG	USCG	USCG
Clearzone	9.3	ANG, Permit to USCG	MAANG	USCG	USCG
FAA Site 130	1.0	ANG, Permit to FAA	FAA	FAA	FAA
FAA Site 601	2.6	ANG, Permit to FAA	FAA	FAA	FAA
FAA Site 650	3.0	ANG, Permit to FAA	FAA	FAA	FAA
Middle Marker	58.0	ANG, Permit to USCG	MAANG	USCG	USCG
Otis	271.5	ANG	MAANG	MAANG	MAANG
Total MAANG Federal Acres			***1,147.7[a]***	***271.5***	***271.5***
State					
B - ANG Dorms	5.9	ARNG	MAANG	MAANG	MAANG
E - ROW	3.1	ANG, Permit to USCG	MAANG	USCG	USCG
F - Drainage	8.0	ANG, Permit to USCG	MAANG	USCG	USCG
G - Safety	2.1	ANG, Permit to USCG	MAANG	USCG	USCG
H - 550 Area	87.1	ANG, Permit to USCG	MAANG	USCG	USCG
H - Airfield	861.3	ANG, Permit to USCG	MAANG	USCG	USCG
H - BMX Track	9.3	ANG, Consent to Cape Cod BMX Track, Inc.	MAANG	Private[e]	Private
H - Driving Range	20.6	ANG, Permit to USCG	MAANG	USCG	USCG
H - EOD Site	5.0	ANG, Permit to US Army	MAANG	MAARNG	MAARNG
H - Landfill	193.3	ANG	MAANG	MAANG	MAANG
H - Old HQ	16.2	ANG, Permit to US Army	MAANG	MAARNG	MAARNG
H - Otis ANGB	707.2	ANG	MAANG	MAANG	MAANG & MAARNG[b]
H - Parking	0.2	ANG, Permit to US Army	MAANG	MAARNG	MAARNG
H - Septic Test	2.5	ANG, License to Barnstable County	MAANG	Barnstable County	Barnstable County
H - Transfer Station	18.9	ANG, Consent to Transfer Station	MAANG	Transfer Station	Transfer Station
H - VOLPE	150.0	ANG, Permit to DOT	MAANG	MAANG, DOT[c]	MAANG, DOT[c]
I - USCG Housing	203.1	ANG, Permit to USCG	USCG	USCG	USCG
J - Rail	0.6	ANG	MAANG	MAANG	MAARNG
Coop - Bourne	0.2	ANG, Consent to Bourne	Town of Bourne	Town of Bourne	Town of Bourne
Coop - Falmouth	0.6	ANG, Consent to Falmouth	Town of Falmouth	Town of Falmouth	Town of Falmouth
Coop - Mashpee	0.1	ANG, Consent to Mashpee	Town of Mashpee	Town of Mashpee	Town of Mashpee
Total MAANG State Acres			2,091.3[a]	1,057.0	728.3[d]
Total All Acres Managed by MAANG			3,239[a]	1,328.5	999.8[d]

Total acres with MAANG real property interest = 1,258.8 acrs (federal) + 2,295.3 acres (state) = 3,554.1 acres

[a]These acreages do not match the 2007 INRMP acreages exactly. This appears to be a result of including the USCG federal and state parcels in the acreage and improved accuracy of Geographic Information System (GIS) data with respect to parcels.

[b]322.2 acres of this parcel proposed to transfer as a Permit to US Army for MAARNG

[c]DOT does manage the infrastructure of this parcel, but the land within it is managed by the MAANG.

[d]Assuming all proposed transfers are completed.

[e]MAANG does retain some management authority over the BMX track.

ANG = Air National Guard; ANGB = Air National Guard Base; EOD = Explosive Ordnance Disposal; FAA = Federal Aviation Administration; HQ = Headquarters; ROW = right-of-way; USCG = US Coast Guard

Joint Base Cape Cod

In addition to the MAANG, MAARNG and USCG, the JBCC is host to the US Department of Veterans Affairs, US Department of Agriculture (USDA), US Department of Transportation (USDOT), Federal Aviation Authority (FAA), and several state, local and private entities.

The entire JBCC was added to the USEPA's National Priorities List in 1989. Since 1996, all Installation Restoration Program (IRP) sites, including those at Otis ANGB have been managed by the USAF, and EPA is responsible for overseeing IRP activities. The MDEP is responsible for ensuring compliance with state environmental regulations and standards. Four sources of contamination were used to assess IRP sites and groundwater plumes at Otis ANGB. The IRP program is actively engaged in the remediation of contamination at Otis ANGB and coordinates potential activities affecting natural resource through the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In addition, there are three other agencies involved in natural resources management on JBCC and which maintain an INRMP (or similar document). See the Integration with Other Plans section for further discussion of other JBCC INRMPs.

Regional Location

Cape Cod is comprised of 15 towns as well as two islands, Nantucket and Martha's Vineyard. JBCC includes portions of the towns of Mashpee, Bourne and Sandwich and abuts the town of Falmouth. Cape Cod is connected to the mainland by a pair of canal-spanning highway bridges, Bourne Bridge (Route 28) and Sagamore Bridge (Route 6), and a vertical-lift railroad bridge. Cape Cod is served by three major routes, Route 6, Route 28, and Route 6A. The entire Cape is roughly bisected lengthwise by Route 6, which is known locally as the Mid-Cape Highway and officially as the Grand Army of the Republic Highway. Route 28 (MacArthur Boulevard) runs north-south along the western boundary of JBCC. The main gate is located off Route 28 at 4000 Connery Avenue East, Buzzards Bay, Massachusetts. JBCC is primarily accessed via the Main Gate on Connery Avenue. One portion of Otis ANGB, however, is only accessible through a second gate (I Gate), which is internal to JBCC. Numerous primary, secondary, and tertiary roads occur throughout and around Otis ANGB and nearby parts of JBCC (see the Regional Location and JBCC Parcel Maps).

Air transportation on Cape Cod is provided primarily out of six airports: Barnstable Municipal Airport, Provincetown Municipal Airport, Chatham Municipal Airport, Falmouth Airpark, Cape Cod Airfield, and USCG Air Station Cape Cod (ASCC) airfield. Barnstable Municipal Airport and Provincetown Municipal Airport are the only two Cape Cod airports that provide scheduled air carrier service.

3.2. Installation History

Installation Supplement:

Cape Cod during the European Contact period from 1500 to 1620 A.D. was privy to a barrage of early explorers and fisherman. In 1602, British explorer Bartholomew Gosnold sailed into Buzzards Bay from Maine. Gosnold has been credited for bestowing the name to the Cape. The Native American population, which occupied much of the southeastern Massachusetts, were the Wampanoags. Trade was a major incentive for both settlers and expansion during the plantation period from 1620 to 1692 A.D.

Population increase characterized the majority of the colonial period from 1692 to 1775. However, with the growing population, land became the primary concern. The remaining common lands were divided and assigned between 1702 and 1717. During this time roads were also improved, increasing transportation, especially on the east to west route that became known as Kings Highway. The area quickly became a haven for Quakers.

The federal period (from 1775 to 1830) saw the greatest growth in the area's history. The growth was mainly due to the Boston and Sandwich Glass Company as well as other industries that began operating during this period, including a cotton mill at Shawme Pond, shipbuilding, and the salt works constructed by Bands and Swift on Buzzards Bay's Mashee Island constructed by Bands and Swift. The industrial boom that began at the end of the federal period would beacon the early industrial period from 1830 to 1870. The Cape Cod Branch railroad further encouraged industrial development. By the late industrial period from 1870 to 1915, Sandwich would be divided into two towns, ultimately causing the collapse of its industrial golden age. Agricultural activities would decline and the maritime industry would collapse. The opening of the Cape Cod Canal in 1914 during the Modern period breathed new life into the economy. The Cape quickly established itself as a resort location. In 1915, the Sagamore Beach Company bought two dozen houses and a hotel along Sagamore Road, quickly developing the Cape's reliance on tourism.

Prior to 1935, the majority of the land forming JBCC was in use as the Coonamessett Sheep Ranch, which was reported to be the largest ranch east of the Mississippi River. Immediately prior to purchase by the Commonwealth, the area suffered a forest fire that severely altered the ecosystem and left the area a dense tangle of scrub oak, pine, and briar (J.M. Montgomery Consulting Engineers, Inc. 1991).

In the early part of the twentieth century, Cape Cod and the area that is presently the JBCC were very sparsely populated. At that time, artillery and the armories of the Massachusetts National Guard were situated on the east coast of the state and in New Bedford and Fall River. Due to increasing populations in those areas, live fire artillery training was moved to Cape Cod to an area named Camp Sandwich. The exact location of Camp Sandwich is not known; however, it is believed that these facilities were located in what is now the northern training area of Camp Edwards (MAANG 2011a).

In 1935, the JBCC was formally established by a legislative act of the Commonwealth of Massachusetts with land taken from the Shawmee Crowell State Forest, and from private sources. The largest portion of the JBCC came from the purchase of the Coonamessett Sheep Ranch (MAANG 2001). The land was used for National Guard and Army Reserve training and was designated as Camp Edwards. From 1935 to 1940, the Commonwealth constructed 63 buildings and two 500-foot wide turf covered runways measuring 3,630 feet long and 3,890 feet long. The grass airstrip was named Otis Field after First Lieutenant Frank Jesse Otis, Jr. M.D. who was killed in 1937 after his airplane crashed into the

Illinois River. From 1935 to the present, two military types of operation have dominated land use at JBCC: Army training, maneuvers, and maintenance support; and military aircraft operations, maintenance, and support (MAANG 2011a).

In 1940, the US Army leased JBCC from the Commonwealth under a 99-year lease, and began construction of an expanded facility to accommodate up to 30,000 troops and a 1,722 bed hospital complex. From 1941 to 1945, during World War II, JBCC experienced its busiest period. In 1946, Camp Edwards was deactivated and phased out under caretaker status. In 1948, the USAF obtained control of Otis Air Field for an air defense mission and assignment of a fighter interceptor unit. At this time, runway 05/23 was extended from 7,000 feet to 8,000 feet to allow for the landing of larger and heavier aircraft. From 1950 to 1952, Camp Edwards was reactivated and training activity approached World War II levels. Activity decreased significantly after the Korean War. In 1953, the USAF established Otis Air Force Base, and selected facilities were transferred from the Department of the Army to the Department of the Air Force. This action also involved the acquisition and operational control of utility systems, communications facilities, supply facilities, fire protection, and the hospital that were previously operated by Camp Edwards (MAANG 2011a).

The MAANG was established in March 1954. In 1956, the USAF leased 19,700 acres, including Otis Air Field and Camp Edwards. At this time, the crosswind runway was extended from 7,000 feet to 9,500 feet. A new control tower, fire station, hangars, nose docks, and a 1,193 -unit family housing area were constructed. Since this time, Otis has hosted several military units. In 1976, the USAF granted the Department of the Army permit to use approximately 14,000 acres in the northern portion of the JBCC, which is now Camp Edwards managed by the MAARNG (MAANG 2011a).

Otis Air Force Base was officially designated as Otis ANGB on 1 October 1980 (J.M. Montgomery Consulting Engineers, Inc. 1991). For more on the history of the Otis ANGB, refer to the *Final Integrated Cultural Resources Management Plan* (MAANG 2011a).

3.3. Military Missions

Installation Supplement:

Generally, the ANG mission is two-fold, with both federal and state components. The federal mission is to maintain well-trained, well-equipped units available for prompt mobilization during war and to provide assistance during national emergencies (e.g., natural disasters or civil disturbances). During peacetime, combat-ready units and support units are assigned to USAF major commands to carry out missions compatible with training, mobilization readiness, humanitarian, and contingency operations. When units are not mobilized, they report to the governor of their respective state. The state mission is to provide protection of life, property, and preserve peace, order and public safety.

In addition to supporting the overall ANG mission above, the 102 IW mission is to provide worldwide precision intelligence and command and control, along with trained and experienced airmen for expeditionary combat support and homeland security. The 102 IW also provides life support services to the Otis ANGB and other tenant organizations at JBCC. The I02 IW includes the following groups (MAANG 2012a, MAANG 2013).

- The **102 Intelligence Group** operates the Distributed Ground Station (DGS) as an integral part of the USAF Distributed Common Ground Station, which is the service's premier globally networked intelligence, surveillance and reconnaissance weapon system. The DGS mission is operated out of 45 geographically separate, networked sites that are a mixture of active duty, ANG, and USAF reserve units working as an integrated combat capability. DGS exploits near-real-time Unmanned Aerial Vehicle (UAV) sensor data to provide timely, actionable, and fused intelligence to theater, joint/combined force, and operational component commanders.

- The **102d Air Operations Group** is attached to the 8th Air Force and augments the 608th Air Operations Center (AOC). The AOC supports the combatant commander and U.S. Strategic Command. This group supports the design and execution of theater air campaign strategy; receives, assembles, analyzes, filters and disseminates intelligence and weather information to support air operations; issues airspace control and coordination instructions; provides overall direction of air defense; conducts operational level combat assessment; and establishes and maintains essential communication links with the AOC. This is a full-time (24/7) operational watch mission.

- The **102d Mission Support Group** provides support to the Wing and tenant organizations for security, civil engineering, utilities, communications, personnel, and services. Contracting, safety, vehicle maintenance, environmental management, public affairs, and finances are a sample of the services provided by this group.

- The **253rd Combat Communications Group** is the enabler of expeditionary communications, provides telephone, internet, tactical communications, and air traffic support for theater operations. This Group includes the 212th Engineering Installation Squadron, which has a complex on Otis ANGB that houses electrical supplies, vehicle maintenance, gasoline and diesel fuel.

- The **202nd Weather Flight** exploits environmental surveillance and prediction capabilities to provide full-spectrum weather services in support of theater operations. Members of this unit are prepared to deploy alone or as part of a Joint Force for extended periods independent of an established airbase or its perimeter defenses.

3.4. Surrounding Communities

Installation Supplement:

Barnstable County is comprised of 15 towns. According to the US Census Bureau's *2010 Census*, Barnstable County has an estimated population of 215,888. JBCC is comprised of portions of three towns (Bourne, Mashpee, and Sandwich) and abuts the town of Falmouth (see the JBCC Parcel Map). Nearly 40 percent (population 85,966) of Barnstable's population occurs within these four towns (USCG 2012b, US Census Bureau 2010).

In the 1990s, Cape Cod's year-round population increased by nearly 20 percent, which was well above the overall 13.2 percent increase in US population. However, between 2000 and 2010, Barnstable County's population began to stabilize and ultimately experienced a slight decrease in population (2.85 percent). Bourne, Mashpee and Sandwich were the only mainland Cape Cod towns to gain year-round population between 2000 and 2010. The growth levels in these towns have consistently ranked in Massachusetts' top 35 of its 351 cities and towns (USCG 2012b, US Census Bureau 2010). Cape Cod as a whole is a seasonal area and a popular summer tourist destination, resulting in a significant

population increase in late spring/early summer. The population on Cape Cod during the tourist season is approximately three times the year-round population levels (USCG 2012b).

JBCC's northern 15,000 acres of undeveloped land is the largest, unfragmented open space outside of the Cape Cod National Seashore. Very little land is available for development on Cape Cod (Cape Cod Commission 2005). Given land availability for development is limited and population increases, the DoD initiated the JLUS program in 1985 (Cape Cod Commission 2005). For more details on JLUS, refer to the Integration with Other Plans and Natural Resource Constraints to Missions and Mission Planning sections.

At the northeast corner, land use surrounding Otis ANGB consists of privately owned woodland and residential development within the towns of Sandwich and Mashpee. On the east side, from Ashumet Road south to Sandwich Road, adjacent land use consists of residential land and forested land cover. Much of the land along this boundary is residentially zoned. State Route 130 and Greenway Road provide access to these residential areas.

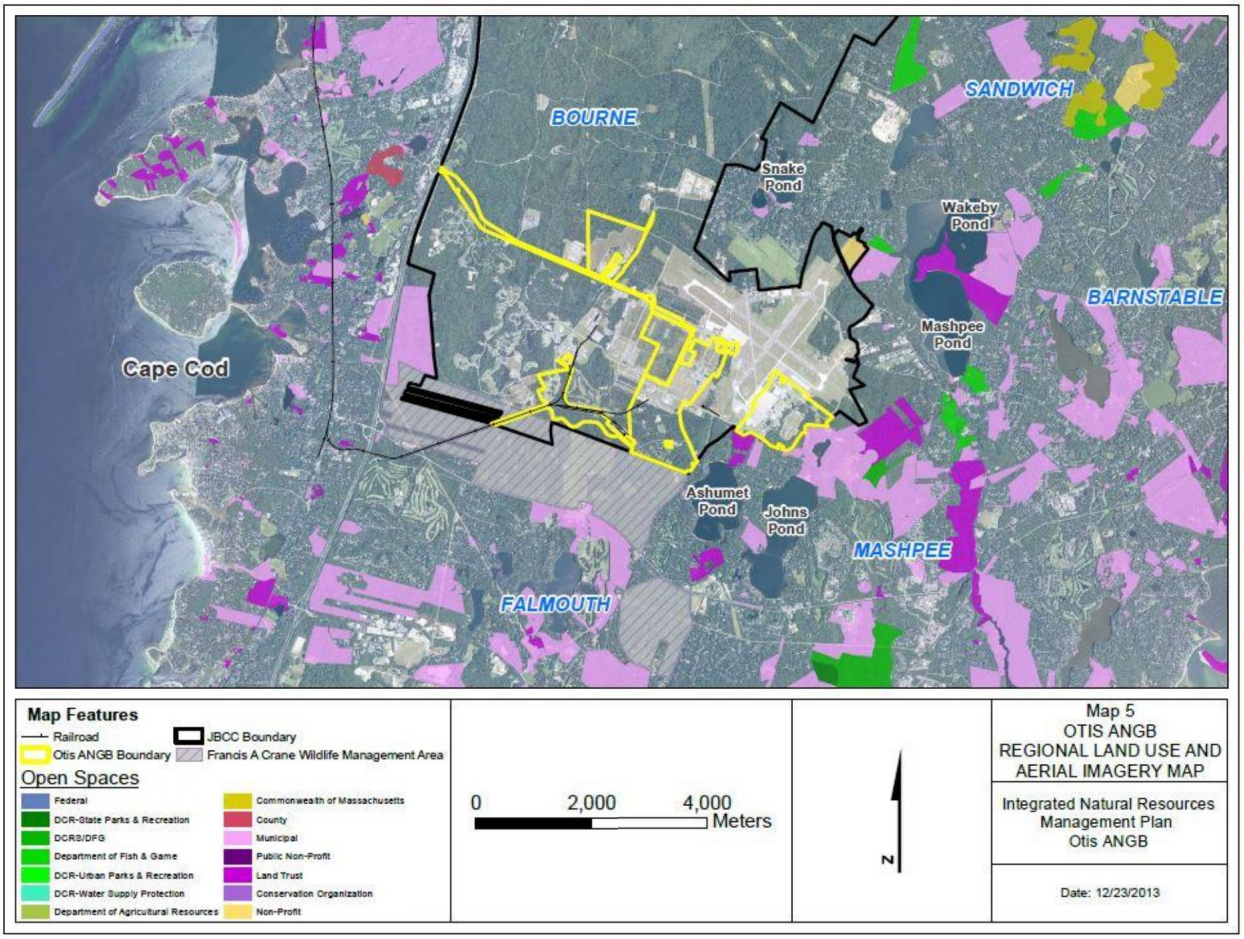
To the west, the MAARNG manages a matrix of commercial, industrial, residential and undeveloped lands. On the central west edge, the MAARNG manages developed land consisting of barracks, office, and industrial buildings. At the northwest corner, the MAARNG owns undeveloped woodland which is actively used for military training. Natural resources management on MAARNG is covered in the Camp Edwards INRMP (MAARNG 2009a). MAARNG has been implementing an active prescribed fire program with complementary habitat enhancement since 2000 (MAARNG 2009a). In the southwest corner, the USCG manages a golf course. North of Otis ANGB, the USCG now manages the airfield which used to be part of Otis ANGB.

3.5. Local and Regional Natural Areas

Installation Supplement:

South of Otis ANGB from Sandwich Road west to the railroad track, Francis Crane Wildlife Management Area borders the base in Falmouth Township (see the Regional Land Use and Aerial Imagery Map). The preserve is managed by MDFW and encompasses approximately 1,800 acres. There are no residences in the preserve and development is prohibited (MAARNG 2001). For more information, see http://www.300committee.org/cranewildlife.htm.

Regional Land Use and Aerial Imagery Map



The Johns Pond Park Conservation Area and the Back Road Conservation Area are located east and south, respectively, of the I-Gate Area within Otis ANGB. Both are owned by the Town of Mashpee and managed by the Town of Mashpee Conservation Commission. Orenda Wildlife Land Trust also owns several parcels near the I-Gate Area.

More generally, Shawme-Crowell State Forest borders JBCC along the northern boundary. The Fisk Forestdale WMA occurs slightly east of JBCC. The Conservation Commission, Water District, and Town Forest of the Town of Bourne all manage parcels near the southwestern and western boundary of JBCC as well.

4. Physical Environment

4.1. Climate

Installation Supplement:

Current Climate Summary

Otis ANGB and JBCC lies within the hot continental division of the humid temperate domain and is characterized by hot summers and cold winters (Bailey 1995). The average relative humidity is greatest at night, and ranges from about 70 percent in the mid-afternoon to 80 percent at dawn. Winds are out of the northwest and are highest, 22 miles per hour, in the winter (Fletcher 1993). The nearest National Climatic Data Center (NCDC) weather station measuring both temperature and precipitation is located in Hyannis, Massachusetts, which is approximately 10 miles east of the Air Station Cape Cod (ASCC) airfield. Temperatures range from an average high of approximately 78 degrees Fahrenheit (°F) in July to an average low of approximately 21°F in January. Average annual precipitation is about 43 inches, and is distributed fairly evenly. Additionally, annual average snowfall is approximately 15.6 inches. NCDC has a precipitation weather station in Hatchville, Massachusetts, located less than one mile south of JBCC, that indicates the ASCC may get slightly more rain than Hyannis, Massachusetts. Between 1981 and 2010, Hatchville's average annual precipitation was about 48 inches (NCDC 2011). Average seasonal snowfall in Barnstable County is 24 inches (Fletcher 1993). Average rainfall, snowfall, and temperature for Otis, Massachusetts are provided below the table of Average Precipitation and Temperature for Hyannis, MA (1981-2010).

Average Precipitation and Temperature for Hyannis, MA (1981-2010)

Month	Average Rainfall (inches)	Average Snowfall (inches	Temperature (°F)		
			Minimum	Maximum	Average
January	3.66	4.3	21.8	38.6	30.2
February	3.32	5.2	23.4	39.9	31.7
March	4.47	1.9	29.8	44.8	37.3
April	3.85	0.2	38.5	53.6	46.0
May	3.20	0.0	47.5	62.7	55.1
June	3.37	0.0	57.4	72.2	64.8
July	2.81	0.0	63.5	78.1	70.8
August	3.20	0.0	63.2	77.2	70.2
September	3.49	0.0	55.7	71.1	63.4
October	3.73	0.0	45.1	61.2	53.1
November	4.04	0.1	37.1	52.9	45.0
December	4.17	3.9	27.8	43.6	35.7
Total/Average	**43.31**	**15.6**	**42.6**	**58.0**	**50.2**

Source: NCDC 2011. Hyannis, Massachusetts Station # USC00193821

Climate Change Assessment

In order to assess the potential impacts from climate change on the natural resources at a given facility, the first step is to identify what the projected range of change might be in the future both in the mid- and long-term. The second step is to identify which species or ecological systems are most likely to be affected by the projected range of changes. Climate change vulnerability assessments are part of this process. Finally, the third step is to identify management activities and projects now and in the future that can respond to these challenges. Species or ecosystems likely to be affected at Otis ANGB and appropriate management priorities, activities and projects for them are identified in the respective management sections in the Management Goals and Objectives section.

Due to the lack of readily available regionally-specific model outputs, the Nature Conservancy's ClimateWizard was used to determine likely future climate regimes under different emissions scenarios. ClimateWizard enables technical and non-technical audiences alike to access leading climate change information and visualize the regional impacts to both temperature and precipitation that are likely to occur in areas within the US. In general, Massachusetts' climate will grow considerably warmer and wetter during this century. The ensemble average of 16 models predict an average 4.5°F (range: 2.79 to 6.51°F) increase in average temperature and an 8.0 inch (range: 3.82 to 25.03 inches) increase in annual precipitation by 2050 under a moderate emissions scenario as summarized on The Nature Conservancy's ClimateWizard site (http://www.climatewizard.org). The Summary of Results from Climate Change Models Table below presents a summary of the predictions for each model. The Figure of View of Historic and Projected Annual Precipitation and Average Temperature for Massachusetts below depicts historic and projected annual precipitation and average temperature for Massachusetts based on data from ClimateWizard.

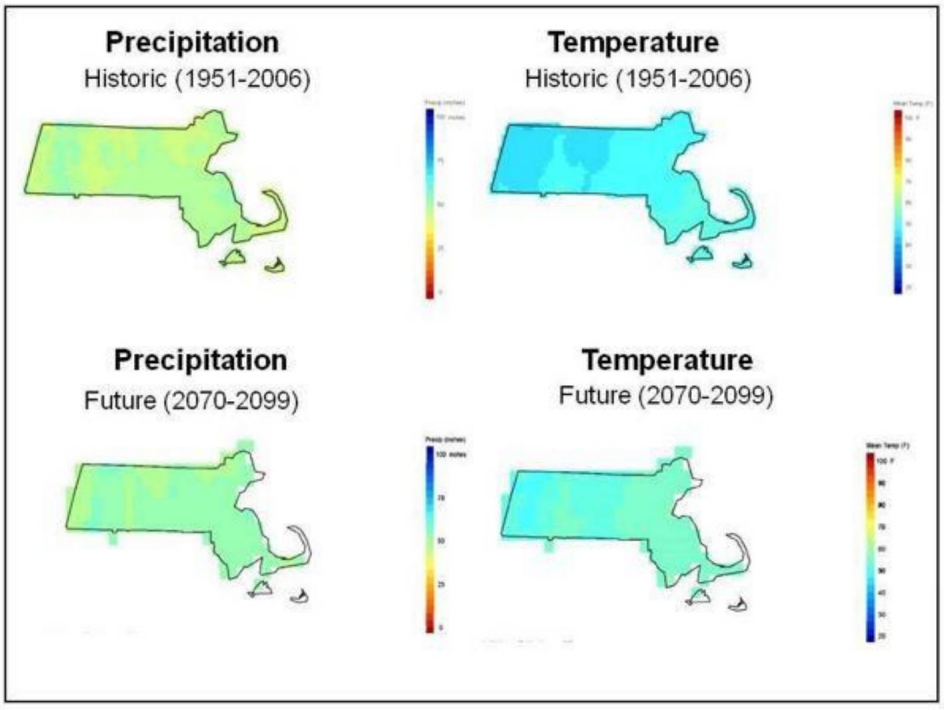
Summary of Results from Climate Change Models Predicted Values for Barnstable County by Mid-Century Under Different Emissions Scenarios

Climate Model	Change in Annual Precipitation (inches)			Change in Average Temperature (°F)		

	B1	A1B	A2	B1	A1B	A2
bccr_bcm2_0.1	0.96	4.29	4.07	2.31	3.73	6.51
cccma_cgcm3_1.1	4.33	8.06	7.69	4.24	5.33	5.36
cnrm_cm3.1	11.71	15.03	7.50	2.71	3.74	3.39
csiro_mk3_0.1	5.6	12.00	9.57	2.63	3.15	3.73
gfdl_cm2_0.1	10.91	4.87	13.76	3.92	5.32	5.04
gfdl_cm2_1.1	7.84	14.27	11.48	3.23	4.10	3.85
giss_model_e_r.1	14.35	10.75	23.05	2.10	2.96	3.00
inmcm3_0.1	5.29	4.37	3.45	3.39	4.37	4.62
ipsl_cm4.1	5.40	4.96	0.51	4.47	6.51	5.70
miroc3_2_medres.1	6.45	3.90	1.67	4.38	5.6	5.21
miub_echo_g.1	-0.01	4.47	-1.52	4.15	4.67	5.14
mpi_echam5.1	7.62	7.73	9.30	3.84	5.44	4.41
mri_cgcm2_3_2a.1	9.12	8.81	6.45	2.69	3.68	2.97
ncar_ccsm3_0.1	7.27	3.81	4.67	3.51	4.42	4.64
ncar_pcm1.1	11.79	5.59	16.66	2.71	2.79	3.04
ukmo_hadcm3.1	10.68	14.31	11.71	3.85	5.61	3.93
Ensemble Average	**10.7**			**4.4**		

Source: http://www.climatewizard.org
Emission Scenarios: B1 = low, A1B = medium, A2 = high

View of Historic and Projected Annual Precipitation and Average Temperature for Massachusetts based on an Ensemble Average for Medium Emissions Scenarios



For Otis ANGB, the models all indicate some shift in growing season over the next century. Due to the nature of Cape Cod and proximity to the Atlantic Ocean, local changes may differ from overall regional changes and are harder to predict. Overall with the likely increase in rainfall and temperature, the resources most likely to be impacted by climate change are water resources, special status species, invasive species, and vegetation.

There are a number of regional reports that discuss the effects of projected climate change for Barnstable County, Massachusetts and the New England Region in general (Frumhoff et al. 2007, NERAG 2001). The climate of New England has changed measurably over the last half century with higher average annual temperatures and increased precipitation (NERAG 2001). There are fewer cold snaps and ice cover has decreased. Heavy rains are also occurring more frequently than they did a century ago, increasing the risk of flooding. Additionally, while more

precipitation occurs, less of it occurs as snowfall (Frumhoff et al. 2007). Consequently, the growing season starts earlier and lasts longer than it did 50 years ago (NERAG 2001).

Based on recent models, and if the current trends continue (Frumhoff et al. 2007), projected effects in Massachusetts include:

- More days over 100°F will increase the risk of heat stress in vulnerable populations;
- High streamflow events will occur more frequently with increased risk of flooding in the winter;
- More short-term summer droughts resulting from warmer summer temperatures but little to no increase in summer precipitation;
- Sea level rise of 7 – 24 inches will impact coastal communities by permanently inundating some areas, destroying coastal marshes, and increasing coastal erosion;
- Sea level rise will likely be associated with increased coastal flooding;
- Increased likelihood of poor air quality;
- Forest communities will gradually shift from spruce/fir and maple/beech/birch forest to an oak/hickory forest; and
- Dairy production and crop yields will likely decline and plant pests will likely increase with increasing temperatures.

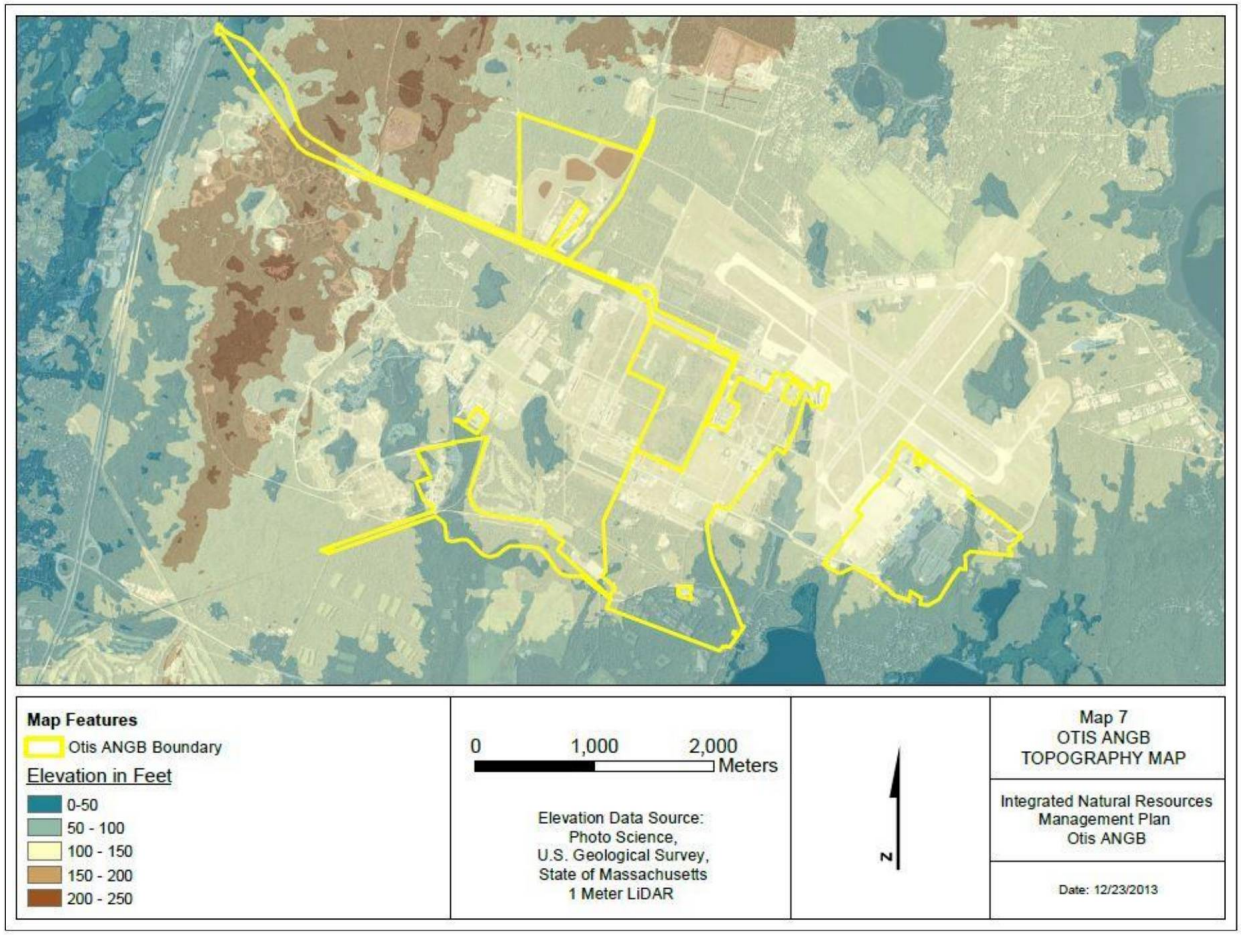
In addition, a project lead by the Federal Highway Administration, in cooperation with USFWS and National Park Service, conducted a vulnerability assessment of Cape Cod in relation to climate change (The Volpe Center 2011). One of the key outcomes from that project was a vulnerability map. No vulnerable areas were identified within or around Otis ANGB.

4.2. Landforms

Installation Supplement:

The landform of Barnstable County is the result of the last phase of continental glaciations and the subsequent rise in sea level (see the Geology and Soils section for details). Surface topography within JBCC varies greatly between the northern and western portions and southern portion (see the Topography Map). The northern and western portions of JBCC are 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. The highest point on Cape Cod, Pine Hill (318 feet above mean sea level [msl]), is situated in the western portion of JBCC, atop the Buzzards Bay Moraine. The southern portion of the JBCC is located within the Mashpee pitted outwash plain, which has very little topographic relief (slopes typically around 0 to 2 percent) and elevations around 100 feet above msl.

Otis ANGB Topography Map



Otis ANGB is located within the Mashpee pitted outwash plain within elevations from 68 to 147 feet above msl. The Mashpee pitted outwash plain is characterized by 130 to 200 feet of medium to coarse brown sand. A thin layer of wind-blown sand and silt caps the glacial deposits. This layer is generally only a few feet thick; the material was deposited when the drift surface had little vegetation, soon after the glacial retreat (Fletcher 1993). The Mashpee pitted outwash plain is generally well sorted sand and gravel with minor amounts of silt. The glacial deposits overlie crystalline bedrock, which probably slopes from west to east in this area.

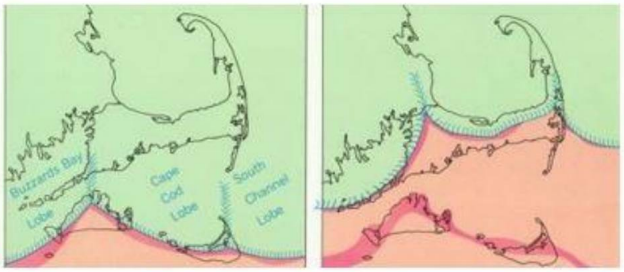
4.3. Geology and Soils

Installation Supplement:

Cape Cod was shaped approximately 12,000 years ago at the end of the Wisconsin glacial stage of the Pleistocene. The last continental ice sheet, the Laurentide ice sheet, advanced over Cape Cod about 23,000 years ago from Canada and Maine, transporting eroded materials from the underlying bedrock to its southernmost limit at the islands of Nantucke and Martha's Vineyard. The retreat of the Laurentide ice sheet resulted in a sea level rise and the deposit of the glacial drift that makes up most of Cape Cod (Oldale 2001, Oldale 1980). This occurred quickly in geological terms, with ice disappearing from the area in about 3,000 years and current geological formations occurring within about 1,000 years (Oldale 2001).

Bulges in the ice front are called lobes. Three main lobes played a role in the formation of Cape Cod – Buzzards Bay Lobe, Cape Cod Lobe, and South Channel Lobe (see the Figure of View of three main lobes and Laurentide ice sheet that played a role in the formation of Cape Cod below) (Odale 1980). As the ice sheet retreated, most of Cape Cod was formed by glacial drift into moraines or outwash plains.

View of three main lobes and Laurentide ice sheet that played a role in the formation of Cape Cod



Moraines are ridges formed by moving ice. Moraines of glacial till were deposited by the Cape Cod Bay Lobe forming the Sandwich moraine and main peninsula of the Cape, and Buzzards Bay Lobe forming the Buzzards Bay Moraine, the western edge of the Cape, and the Elizabeth Islands (Strahler 1966). Otis ANGB is situated on the northwest corner of Cape Cod where these two moraines converge. Much of the geologic material forming Cape Cod and the lands of Otis ANGB are an amalgam of well-scoured rock fragments that originated in northern New England.

Outwash plains make up most of the Cape Cod landscape. They are sand and gravel deposits created by meltwater streams which meandered over the landscape. 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 JBCC and Otis ANGB is situated on the Mashpee pitted outwash plain. As a result, much of the soil in the area is a loose sand material.

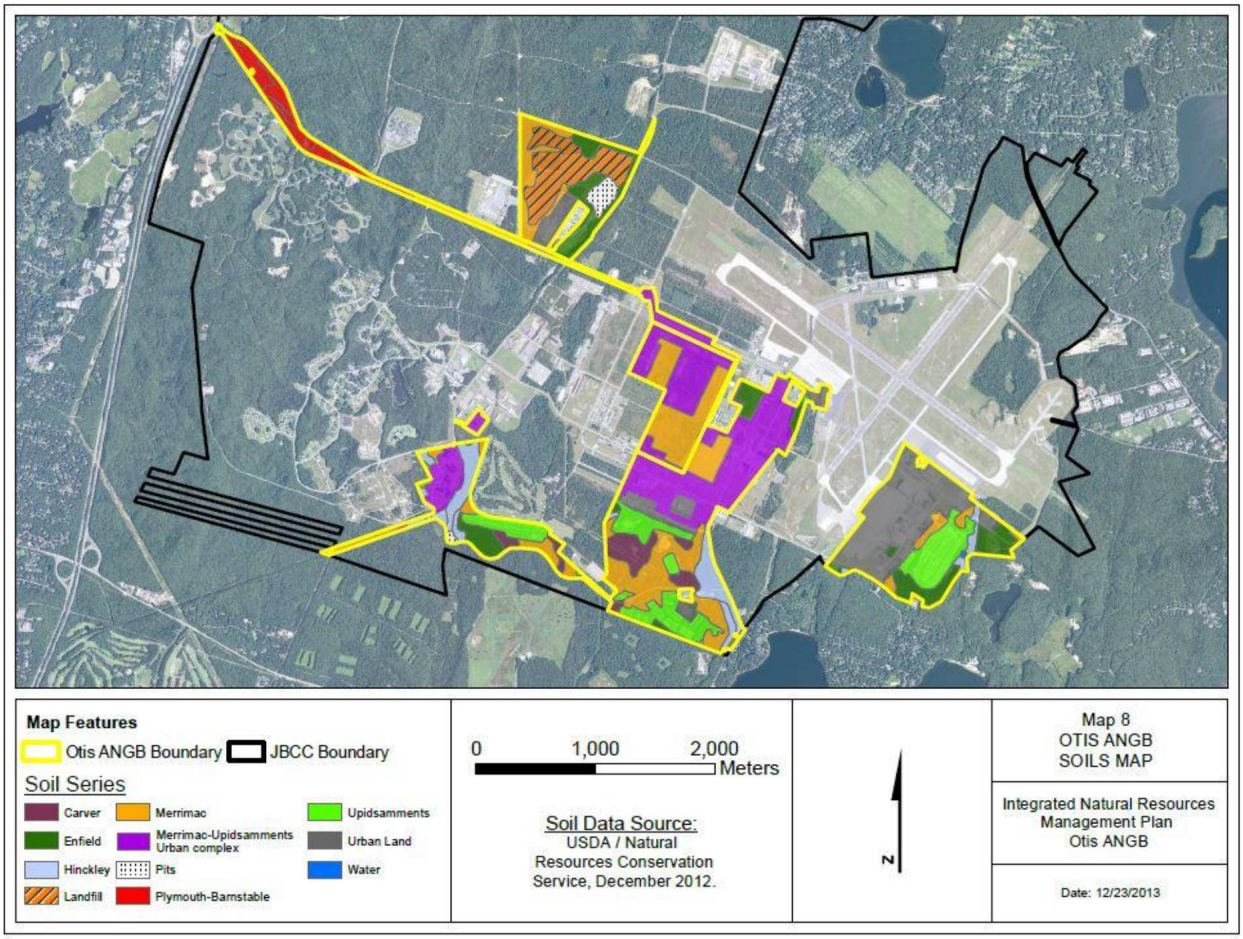
Outwash deposits create irregular morphology that combined with buried glacial ice results in kettles found on Cape Cod. During the period when the glacier retreated northward across what is now Cape Cod, large blocks of ice were left scattered throughout what would become the Mashpee pitted outwash 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 the JBCC, but do not occur on Otis ANGB.

Otis ANGB lies within the Enfield-Merrimac-Carver general soil group, while the Plymouth Barnstable-Nantucket series is found in western and northern portions of JBCC. The soils of the Enfield-Merrimac-Carver series are associated with the glacial outwash and loamy eolian material. General characteristics are nearly level to steep, very deep, well drained and excessively drained loamy and sandy soils. These soils are typically covered with a thin layer of undecomposed and decomposed leaves and twigs. The surface layer is silt loam, sandy loam, or loamy coarse sand about 3 inches thick. The subsoil ranges from silt loam to loamy coarse sand and is more than 65 inches deep. Typical land uses of this map unit are woodland, homesites, and farming. This unit is well suited to cropland and pasture. The pollution of groundwater is a hazard if the soils are used as sites for septic tank absorption fields or sanitary landfills (Fletcher 1993).

Soils in most of the Otis ANGB have been excavated, filled or obscured by urban land development and occur throughout the developed portions of the cantonment area. Characteristics of these soils vary from site to site. Generally, these soils have a surface layer of friable loamy sand about 4 inches thick. Below this, to a depth of 65 inches or more, is a loose, coarse sand.

A total of 13 distinct soil map units have been mapped on Otis ANGB by the National Resources Conservation Service (Fletcher 1993, NRCS 2010). Soil types are illustrated on the Soils Map and described in the table of Soil Descriptions for Otis ANGB below. Approximately 84 percent of ASCC consists of Enfield silt loams, Merrimac sandy loam, Udipsamments, urban land, dumps (landfill area), or a combination of Merrimac, Udipsamments and urban land. Enfield and Merrimac soils are found on outwash plains and are primarily found in forested or undeveloped areas of the installation. Nearly 56 percent of the ASCC is composed of Udipsamments, urban land, dumps, pits, or the Merrimac, Udipsamments and urban land complex. These disturbed soils are found throughout the various Otis ANGB parcels. Approximately 16 percent of the soils consist of Carver sand, Hinckley sandy loams and the Plymouth-Barnstable complex. Carver and Hinckley soils occur in the forested portions near the southern and easternmost boundaries of the, while the Plymouth-Barnstable complex with stones and boulders occurs within the western portion of the Connery Avenue parcel. No hydric soils occur on Otis ANGB.

Otis ANGB Soils Map



Soil limitations at Otis ANGB include poor filtering capacity, droughtiness, susceptibility to erosion, stoniness, and subsidence. Nearly all soil types found on the installation have poor filtering capacity; therefore, groundwater pollution is a hazard when soils are used for septic fields and landfills. Droughtiness, erosion, and/or stoniness are management concerns for Carver, Enfield, Hinckley, and Plymouth-Barnstable soils.

Soil Descriptions for Otis ANGB					
Map Unit Name	**Mapy Symbol ***	**Site Cover**		**Slope (%)**	**Description**
		Acres	**%**		
Carver coarse sand	252A, 252B, 252C	42.5	4	0 to 15	Very deep, nearly level to steep, excessively drained soils with 1-inch organic layer. Most areas are woodlands for which these soils are poorly siuted. Lawns, shrubs and shallow-rooted trees are limited due its droughtiness. Low available water capacity and susceptibility to erosion are management concerns.
Carver loamy coarse sand	259A, 259b	3.2	< 1	0 to 8	Very deep, gently sloping, excessively drained soil generally in broad areas on outwash plains with a 2-inch organic layer. Most areas are used for woodland, but some areas have been developed for home sites or are cultivated. The soil is poorly suited for woodland use as well as lawns, shrubs and shallow-rooted trees dues to its low droughtiness. Low

					available water capacity and susceptibility to erosion are management concerns.
Enfield silt loam	265A, 265B	132.4	11	0 to 15	Very deep, nearly level to strongly sloping, excessively drained soil with a 1-inch organic layer. Most areas are woodland and are well suited to that use. Strongly sloping areas are susceptible to erosion.
Hinckley gravelly sandy loam	242C, 242D	54.1	5	8 to 35	Very deep, strongly sloping to steep, excessively drained soil hills and ridges with a 2-inch organic layer. Most areas are used for woodland, but some areas have been developed for home sites or are cultivated. The soil is poorl suited for woodland use as well as lawns, shrubs and shallow-rooted trees due to its droughtiness.
Hinckley sandy loam	245A, 245B	22.7	2	0 to 8	Very deep, nearly level to genlty sloping, excessively drained soil with a 2-inch organic layer. Most areas are used for woodland, but some areas have been developed for home sites or are cultivated. The soil is poorly suited for woodland use as well as lawns, shrubs and shallow-rooted trees due to its droughtiness.
Merrimac sandy loam	254A, 254B	265.8	17	0 to 8	Very deep, nearly level to moderately steep, well drained soil with 3-inch organic layer. Most areas are used woodland; however, these soils are suitable to a variety of uses including woodland, cultivated crops and dwellings. However, one limitation to this soil is poor filtering capacity.
Merrimac Udipsamments - Urban complex	299C	309.4	19	8 to 15	Nearly level and gently sloping areas of Merrimac soil, Udipsamments, and urban land. Soil properties and characteristics vary greatly within short distances. These areas typically consist of open grasses, buildings, roads, and parking lots with some areas reverting to woodland vegetation.
Plymouth - Barnstable, extremely bouldery	484C, 484D	29.6	3	8 to 35	Very deep, undulating and rolling, excessively drained soils with a 1-inch organic layer. Stones and boulders cover 1 to 3 percent of the surface. Most areas are used for woodlands. These soils are suitable for woodlands and native pasture, but not

					idea for cultivated crops due to their stoniness.
Plymouth - Barnstable, very bouldery	483C	18.8	2	8 to 15	Very deep, rolling to hilly, excessively drained soils with a 1-inch organic layer. Stones and boulders cover 3 to 15 percent of the surface. Most areas are used for woodlands; however, these soils are poorly suited for woodland use. Low available water capacity, boulders, and susceptibility to erosion are management concerns.
Udipsamments smoothed	665	139.8	12	--	Nearly level areas excavated or filled for construction in the past. Most areas are used for roads, schools, housing developments or open fields. Generally, areas that are level have structures on them, while sloping areas are vegetated.
Dumps landfill	652	76.9	6		Areas used for trash disposal that consist mostly of paper, metal, plastic, glass, rubble, cinders, and organic debris. The characteristics vary depending on the kinds of refuse and the manner in which it was deposited and packed. All areas are subject to some degree of subsidence.
Pits, sand and gravel	600	14.5	1	--	Areas where sand and gravel have been removed with 5 to 40-foot deep pits with steep sides and a nearly level floor. Soils properties and slope vary. Areas are typically devoid of vegetation, but older pits may have scattered shrubs or grasses. These areas are poorly suited for woodland, cultivated crops and residential development.
Urban land	602	207	18	--	Nearly level to moderately steep developed areas altered or obscured by urban works and structures. Buildings and pavement cover more than 85 percent of surface.
Note: < 1 acre of Otis ANGB is water *A = nearly level (0 to 3% slope) B = gently sloping (3 to 8% slope) C = strongly sloping (8 to 15% slope) D = moderately steep to steep (15 to 35%) *Source*: NRCS 2012, NRCS 2010, Fletcher 1993					

4.4. Hydrology

Installation Supplement:

Water resources encompass both groundwater and surface water. Groundwater comprises subsurface water resources, which are essential to agricultural and industrial activities in many areas. Groundwater properties are often described in terms of depth to aquifer, aquifer or well capacity, and/or water quality. Surface water resources include lakes, rivers, streams, and wetlands, all of which are important for ecological, economical, recreational, and health related reasons.

Groundwater Resources

Otis ANGB overlies the Cape Cod Aquifer. In 1982, the USEPA designated this aquifer as the sole or principal source of drinking water for Cape Cod, Massachusetts pursuant to the Safe Drinking Water Act, and that the Cape Cod aquifer, if contaminated, would create a significant hazard to public health. The Cape Cod Sole Source Aquifer provides drinking water for 200,000 year-round and 500,000 seasonal residents of Cape Cod (Executive Office of Energy and Environmental Affairs [EEA] 2004).

The Cape Cod Aquifer is comprised of six lenses. Otis ANGB, along with the rest of the JBCC, is situated on top of the Sagamore Lens, which runs from the Cape Cod Canal eastward into the town of Yarmouth (MAANG 2011b). The US Geological Survey (USGS) has established a monitoring well at the high point of the Sagamore Lens, which is in the northern part of the JBCC. Groundwater flows from this high point in all directions and off site. The Sagamore Lens is the largest lens of the six lenses with the greatest flux of water and accounts for approximately 60 percent of total groundwater flow (Walter et. al 2004); it is approximately 300 feet thick (Executive Office of EEA 2004). Maximum water levels in the Sagamore Lens are nearly 70 feet above msl (Walter et. al. 2004). The lower boundary of the aquifer throughout Cape Cod is bedrock or slightly permeable glacial deposits (e.g., silt and very fine sand) or the transition zone between freshwater and saltwater; Olcott 1995).

The course sandy soils of Cape Cod result in a highly permeable groundwater system; the system is recharged solely from precipitation, at a rate of 27 inches per year, which is approximately 60 percent of the total annual precipitation (Executive Office of EEA 2004). Otis ANGB is located within several wellhead protection areas (i.e., identified as Zone II by MDEP). Zone II areas include the land area that contributes water to the well in a 180-day period of non-drought conditions. The well's water supply is replenished when precipitation or stormwater percolates through the soil to the water table. MDEP Zone II areas are protected under 310 Code of Massachusetts Regulations (CMR) 22.21(2). The Cape Cod Commission identifies performance standards in its Regional Policy Plan (RPP) for these areas to protect groundwater quality within this sole-source aquifer (Cape Cod Commission 2012).

Because of the permeability of the Cape Cod Aquifer, it is extremely vulnerable to contamination. Historical use of the JBCC has resulted in groundwater contamination that is currently being investigated and mitigated. Two major remediation programs are being conducted to address plume contamination at JBCC with oversight from the USEPA and MDEP; they include the Installation Restoration Program of the USAF Civil Engineering Center (southern portion of JBCC) and the Impact Area Groundwater Study Program managed by the MAARNG (northern portion of JBCC). More information on the specifics of these programs can be found at www.JBCC.org and http://JBCC-iagwsp.org.

Groundwater in the area near Otis ANGB ranges from 45 feet to 60 feet mean sea level or greater. The high point of the water table is located in the northern end of JBCC. From here it flows in all directions including south, under Otis ANGB and off site. The water table on and around JBCC may fluctuate up to 7 feet over the course of a year based on seasonal variability in recharge and pumping demand (MAANG 2001). Spring typically has the highest groundwater levels while the lowest levels typically occur in late summer/ early autumn.

Surface Water

JBCC is situated entirely within the Sagamore groundwater flow cell sub-watershed (USGS Hydrologic Unit Code [HUC] # 010900020206) of the Cape Cod watershed (HUC #0109000202). The overall installation is located approximately 1.5 miles east of Buzzards Bay, 2.5 miles south of Cape Cod Bay and 5 miles north of Nantucket Sound, which all connect directly to the Atlantic Ocean. All of Cape Cod is located within the coastal zone; it occurs within the Cape Cod and Island Towns Coastal Zone Management (CZM) sub-region.

The nearest waterways include the Cape Cod Canal immediately northeast of the JBCC boundary and the Mashpee River approximately 1 mile east of the I-Gate Area. While surface water is abundant in the vicinity of Otis ANGB, surface water features on Otis ANGB are limited to one palustrine emergent wetlands. Information on wetlands is provided below.

No CWA 303d listed waters occur within Otis ANGB or JBCC. However, two ponds to the southeast of Otis ANGB, outside of JBCC, are listed as impaired (Ashumet and Johns Ponds). These ponds to the east of JBCC are typically listed for high mercury, and portions of the Buzzard Bay estuaries and Cape Cod Canal are listed for fecal coliform (Massachusetts Division of Watershed Management [MDWM] 2011).

Water resources at Otis ANGB include one wetland, drainage ditches, and groundwater. Perennial and intermittent streams do not exist within Otis ANGB due to rapid infiltration by permeable soils. Precipitation infiltrates quickly or drains from storm drainage systems to swales then into nearby ponds and wetlands. The major drainage swale for Otis ANGB, located in the south central portion of the base, flows from north to south. Two minor drainage swales, also flowing from north to south, are located to the east and west of the central swale. These swales drain south towards Ashumet Pond, Johns Pond, Moody Pond, and cranberry bogs that are directly south of Otis ANGB (see the Water Resources Map).

Floodplains

Floodplains generally are areas of low, level ground present on one or both sides of a stream channel that are subject to periodic or infrequent inundation by flood waters. Floodplains are typically the result of lateral erosion and deposition that occurs as a river valley is widened. The porous material that composes the floodplain is conducive to retaining water that enters the soil during flooding events and at times when the groundwater table is elevated. Floodplains in their natural form are beneficial in reducing the number and severity of floods, minimizing non-point source water pollution, filtering stormwater, providing habitat for plants and animals, and providing aesthetic appeal and outdoor recreation benefits. Inundation dangers associated with development of floodplains have prompted federal, state, and local legislation to limit floodplain development to recreation, agriculture, and preservation activities. Floodplains are regulated by the Federal Emergency Management Agency (FEMA) with standards outlined in 44 CFR Part 60.3. EO 11988 (Floodplain Management) requires agencies to assess the effects that their actions may have on floodplains and to consider alternatives to avoid adverse effects and incompatible development on floodplains.

The Otis ANGB is located in an area of minimal flooding according to Flood Insurance Rate Map (FIRM) 25023C0625J (FEMA 2012). No FEMA designated floodplains have been mapped on JBCC to date.

See the Waters of the US, Wetlands, and Floodplains section for a summary of wetlands.

5. Ecosystems and the Biotic Environment

5.1. Ecosystems Classification

Installation Supplement:

Cape Cod is located in the US Ecoregion – Humid Temperate Domain – Hot Continental Division – Eastern Broadleaf Forest (Oceanic) Province (Bailey 1995), which is equivalent to the Eastern Temperate Forest Region (Level I) and the Mississippi Alluvial and Southeast US Coastal Plains (Level II) USEPA Ecoregions (Commission for Environmental Cooperation [CEC] 1997). Cape Cod is the only part of New England in that Level II Ecoregion, which stretches from Cape Cod along the Atlantic Seaboard to Florida. The Eastern Broadleaf Forest (Oceanic) Province encompasses an area of varying topography ranging from 1,000 feet to sea level east of the Appalachian Mountains, and from about 1,000 to 3,000 feet west of the mountains. The area east of the mountains includes the Piedmont Plateau and coastal plain (Bailey 1995).

The Eastern Broadleaf Forest (Oceanic) Province is characterized by winter deciduous forest that is dominated by tall broadleaf trees that provide a dense summer canopy and shed their leaves in the winter. Forests are divided into three types: mixed mesophytic, Appalachian oak, and pine- oak (Pinus-Quercus spp.). Pine-oak forest, also known as Pine Barrens, occurs on dry sandy soils on the northern coastal plains. This forest type is prevalent on Cape Cod; it has a thick shrub layer beneath the pines and historically has been exposed to frequent naturally occurring fires (Bailey 1995).

Following the USEPA ecoregion hierarchy, Otis ANGB is situated within the Cape Cod/Long Island ecoregion (Level IV), which is located within the larger Atlantic Coastal Pine Barrens ecoregion (Level III). The Atlantic Coastal Pine Barrens is differentiated from the ecoregion to the north and south by its climate, soils and oak-pine forests. The Cape Cod/Long Island ecoregion includes Cape Cod and an inland area from Plymouth to the head of Buzzards Bay, Nantucket, Martha's Vineyard, and the Elizabeth Islands of Massachusetts, Rhode Island's Block Island, and a large part of New York's Long Island. These lands were made by the continental glacial ice sheet, which resulted in terminal moraines, outwash plains and coastal deposits. Elevations are primarily less than 150 feet above msl with a high point of 395 feet above msl. Unique features of this ecoregion include its moderate maritime climate, pine-oak forests, kettle ponds and the unique habitats in marshes, swamps, bogs, and sand dunes. Natural vegetation within this ecoregion typically consists of forests of pitch pine (*Pinus rigida*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), white oak (*Quercus alba*), black huckleberry (*Gaylussacia baccata*) and blueberry (.*Vaccinium* spp). Other distinct vegetative communities include coastal forests, maritime woodlands and shrublands, dune woodlands, sandplain grassland and heathlands, sand dune grasslands and beach strand (Griffith et al. 2009).

5.1.1. Vegetation

5.1.1.1. Historic Vegetative Cover

Installation Supplement:

Prior to European settlement, Cape Cod was primarily forested with pine and oak woodlands with less hickory (*Carya* spp.), beech (*Fagu*s spp.) and other species, particularly on inner Cape Cod (Motzkin et al. 2002). Rapid clearing for settlement and agriculture in the mid-1600s greatly altered the natural vegetative communities across Cape Cod as a result of repeated grazing, burning, harvesting and other activities. However, by the mid-1800s, only 41 percent of the area was wooded with the majority of the woodlands occurring on inner Cape Cod into southeastern Massachusetts. Remaining woodlands experienced frequent harvests for wood products with the majority of the trees harvested being less than 40 years old. Forests rebounded in the 19th and early 20th centuries as a result large-scale farm abandonment. However, not all areas were reforested; heathlands dominated by kinnikinnick (*Arctostaphylos uva-ursi*), broom crowberry (*Corema conradii*), and pine barren goldenheather (*Hudsonia ericoides*) became quite common in the more heavily disturbed areas. Today, only a few hectares of heathlands remain on Cape Cod due to residential development and encroachment of taller woody vegetation (Motzkin et al. 2002).

Periodic fires have been especially important in establishing and maintaining the pitch pine/ scrub oak community which dominates the forested areas of JBCC (MAARNG 2000). Between 1836 and 1938 seven major wildfires of 5,000 to 25,000 acres occurred in the area. Fire frequency increased during training activities. However, this was somewhat mitigated by the use of troops to contain and suppress woodland fires. From 1982 to 1989, fuel loads built up and contributed to the frequency of wildfires. Currently, wildfires are generally suppressed resulting in increased fuel and wildfire potential.

5.1.1.2. Current Vegetative Cover

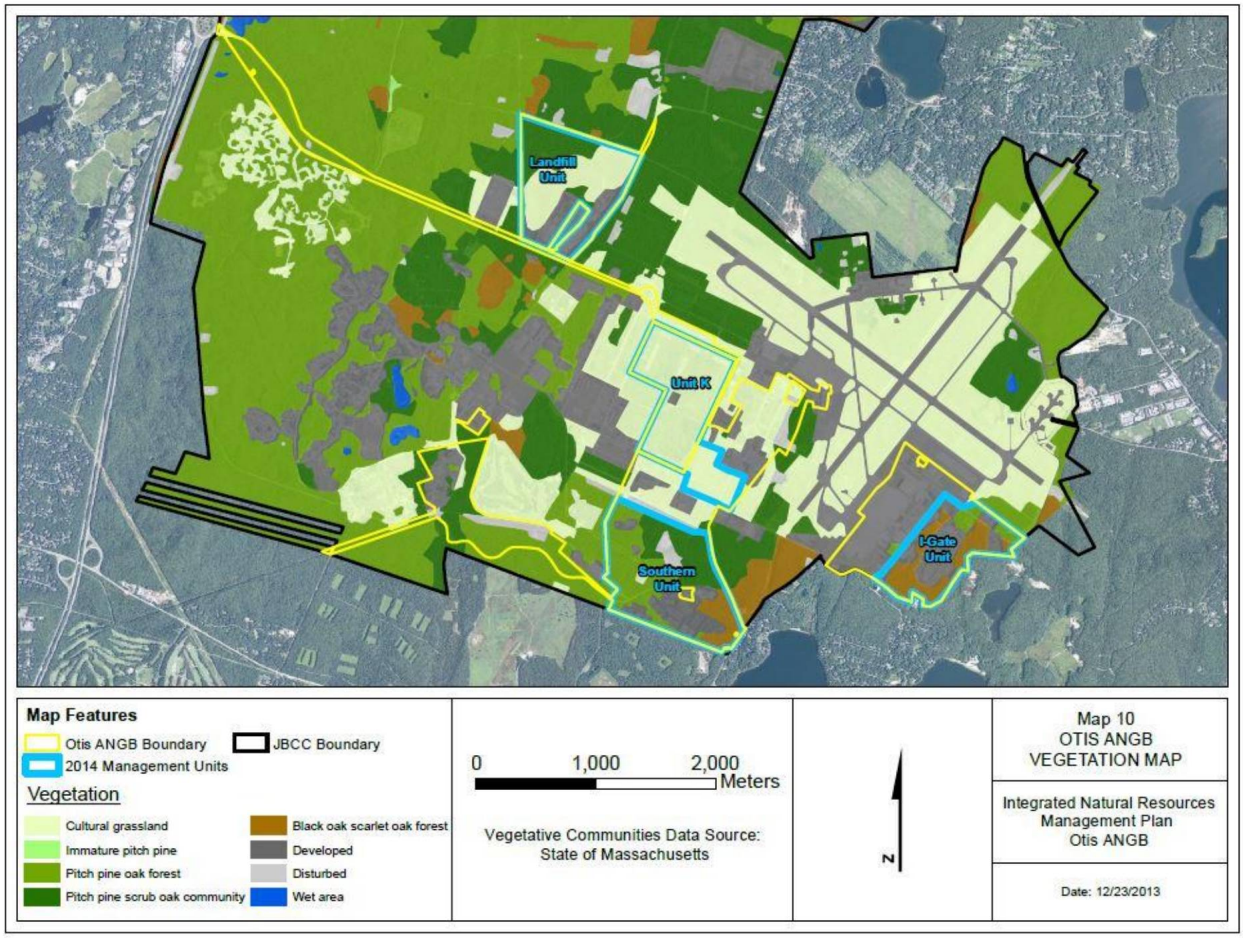
Installation Supplement:

Natural vegetative communities were mapped for JBCC using MAARNG floristic data collected during the initial floristic survey for JBCC (Jenkins 1994) and annual Range and Training Land Assessment (RTLA) surveys, and classified using Massachusetts Natural Heritage and Endangered Species Program's (NHESP's) *Classification of the Natural Communities of Massachusetts*[1] (Swain and Kearsley 2011). The plant communities of JBCC are generally classified as mid to late successional forest with intermittent early successional disturbed areas and kettle-hole ponds and wetlands. Current plant communities have been influenced by past weather events, naturally occurring fire and prescribed fires, insects, and historic land activities such as logging and grazing (MAARNG 2009a).

No floristic surveys or vegetation mapping has been done specifically for Otis ANGB. However, given Otis ANGB's location within JBCC, vegetation cover types and species data from MAARNG were used to summarize vegetation on Otis ANGB (MAARNG 2009a, MAARNG 2006, Jenkins 1994). Based on this data, approximately 63 percent (840 acres) of Otis ANGB is composed of developed, disturbed or cultural[2] grasslands, while the remainder of the land includes four terrestrial plant communities comprising approximately 487 acres and less than 1-acre of wetlands. A total of 433 species of vascular plants were identified at JBCC during the initial floristic survey (Jenkins 1994), and an additional 109 species were identified during subsequent RTLA surveys (MAARNG 2009a). Species diversity is considered to be fairly low within JBCC forests. Approximately 53 plant species on average were identified in each forest community, whereas most fertile woodlands in western New England have up 200 species (Jenkins 1994).

Current vegetation and land cover is summarized in the table of Land Cover Types on Otis ANGB and the Otis ANGB Vegetation Map below. For information regarding management of these areas, see the Forest Management section of this INRMP.

Otis ANGB Vegetation Map



Land Cover Types on Otis ANGB		
Land Cover Type	**Acres**	**Percent Cover**
Natural Communities - NHESP Classifications		
Black Oak Scarlet Oak Forest/Woodland	80.79	6.1
Pitch Pine Pak Forest/Woodland	219.35	16.5
Pitch Pine Scrub Oak Community	186.78	14.1
Scrub Oak Shrubland	0.47	< 1
Wetland Area*	0.8	< 1
Altered Land Cover Types		
Cultural grassland	415.89	31.3
Developed	383.78	28.9
Disturbed land	39.99	3.0
*See Table 9 for Summary of wetlands. Source: Swain and Kearsley 2011, MAARNG 2006		

Black Oak Scarlet Oak Forest/Woodland

The Black Oak Scarlet Oak Forest/Woodland is a fairly open heath forest community on dry sandy or rocky slopes that is maintained by regular, light fire. Without fire, more shrubby species exist with a deeper leaf litter that is slow to decompose (Swain and Kearsley 2011). Although this community comprises only approximately 6 percent (81 acres) of Otis ANGB, it represents the most advanced state of succession of all the plant communities.

Dominant canopy species are black oak (*Quercus velutina*) and scarlet oak (*Q. coccinea*), with white oak (*Q. alba*) and red maple (*Acer rubrum*) as common associates. The understory is usually sparse due to frequent fire and includes grey birch (*Betula populifolia*), black cherry (*Prunus serotina*), and sassafras (*Sassafras albidum*), as well as species less tolerant of fire such as flowering dogwood (*Cornus florida*) or

shadbush (*Amelanchier arborea*). A fairly dense and clumped low shrub layer also exists with a scattered open herbaceous layer (Swain and Kearsley 2011).

Plant species present in these woodlands provide food important for a variety of wildlife. Black oak acorns and berries in the understory are attractive to white-tailed deer (*Odocoileus virginianus*), grey squirrels (*Sciurus carolinensis*), wild turkeys (*Meleagris gallopavo*) and others. Birds present in this community include the red-eyed vireo (*Vireo olivaceus*), white-breasted nuthatch (*Sitta carolinensis*), ovenbird (*Seiurus aurocapillus*), black-and-white warbler (*Mniotilta varia*), scarlet tanager (*Piranga olivacea*), great crested flycatcher (*Miarchus crinitus*), and downy woodpecker (*Picoides pubescens*) (Swain and Kearsley 2011).

This community supports the eastern box turtle (*Terrapene c. carolina*) and several rare invertebrates, including the threatened barrens daggermoth *(Acronictan albarufa*), Gerhard's underwing (*Catocala herodius gerhardi*), and coastal barrens buck moth (*Hemileuca maia maia*). Common species found at JBCC in this community type include American toad (*Bufo americanus*), Fowler's toad (*Bufo woodhousei fowleri*), spring peeper (*Pseudacris crucifer*), ovenbird (*Seiurus aurocapillus*), pine warbler (*Dendroica pinus*), northern oriole (*Icterus galbula*), black-capped chickadee (*Parus atricapillus*), common yellowthroat (*Geothlypis trichas*), coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), and southern flying squirrel (*Glaucomys volans*) (Swain and Kearsley 2011, MAARNG 2009a).

Pitch Pine Oak Forest/Woodland

Approximately 17 percent (219 acres) of Otis ANGB is composed of the pitch pine oak forest/woodland community, making it the most common natural land cover type. This community is characterized by dry, low-nutrient soils with a variable proportion of dominant species – either predominantly pine with scattered oaks or predominantly oaks with scattered pines. The structure of this forest/woodland is either open canopy with a thick understory of shrubs or a closed canopy with scattered clumps of shrubs. The community is fire-dependent (Swain and Kearsley 2011).

Pitch pine oak communities have a canopy of pitch pine and oaks (black, scarlet, chestnut and white oaks). White pine (*Pinus strobus*) and red maple also contribute to the canopy. The shrub layer is continuous and is composed of blueberries (*Vaccinium angustifolium* and *V. pallidum*), black huckleberry (*Gaylussacia baccata*) and other ericaceous shrubs forming an often continuous low shrub layer. Scattered patches of scrub oak (*Quercus ilicifolia*) and bear oak (*Q. prinoides*) can be dense. Catbriar (*Smilax rotundifolia*) and other briars (*Smilax* spp.) often make dense barriers around low, damp openings. The herb layer is generally sparse (Swain and Kearsley 2011).

This community also supports the eastern box turtle and several rare invertebrates, including the threatened barrens daggermoth, Gerhard's underwing, Melsheimer's sack bearer (*Hemileuca maia maia*), coastal barrens buck moth, and water-willow stem borer (*Papaipema sulphurata*). Common species found at JBCC in this community type include spotted salamander (*Ambystoma maculatum*), American toad, Fowler's toad, spring peeper (*Pseudacris crucifer*), black racer (*Coluber constrictor*), ringneck snake (*Diadophis punctatus*), rufous-sided towhee (*Pipilo erythrophthalmus*), pine warbler, common yellowthroat, black-capped chickadee, hermit thrush (*Catharus guttatus*), ovenbird, coyote, red fox, and southern flying squirrel (Swain and Kearsley 2011, MAARNG 2009a).

Pitch Pine Scrub Oak Community

Pitch pine scrub oak communities, also called pine barrens, are open shrublands that occur on outwash sandplains. This community is found on approximately 14 percent of Otis ANGB (187 acres); it represents the second most abundant natural vegetative community type. Pitch pine/scrub oak communities are fire-dependent, adapted to occasional low-intensity fires. The vegetation typical of the pine barrens are highly fire-adapted: scrub oaks and huckleberries sprout readily from their root crowns and pitch pine has thick bark that resists fire damage and produces some cones that release their seeds only when heated by fire (Swain and Kearsley 2011).

The canopy of these communities is dominated by pitch pine (*Pinus rigida*), with a dense understory of scrub oak and huckleberry (*Gaylussacia baccata*). Lowbush blueberries form even lower patches, or grow mixed with other species. Bearberry (*Arctostaphylos uva-ursi*) and large patches of lichens, intermixed with sedges or little blue stem (*Schizachyrium scoparium*) occur in openings between the taller shrubs (Swain and Kearsley 2011).

A large number of species of Lepidopterans are restricted to the pitch pine scrub oak community. Birds utilizing this community are generally those in oak woodlands and utilize the openings: rufous-sided towhee, pine warbler, common yellowthroat, chipping sparrow (Spizella passerine), and whip-poor-will (*Caprimulgus vociferus*) (Swain and Kearsley 2011). Other common species found at JBCC in this community type include spotted salamander, America toad, spotted turtle (Clemmys guttata), black racer, coyote, white-tailed deer, and red fox (MAARNG 2009a).

Scrub Oak Community

The scrub oak community is generally an earlier successional stage of the pitch pine community (Jenkins 1995). This community is found on less than 1 percent of Otis ANGB (0.5 acre). On and near Otis ANGB, scrub oak communities were dominated by scrub oaks ranging from 3 to-9 feet high. Depending on the successional stage or previous land use, scrub oak communities ranged from impenetrable to open scrub and grass areas. Scrub oak communities generally consist of scrub oak and pitch pine understories with sparse or no herbaceous cover. In more open areas, species included sumac (*Rhus typhina*), bigtoothed aspen, scarlet oak, low bush blueberry, huckleberry, smilax (*Smilax rotundifolia*), and *Andropogon* spp.

Based on observations at JBCC, the successional rate of scrub-shrub communities is fairly slow. Although recently disturbed areas may succeed within 3 to 5 years from open scrub grassland areas to thick scrub oak thickets, the thickets appear to remain in a relatively steady successional state. At Otis ANGB, burned pitch pine forests were observed to remain as scrub oak thickets for longer than 5 years (Cavanaugh et al. 1996). Scrub oak communities may provide particularly important habitat for Lepidopteran species within the pitch pine community.

Wetland Areas

Water resources are rather sparse on Otis ANGB, with only two features with less than 1 percent of the land cover (< 1 acre). One wetland has been identified by NHESP as a potential vernal pool, but this has not been field verified. The other wetland is a wooded swamp, but has not been identified as a potential vernal pool. No formal delineation or assessment of the wetlands or ponds has been done for Otis ANGB. A water resources delineation is currently underway on Otis ANGB; this section will be updated when that data is available.

Six types of water resources were identified on JBCC, including ponds, coastal plain pond shore, kettlehole level bogs, red maple swamps, highbush blueberry thickets, and woodland vernal pools (MAARNG 2009a). Woodland vernal pools are small, shallow depressions with little or no vegetation within upland forests. They are temporarily 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 are not adapted to fish predation. Most wetlands on JBCC are either vernal pools or function as one (Swain and Kearsley 2011, MAARNG 2009a).

This cover type on JBCC has the most diverse plant community. These wetlands also support the eastern box turtle and a number of rare invertebrates including the threatened water willow stem borer (*Papaipema sulphurata*), and several Odonates. Common species found at JBCC in this community type include American toad, Fowler's toad, gray treefrog (*Hyla versicolor*), spotted turtle, snapping turtle (*Chelydra serpentina*), rufous-sided towhee, pine warbler, American robin (*Turdus migratorius*), common grackle, short-tailed shrew, masked shrew (*Sorex cinereus*), and muskrat (*Ondatra zibethicus*) (MAARNG 2009a).

Cultural Grasslands

Cultural grasslands are created and maintained by humans and are dominated by grasses; they are typically maintained by mowing. This community type is the most abundant vegetated community type on Otis ANGB, comprising approximately 416 acres or 31 percent of the installation. Large tracts of grasslands are disappearing in the northeastern US due to development and forest succession. Large grasslands are defined by Jones and Vickery (1997) as grasslands of more than 75 contiguous acres, including conservation lands (may be a mixture of pastures, meadows, and hayfields), airports, and capped landfills. Large grasslands are home to a diversity of wildlife: mammals, butterflies, and birds-including some of our rarest grassland birds – upland sandpiper (*Bartramia longicauda*), grasshopper sparrow (*Ammodramus savannarum*), northern harrier (*Circus cyaneus*), and vesper sparrow (*Pooecetes gramineus*). These birds need large contiguous patches of grassland habitat for successful breeding. In some areas, airports and military bases provide the best remaining habitat (Jones and Vickery 1997).

Lawns and actively maintained building areas typically contain the mixtures of introduced grasses and dry soil weeds commonly found in eastern Massachusetts (Jenkins 1995). Where soils are very dry and sandy, they may contain substantial amounts of native grasses and alien species. In recently abandoned sites, characterized by abandoned or demolished buildings or pavement, soils are generally poor and cover is sparse. Species include native grasses such as Fall panic grass (*Panicum dichotomoflorum*), churchmouse three-awn (*Aristida dichotoma*), and poverty grass (*Sporobolus vaginiflorus*), as well as introduced species such as yellow foxtail-grass (*Setaria glauca*), Canada bluegrass (*Poa compressa*), spotted spurge (*Euphorbia maculata*), bracted plantain (*Plantago aristida*), English plantain (*Plantago lanceolata*), and lady's thumb (*Polygonum persicaria*). Abandoned sites where soils remain somewhat intact, are observed to succeed to a fairly natural grassland community with native species such as andropogon and switchgrass (*Panicum virgatum*) present among aliens such as wild carrot (*Daucus carota*), spotted knapweed (*Centaurea stoebe ssp. micranthos*), bella honeysuckle (*Lonicera morrowi*), and autumn olive (*Elaeagnus umbellata*).

Developed

Developed lands are areas altered or obscured by urban works and structures. Approximately 382 acres (29 percent) of Otis ANGB is currently developed; this represents the second largest land cover type (although unvegetated) on Otis ANGB.

Disturbed land

Disturbed plant communities on Otis ANGB are the result of facility development or operations. Approximately 40 acres (3 percent) of Otis ANGB is composed of disturbed plant communities. Some exotic and invasive plant species benefit from disturbance as they typically outcompete native species and proliferate in disturbed systems. One example of such a proliferation is that of spotted knapweed in the Cantonment Area (MAARNG 2009a).

[1]NHESP's natural communities' classifications are updated periodically. The latest version was reviewed to ensure the up to date information was being used to describe Otis ANGB's natural vegetative communities.
[2]Cultural grasslands are created and maintained by humans and are dominated by grasses.

5.1.2. Fish and Wildlife

Installation Supplement:

No comprehensive species surveys have been conducted specifically for the Otis ANGB. However, the MAARNG have surveyed JBCC (i.e., Camp Edwards land) extensively since 1993 as part of the RTLA program, resulting in a large database of documented fauna. A copy of the Camp Edwards species lists are inclueed in the Camp Edwards Training Site INRMP. Given the Otis ANGB is limited to the southern portion of JBCC, some of these species have limited potential to occur within Otis ANGB. The following sections provide an overview of fauna with the potential to occur within Otis ANGB based on this available data.

Birds
A total of 111 bird species have been documented on JBCC based on previous surveys and bird/wildlife airstrike data (MAARNG 2009a, USCG 2012a, USCG 2013). JBCC 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, field sparrow, song sparrow, prairie warbler, whip-poor-will, and gray catbird, have exhibited significant regional declines, but are relatively abundant on JBCC. These species are likely also prevalent on Otis ANGB as well.

Grassland birds are declining in Massachusetts and throughout the northeastern U.S (Mass Audubon 2011). More than 90 percent of coastal heathlands and grasslands have been estimated to have been lost since the 1850s due to development, cultivation, and shrubland encroachment.

Grassland habitat is critical for four state-listed bird species, which include the endangered upland sandpiper (*Bartramia longicauda*), threatened grasshopper sparrow (*Ammodramus savannarum*), threatened northern harrier (*Circus cyaneus*), and threatened vesper sparrow (*Pooecetes gramineus*). Grasshopper sparrows are the most abundant, while upland sandpiper observations have decreased over the past few years. Northern harriers have been observed in the grasslands and scrub oak shrublands within JBCC.

Reptiles and Amphibians

No surveys have been conducted for reptiles and amphibians on Otis ANGB. However, 12 amphibians and 12 reptiles have been observed on JBCC (MAARNG 2009a). The most commonly observed amphibians include bullfrogs (*Rana catesbeiana*), green frogs (*Rana clamitans*), grey treefrogs (*Hyla versicolor*), wood frog (*Rana sylvatica*), and spring peepers (*Pseudacris crucifer*); however, American toads (*Bufo americanus*) spotted salamanders (*Ambystoma maculatum*) and eastern newts (*Notophthalmus viridescens*) were also frequently observed. The redback salamander (*Plethodon cinereus*), pickerel frog (*Rana palustris*), and American toad (*Bufo americanus*) have been observed at areas of Camp Edwards not necessarily associated with delineated wetlands (MAARNG 2009a).

Reptiles observed include five turtles and seven snakes. The eastern box turtle, a species of concern, is the only state listed reptile species known to occur within JBCC and is found throughout all of JBCC's habitat types (MAARNG 2009a), including on Otis ANGB.

Mammals

No surveys have been conducted for mammals on Otis ANGB. More than 30 species of mammals have been documented during surveys at Camp Edwards with the most common species being white-footed mouse (*Peromyscus leucopus*) and southern redbacked vole (Clethrionomys *gapperi*). The white-footed mouse was captured in every plant community on Camp Edwards, whereas the southern red-backed vole was found mostly within communities dominated by pitch pine. In the relatively small grasslands that were surveyed, the meadow vole (*Microtus pennsylvanicus*) was common. Seven other small mammals have been observed (MAARNG 2009a).

Ten species of medium-sized small mammals have been observed within JBCC. With the exception of the fisher (*Martes pennanti*) and the federal candidate New England cottontail (*Sylvilagus transitionalis*), these species are all common southeastern Massachusetts species. New England cottontails generally inhabit the pitch pine scrub oak community. The only large mammals observed on JBCC include coyote and white-tailed deer. Four bat species have also been captured throughout JBCC: big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), northern myotis (*Myotis septentrionalis*), and eastern pipistrelle (*Pipistrellus subflavus*) (MAARNG 2009a).

Fish

Only limited fish surveys have been conducted on JBCC. Thus, only a handful of species have been documented to date, including golden shiner (*Notemigonus crysoleucas*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), and largemouth bass (*Micropterus salmoides*) (MAARNG 2009a). Given Otis ANGB has only one wetland and no ponds or streams, the potential for fish to be present on Otis ANGB is very limited.

Invertebrates

No invertebrate surveys have been conducted for Otis ANGB. Past surveys and inventories on JBCC have concentrated on three groups of invertebrates: moths, dragonflies, and aquatic invertebrates (MAARNG 2009a).

Mello et al. (1999) surveyed a variety of plant communities for moths and butterflies from 1996 to 1998, including scrub oak shrublands, pitch pine scrub oak forests, pitch pine-oak forest woodland, and grasslands. A total of 524 species of Lepidoptera were documented, including 13 rare state listed species (see **Appendix E** for the species list). The most significant plant communities for state-listed rare moth species are the scrub oak shrubland and the cultural grasslands (MAARNG 2009a, Mello et al. 1999).

No comprehensive survey for dragonflies and damselflies has occurred at JBCC, but various summer surveys have occurred during 1995-2005 (MAARNG 2009a). For example, Mello et al. (1999) noted 20 species of odonates during the lepidoptera survey. A list of species previously documented at JBCC is included in **Appendix E**, but should not be considered comprehensive. Of the species identified, four of them are rare state listed species: comet darner (*Anax longipes*), the spatterdock darner (*Rhionaeschna mutata*), the tule bluet (*Enallagma carunculatum*), and the pine barrens bluet (*Enallagma recurvatum*).

An aquatic invertebrate survey was conducted in the ponds and wetlands of Camp Edwards during the summer of 1997 (Wojtowicz 2000). The majority of the taxa were in the orders Diptera (flies), Odonata (dragonflies and damselflies), Coleoptera (beetles), and Hemiptera (true bugs). Non-insect invertebrates were rather diverse and included Collembola (springtails), Nematoda (roundworms), Hydracarina (water mites), Hydra, Oligochaeta (aquatic earthworms), Isopoda (aquatic sow bugs), Hirudinea (Leeches), Conchostraca (clam shrimp), Gastropoda (snails), Amphipoda (scuds and sideswimmers), Copepoda, and Cladocera (water fleas) (MAARNG 2009a).

5.1.3. Threatened and Endangered Species and Species of Concern

Installation Supplement:

Federal status, as a threatened or endangered species, is derived from the ESA (16 USC §1531 et seq.) and is administered by the USFWS. The USFWS maintains a current list of federally endangered and threatened species, candidate species, and species of concern. Candidate species and species of concern designated by the USFWS receive no statutory protection under the ESA. Federally listed species with known occurrence in Barnstable County include three birds, four reptiles, two mammals, one insect and one flowering plant (USFWS 2012a). A summary of these species is included in the table of Special Status Species Known to Occur within the Vicinity of Otis ANGB. No current federally listed endangered or threatened species are known to occur on JBCC; however, the New England cottontail (*Sylvilagus transitionalis*), red knot (*Calidris canutus rufa*), and northern long-eared bat (*Myotis septentronialis*) have all been documented (MAARNG 2009a). The northern long-eared bat is proposed for listing as endangered, rufa red knot is proposed as threatened, and the New England cottontail is a candidate species.

Camp Edwards may be a stronghold for the New England cottontail on Cape Cod, but they are primarily found in the impact area (MAARNG 2009a). While they may occur on Otis ANGB, they are not likely to occur in high abundance as suitable habitat is limited. The red knot is a long distance migratory shorebird that uses the Cape Cod region every spring and fall as a stopover during its spring and fall migration. While the red knot was observed during a previous JBCC survey, the likelihood of this shorebird occurring on Otis ANGB is low due to a lack of suitable habitat on site (e.g., tidal mudflats, rocky shores and beaches).

In Massachusetts, the Massachusetts Endangered Species Act (MESA) (M.G.L.c. 131A) and its regulations (321 CMR 10.00) protect rare species and their habitats by prohibiting the "take"[3] of any plant or animal species officially listed as endangered, threatened or special concern by MDFW. The NHESP, part of the MDFW, is responsible for the conservation and protection of hundreds of species that are not hunted, fished, trapped, or commercially harvested in the state, including those species officially listed as endangered, threatened, or of special concern in Massachusetts.

Currently, 432 rare species are officially listed as endangered, threatened or special concern species; they include 4 amphibians, 29 breeding birds, 10 fish, 104 invertebrates (non-marine), 14 mammals (includes 6 whales), 15 reptiles (includes 5 sea turtles), and 256 plants (NHESP 2013). Of these 432 species, a total of 33 state listed species have been documented on JBCC (MAARNG 2009a), including 1 amphibian, 8 birds, 19 invertebrates, 1 mammal, 1 reptile, and 5 plants (see the table of Special Status Species Known to Occur within the Vicinity of Otis ANGB). An additional six plants have been documented on JBCC that are listed on NHESP's watch list (see the table of Special Status Species Known to Occur within the Vicinity of Otis ANGB), which is a non-regulatory list of plants of known or suspected conservation concern. A calculated climate change vulnerability index (CCVI) is included for wildlife species where it is available. A CCVI is not available for any of the plants. For additional information on rare wildlife and plant species in Massachusetts, refer to NHESP's rare species information at: http://www.mass.gov/dfwele/dfw/nhesp/species_info/species_home.htm.

No federally designated critical habitat occurs within JBCC (USFWS 2012b). However, approximately 86 percent of Otis ANGB has been delineated as Priority Habitat for one or more state listed species in accordance with 321 CMR 10.12. Priority Habitat is based on the known geographical extent of habitat for all state-listed rare species and is codified under MESA. Twelve insects, five birds, and one reptile, as shown in the table of Special Status Species Known to Occur within the Vicinity of Otis ANGB and table of Priority Habitat for State-Listed Species by MAANG Personnel, have Priority Habitat on the primary areas of Otis ANGB. An additional four insects and one amphibian also have priority habitat designated within small areas proposed for transfer to the MAARNG (NHESP 2013). Projects and activities undertaken within designated Priority Habitat that are not considered exempt under 321 CMR 10.14 of the MESA are reviewed by NHESP in accordance with the NEPA process. More information on MESA reviews and rare species habitat management at Otis ANGB are included in the Management of Threatened and Endangered Species and Habitats section.

Priority Listed Wildlife Species for Otis ANGB

- Federally proposed and state endangered northern long-eared bat (*Myotis septentrionalis*)
- Federal candidate New England cottontail (*Sylvilagus transitionalis*)
- State endangered upland sandpiper (*Bartramia longicauda*)
- State threatened grasshopper sparrow (*Ammodramus savannarum*)
- State threatened northern harrier (*Circus cyaneus*)
- State threatened vesper sparrow (*Pooecetes gramineus*)
- State species of concern eastern whip-poor-will (*Caprimulgus vociferus*)
- State species of concern eastern box turtle (*Terrepene carolina*)
- State threatened the pink streak (*Dargida rubripennis*)
- State species of concern frosted elfin (*Callophrys irus*)

Priority listed species for Otis ANGB are primarily grassland species with the exception of the two potentially federally listed species. See the USFWS and NHESP Special Status Species Fact Sheets for descriptions of each of these priority species.

Special Status Species Known to Occur within the Vicinity of Otis ANGB

Scientific Name	Common Name	Federal Status	State Status	CCVI	NHESP Priority Habitat on Otis ANGB	Documented on JBCC	Potential on Otis on ANGB	Habitat Description
Mammals								
Myotis septentrionalis	Northern long-eared bat	PE	E	-	-	✓	Moderate	Overwinters in caves and roosts primarily under loose tree bark through the spring and fall. Also roosts in manmade structures.
Sylvilagus transitionalis	New England cottontail	C	-	MV2	-	✓	Low	Shrublands associated with sandy soils or wetlands and regenerating forests associated with small-scale disturbances.
Amphibians								
Scaphiopus holbrooki	Eastern spadefoot	-	T	EV2,3,4	✓*	✓	Low	Burrows in dry sand or sandy loam soils of Pitch Pine barrens, coastal oak woodlands or sparse shrub growth with temporary ponds.
Birds								

Accipter striatus	Sharp-shinned hawk	-	SC	-	-	✓	Low	Mixed woodland/conifer forests with spruce, pine and white cedar near open areas and water.
Ammodramus savannarum	Grasshopper Sparrow	-	T	IL1	✓	✓	Known	Grasslands, pastures, and old fields with minimal grass and litter cover, and airports.
Bartramia longicauda	Upland sandpiper	-	E	PS1	✓	✓	Known	Open grassy uplands, wet meadows, old fields, pastures, and airports.
Calidris canutus rufa	Red knot	PT	-	-	-	✓	Low	Stopover and winter areas are preferably large tidal mudflats, rocky shores and beaches.
Caprimulgus vociferus	Eastern Whip-poor-will	-	SC	IL1	✓	✓	Moderate	Fire adapted landscapes such pine barrens and oak glade communities.
Charadrius melodus	Piping plover	T	T	MV2	-	-	-	Coastal beaches, sandflats on barrier islands, and coastal inlets.
Circus cyaneus	Northern harrier	-	T	-	✓	✓	Known	Wet meadows, grasslands, abandoned fields, and coastal/inland marshes.
Parula americana	Northern parula	-	T	-	-	✓	Low	Wet woodlands, red maple or white cedar swamps, river margins, or small depressions.
Pooecetes gramineus	Vesper sparrow	-	T	-	✓	✓	Known	Airfields, heavily disturbed lands, active and abandoned hay fields, or grasslands.
Sterna dougallii dougallii	Roseate tern	E	E	MV2	-	-	-	Nests on small islands, sand dunes or ends of barrier beaches, and forages over shallow coastal waters.
Insects								
Abagrotis nefascia	Coastal heathland cutworm	-	SC	-	✓	✓	Low	Sandplain grasslands, coastal heathlands, occasionally pitch pine-scrub oak barrens
Acronicta albarufa	Barrens dagger moth	-	T	-	✓	✓	Low	Open canopy pitch pine-oak barrens, especially oak thickets

Anax longpipes	Comet darner	-	SC	-	✓*	✓	Low	Ponds with floating emergent vegetation
Callophrys irus	Fristed elfin	-	SC	EV2 PS3	✓	✓	Moderate	Xeric, open disturbed habitats, grassy openings, sand/gravel pits, or airports.
Catocala herodias gerhardi	Gerhard's underwing	-	SC	-	✓	✓	Low	Open canopy pitch pine scrub oak barrens, especially scrub oak thickets.
Cicindela dorsalis dorsalis	Northeastern beach tige beetle	T	E	-	-	-	-	Occur in open sand flats, dunes, water edges, beaches, woodland paths and sparse grassy areas.
Cicindela purpurea	Cow path tiger beetel	-	SC	-	✓	-	Low	Sandplain grasslands and heathlands.
Cicinnus melsheimeri	Melsheimer's sack bearer	-	T	-	✓	✓	Low	Sandplain pitch pine-scrub oak barrens, especially oak thickets.
Cingilia catenaria	Chain dot geometer	-	SC	-	✓	✓	Low	Coastal plain shrublands, sand plain grasslands, heathlands
Cycnia inopinatus	Unexpected cycnia	-	T	-	✓*	-	Low	Sandplain grasslands and heathlands.
Dargida rubripennis	The pink streak	-	T	-	✓	✓	Moderate	Sandplain grasslands and dunes, airports and power line cuts.
Enallagma carunculatum	Tue bluet	-	SC	-	-	✓	-	Variety of wetlands, but most numerous on large lakes
Enallagma recurvatum	Pine barrens bluet	-	T	PS2	✓*	✓	Low	Coastal plain ponds
Euchlaena madusaria	Sandplain euchlaena	-	SC	-	-	✓	-	Sandplain pitch pine-scrub oak barrens, heathlands and grasslands
Hemileuca maia	Barrens buckmoth	-	SC	MV2	✓	✓	Low	Xeric, open habitats with extensive scrub oak thickets
Metarranthis pilosaria	Coastal swamp metarranthis	-	SC	-	✓	✓	Low	Acidic swamps and bogs as well as pitch pine-scrub oak barrens and heathlands
Papaipema sp.	Ostrich fern borer	-	SC	-	-	✓	-	Floodplain forest and wooded swamps
Papaipema sulphurata	Water-willow stem borer	-	T	-	-	✓	-	Coastal plain wetlands where water-willow grows.

Psectraglaea carnosa	Pink Swallow moth	-	SC	-	-	✓	-	Sandplain pitch pine/scrub oak barrens and heathlands
Rhionaeschna mutata	Spatterdock darner	-	SC	IL2	✓*	✓	Low	Boggy ponds with a lot of emergent and floating vegetation.
Speranza exonerata	Pine barrens speranza	-	SC	-	✓	✓	Low	Pitch pine-scrub oak barrens on sandplains, rocky summits and ridges
Sympisitis riparia	Dune noctuid moth	-	SC	-	-	-	-	Coastal dunes, bluffs, coastal sand plain grasslands, heathlands
Zale lunifera	Pine barrens zale	-	SC	-	✓	✓	Low	Sandplain pitch pine-scrub oak barrens, scrub oak thickets
Reptiles								
Dermochelys coriacea	Leatherback sea turtle	E	E	-	-	-	-	Shallow coastal waters and bays; nesting on beaches.
Eretmochelys imbricata	Hawksbill sea turtle	E	E	-	-	-	-	Rocky areas, coral reefs, or shallow coastal areas.
Pseudemys rubriventris	Plymouth red-belled turtle	E	E	-	-	-	-	Natural/man-made freshwater coastal lakes or ponds in oak- pine barrens.
Chelonia mydas	Green sea turtle	T	T	-	-	-	-	Wide, flat, open, sandy beaches with very little grass or other vegetation.
Terrepene carolina	Eastern box turtle	-	SC	PS2	✓	✓	Known	Many habitat types including both dry and moist woodlands, thickets, marsh edges, swales, and stream banks.
Plants								
Agalinis acuta	Sandplain gerardia	E	E	-	-	-	?	Dry sandy soils within grasslands, roadsides, pine/oak scrub openings.
Asclepias tuberosa	Orange milkweed	-	WL	-	-	✓	?	Dry sandy soils and requires full sun
Eleocharis ovata	Ovate spike-sedge	-	E	-	-	✓	-	Grows along sandy freshwater margins
Fuirena pumila	Umbrella sedge	-	WL	-	-	✓	-	Coatal plain pond shores
Lechea minor	Thyme-leaf pinweed	-	WL	-	-	✓	?	Dry, sandy soils woods
Lupinis perennis	Wild lupine	-	WL	-	-	✓	?	Sandy plains, open pine barrens, disturbed areas such as power line cuts
Ophioglossum	Adder's tongue	-	T	-	-		-	Boggy meadows,

pusillum	fern					✓		acidic fens, borders of marshes, wet fields and moist woodland clearings
Polygala nuttallii	Nutall's milkwort	-	WL	-	-	✓	?	Dry, sandy areas, sand plain grasslands
Rhynchospora torreyana	Torrey's beak-sedge	-	E	-	-	✓	-	Seasonally wet, sandy to peaty soils of low nutrient, acidic wetlands, primarily coastal plain pond shores
Stachys hyssopifolia	Hyssop hedge nettle	-	WL	-	-	✓	-	Sandy, gravelly or peaty shores and bog
Thuja occidentalis	Northern white cedar	-	E	-	-	✓	-	Moist sites near streams or on calcareous soils
Triosteum perfoliatum	Broad tinker's-weed	-	E	-	-	✓	?	Dry, open woods or thickets, usually shunning dense shade

FEDERAL STATUS
E = Endangered = Danger of extinction throughout range
PE = Proposed Endangered
T = Threatened = Likely to become endangered in foreseeable future throughout range
PT = Proposed Threatened
C = Candidate = In process for listing or recommended for listing but currently precluded
STATE STATUS
E = Endangered = Applies to a species in danger of extinction throughout all or a significant portion of its range
T = Threatened = Applies to a species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range
SC = Special Concern = Applies to a species documented to have suffered a decline in numbers or occurring in such small numbers that it could become threatened
WL = Watch List = Non-regulatory list of plants of known or suspected conservation concern that NHESP is interested in tracking.
CLIMATE CHANGE VULNERABILITY INDEX
IL = Increase Likely = Available evidence suggests that abundance and/or range extent within the geographical area assessed is likely to increase
PS = Presumed Stable = Available evidence does not suggest that abundance and/or range extent will change by 2050
MV = Moderately Vulnerable = Abundance and/or range extent within the geographical area assessed likely to decrease by 2050
EV = Extremely Vulnerable = Abundance and/or range extent within the geographical area assessed extremely like to substantially decrease or disappear by 2050 Climate Change Vulnerability Assessments were conducted in: [1]Illinois, [2]New York, [3]Pennsylvania, [4]West Virginia
POTENTIAL TO OCCUR
Low = Unlikely to occur due to a lack of habitat on ASCC
Moderate = Moderate potential to occur due to documented occurrence in the immediate vicinity, but potential habitat is lacking on ASCC
High = Likely to occur due to potential habitat on ASCC as well as documented occurrence in the immediate vicinity
Documented = Has been documented to occur on ASCC

Sources: USFWS 2012a, USFWS 2012b, NHESP 2012, 2013, MAARNG 2009a, Byers and Norris 2011, Furedi et al. 2011, Schlesinger et al. 2011, and Walk et al. 2011

[3]"Take" is defined by MESA as, "in reference to animals 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 to assist in any such conduct. Disruption of nesting, breeding, feeding or migratory activity may result from, but is not limited to, the modification, degradation or destruction of Habitat."

5.1.4. Waters of the US, Wetlands, and Floodplains

Installation Supplement:

Wetlands are an important natural system because of the diverse biological and hydrologic functions they perform. These functions may include water quality improvement, groundwater recharge, pollution treatment, nutrient cycling, the provision of wildlife habitat and niches for unique flora and fauna, stormwater storage, and erosion protection. Wetlands are protected as a subset of the "waters of the United States" under Section 404 of the CWA, as well as EO 11990 (Protection of Wetlands) which requires federal agencies to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the beneficial values of wetlands. The USACE defines wetlands as:

> "…those areas that are inundated or saturated with ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR Part 328)."

According to National Wetland Inventory (NWI) and MDEP wetland mapping, two palustrine wetlands occur on Otis ANGB that are composed of approximately 0.8 acre or less than 1 percent of the installation (see the Water Resources Map). No certified vernal pools have been documented on Otis ANGB by NHESP; however, one of the two wetlands is identified as a potential vernal pool[4] (MassGIS 2012). A description of these two wetlands is provided below and in the Summary of NWI and MassGIS Data for Otis ANGB table. A water resources delineation is currently underway at Otis ANGB; this data will be incorporated in this section when it becomes available.

Munitions Wetland – This palustrine, emergent wetland is located east of the munitions storage facility in the southeastern corner of Otis ANGB. This wetland covers about 0.3 acre and has not been field verified; it contains cattails, pussy willow, and rushes. This emergent wetland has been identified as a potential vernal pool by NHESP (MassGIS 2012). There is an intermittent drainage carrying stormwater from the north. Surface water from drainage area DA-4 is collected and conveyed to outfall location SD-4 (see the Water Resources Map). The collected water runs through an interceptor chamber and then discharges into the drainage channel that leads to the wetland. This wetland receives significant drainage during storm events. A pattern of sediment deposition was observed where the intermittent drainage discharges into the wetland. The banks of the drainage were cut with little vegetation, indicating that high flows are experienced. A snapping turtle, frogs, and tadpoles have been observed during certain times of the year. Water in the wetland drains to the south via a vegetated swale. Overflows, under certain storm events, are then conveyed off the base towards Johns Pond.

Connery Avenue Wetland – This is a palustrine, scrub-shrub located south of Connery Avenue near the western boundary of JBCC. This wetland covers about 0.5 acre and has not been field verified. This wetland is identified in both NWI and MDEP Geographic Information System (GIS) data (USFWS 2013, MassGIS 2012).

Summary of NWI and MassGIS Data for Otis ANGB

Type	Cowardin Classification	DEP Classification	Name	NHESP Potential Vernal Pool	Acres
Wetland	PEM	Shallow marsh Meadow	Munitions Wetland	Yes	0.33
Wetland*	PSS	Wooded Swamp	n/a	No	0.48
				Total	0.81

PEM = Palustrine Emergent
PSS = Palustrine Scrub-shrub
*This wetland is in an area that may potentially transfer to the MAARNG in the future.

Source: MassGIS 2012, MassGIS 2009, MassGIS 2007, MassGIS 2000, Cowardin et al. 1979, USFWS 2013
Note: PVP is from MassGIS NHESP data for PVPs.

In addition to the wetlands located with the Otis ANGB boundaries, a number of wetlands surround the installation, particularly to the east and to the south. The Water Resources Map shows the location of these wetlands areas in relation to Otis ANGB.

[4] Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. Vernal pool habitat is extremely important to a variety of wildlife species including some amphibians that breed exclusively in vernal pools, which spend their entire life cycles confined to vernal pool habitat. Certified vernal pools are protected if they fall under the jurisdiction of the Massachusetts Wetland Protection Act Regulations (310 CMR 10.00). Certified vernal pools are also afforded protection under the state Water Quality Certification regulations (401 Program), the state Title 5 regulations, and the Forest Cutting Practices Act regulations.

5.1.5. Other Natural Resource Information

Installation Supplement:

Completed Surveys

With the exception of recent bird surveys conducted on some of the current Otis ANGB parcels (e.g., Landfill Area), no surveys have been completed that are specific to Otis ANGB. The USCG conducts annual bird surveys on the airfield, which were originally conducted by MAANG prior to transfer to the USCG. A total of 73 bird species have been documented by the USCG on the airfield to date (USCG 2012a, and draft Natural Resources Management Plan [NRMP]).

NHESP conducted a grassland bird survey of the cantonment area of the JBCC (White and Melvin 1985), a comprehensive floristic survey of JBCC (Jenkins 1994), and moth survey of JBCC (Mello et al. 1999).

Other than these surveys, the majority of surveys have been conducted by the MAARNG on Camp Edwards. The MAARNG maintains a website describing the natural resources on Camp Edwards at http://www.eandrc.org. The MAARNG conducts annual surveys for plants and birds as part of their RTLA program. Populations of small mammals on Camp Edwards have been monitored since 1994 during annual RTLA surveys. The wetlands of Camp Edwards were surveyed in 1995 for secretive waterbirds (Wilson and Cavanaugh 1996). Some of the ponds and wetlands of Camp Edwards were surveyed for dragonflies during the summers of 1995-2005 (MAARNG 2009a). An aquatic invertebrate survey was conducted in the ponds and wetlands of Camp Edwards during the summer of 1997 (Wojtowicz 2000). A survey of the bat species on Camp Edwards was conducted during 1999 and 2000 (MAARNG 2009a). A survey of the reptiles and amphibians of Camp Edwards was conducted in 1995 as part of the Massachusetts Herpetological Atlas Project (MAARNG 2009a).

See the Vegetation, and Fish and Wildlife sections for more detail about the results of these surveys.

Invasive Species

Lists of invasive plant species specific to New England and Massachusetts have been compiled by the Invasive Plant Atlas of New England (IPANE) and Massachusetts Invasive Plant Advisory Group (MIPAG), respectively. IPANE lists 110 species that are considered noxious and/or invasive in New England. The IPANE species list has no legal status. However, of the 110 species listed, two of them are on the Federal Noxious Weed List. These species include the giant hogweed (*Heracleum mantegazzianum*) and hydrilla (*Hydrilla verticillata*); neither of these species has been observed on JBCC to date. MIPAG has identified 66 invasive and/or noxious species in Massachusetts, which include 39 "Invasive", 24 "Potentially Invasive" and 3 "Likely Invasive" species, which include species known to be invasive, with the potential to be invasive, and those that have not spread to Massachusetts yet, respectively (MIPAG 2005).

The Massachusetts Department of Agricultural Resources (MDAR) maintains a *Massachusetts Prohibited Plants List*. It is currently illegal to import, propagate or sell any of the plants on this list within the Commonwealth of Massachusetts. MDAR derives its authority to enact this ban under M.G.L. c 128 §§ 2, 16-31A. The MIPAG assisted in the development of this list; thus, several of the 138 species on the current list are species identified as invasive and/or noxious by MIPAG and IPANE.

Based on previous surveys, 24 invasive plant species have been observed on JBCC that occur on the IPANE, MIPAG and/or MDAR species lists (IPANE 2012, MDAR 2012, MAARNG 2009a, MIPAG 2005). However, they are generally not wide spread, but they tend to occur in small, localized areas (MAARNG 2009a). Eight of these species have been identified by MAARNG (2009a) previously as high priority species due to their potential to threaten native plant communities on JBCC. Invasive plant species known to occur on JBCC and their listings are provided in the Invasive Plant Species Known to Occur on JBCC table. Six species have been identified as high priority species for Otis ANGB and are described briefly below.

- **Asiatic bittersweet** (*Celastrus orbiculatus*) – this woody vine has been documented along fencelines and throughout the Cantonment Area (Unit K).
- **Autumn olive** (*Eleagnus umbellata*) – this invasive shrub is found in previously disturbed sites within the Cantonment Area and along roadsides within JBCC.
- **Japanese honeysuckle** (*Lonicera japonica*) – this climbing vine is a highly invasive plant that is often associated with the habitat of broad tinker's weed (*Triosteum perfoliatum*), a state-listed endangered plant.
- **Morrow's honeysuckle** (*Lonicera morrowii*) – this deciduous honey suckle is a highly invasive plant in the Northeast and commonly invades forest edges and interiors, floodplains, pastures, old fields, roadsides, and other disturbed areas.
- **Japanese knotweed** (*Polygonum cuspidatum*) – this herbaceous plant has been found on well pads and in the Cantonment Area.
- **Spotted knapweed** (*Centaurea stoebe ssp. micranthos*) – this herbaceous thistle-like flowering plant is highly invasive in disturbed grasslands; it is found in the grasslands in southern portion of JBCC and tends to decrease as native plants increase.

Although any of the species identified in the Invasive Plant Species Known to Occur on JBCC table have the potential to occur and/or spread to Otis ANGB, some of them are more likely to pose a greater risk to natural communities than others. In addition to the JBCC high priority species previously identified, MAANG will also monitor for tree of heaven (*Ailanthus altissima*), Japanese barberry (*Berberus thunbergii*), Scotch broom (*Cytisus scoparius*), winged burning bush (*Euonymus alatus*), common reed (*Phragmites australis*), common buckthorn (*Rhamnus cathartica*), black locust (*Robinia pseudoacacia*), multiflora rose (*Rosa multiflora*), as they are known to be invasive in Massachusetts.

Invasive Plant Species Known to Occur on JBCC

Scientific Name	Common Name	IPANE List	MIPAG List	MDAR List	JBCC Priority Species	MAANG Priority Species
Ailanthus altissima	Tree of heaven	✓	I	✓	-	Medium
Aira carophyllea	Silver-hairgrass	✓	-	-	-	Low
Berberis thunbergii	Japanese barberry	✓	I	✓	✓	Medium
Catalpa speciosa	Northern catalpa	✓	-	-	-	Low
Celastrus orbiculata	Oriental bittersweet	-	I	✓	✓	High
Centaurea stoebe ssp. micranthos	Spotted knapweed	✓	LI	✓	✓	High
Cuscuta gronovii	Common dodder	-	-	✓	-	Low
Cytisus scoparuis	Scotch broom	✓	I	-	✓	Medium
Elaeagnus umbellata	Autumn olive	✓	I	✓	✓	High
Euonymus alatus	Winged burning bush	✓	I	-	-	Medium
Fragula alnus	Glossy buckthorn	✓	-	✓	-	Low
Lonicera japonica	Japanese honeysuckle	✓	I	✓	✓	High
Lonicera morrowii	Morrow's honeysuckle	✓	I	✓	-	High
Pennisetum villosum	Feathertop	-	-	-	-	Medium
Phragmites australis	Common reed	✓	I	✓	✓	Medium

Poa compressa	Canada bluegrass	✓	-	-	-	Low
Polygonum cuspidatum	Japanese knotweed	✓	I	✓	✓	High
Populus alba	White poplar	✓	-	-	-	Low
Rhamnus cathartica	Common buckthorn	✓	I	✓	-	Medium
Robinia pseudoacacia	Black locust	✓	I	✓	✓	Medium
Rosa multiflora	Multiflora roase	✓	I	✓	-	Medium
Rosa rugosa	Rugosa rose	✓	-	-	-	Low
Rumex acetosella	Sheep sorrel	✓	-	-	-	Low
Solanum dulcamara	Bittersweet nightshade	✓	-	-	-	Low
Tussilago fafara	Colt's-foot	✓	LI	-	-	Low
Key: ✓ = found on the IPANE or MDAR species lists; Species of particular concern on ASCC and JBCC. I = "Invasive" species according to MIPAG LI = "Likely Invasive" species according to MIPAG						
Source: IPANE 2012, MDAR 2012, MAARNG 2009a, MIPAG 2005						

Animals

No invasive forest or aquatic species have been identified to date on JBCC that pose a threat to the natural communities on Otis ANGB. According to the IPMP, pests include mosquitoes, ticks, flies, wasps, termites, cockroaches, ants, spiders, mice, geese, bats, raccoons, coyotes, feral dogs and cats, and other miscellaneous household pests. Mosquitoes are major pest on Otis ANGB from March to October. Every summer, USCG analyzes for the presence of the West Nile virus and Eastern Equine Encephalitis. USDA-Animal and Plant Health Inspection Service (APHIS) also undertakes rabies management on JBCC. The Barnstable County Health Department actively monitors and control mosquitoes in the area and provides cooperative information exchange with all tenants of the JBCC. In general, tick populations are fairly well managed by wildlife on-site (USCG 2009). Similar pest species have been identified by MAARNG (2009a) and USCG (2009).

6. Mission Impacts on Natural Resources

6.1. Natural Resources Needed to Support the Military Mission

Installation Supplement:

Missionscape refers to the condition of the landscape best suited to support the various missions and varies depending upon the type of training. Given the 102 IW mission is primarily an administrative mission, the ideal missionscape for this unit is to transition Otis ANGB lands into a campus-like environment that allows for consolidated facilities in a smaller footprint with some open space. Thus, natural resources needed to support the 102 IW mission include vegetated buffers for water quality preservation and some open space for security and safety clear zones associated with Anti-Terrorism / Force Projection (AT/FP) and training exercises.

This INRMP integrates aspects of natural resources management into the military mission. As such, it becomes the primary tool for ecosystem management at Otis ANGB while ensuring the successful, efficient accomplishment of the military mission. A multiple-use ecosystem management approach will be implemented to accommodate mission-oriented activities and provide for good stewardship, thereby maintaining and improving the quality, aesthetic values and ecological relationships of the environment.

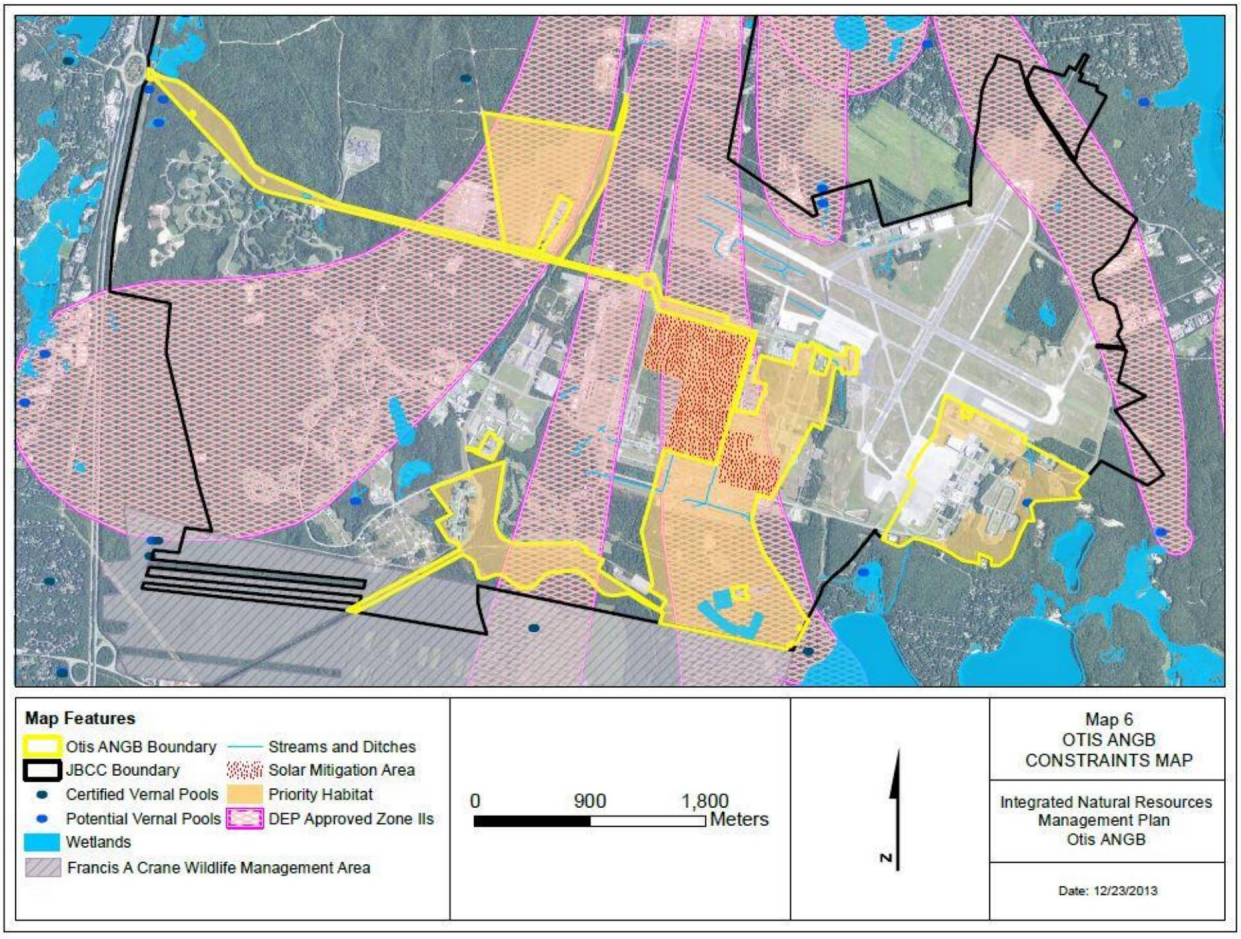
Specific military missions and training requirements are fluid and change from time to time with realignments, transformations, and changes in equipment and tactics. This requires the establishment of basic underlying natural resource management principles and practices that have broad application and can be adapted for multiple situations, such as is the case with surface water and soil management practices. Implementation of this INRMP will promote adaptive stewardship practices that protect and enhance natural resources for multiple use, sustainable yield and biological integrity, while supporting the military mission.

6.2. Natural Resources Constraints to Missions and Mission Planning

Installation Supplement:

The primary sustainability challenges (i.e., natural resources constraints) to the military mission on Otis ANGB, as it is currently used and projected to be used in the near future, are the ability to (1) manage federally and state listed species without impacting the mission, and (2) protect groundwater. Any new activities or infrastructure could be limited in areas where federally or state- listed species are known to occur or where there is state priority habitat. New activities and infrastructure also have to avoid critical areas for protecting groundwater quality, as described in the JBCC Groundwater Protection Policy (2011). For more on threatened and endangered species with the potential to occur on the installation see the Threatened and Endangered Species and Species of Concern section, Management of Threatened and Endangered Species and Habitats section, and USFWS/NHESP Special Status Species Fact Sheets. Additionally, the known constraints discussed in this section are presented graphically in Otis ANGB Constraints Map.

Otis ANGB Constraints Map

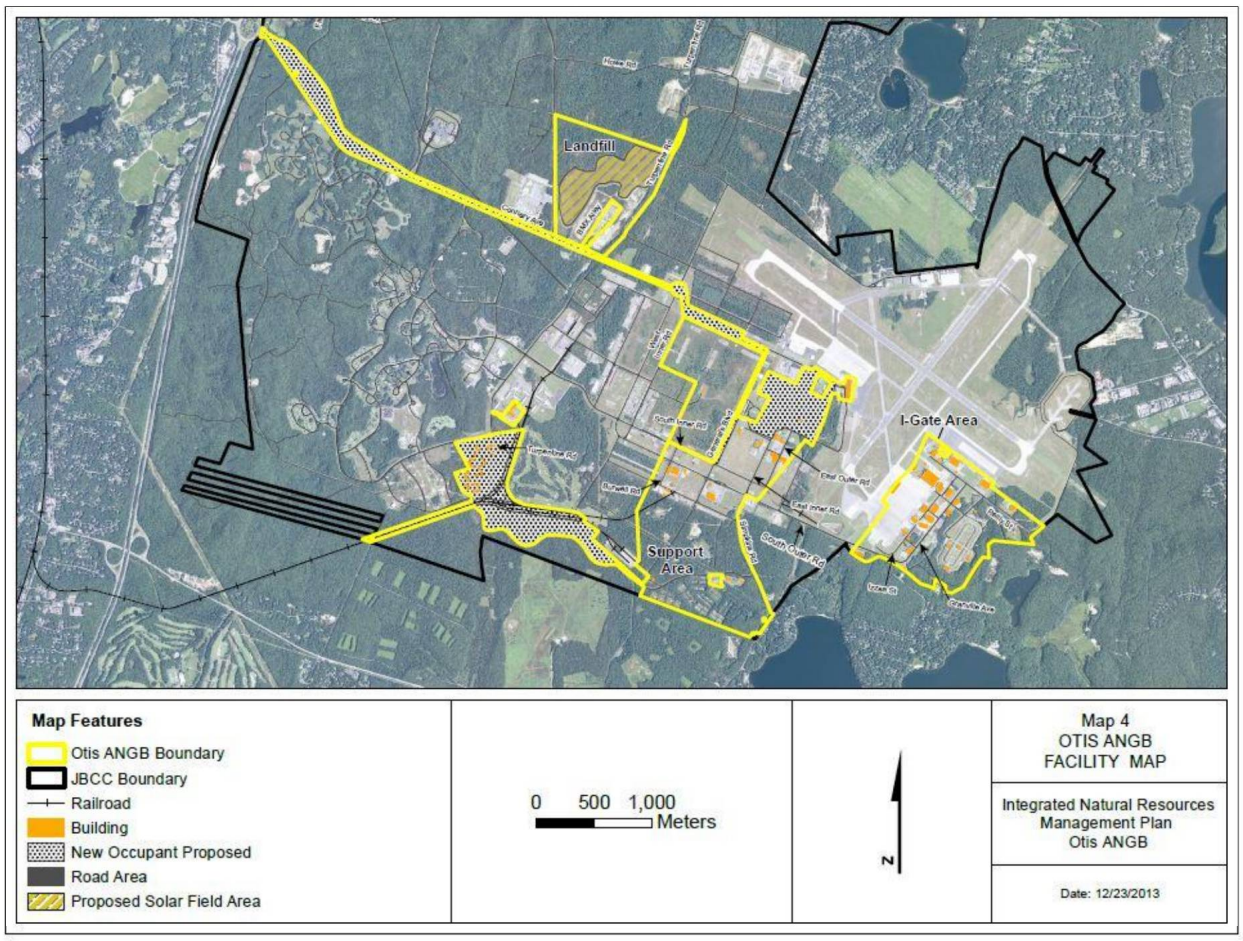


Land Use

Otis ANGB is located on the approximately 21,000-acre JBCC, which is a multi-tenant installation. The northern 15,000 acres of JBCC are used by Camp Edwards for maneuvers and small arms training. This area also includes an approximately 570-acre USCG communications station and the 80-acre Precision Avionics Vectoring Equipment (PAVE) Phased Array Warning System (PAWS) area, which is an USAF Space Command radar system operated by the 6th Space Warning Squadron. The southern portion of JBCC contains the Cantonment Area, which includes USCG, MAARNG and MAANG facilities. Facilities include aircraft runways, maintenance areas, housing, various support facilities, a golf course, and the 750-acre National Cemetery.

As discussed in the Location and Area section, Otis ANGB currently occupies approximately 1,328.5 acres of non-contiguous land within the southern portion of JBCC. The primary land use categories within the developed portions of Otis ANGB include industrial and administration. Undeveloped areas are maintained as successional grasslands, mown open areas, or passively managed woodland. The Otis ANGB Facility Map provides an overview of Otis ANGB land uses and facilities. Land use on Otis ANGB is further categorized by functional use and ground cover later in this section.

Otis ANG Facility Map



Functional Areas

Currently, Otis ANGB consists of four general functional land use areas, which include the I-Gate Area (102 IW Mission Area), 102 IW Support Area, Landfill Area, and Non-Mission Essential Assets/Land. Non-Mission Essential Assets/Land include infrastructure that is no longer needed for the 102 IW mission (e.g., several roads and associated right-of-ways, rail line area in the southwestern area), but that still support the JBCC community. These parcels comprise approximately 322.8 acres and are identified as areas to be transferred to other JBCC entities in the Otis ANGB Real Property Map and summarized in the Summary of JBCC Parcels Licensed to and/or Managed By MAANG table in the Location and Area section. The remaining three areas will continue to be part of Otis ANGB, and are summarized below the Functional Areas on Otis ANGB table. For more detailed information on the 102 IW mission and activities, refer to the Military Missions section.

Functional Areas on Otis ANGB

Functional Area	Land Use Category	Acres	Description
I-Gate Area	Administrative	207.8	This 271.5-acre parcel is considered the 102 IW Mission Area where the command and administrative components of the mission are facilitated. This restricted parcel is fenced and is accessed via an internal security gate (I-Gate) on South Outer Road. Open areas include some
	Open Space	63.7	

			wooded areas in the eastern portion of this parcel in and around the old munitions igloos.
102 IW Support Area	Industrial	72.6	This 793.3-acre area includes MAANG land in the south-central portion of JBCC outside of the fenced I-Gate parcel. Support operations include facilities maintenance, ground vehicle maintenance, and fueling of ground vehicles. Other support facilities include the wastewater treatment plant and a composting area. Open areas within this portion of the installation consist of forested areas in and around these facilities and the 183-acre Unit K, which is the grassland mitigation area (see the Forest Management section for more information).
	Open Space	720.7	
Landfill Area	Industrial	50.5	This 199-acre parcel is fenced. The approximately 70-acre capped landfill occurs in the center of this parcel. Portions of the site contain infrastructure from past site use. Open areas include the grassland area where solar arrays are going to be constructed and the wooded area to the north that is contiguous with Camp Edwards.
	Open Space	148.5	

In addition to the parcels discussed above, the MAANG is the host for utilities at JBCC. The 102 IW owns and maintains the electric distribution system including the 12,500 kilovolt-ampere substation, the water distribution system including a public water supply well, and the sewage collection system including a waste water treatment plant. The telephone system for all agencies is also maintained by the 102nd Communications Flight Group. Each utility requires extensive staff and funding to maintain. The intention of the 102d IW is to divest in all three utilities and purchase these services from a provider that would acquire the existing systems from the MAANG (MAANG 2012a).

Ground Cover

Improved grounds are developed areas that have either an impervious surface (e.g., sidewalks, parking lots, roadways, and buildings, excluding runway and apron areas) or landscaped areas that require intensive maintenance and upkeep. Improved grounds at Otis ANGB consist of the operational, maintenance and administrative areas. It also includes all paved roads, taxiways and landscaped areas.

Semi-improved grounds are areas where periodic maintenance is performed for operational reasons. These areas included open grasslands areas that are occasionally mowed, as well as areas that have been/are disturbed.

Unimproved grounds are areas where minimal to no maintenance is performed, including all the forests, woodlands, scrublands, and the wetlands.

The Land Use Categories on Otis ANGB table identifies land use categories, acreage, and descriptions.

Land Use Categories on Otis ANGB		
Land Use Category	**Acres**	**Description**
Improved Grounds	384	Developed area with impervious surface or landscaping with intensive upkeep. These areas are designated as 'Developed' in the Vegetation section.
Semi-Improved Grounds	456	Areas with periodic maintenance for operational purposes. These areas are designated as 'Disturbed' and 'Cultural Grounds' in the Vegetation section.
Unimproved Grounds	488	Areas that receive little to no grounds maintenance. These areas are designated as the natural vegetation communities in the Vegetation section.

Encroachment Management

The MAANG is an active participant in the JLUS program. This program was first developed in 1985 by the DoD in response to land availability and population increases on Cape Cod. The principal goal of this program is to ensure future growth and development in the nearby towns is compatible with the training and operational missions for the various JBCC entities. During past three decades, the Cape Cod Commission has a played a large role in developing a land use vision for JBCC and have worked closely with representatives from the four nearby towns (Bourne, Sandwich, Falmouth, and Mashpee), state environmental regulatory agencies, MAARNG, MAANG, USCG, the US Congress, Massachusetts Legislature and other citizens and consulting groups. Over the years, Cape Cod Commission has conducted updates to the JLUS study and master plan. For more information on the recent JLUS study, refer to the Integration with Other Plans section and the Cape Cod Commission website at: http://www.capecodcommission.org/departments/planning/MMR.

In 2005, the MAANG published an Air Installation Compatible Use Zone (AICUZ) Study in order to update the AICUZ study dated May 2002. The AICUZ is designed to aid local planners in establishing land use guidelines, which ensure public safety and health and preserve the

operational capabilities of the military services at Otis ANGB. Similar to the JLUS program (discussed above), the goal of this program is to promote compatible land use development. The AICUZ identifies constraints associated with flight operations, including height restrictions, noise zones resulting from aircraft operations, and accidental protection zones based on past aircraft accidents. Using the identified constraints, the AICUZ identifies guidelines for managing land use around the airfield. However, since the MAANG no longer manages the airfield, this study is no longer applicable to MAANG.

To manage encroachment concerns, the MAANG currently maintains four easements off-Post that are adjacent to the north and east of, which include primarily publicly owned municipal and state conservation land with some privately held land interspersed. The easements include two aviation easements located north of Runway 23 and east of Runway 32 and a drainage easement east of JBCC near the Falmouth Gate that are in the process of being transferred to the USCG.

A munitions easement also occurs adjacent to the east and south of the munitions area in the I- Gate Area, which will continue to be maintained by the MAANG (MAANG 2012a).

Current Major Impacts

The Otis ANGB mission has limited impacts on land use currently as the mission is primarily conducted inside buildings. The limited activities outside occur primarily in already maintained areas following the appropriate plans and protocols. Potential mission impacts are limited to air emissions and groundwater.

Stormwater runoff, especially related to periods of intense rainfall, may drain through vegetative areas that otherwise remain dry at most times. The influx of stormwater through these drainages may result in erosion and sedimentation. This runoff may deposit sediments in waterways and ponds. To address adverse effects related to stormwater runoff, the installation implements a SWPPP (MAANG 2010b). The implementation of some of the remedial activities may have temporary adverse impacts on aquatic systems.

The DoD's IRP at Otis ANGB has been actively engaged in the determination of the extent of contamination in soil, surface water, and groundwater in and around Otis ANGB for several years. Although not considered an element of the base's military mission, the IRP Program will continue to characterize contamination, develop remedial plans, and implement remedial actions. Those activities are addressed under CERCLA and the Superfund Amendments and Reauthorization Act of 1986 (SARA). Some activities may have impacts on vegetative communities (e.g., placement of drilling rigs in forested areas to obtain groundwater samples, remedial activities, etc). The clearing of brush for equipment access may result in the displacement of wildlife and the disturbance of habitat. The program is actively engaged in a community involvement program to advise the local citizens of planned activities.

Potential Future Impacts

As a result of BRAC, the 102nd Fighter Wing (102 FW) was officially designated as the 102 IW in 2008 and received the DGS and AOC missions (see the Military Missions section). Now that the 102 IW mission has been in operation for over five years, the MAANG has a better understanding of its requirements. The Otis ANGB General Plan for Space Reutilization identifies both short and long term construction, renovation, and demolition projects to facilitate the 102 IW missions (MAANG 2012a).

Because Otis ANGB was designed for flying missions, the MAANG has a great deal of aircraft support space and very little modern office space that is needed for an intelligence mission. The MAANG is in the process of implementing an aggressive demolition plan and divesting a large amount of land to other JBCC entities to facilitate this transition. The next phase of this transition is to reduce the Otis ANGB footprint even further. The MAANG would like to divest from the public works and utility services in the future and focus all of its mission support functions and facilities over in the I-Gate Area. MAANG's goal is create a campus area environment within the main mission area and move toward a smaller energy footprint (MAANG 2012a). Therefore, future plans for Otis ANGB are anticipated to minimize MAANG's overall footprint at JBCC and reduce future sustainability challenges.

The primary activities with the potential to impact the environment at Otis ANGB include construction activity within the I-Gate Area to accommodate facility changes for the 102 IW mission, ground and surface water discharges, and the IRP program. Construction activities and discharges would be more focused as facilities become more centralized. The IRP program will continue to coordinate potential effects on natural resources through the CERCLA process. If the mission changes significantly, the sustainability challenges could increase. Additional infrastructure development or a significant increase in on-the-ground training could pose challenges for the long-term sustainability of Otis ANGB, if the constraints of the site are not taken into account.

Projects, activities, new development and mission changes are typically reviewed by multiple entities within the MAANG including the 102 CES/CEV. New construction projects and work orders are reviewed by the Facilities Utilization Board, which meets quarterly. Other types of changes and activities are reviewed by the Environmental Safety, and Occupational Health (ESOH) Council (see the Responsibilities section). If there is potential for environmental impacts, the NEPA process is started, as described in the Integration with Other Plans section. If there are additional environmental compliance requirements, the 102 CES/CEV facilitates any required consultation or permit applications, as described in the Authority section.

7. Natural Resources Program Management

This section describes the current status of the installation's natural resources management program and program areas of interest. Current management practices, including common day-to-day management practices and ongoing special initiatives, are described for each applicable program area used to manage existing resources. Program elements in this outline that do not exist on the installation are identified as not applicable and include a justification, as necessary.

7.1. Fish and Wildlife Management

Installation Supplement:

Fish and wildlife management at Otis ANGB will focus on maintaining and restoring natural habitat favorable for indigenous fish and wildlife in a manner consistent with the military mission and all applicable laws and regulations. Information pertaining to fish and wildlife species known or with the potential to occur at Otis ANGB, including protected species, is summarized in the Fish and Wildlife, and Waters of the US/Wetlands and Floodplains sections, and potential species lists are identified in the Camp Edwards Training Site INRMP. Currently, no negative impacts from mission activities appear to be affecting wildlife populations on Otis ANGB.

Coyotes, Canada geese, and turkey are abundant on Otis ANGB; however, the MAANG does not undertake any active management of these species. MAANG will collaborate with other agencies within JBCC and the region for the management of these species should the opportunity arise.

Management Strategies for Wildlife Management

Wildlife management involves manipulating various aspects of an ecosystem to benefit chosen wildlife species. Management of habitats generally is focused to benefit native species, particularly listed species and game species. The MAANG will manage the wildlife and its habitat at Otis ANGB by implementing the strategies listed below:

- Limit the amount of pesticides used for invasive species control, and use mechanical methods whenever possible;
- Maintain grasslands for wildlife, while avoiding activities during the nesting season from 1 April – 15 August;
- Provide for wildlife movement between natural areas where possible;
- Preserve snags and dead logs where compatible with the military mission; and
- Limit disturbance of forested areas when feasible from 1 April to 1 November to protect migratory birds and bats.

7.1.1. Federal Wildlife Policies and Regulations

7.1.2. Nuisance Wildlife and Wildlife Diseases

Installation Supplement:

Other than those that present a BASH risk, there are few nuisance wildlife species at Otis ANGB. Future nuisance wildlife problems will be evaluated in conjunction with USDA-WS personnel, if appropriate. Any solutions to nuisance wildlife problems will follow the IPMP. Diseases affecting fish and wildlife may occur on the installation. Any large-scale fish and wildlife deaths and unnatural behavior occurring on the installation will be reported, recorded and investigated, in conjunction with USFWS, USDA-WS and MDFW personnel, if appropriate. Otis ANGB does cooperate with USDA-APHIS for the placement of bait stations for rabies management.

7.1.3. Management of Threatened and Endangered Species and Habitats

Installation Supplement:

This section presents information about the management of sensitive species that are located within, or may be located at, Otis ANGB, along with requirements and strategies for management. While several listed species have been documented on JBCC, only a few state-listed species have been documented on Otis ANGB, primarily the four grassland birds and the eastern box turtle (see the Threatened and Endangered Species and Species of Concern section, and the table of Special Status Species Known to Occur within the Vicinity of Otis ANGB for details). It is possible other species may be documented in the future as additional surveys and natural resources management are conducted.

Ten priority listed species have been identified for the Otis ANGB. USFWS and/or NHESP Fact Sheets are presented for each priority species in the USFWS/NHESP Special Status Species Fact Sheets. The following is the list of priority listed species:

- Federally proposed and state endangered northern long-eared bat (*Myotis septentrionalis*)
- Federal candidate New England cottontail (*Sylvilagus transitionalis*)
- State endangered upland sandpiper (*Bartramia longicauda*)
- State threatened grasshopper sparrow (*Ammodramus savannarum*)
- State threatened northern harrier (*Circus cyaneus*)
- State threatened vesper sparrow (*Pooecetes gramineus*)
- State species of concern eastern whip-poor-will (*Caprimulgus vociferus*)
- State species of concern eastern box turtle (*Terrepene carolina*)
- State threatened the pink streak (*Dargida rubripennis*)
- State species of concern frosted elfin (*Callophrys irus*)

7.1.3.1. Federally Special Status Wildlife Species

Installation Supplement:

The MAANG is required to manage for federally listed species. Failure to protect federally listed species could lead to an ESA violation, which could negatively impact the mission. Details regarding potentially occurring federally listed species are provided in the Threatened and Endangered Species and Species of Concern section, and the species checklists found in the Camp Edwards Training Site INRMP. There are no priority species that are currently federally listed. There are only two species proposed for federal protection that are priority species at Otis ANGB and the management strategies are listed below.

Northern long-eared bat: Northern long-eared bats were documented on JBCC, but not on Otis ANGB, in the 1990s (MAARNG 2009a); however, no surveys have occurred since this time. If this bat species is still present on JBCC, it likely uses some of Otis ANGB at least for foraging. Roosting habitat consists of cavity trees and dead snags. The locations of hibernacula are not known. The following management strategies for northern long-eared bat are recommended:

- Monitor federal ESA status and consult with USFWS if this species becomes listed to ensure appropriate management strategies are implemented;
- Protect snags greater than 5 inches in diameter in early stages of decay, where they do not pose a safety hazard, particularly in the areas currently forested;
- Maintain forests with a diverse range of tree sizes and age classes;
- Reduce the use of pesticides in potential bat foraging areas;
- Maintain vegetation along and reduce bank erosion to surface water features, which serve as critical foraging areas; and
- Avoid tree removal between 1 April and 31 October when bats are present.

New England cottontail: Camp Edwards may be a stronghold for the New England cottontail on Cape Cod (MAARNG 2009a). New England cottontails are documented on JBCC, primarily in the impact area. While they may occur on Otis ANGB, they are not likely to occur in high abundance. On JBCC, the New England cottontail is found in early successional pitch pine-scrub oak communities and scrub oak shrublands, which are not common communities on Otis ANGB (MAARNG 2009a). The primary threat to this species is loss of habitat through succession and habitat alteration. The USFWS is slated to make a determination regarding the need to list this species as endangered or threatened in the ESA, or remove it from the candidacy list. The following management strategies are recommended for New England cottontail (Chapman and Smith 2011):

- Monitor federal ESA status for this species and consult with USFWS if status changes,
- Maintain early successional and shrub habitat (minimum patch size of 12 acres with stem densities greater than 30 stems per 100 square feet),
- Manage deer populations to prevent impacts to shrubs from deer browsing, and
- Manage invasive shrub species to limit impacts in shrub habitat.

Additional management information for this species can also be found in *A Landowner's Guide to New England Cottontail Habitat Management* (Arbuthnot 2008).

7.1.3.2. State Special Status Species

Installation Supplement:
State Listed Species Under MESA

In Massachusetts, MESA (M.G.L.c. 131A) and its regulations (321 CMR 10.00) protect rare species and their habitats by prohibiting the "take" of any plant or animal species officially listed as endangered, threatened or special concern by MDFW. Details regarding potential state-listed species on Otis ANGB are provided in the Threatened and Endangered Species and Species of Concern section. Five state-listed species have been documented on Otis ANGB, which include the upland sandpiper, grasshopper sparrow, northern harrier, vesper sparrow, and eastern box turtle. Another three state-listed species are identified as having a moderate potential to occur on Otis ANGB because the NHESP has identified Priority Habitat on Otis ANGB for them (see the Management of Threatened and Endangered Species and Habitats section for more on state-designated Priority Habitat). The remaining three species include a bird and two insects: eastern whip-poor-will, the pink streak, and frosted elfin. Management recommendations for documented and high potential species are broken down by species and when feasible by habitat type below. Additional information on these species can be found in the species checklists found in the Camp Edwards Training Site INRMP.

The MDFW has developed the Vernal Pool and Rare Species (VPRS) Information System to allow for a more efficient method for NHESP to review and process submitted data, and in turn, more real-time updates to publically available rare species data. The VPRS system is an online mapping and data submittal application that provides users with a way to submit rare species observation reports and vernal pool certification forms to NHESP electronically. Previously, observations were submitted to NHESP via a Rare Animal Observation Form. The VPRS also offers a mobile application for registered users that allows users to capture key data onsite for generating animal, plant or vernal pool observation reports. MAANG personnel and their contractors will utilize this electronic system as much as possible. More information on the VPRS system can be found at: http://www.mass.gov/dfwele/dfw/nhesp/species_info/vprs_home.htm.

Documented Species

Eastern box turtle: On JBCC, eastern box turtles are found in nearly every habitat type (MAARNG 2009a). Priority habitat for this species has been established by NHESP on at least a portion of every Otis ANGB parcel. The MAANG will follow the Mowing Advisory Guidelines in Rare Turtle Habitat: Pastures, Successional Fields, and Hayfields (NHESP 2009) and the Massachusetts Forestry Conservation Management Practices for Eastern Box Turtles (NHESP 2007) for turtle protection as described in the Eastern Box Turtle Regulatory Guidance. The intent of this template is to minimize costs associated with developing an entirely new plan for every project. Specific project information will be modified, but the overall template and guidelines will remain the same.

Eastern box turtles are active in all habitats between 1 April and 31 October on Cape Cod with the turtles normally remaining within forested uplands or wetlands in the winter. Most overland movement is in May and June. The active season (1 April to 31 October), defined by NHESP, is meant to be conservative. It may be possible depending on the type of work, type of habitat impacted (e.g., early-successional vs. forested), and/or seasonal weather conditions to get approval from NHESP to work within this timeframe. If work is necessary within this timeframe, consultation with NHESP is required.

The following management strategies are recommended for eastern box turtle on Otis ANGB when feasible (NHESP 2012, 2009, 2007):

- Maintain unfragmented forest and grassland habitats, with overall high habitat diversity;
- Consult with NHESP prior to conducting new projects or activities with the potential to disturb eastern box turtle habitat (i.e., that occur in areas designated as Priority Habitat for this species).
- Follow the guidelines or recommended practices described in the NHESP's (2007) *Massachusetts Forestry Conservation Management Practices for Eastern Box Turtles* (see the Eastern Box Turtle Regulatory Guidance) when conducting natural resources management activities;

- Follow NHESP's (2009) *Mowing Advisory Guidelines in Rare Turtle Habitat: Pastures, Successional Fields, and Hayfields* (see the Eastern Box Turtle Regulatory Guidance) to reduce mortality by using mowers that limit mortality of turtles and mow between 7 – 14 inches in height from the center out slowly; and
- Leave unmowed field edges until after 15 September.

Grassland birds: Upland sandpiper, vesper sparrow, grasshopper sparrow and northern harrier have all been documented on and have Priority Habitat designated on Otis ANGB. Upland sandpipers use large grasslands, including old fields, wet meadows, and maintained grasslands during summers for nesting and foraging (NHESP 2012). Northern harriers use wet meadows, marshes, old fields and grasslands for foraging year round and nesting (NHESP 2012). Vesper sparrows use old fields and dry grasslands with occasional woody vegetation during summers for nesting and foraging (NHESP 2012). Grasshopper sparrows use old fields and patchy grasslands with bunch grasses in the summer for nesting and foraging (NHESP 2012). Of these four birds, grassland sparrows are the most prevalent.

The following management strategies are recommended for all four species (NHESP 2012):

- Prevent or reverse woody encroachment to promote grassland habitat;
- Avoid mowing during the breeding season (1 April – 15 August); and
- Manage invasive species to prevent impacts to grasslands

Species with Moderate Potential to Occur

Eastern whip-poor-will: Eastern whip-poor-will has been documented on JBCC, but not on Otis ANGB; however, Priority Habitat has been designated by NHESP for this species on Otis ANGB. Eastern whip-poor-wills generally prefer pitch pine and scrub oak barrens and other fire-adapted landscapes (NHESP 2012). On JBCC, the eastern whip-poor-will is common and found in its preferred pitch pine and scrub oak barrens, which are uncommon (187 acres, 14%) on Otis ANGB (MAARNG 2009a). The following management strategies are recommended for eastern whip- poor-will (NHESP 2012):

- Implement prescribed fire program, where feasible, to maintain barrens; or
- Implement other management activities that mimics the structure created by prescribed fire.

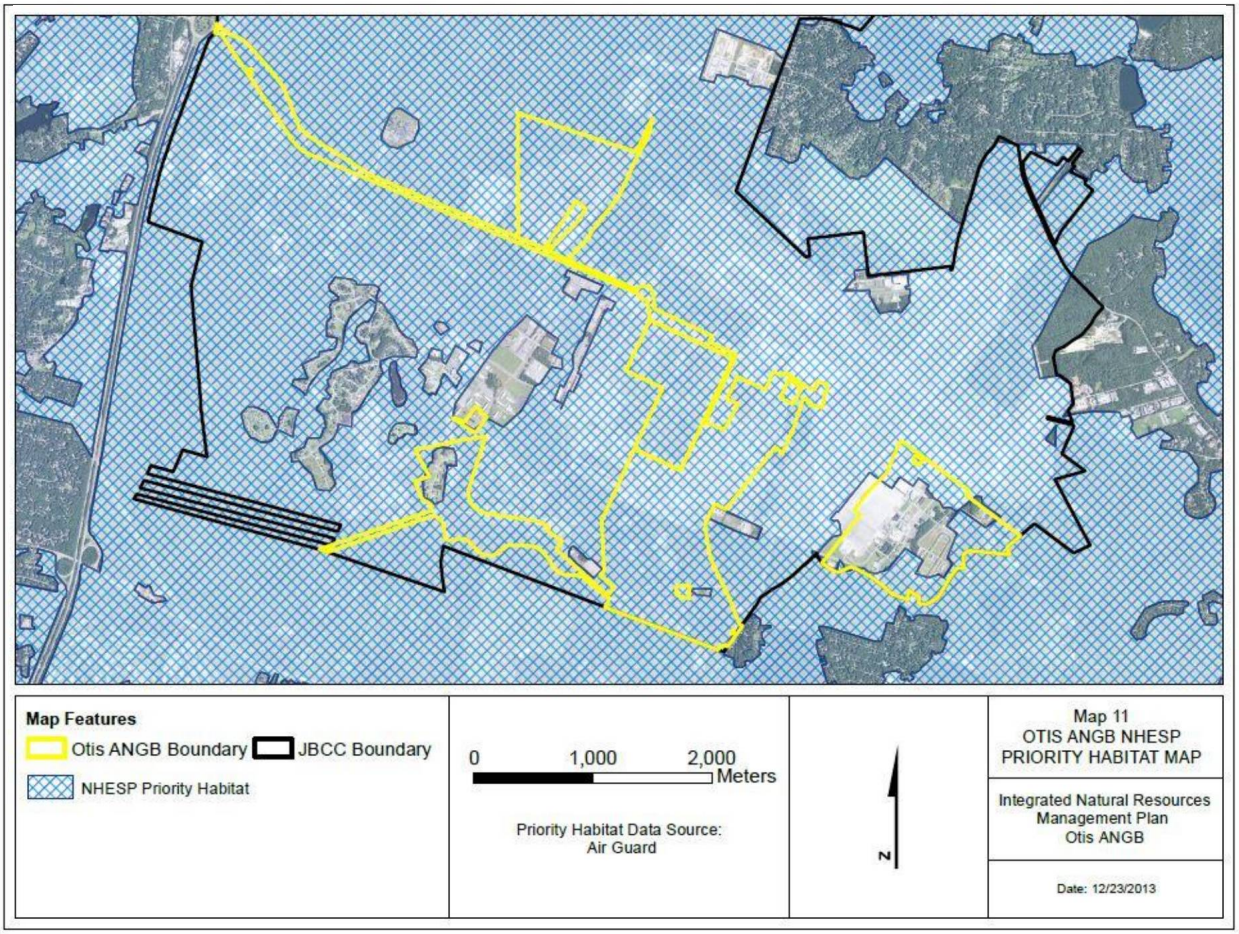
Grassland insects: The pink streak and frosted elfin have all been documented on JBCC, but not Otis ANGB to date; however, Priority Habitat for these species has been designated by NHESP on Otis ANGB. The pink streak occurs in sandplain grasslands and dunes with switchgrass (*Panicum virgatum*) as the host plant (NHESP 2012). Frosted elfin occurs in dry, open disturbance-dependent habitat on sandy soils with wild indigo (*Baptisia tinctoria*) and lupines (*Lupinus perennis*) as the host plants (NHESP 2012). On JBCC, these two moths are found in early successional pitch pine-scrub oak communities (MAARNG 2009a). The following management strategies are recommended for these grassland insects (NHESP 2012):

- Implement prescribed fire program to maintain grasslands;
- Implement other management activities that mimic the structure and species composition created by prescribed fire;
- Manage invasive shrub species to limit impacts in grassland habitat; and
- Reduce insecticide use in these habitats.

Priority Habitat and MESA Reviews

Priority Habitat is defined as "the geographic extent of habitat for state-listed species" as delineated by the MDFW pursuant to 321 CMR 10.12. As shown in the NHESP Priority Habitat Map, approximately 1,149 acres (86 percent) of Otis ANGB is designated as Priority Habitat for one or more state-listed species. The vast majority of JBCC is also designated as Priority Habitat. A summary of Priority Habitat by species for each Otis ANGB parcel (see the NHESP Priority Habitat Map) is included in the table of Priority Habitat for State-Listed Species by MAANG Parcel. Approximately 180 acres of land are not currently designated as Priority Habitat. Projects and activities that are not located in a Priority Habitat are not subject to MESA, except in the circumstances described in 321 CMR 10.13(1)(a) and (b). MDFW may request a review as a result of new occurrence information being received for the proposed site or an assessment of whether a state-listed species is present as result of a NEPA review.

Otis ANGB NHESP Priority Habitat Map



Projects and activities undertaken within designated Priority Habitat that are not considered exempt under 321 CMR 10.14 of the MESA are reviewed by NHESP in accordance with the NEPA review process. Project and activities that are exempt include, but are not limited to, activities on land adjacent to or in the immediate vicinity of agricultural land; replacement or maintenance projects; and rare species management (e.g., mowing, burning, cutting, and invasive species removal) for the purpose of maintaining or enhancing habitat in accordance with a habitat management plan approved by NHESP.

Three levels of MESA filing are available through NHESP and described below. More information on NHESP reviews for projects and activities can be found at: http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_home.htm.

1. **Information Request for Rare Species Information** – This is not required. However, NHESP recommends making this request when a project/activity occurs within Priority Habitat for a rare species, so that possible MESA issues can be identified early in the planning stage.
2. **MESA Project Review** – For a project located within Priority Habitat that does not meet one of the exemptions in 321 CMR 10.14, the project proponent is required to file with NHESP. If a project requires filing with the local Conservation Commission pursuant to the Massachusetts Wetlands Protection Act (MWPA) and the proposed project is within Estimated Habitat for state-listed wildlife, a copy of the filing must be submitted to the NHESP, even if the project qualifies for a MESA filing exemption.
3. **Conservation and Management Permit Application** – If it is determined through the MESA review that the project will result in a "take" of a state-listed species, the project may be eligible for a Conservation and Management Permit (321 CMR 10.23). To be eligible for this permit, the applicant must assess alternatives, demonstrate an insignificant portion of the local population will be affected, and design and implement a conservation and management plan that provides long-term net benefits to the conservation of the affected rare species. Long-term net benefits to the conservation of rare species generally involves some combination of (1) on or off-site permanent habitat protection, (2) management or restoration of state-listed species habitat, or (3) conservation research designed to benefit the species affected by a given project.

As a federal agency, the MAANG is not required to obtain a state Conservation and Management Permit from NHESP in accordance with MESA, as sovereign immunity has not been waived for the ESA5. While a MESA permit is not required, the MAANG will continue to initiate a MESA project review for proposed projects and activities in accordance with the NEPA review process, assess alternatives to minimize impacts to state-listed species, and implement conservation measures as practicable.

5 The doctrine of sovereign immunity holds that federal activities are not subject to state and local laws unless Congress has waived it through explicit legislation. It should be noted that Congress has waived sovereign immunity for a portion of the CWA; thus, the USCG would be required to obtain a MWPA permit for wetland impacts.

Priority Habitats for State-Listed Species by MAANG Parcel					
State-Listed Species	**Parcel**				
	Otis ANGB (I-	**Otis ANGB (Parcel**	**Landfill (Parcel H,**	**ANG Dorms**	**Rail (Parcel J,**

	Gate)	H)	State)	(Parcel B, State)	State)**
Vertebrates					
Eastern Box Turtles	X	X	X	X	X
Eastern Whip-poor-will		X	X		
Grasshopper Sparrow	X	X	X		
Northern Harrier	X	X	X		
Upland Sandpiper	X	X	X		
Vesper Sparrow	X	X	X		
Invertebrates					
Barrens Buckmoth		X	X	X	
Barrens Dagger Moth		X	X		
Chain Dot Geometer		X	X	X	
Coastal Heathland Cutworm			X		
Coastal Swamp Metarranthis		X	X		
Cow Path Tiger Beetle		X		X	
Frosted Elfin		X	X	X	
Gerhard's Underwing		X	X		
Melsheimer's Sack Bearer		X	X	X	
Pine Barrens Speranza		X	X		
Pine Barrens Zale		X	X		
The Pink Streak		X			
Priority Habitat Only Occuring in Areas Proposed for Transfer (primarily along Connery Ave)					
Eastern Spdefoot		X			
Unexepected Cycnia		X			
Comet Darner		X			
Pine Barrens Bluet		X			
Spatterdock Darner		X			
* Portions of parcel are proposed for transfer to MAARNG ** Parcel is proposed for transfer to MAARNG					

7.1.3.3. Management Strategies for Special Status Species

7.2. Waters and Wetland Resource Protection

Installation Supplement:

Wetland Protection

For a summary of wetlands on Otis ANGB, see the Waters of the US, Wetlands, and Floodplains section. Two wetlands occur on Otis ANGB based on NWI and MDEP mapping data that include a small wetland near the eastern boundary and a small wetland along Connery Avenue. Wetlands are some of the most productive habitats, and often provide migration corridors for a variety of species. Because wetlands and other open freshwaters are so sparse, protecting them is critical.

Management Strategies for Wetlands

In general, wetlands will be managed through conservation and impact avoidance. The following guidelines will be implemented to ensure compliance and to protect and enhance Otis ANGB wetlands.

- Consult with the 102 CES/CEV Office prior to initiating projects with the potential to disturb wetlands or their buffers;
- Restrict vehicles within 100 feet of water resources except where established crossings and roads exist;
- Adhere to all signage posted on the installation to further protect environmentally sensitive areas;
- Maintain vegetated buffers around water resources;
- Avoid disturbance of wetlands and aquatic habitats where practicable;
- Apply for an appropriate permit when regulated waters, including wetlands and associated buffers, will be impacted;

- Plan development to avoid impacts to wetlands to the maximum extent possible and mitigate unavoidable impacts; and
- Manage invasive species to promote desirable native species.

7.2.1. Regulatory and Permitting

Installation Supplement:

Regulatory Requirements

USACE regulates the discharge of dredged or fill material into "waters of the US", including wetlands, under Section 404 of the CWA. Under CWA, for an area to be classified as a wetland, three conditions must be present: (1) wetland hydrology; (2) hydric soil; and (3) hydrophytic vegetation. Areas that may be periodically wet, but that do not meet the requisite criteria, are not classified as "delineated" wetlands. Once a wetland delineation is completed, then a jurisdictional determination can be made. A jurisdictional determination is made based on multiple criteria, but the relationship of the wetland to other waters of the US is important.

Section 401 of the CWA gives the Commonwealth of Massachusetts the authority to regulate, through the state water quality certification program, proposed federally-permitted activities that may result in a discharge to water bodies, including wetlands. In addition, the MWPA (M.G.L. c. 131, § 40) authorizes MDEP and the city or town's Conservation Commission to protect wetlands and waterways as well as the land under the water, coastal banks, dunes, and land subject to coastal storm flowage. Wetlands under the jurisdiction of this act include:

- Any bank, freshwater wetland, coastal wetland, beach, dune, tidal flat, marsh or swamp bordering on the ocean, any estuary, creek, river, stream, pond, lake, or certified vernal pool;
- Land under any of the water bodies listed;
- Land subject to tidal action, coastal storm flowage, or flooding; and
- Riverfront areas in the Commonwealth of Massachusetts.

A 100-foot buffer zone around any fresh water or coastal resource listed above is subject to jurisdiction under the MWPA. The "boundary of the buffer zone" is determined by measuring 100 feet horizontally from the outer (landward) boundaries of bordering vegetated wetland, inland or coastal bank, coastal or barrier beach, rocky intertidal shore, salt marsh, and/or coastal dune.

Permitting

As discussed above, the USACE and MDEP have regulatory authority over waters of the US and state under Sections 404 and 401 of the CWA. In Massachusetts, the USACE issues Individual Permits and a Massachusetts PGP that covers many routine or minor projects that result in placement of fill material; dredging or removal of soil or minerals; construction, operation or maintenance of any use or development; and discharge of stormwater into a wetland.

Any construction in or near a wetland resource or its buffer (i.e., 100-foot buffer zone) on Otis ANGB is subject to the provisions of the MWPA. A Notice of Intent (NOI) should be filed with the town or city's Conservation Commission that describes the type and boundaries of the resource areas and type of work proposed. A copy of the NOI is also submitted to the regional office of MDEP, which issues a project number for the proposed activity. If the project is approved or approved with conditions, the Commission will issue an Order of Conditions, which specifies construction methods that will avoid or minimize and mitigate damage to wetland areas.

7.2.2. Coastal Management Zones

Installation Supplement:

Otis ANGB is located in the state coastal zone. Any project undertaken by a federal agency, requiring a federal permit, or receiving federal funding that is in the coastal zone is subject to a federal consistency review in accordance with the CZMA (16 USC 1456). The "federal consistency" requirement of the CZMA holds that federal actions that have reasonably foreseeable effects on any land or water use or natural resources of a state coastal zone must be consistent with the enforceable policies of the federally approved coastal management program for that state. In the Commonwealth of Massachusetts, the Office of CZM is responsible for implementing the CZMA, and the regulations governing Federal Consistency Review Procedures are set forth under 301 CMR 21.00 et seq. Activities at Otis ANGB are not in conflict with any of the regulatory policies of the CZMP. The *Massachusetts Office of Coastal Zone Management Policy Guide* provides an overview of the Massachusetts coastal program policies and legal authorities, and outlines the federal consistency application and review process. A copy of this policy guide and additional CZM program information can be found at: http://www.mass.gov/czm/fcr/.

7.2.3. Vegetation Buffers

7.3. Grounds Maintenance

Installation Supplement:

Given that large parts of Otis ANGB consist of cultural grasslands and landscaping, the management and design of those areas have significant implications for water quality and native species. The MAANG protects activities surface water and groundwater quality during land management by adhering to the Massachusetts Wellhead Protection rules (310 CMR 22), Cape Cod Commission RPP minimum performance standards, JBCC Groundwater Protection Policy, and by implementing appropriate BMPs. The JBCC Environmental Committee is responsible for ensuring compliance with the JBCC policy, other installation plans (e.g., SPCCP, SWPPP), and federal and state laws and regulations; advising Commanders on the appropriate safeguards and BMPs; and reviewing any new projects or activities at JBCC.

Native species, including state-listed grassland species, are considered during mowing and landscaping activities. No formal mowing plan exists for Otis ANGB. However, there are designated areas that are managed for grassland birds (e.g., Unit K); these areas are not mowed from 1 April to 15 August. The MAANG Roads & Grounds typically mow 50 feet on either side of all roadways regularly. Areas beyond this buffer that are not already designated for grassland bird management are mowed on an as needed basis to minimize impacts to ground nesting birds and maintenance time and costs.

The following recommended landscaping practices would also benefit the environment and generate long-term savings in cost and maintenance time. The use of native plants not only protects biodiversity and provides wildlife habitat, but it can also reduce demands for fertilizer, pesticides, and irrigation and their associated costs.

General recommendations to promote environmentally beneficial landscaping include:

- Design landscaping to be suitable to the specific site and appropriate for the use and operation of the facility.
- Implement water-efficient practices, use efficient irrigation systems and recycled water, and use landscaping to conserve energy.
- Limit turf areas where practical to reduce water use and maintenance requirements.
- Use wood mulch instead of rock mulch when practical.
- Prevent expansion of nonnative plants into native plant areas by using regionally native plants for landscaping where practicable.
- Reuse landscape trimmings on site as appropriate.
- Do not use seed-bearing or fruiting plants that provide food for wildlife and wildlife habitat in areas near airfields.

All invasive plants identified in IPANE (http://www.eddmaps.org/ipane/ipanespecies/ipanespecies.htm) and MIPAG (http://www.massnrc.org/MIPAG/invasive.htm), as well as any noxious weeds or MDAR's Massachusetts Prohibited Plants List (http://www.mass.gov/eea/agencies/agr/farm-products/plants/massachusetts-prohibited-plant-list.html) are not acceptable for landscaping planting within the Otis ANGB. See the Other Natural Resources Information section for more details on invasive plants on Otis ANGB and JBCC generally. All non-native grasses (except those used for lawns) are also not acceptable for landscape planting.

Landscaping occurs within a number of areas on Otis ANGB (e.g., I-Gate area). Suitable native plant species can be found at: http://www.newfs.org/grow. NHESP also maintains a list of *Native Shrubs for Planting as Wildlife Food* at http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/rare-plants/native-shrubs-for-plantings-as-wildlife-food.html.

In addition to these more general landscaping practices, the use of green infrastructure or low impact development techniques can reduce the risk of negatively impacting water quality. These practices often include the use of native plants and provide some wildlife habitat as well. The *Massachusetts Low Impact Development Toolkit* (Metropolitan Area Planning Council 2013) also provides details on specific BMPs. See the Waters and Wetland Resource Protection section above for more on managing water quality on Otis ANGB.

7.4. Forest Management

Installation Supplement:

Vegetation and Forest Management

While this section is entitled 'Forest Management', it is more encompassing and includes all vegetation not covered in the Grounds Maintenance section. Vegetation management includes forest management, fish and wildlife habitat management, rare species habitat management and some invasive plant species management. There is a significant overlap in the objectives, activities and projects within this section and all ther sections within the INRMP, which is indicative of the essential role vegetation plays in ecosystems and natural resources management. The vegetation on Otis ANGB is a mixture of oak and pitch pine forests, woodlands and barrens, along with some cultural grasslands. For more details on vegetation on Otis ANGB, refer to the Vegetation section.

A key element of historic vegetation management on Cape Cod is wildland fire. Many of the habitats (i.e., grasslands and scrub oak thickets) are fire-adapted landscapes and benefit from wildland fire, both wildfires and prescribed fires, to reduce woody encroachment and reset forest succession. Historically, grasslands within the region were dominated by warm season grasses, primarily little bluestem (*Schizachyrium scoparium*), and maintained by fire. Warm season grasses tend to grow more slowly and are more clumped allowing for better visibility than cold season grasses. Cold season grasses typically become more prevalent in areas with repeated mowing and a lack a fire. While promoting native grassland habitat would be beneficial to native fauna, it could also provide potential safety and operational benefits (e.g., better visibility and less mowing). Introducing prescribed fire on Otis ANGB lands would facilitate the transition of the vegetation composition from cold season grasses to native, warm season grasses. See the Stormwater Management section for more on wildland fire management.

On Otis ANGB, there are two basic types of vegetation, forested and grassland and different management is required in each.

Forest and Barrens Management

Forests are the predominant vegetative community in Massachusetts and generally on JBCC as well. Approximately 37 percent (487 acres) of Otis ANGB is forested. The oak forests (81 acres) are generally along the south and east boundary of the installation. The pitch pine-oak forests (219 acres) and barrens (187 acres) generally occur in the southern and western parts of the installation, with some pitch pine-oak barrens in the former landfill area. Some of the forest areas do have built infrastructure within them, but some of the forest areas also are contiguous with larger forests outside Otis ANGB. Forested areas occur primarily within the designated I-Gate and Southern Land Management Units, while the northwestern portion of the Landfill Management Unit also contains forested habitat (see the Otis ANGB Facility Map and Vegetative Communities Map).

General recommendations for forest management include protecting riparian forests and preventing additional fragmentation. In Massachusetts, many forests do not have sufficient oak regeneration and have an overabundance of red maples and black birch (MDFW 2000). While there may be several reasons for the lack of oak regeneration, the primary reason is likely the lack of wildland fire (MDFW 2000). The mast production from oak and cherry trees is important for wildlife. While forest is a common vegetative community on Otis ANGB, there is little active management of the forest areas.

Modeling of climate changes in eastern US forests indicate that the forests in the area around Otis ANGB will shift from mixed oak-pine forests to predominantly oak forests based on the US Department of Agriculture Forest Service Climate Change Tree Atlas (http://www.nrs.fs.fed.us/atlas/tree/fut_fortypes.html#).

Recommendations for managing forest as wildlife habitat, while supporting the mission and specific use of the forest include:

- Protect intact, large blocks of forest;
- Thin the understory periodically;
- Allow openings within the forest to form naturally (e.g., storm blow down) and then natural succession to occur; and
- Follow NHESP's *Forestry Conservation Management Practices* for eastern box turtle (see the Eastern Box Turtle Regulatory Guidance), if implementing any tree removals or logging for natural resources management activities.

- Due to the potential for northern long-eared bats, any tree management that occurs between 1 April and 1 November requires consultation with the USFWS until new guidelines are developed.
- Maintain mature trees, including snags, unless they pose a safety hazard.

Grassland Management

While there is no undisturbed grasslands, there are large areas of cultural (i.e., maintained) grasslands totaling 416 acres (31 percent) of Otis ANGB. Grasslands largely occurs in two Land Management Units: (1) the former Landfill Area (proposed solar field area) and (2) Unit K in the Otis ANGB Support Area (see the Otis ANGB Facility Map and Vegetative Communities Map).

Large grasslands are home to a diversity of wildlife: mammals, butterflies, and birds, including some of Massachusetts' rarest grassland birds. These birds need large contiguous patches of grassland habitat for successful breeding. In some areas, airports and military bases provide the best remaining habitat (Jones and Vickery 1997). Given the limited grassland tracts remaining in Massachusetts, particularly large grassland areas (e.g., greater than 75 acres), Otis ANGB grasslands provide a unique habitat type on JBCC but also regionally. More detail on regional and Otis ANGB grasslands, and their importance to rare grassland birds is provided in the Vegetation and Management of Threatened and Endangered Species and Habitats sections.

Recommendations for managing grasslands as wildlife habitat, while supporting the mission and specific use of the forest include:

- Use native species in landscaping and ecological restoration;
- Ensure grassland areas are re-vegetated (when necessary) with native seed mixes;
- Remove trees encroaching into grasslands to maximize benefits to wildlife and their habitat, when feasible;
- Maintain grasslands using prescribed fire;
- Maintain 100-foot vegetated buffers per Massachusetts wetland rules and riparian buffer guidelines along streams and wetlands; and
- Practice Early Detection-Rapid Response by regularly monitoring for invasive species and treating when populations are small.

Grassland Mitigation Activities

Due to the proposed solar panel array in the former landfill, which impacts the four state-listed grassland bird species, there will be mitigation activities to maintain grasslands in the Unit K land management unit that is located in the Otis ANGB Support Area (see the Habitat Management Plan for more information).

7.5. Outdoor Recreation, Public Access, and Public Outreach

Installation Supplement:

Outdoor Recreation/Public Access

JBCC is a secure federal military facility, and public access is limited. There is currently no unsupervised public access or individual public access programs at Otis ANGB. Otis ANGB is open to those with military IDs, military dependent IDs, and retired military IDs. MAANG has no DoD housing or active morale, welfare, and recreation (MWR) program. However, USCG does have a housing area and an MWR program. MWR facilities on JBCC managed by USCG include the golf course, movie theater, bowling alley and other MWR facilities. The use of these facilities is restricted to members and retirees of the military and others who hold access privileges to JBCC.

Most outdoor recreational activities are prohibited at JBCC due to the presence of hazards related to training activities. Hunting has been available on Camp Edwards since 1956 through a permit system and controlled hunt managed by the MDFW and cooperating agencies. Hunting on Camp Edwards is limited to certain dates during deer and turkey hunting seasons. Pre-registration is required to participate on an established hunting day.

No 'Open' public access areas occur on Otis ANGB or JBCC. The only 'Off-Limits' area on Otis ANGB is the former landfill area. Other 'Off-Limits' areas on JBCC include the MAARNG impact area and USCG airfield. In general, the remainder of JBCC and all of Otis ANGB is 'Restricted' access for those who hold authorization to be on JBCC. The I-Gate Area is further 'Restricted' to only those personnel authorized for access to Otis ANGB. Within the I-Gate area, a small recreational trail is available to Otis ANGB personnel only.

There is a Bicycle Motor Cross (BMX) track within the old landfill area of Otis ANGB.

Public Outreach

Public outreach activities associated with the IRP occur due to the presence of sites along the boundary of the facility. Personnel from 102 CES and 102 IW/SE at Otis ANGB are also involved with various regional planning efforts (see the Responsibilities section).

The primary means of internal environmental awareness for Otis ANGB is the ESOH Council (see the Responsibilities section). The ESOH Council consists of the Otis ANGB stakeholders that have an interest in the natural resources and other environmental issues and is the primary forum for information exchange on environmental issues within the Otis ANGB.

7.6. Conservation Law Enforcement

Installation Supplement:

Not applicable at Otis ANGB.

7.7. Geographic Information Systems (GIS)

Installation Supplement:

Site-specific natural resources data for Otis ANGB is limited at this time. The MAANG has some GIS capability on Otis ANGB. Access to maps generated from accurate and usable GIS data is essential for efficient natural resources management at Otis ANGB. In addition, it facilitates accurate analysis of potential effects of all future projects and activities. There is general data available for the facility through the Common Installation Picture (CIP), which maintains a master dataset for every DoD installation with an emphasis on boundaries and infrastructure. The following table, Summary of GIS Data Available for Otis ANGB, provides a summary of GIS data currently available for Otis ANGB.

Summary of GIS Data Available for Otis ANGB		
GIS Data	**Source**	**Needs updating?**
JBCC boundary and parcels	JBCC	No (unless land ownership / control chages occur)
Otis ANGB boundary and parcels	MAANG	Yes
Buildings	CIP, JBCC	No
Fences & Gates	CIP, JBCC	No
Transportation	CIP, JBCC	No
Utilities	CIP, JBCC	No
Landfills	CIP, JBCC	No
Recreation (e.g., golf course)	CIP, JBCC	No
Elevations, Open Space	MassGIS	No
Aerial imagery	Mulitple sources and years available	No, as needed
Streams, lakes, watersheds, and open water	CIP, MassGIS	No
Sole source groundwater aquifer and water supply wells	MassGIS	No
Wetlands	NWI, MassGIS	In process
Floodplains	FEMA	Yes, new FIRM will be available in 2014
Soils	NRCS	No
Natural Communities (Vegetation)	MAARNG	Yes
Management Units	Created	No
Priority Habitats for State-Listed Species	NHESP (MassGIS)	No
CIP = Common Installation Picture	Mass GIS = www.mass.gov/mgis/	

7.8. Other Plans

7.8.1. Integrated Pest Management Plan

Installation Supplement:

Noxious weeds are defined as "any living stage (e.g., seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the US, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the US or the public health (Federal Noxious Weed Act of 1974)." Most noxious weeds are introduced species (non-native) and have been introduced into an ecosystem by ignorance, mismanagement, or accident. Typically they are plants that grow aggressively, and multiply quickly without natural controls.

Integrated Pest Management

Otis ANGB has an Integrated Pest Management (IPM) Program implemented by the MAANG IPMP (MAANG 2010a). IPM is the use of multiple techniques in a compatible manner to avoid damage and minimize adverse environmental affects while obtaining control of target pests. The goal of IPM is to utilize non-chemical procedures to control pests, including invasive, exotic plant and animal species. Typically a combination of the following IPM techniques is required to resolve a problem on a sustained basis:

- Mechanical control, which alters environments in which pests live, traps or removes pests (e.g.., glue boards and live-traps) from where they are not wanted, or excludes pests from where they are not wanted (e.g., screening, fencing);
- Cultural control, which manipulates environmental conditions to suppress or eliminate pests (e.g.., removal of food scraps or spreading manure on fields);
- Biological control, which uses predators, parasites, or disease organisms to control pests; and
- Chemical control, which relies on pesticides and/or herbicides to kill pest and/or undesirable species of plants.

The IPMP includes pest identification and management requirements, outlines the resources necessary for surveillance and control, and describes the administrative, safety, and environmental requirements of the program. This plan serves as a tool to reduce pesticide use, enhance environmental protection, and maximize the use of IPM techniques safely. It is the policy of the MAANG to minimize the use of all pesticides, including herbicides, at the installation. While MAANG has not being using any pesticides in the past few years at Otis ANGB, some herbicide use will be necessary in order to control invasive plant species, particularly in the Unit K management area (see the Vegetative Communities Map).

7.8.2. Invasive Species

Installation Supplement:

Invasive and exotic species may include plants, insects, or animals. An invasive species is defined as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." An alien (or non-native) species is defined as a "species including its seeds, eggs, spores, or other biological material capable of propagating that species that is not native to that ecosystem" (EO 13112). Because of the invasive capacity, many exotic species have the ability to spread rapidly through ecosystems since natural predators are often not present. Such species often retard natural succession and reforestation and generally cause a reduction of biological diversity in natural ecosystems, and can usurp the position of native species in the environment.

Invasive Species in Massachusetts

Invasive, non-native species and noxious weeds have the capability to significantly impact native vegetation and wildlife. A key element of INRMP implementation is to ensure "no net loss" of the MAANG's mission capability. Management of undesirable species is necessary to maintain installation lands and facilities in usable condition. In addition, uncontrolled animal pests can become health hazards, which could threaten the mission.

Information on invasive species identification, prevention, and control and management measures for Massachusetts is available through a variety of sources. A summary of these sources is provided below.

- MIPAG's (2005) The Evaluation of Non-native Plant Species (http://massnrc.org/mipag/) – a master list of non-native plant species and their potential for invasiveness in Massachusetts.
- A Guide to Invasive Plants in Massachusetts, 2nd Edition (Somers et al. 2008) – this guide provides photos and descriptions for identifying the 66 invasive species identified on the MIPAG list.
- IPANE (http://www.eddmaps.org/ipane/) – a web-accessible database of invasive and potentially invasive plants in New England with a focus on the early detection of, and rapid response to, new invasions.
- Massachusetts Introduced Pests Outreach Project (http://massnrc.org/pests/) – collaborative effort between MDAR and UMass Extension Agriculture and Landscape Program for the purpose of increasing environmental awareness; this website offers Fact Sheets for several pests in Massachusetts (e.g., insects, diseases, plants, etc).
- Massachusetts Association of Conservation Commissions' Identification, Ecology and Control of Invasive Plants (http://maccweb.org/resources_inv_eco.html) – a comprehensive review of introduced plant species that are currently, or likely to become invasive in Massachusetts.
- Massachusetts Department of Conservation and Recreation's A Guide to Selected Invasive Non-native Aquatic Species in Massachusetts (http://www.mass.gov/dcr/watersupply/lakepond/ais.htm).
- Office of CZM's (2002) Massachusetts Aquatic Invasive Species Management Plan (http://www.mass.gov/czm/invasives/) – includes information on both freshwater and marine invasive species.

Management Strategies for Invasive Species

MAANG will work to prevent the introduction of invasive species and take measures to control them in an economically and environmentally sound manner in accordance with laws and regulations pertaining to the management of these species. The task of controlling invasive and exotic species and noxious weeds is often expensive, lengthy, and risky because total eradication is required to prevent reestablishment. Prevention is the best approach. One of the most effective ways of preventing new invasive species is to limit all landscaping plants to only native species. See the Forest Management section for more on landscaping with native plants.

MAANG will implement the following general management strategies when feasible:

- Implement BMPs to minimize land disturbances that favor invasion of non-native species and re-vegetate disturbed areas with native species;
- Utilize mulches from JBCC or certified-weed free sources to facilitate the establishment of native ground cover on impoverished soils;
- Maintain biodiversity and undisturbed habitat to maximize resistance to and competition with invasive species;
- Control invasive and exotic species and noxious weeds through early detection, isolation of infested areas, and control of individual plants with physical, chemical or mechanical means, depending on the species;
- Favor basal application and spot treatment and avoid aerial or broadcast application of pesticides to prevent adverse impacts to native plants and wildlife;
- Do not use invasive, non-native species in landscaping when feasible;
- Continue to reseed exposed soils using a certified weed-free native grass mix;
- Coordinate applicable federal and state agencies prior to implementing new control measures, including NHESP to ensure they will not impact state-listed species; and
- Incorporate invasive species detection and prevention in the environmental awareness program.

The use of chemicals to control invasive and exotic species can hinder an installation's efforts to reduce usage of herbicides and pesticides. Therefore, it is important to prevent the initial spread of invasive and exotic species and address the spread of such species as early as possible to reduce the amount of required herbicide and pesticide applications, and reduce costs associated with treatment. The Environmental Office should evaluate the threat of invasive species as well as the environmental impacts to the environment and permitting requirements of herbicide usage (if applicable) prior to implementing any eradication and/or control program.

Management Strategies for High Priority Invasive Species

Asiatic bittersweet (*Celastrus orbiculatus*) – Manual, mechanical and chemical control methods are all effective in removing and killing Asiatic bittersweet (PCA 2013). Employing a combination of methods yields the best results and may reduce potential impacts to native plants, animals and people. The selected method will depend on the extent and type of infestation, the amount of native vegetation on the site, and the time, labor and other resources available. When possible and especially for vines climbing up trees or buildings, a combination of cutting followed by application of concentrated systemic herbicide to rooted, living cut surfaces is likely the most effective approach. For large infestations spanning extensive areas of ground, a foliar herbicide may be the best choice rather than manual or mechanical means which could result in soil disturbance. For more information, visit http://www.nps.gov/plants/alien/fact/pdf/ceor1.pdf.

Autumn olive (*Eleagnus umbellata*) – Manual, mechanical and chemical methods all can be used to control autumn olive (Mervosh et al. 2001). Autumn olive is effectively controlled by manual removal of young seedlings. Plants should be pulled as soon as they are large enough to grasp, but before they produce seeds. The entire root must be removed since broken fragments may re- sprout. Cut trees at ground level

with power or manual saws. Cutting is most effective when trees have begun to flower to prevent seed production. Because autumn olive spreads by suckering, re-sprouts are common after cutting. Cutting is an initial control measure, and success will require either herbicide application or repeated cutting of re-sprouts. Girdling can be used for large trees but this method will kill only the top of the tree with re-sprouts being common, and may require follow-up treatments for several years. Autumn olive tends to be more susceptible to triclopyr than to glyphosate, especially prior to late summer. Where possible, foliar sprays are effective once the leaves are fully expanded. For larger trees, three approaches are possible: 1) girdle the tree (see description above) with an axe, and apply undiluted triclopyr in the cut around the trunk; 2) cut down tree and apply undiluted triclopyr into the freshly cut surfaces of the stump to prevent re-sprouting, or 3) cut down tree and spray re-sprouts before they get too tall to spray. For more information, visit http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm.

Japanese honeysuckle (*Lonicera japonica*) – Several effective methods of control are available for Japanese honeysuckle, including chemical and non-chemical, depending on the extent of the infestation and available time and labor (PCA 2013). For small patches, repeated pulling of entire vines and root systems may be effective. Cut and remove twining vines to prevent them from girdling and killing shrubs and other plants. An effective method for removal of patches of honeysuckle covering the ground is to lift up and hold a portion of the vine mass with a rake and have a chain saw operator cut the stems low to the ground. Mowing large patches of honeysuckle may be useful if repeated regularly, but is most effective when combined with herbicide application. Burning removes above ground vegetation but does not kill the underground rhizomes, which will continue to sprout. In moderate cold climates, Japanese honeysuckle leaves continue to photosynthesize long after most other plants have lost their leaves. This allows for application of herbicides when many native species are dormant. However, for effective control with herbicides, healthy green leaves must be present at application time and temperatures must be sufficient for plant activity. A cut stem herbicide application can be applied any time of year as long as the ground is not frozen. For more information, visit http://www.nps.gov/plants/alien/fact/loja1.htm.

Morrow's honeysuckle (*Lonicera morrowii*) – Mechanical and chemical methods are the primary means of control of exotic bush honeysuckles (PCA 2013). Hand removal of seedlings or small plants may be useful for light infestations, but care should be taken not to disturb the soil any more than necessary. In shaded forest habitats, where exotic bush honeysuckles tend to be less resilient, repeated clippings to ground level, during the growing season, may result in high mortality. Clipping must be repeated at least once yearly because bush honeysuckles that are cut once and left to grow will often form stands that are more dense and productive than they were prior to cutting. Prescribed burning has shown some promise for exotic bush honeysuckles growing in open habitats. In all instances, control should be initiated prior to the seed dispersal period (late summer to early autumn) to minimize reinvasion of treated habitats. For more information, visit http://www.nps.gov/plants/alien/fact/loni1.htm.

Japanese knotweed (*Polygonum cuspidatum*) – Grubbing is effective for small initial populations or environmentally sensitive areas where herbicides cannot be used; otherwise herbicide is the most effective control (PCA 2013). Juvenile plants can be hand pulled depending on soil conditions and root development. Any portions of the root system not removed will potentially resprout. All plant parts (including mature fruit) should be bagged and disposed of in a trash dumpster to prevent reestablishment. Use cut stem herbicide application in areas where plants are established within or around non-target plants or where vines have grown into the canopy. This treatment remains effective at low temperatures as long as the ground is not frozen. Use foliar herbicide application to control large populations. It may be necessary to precede foliar applications with stump treatments to reduce the risk of damaging non-target species. For more information, visit http://www.nps.gov/plants/alien/fact/faja1.htm.

Spotted knapweed (*Centaurea stoebe ssp. micranthos*) – The most cost effective management strategy for spotted knapweed is to prevent its spread to non-infested areas (PCA 2013). Spread by seed can be minimized by avoiding travel through infested areas; by cleaning footwear, clothing, backpacks, and other items after hiking through infested areas; and by using weed free hay. Small infestations of spotted knapweed can be controlled by persistent hand-pulling done prior to seed set. Gloves should be worn due to the possibility of skin irritation. Because spotted knapweed can regrow from the base, care must be taken to remove the entire crown and taproot. A variety of natural enemies are used as biological control agents for large infestations of spotted knapweed. Most biological control techniques use insect larvae to damage the root, stem, leaf, or flower. Biological control agents may be more effective when combined with other control methods such as herbicides, grazing, and revegetation with desirable, competitive plants. Control of spotted knapweed infestations using three chemical herbicides has been reported, but is problematic. In the absence of desirable native grasses, longevity of control may be increased by revegetating with competitive grasses and forbs. Long-term grazing by sheep and goats has been found to control spotted knapweed. Burning, cultivation, and fertilization typically are not effective on spotted knapweed unless combined with other methods of control. For more information, visit http://www.nps.gov/plants/alien/fact/cest1.htm.

7.8.3. Stormwater Management

Installation Supplement:

Water Resources Protection

ASCC overlies the Cape Cod Aquifer, which is designated as the sole or principal source of drinking water for Cape Cod. Because of the permeability of the Cape Cod Aquifer, it is extremely vulnerable to contamination. Thus, groundwater protection is paramount on JBCC to ensure the protection of future and existing drinking water, the prevention of temporary or permanent contamination of the subsurface environment, and the preservation of the ecological integrity of fresh and marine resources that are interconnected on JBCC and upper Cape Cod.

Surface water features are rather limited due to the well drained sandy soils found on Otis ANGB and JBCC generally. Given how quickly surface water infiltrates on JBCC and the fact a large portion of JBCC land is located within a Groundwater Protection Area and/or Zone II wellhead protection area, soil conservation, erosion management and stormwater management are critical for water quality protection throughout JBCC. As a result, JBCC developed a Groundwater Protection Policy and an Environmental Committee responsible for implementing this policy. The MAANG serves as a signatory to this policy. For a complete summary of water resources on Otis ANGB see the Hydrology section. For wetland protection, see the Waters of the US/Wetlands and Floodplains Protection.

As described in the Climate section, climate change is likely to increase precipitation and temperature in Massachusetts, which could lead to increased flooding and sea level rises. Depending on how things change, water resources could be significantly impacted, either be expanding or shrinking. While water resources are highly likely to be impacted, it is impossible to determine at this time, how they will be fully impacted.

Regulatory Requirements

USACE regulates the discharge of dredged or fill material into "waters of the US", including wetlands, under Section 404 of the CWA. Even an inadvertent encroachment into waters of the US resulting in a displacement or movement of soil or fill material has the potential to be viewed as a violation of the CWA if an appropriate permit has not been issued by the USACE. Waters of the US are defined under 33 CFR Part 328.3(a) and referred to as jurisdictional waters. Jurisdictional waters may include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, vernal pools, wetlands, and other waters, that if degraded or destroyed could affect interstate commerce. For more on wetlands, see the Waters of the US/Wetlands and Floodplains Protection.

According to USEPA regulations issued under Section 404(b)(1) of the CWA, permitting of fill activities will not be approved unless the following conditions are met: no practicable, less environmentally damaging alternative to the action exists; the activity does not cause or contribute to violations of state water quality standards (or compliance under Section 401 of the CWA); the activity does not jeopardize listed species or sensitive cultural resources (33 CFR Part 320.3 [e] and [g]); the activity does not contribute to significant degradation of waters of the US; and all practicable and appropriate steps have been taken to minimize potential adverse impacts to the aquatic ecosystem (40 CFR Part 230.10).

Section 401 of the CWA gives the Commonwealth of Massachusetts the authority to regulate, through the state water quality certification program, proposed federally-permitted activities that may result in a discharge to water bodies, including wetlands. The state may issue certification, with or without conditions, or deny certification for activities that may result in a discharge to water bodies. In Massachusetts, the MDEP is responsible for issuing Section 401 Water Quality Certification (WQC). The Massachusetts Clean Water Act (M.G.L. c. 21, §§ 26-53), which mirrors the federal CWA, and its implementing regulations (314 CMR 4.00 and 314 CMR 9.00) set forth surface water quality standards for the Commonwealth.

The MWPA (M.G.L. c. 131, § 40) authorizes MDEP and the city or town's Conservation Commission to protect wetlands and waterways as well as the land under the water, coastal banks, dunes, and land subject to coastal storm flowage. In addition, a 100-foot buffer zone around any protected fresh water or coastal resource is subject to jurisdiction under the MWPA. The "boundary of the buffer zone" is determined by measuring 100 feet horizontally from the outer (landward) boundaries of bordering vegetated wetland, inland or coastal bank, coastal or barrier beach, rocky intertidal shore, salt marsh, and/or coastal dune.

Floodplains

No FEMA-designated floodplains have been mapped on Otis ANGB to date. Floodplains are protected under EO 11988 (*Floodplain Management*) and Massachusetts EO 149 (*FEMA* and *Flood Plain Use*). The purpose of the EOs is to reduce the risk of flood loss, minimize the impacts of flooding, and restore and preserve the natural and beneficial values of floodplains when acquiring, managing or disposing of federal and state lands. Projects proposed in floodplains in Massachusetts are reviewed in conjunction with NEPA, MWPA, and Coastal Zone Management Act (CZMA) reviews. No additional forms or permit applications are required for floodplain reviews.

Groundwater

In addition to the CWA, groundwater is regulated under the Safe Drinking Water Act and Regulations (42 USC 300h-3(e), 40 CFR 141, 144-147), State Drinking Water Regulations (310 CMR 22.00), State Wellhead Protection Regulations (310 CMR 22.21), and Massachusetts Water Management Act (M.G.L. c. 21G). Pursuant to Section 1424(e) of the Safe Drinking Water Act, the USEPA-designated Cape Cod aquifer as a sole source of drinking water for Cape Cod, Massachusetts. The State Drinking Water Regulations identify the standards and maximum contaminant levels for safe drinking in Massachusetts, while the State Wellhead Protection Regulations establishes the land uses and activities that MDEP has determined present the greatest threat to groundwater quality within wellhead protection areas. Finally, the Massachusetts Water Management Act authorizes MDEP to regulate the quantity of water withdrawn from both surface and groundwater supplies. The purpose of these regulations (310 CMR 36.00) is to ensure adequate water supplies for current and future water needs.

Otis ANGB is located within several wellhead protection areas that are illustrated in the Water Resources Map (i.e., identified as Zone II by MDEP). The Cape Cod Commission identifies performance standards in its RPP for these areas to protect groundwater quality within this sole-source aquifer (Cape Cod Commission 2012). In addition, the JBCC Groundwater Protection Policy outlines installation specific requirements.

Stormwater

Under the National Pollution Discharge Elimination System (NPDES) provisions of the CWA (33 USC 1342), the USEPA regulates water quality, sediment, and pollutant discharge of stormwater runoff to waters of the US from construction activities, industrial activities, municipal separate storm sewer systems (MS4s), and those designated by USEPA due to water quality impacts. Massachusetts is one of the five remaining states in the US that are classified as a non-delegated state where the USEPA administers the NPDES program. Delegated states have assumed control over the program from the federal government. As the NPDES stormwater permitting authority for Massachusetts, the USEPA is responsible for promulgating rules and issuing permits, managing and reviewing permit applications, and performing compliance and enforcement activities. Additional information on the stormwater program and permitting requirements can be found on the USEPA and MDEP websites, respectively: http://www.epa.gov/region1/npdes/stormwater/ and http://www.mass.gov/dep/water/ wastewater/stormwat.htm.

Permitting

Permitting requirements vary depending on type, location, and extent of disturbance. Prior to initiating projects or activities (e.g., dredging, filling, work in and around a stream) occurring within or with the potential to affect a floodplain, wetland or other water body, the appropriate agencies (USACE, MDEP, Office of CZM, USEPA, or the local Conservation Commission) should be consulted to determine permitting requirements.

As discussed above, the USACE and MDEP have regulatory authority over waters of the US and state under Sections 404 and 401 of the CWA. In Massachusetts, the USACE issues Individual Permits and a Massachusetts Programmatic General Permit (PGP) that covers many routine or minor projects that result in placement of fill material; dredging or removal of soil or minerals; construction, operation or maintenance of any use or development; and discharge of stormwater into a wetland. All nationwide permits (NWPs) have been suspended in New England. The Massachusetts DEP issues the 401 WQC for federally permitted activities.

Because Otis ANGB overlies the USEPA-designated Cape Cod aquifer, any federally funded or assisted construction project is subject to USEPA review to ensure it will not result in a significant impact to the public. In addition, portions of Otis ANGB are located within wellhead protection

areas or MDEP Zone II; therefore, certain land use and activities may be prohibited or limited within these areas pursuant to the Massachusetts Wellhead Protection rules (310 CMR 22), Cape Cod Commission RPP minimum performance standards, and JBCC Groundwater Protection Policy.

As a result of a recent USEPA ruling and in compliance with the provisions of the Federal Water Pollution Control Act as amended (33 USC § 1251), USEPA issued a NPDES Pesticide General Permit for point source discharges from the application of pesticides to waters of the US. The NPDES Pesticide General Permit covers Operators that apply pesticides that result in discharges from the following use patterns: (1) mosquito and other flying insect pest control; (2) weed and algae control; (3) animal pest control; and (4) forest canopy pest control. The permit requires permittees to minimize pesticide discharges through the use of pest management measures and monitor for and report any adverse incidents. Some permittees are also required to submit NOIs prior to beginning to discharge and implement integrated pest management (IPM)-like practices. As mentioned above, Massachusetts is one of the five remaining states in the US that are classified as a non-delegated state where the USEPA administers the NPDES program. Additional information on this NPDES permit and whether or not it applies to a particular project can be found on the USEPA NPDES program website at: http://cfpub.epa.gov/npdes/home.cfm?program_id=410.

Soil Conservation and Erosion Management

Two main types of soil erosion exist: wind erosion and water erosion. Several factors affect water erosion. These factors include rainfall, slope steepness and length, soil texture or erodibility, cover protecting the soil, and special practices such as terracing or planting on the contour. Sediment resulting from erosion affects surface water quality and aquatic organisms. Soils within the terminal moraines or on slopes within the outwash plains are more susceptible to erosion (see the Soils Map). Soil types with high susceptibility for soil erosion on Otis ANGB include Carver, Enfield, Hinckley and Plymouth Barnstable soils, particularly along slopes (see the Soils Map). For a complete summary of soils on Otis ANGB see the Geology and Soils section.

Stormwater Management

Stormwater runoff is produced when rainfall during a storm exceeds the infiltration capacity of the soil or encounters an impervious surface. Stormwater runoff can be a significant source of pollutants as well as sediments to surface waters, especially in areas with impervious surface cover or where groundcover has been disturbed. Sources of stormwater runoff and pollution could originate from operational, maintenance, and/or administrative areas within Otis ANGB. Additionally, stormwater runoff from impervious surfaces has a high potential to carry pollutants into wetlands, surface waters, and groundwater. Nearly all soil types found on the installation have high percolation rates and in turn poor filtering capacity; therefore, groundwater pollution is a hazard. Impervious surfaces at Otis ANGB include roads, parking lots, sidewalks, and buildings. MAANG, however, has a number of stormwater controls already in place, which greatly reduces runoff and increases infiltration through a controlled environment before the stormwater enters either surface or groundwater.

Stormwater management is important at Otis ANGB and JBCC generally given the extent of development, high percolation rates, and poor filtering capacity of the soils. A number of mechanisms are in place to protect water quality. In December 2008, the 102 IW submitted a Notice of Intent for and was granted coverage under USEPA's 2008 NPDES Stormwater Discharge Multi-Sector General Permit (MSGP). The permit tracking number is MAR05CY28 (MAANG 2010b). The MAANG obtains a NPDES Construction General Permit from the USEPA when construction and other land disturbing activities result in 1 acre or more of soil disturbance and discharge to a water of the US. Furthermore, MAANG maintains a SWPPP and SPCCP in compliance with 40 CFR 122 and 112, respectively (MAANG 2010b, 2012b). The SWPPP describes the programs, BMPs, monitoring and other measures already used on Otis ANGB. There are no waters listed under 303(d) of the Clean Water Act on or adjacent to Otis ANGB.

USEPA and MDEP are good sources for stormwater BMPs. The MDEP's *Massachusetts Stormwater Handbook* (MDEP 2008), MDEP's *Erosion and Sedimentation Control Guidelines: a guide for planners, designers, and municipal officials* (MDEP 2003), the *Massachusetts Unpaved Roads BMP Manual: A Guidebook on How to Improve Water Quality While Addressing Common Problems* (MDEP 2001), and the USEPA's *Developing your Stormwater Pollution Prevention Plan: A Guide for Construction Sites* (USEPA 2007) are useful references. A copy of the MDEP manuals as well as additional policies and guidance for specific activities related to erosion and stormwater management can be found at: http://www.mass.gov/dep/water/laws/policies.htm.

Riparian Buffers

The MAANG will maintain riparian buffers around water resource to reduce the influx of sedimentation and other materials into the water resources in compliance with the CWA and MWPA. Riparian buffers are sometimes also referred to as riparian management zones, vegetation buffers, buffer strips, filter strips or streamside management areas.

One of the primary purposes of a riparian buffer is for water quality protection by providing vegetation to interrupt water flow and to trap and filter out suspended sediments, nutrients, chemicals, and other polluting agents before they reach the body of water. Riparian buffers should be maintained along all perennial and intermittent streams, lakes or ponds where nearby management activities result in surface/soil disturbance, earth changes and where erosion and sediment transport occur during rain events. Maintaining the forest cover around the small water resources within the forest is important for preventing sedimentation and impacts to water quality.

Buffers can take many forms and may vary depending on the upland land use and the type of water resource being protected. Vegetation buffers can either be grassland or forest and may or may not be mowed and maintained occasionally. In general, riparian buffers in Massachusetts should be a minimum 100 feet wide with increasing buffers in steeper terrain.

Management Strategies for Water Quality

Although water quality monitoring is not required, it is a good way to measure ecosystem health. Land-based environmental degradation eventually affects water quality and aquatic ecosystems. In general, water resources will be managed through conservation and impact avoidance. The following guidelines will be implemented to ensure compliance and to protect and enhance Otis ANGB water resources and water quality.

- Consult with the 102 CES/CEV Office prior to initiating projects with the potential to disturb water resources or their buffers;
- Restrict vehicles within 100 feet of water resources except where established crossings and roads exist;
- Adhere to all signage posted on the installation to further protect environmentally sensitive areas;
- Maintain vegetated buffers around water resources;

- Apply for an appropriate permit when regulated waters, including associated buffers, will be impacted;
- Plan development to avoid impacts to water resources to the maximum extent possible and mitigate unavoidable impacts;
- Ensure all activities implemented within MDEP Zone II areas are in compliance with Massachusetts wellhead protection rules (310 CMR 22), Cape Cod Commission RPP minimum performance standards, and the JBCC Groundwater Protection Policy and that new activities, when applicable, are reviewed by USEPA, MDEP, and JBCC's Environmental Committee prior to implementing them;
- Review operations and maintenance programs that potentially affect water resources, and develop procedures and guidelines to avoid the loss of function;
- Adhere to BMPs during construction and operational activities as described in applicable manuals, plans and permits;
- Maintain and repair trails (i.e., unpaved roads) as needed, and consult the *Massachusetts Unpaved Roads BMP Manual: A Guidebook on How to Improve Water Quality While Addressing Common Problems* (MDEP 2001) for guidance on ways to properly maintain unpaved roads to minimize erosion and water quality problems;
- Minimize the amount of impervious surfaces in newly developed areas;
- Minimize the use of pesticides and herbicides;
- Revegetate barren ground;
- Monitor water quality; and
- Ensure the SWPPP, SPCCP and other relevant MAANG environmental plans are implemented.

Wildland Fire Management

Currently, MAANG lacks personnel with the training and knowledge of wildland fire as well as other resources (e.g., funding) necessary to implement a prescribed burn program. The MAANG does recognize that the use of prescribed fire in the grasslands on Otis ANGB is a beneficial vegetation management tool. As a result, the MAANG will cooperate with other experienced regional parties and facilitate prescribed fire activities on Otis ANGB. When feasible, the MAANG will develop cooperative agreements or hire local contractors to implement prescribed fire. See the Forest Management section for wildland fire related objectives.

Agricultural Outleasing

There is no agricultural outleasing program at Otis ANGB.

7.8.4. Bird/Wildlife Aircraft Strike Hazard (BASH)

Installation Supplement:

There is not a BASH program at Otis ANGB.

8. Management Goals and Objectives

The installation establishes long term, expansive objectives, and supporting targets to manage and protect natural resources while supporting the military mission. Objectives express a vision for a desired condition for the installation's natural resources and are the primary focal points for INRMP implementation. Targets indicate a management initiative or strategy for specific long or medium range outcomes and are supported by targets. Tasks are specific actions that can be accomplished within a single year. Also, in cases where off-installation land uses may jeopardize ANG missions, this section may list specific tasks aimed at eliminating, reducing or mitigating the effects of encroachment on military missions. The installation's objectives and targets are displayed in the widget below. These objectives and targets are key elements of the annual work plans and are programmed into the conservation budget, as applicable.

Using the objectives and targets below, annual and yearly work plans are developed. Specific methods and procedures that will be used (i.e., scopes of work) to implement each INRMP project have been, or will be, developed as site-specific management plans are developed and incorporated into appropriate contracts and base work requisitions. INRMP Annual Work Plan projects are listed in the Installation Supplement below, including the current year and four succeeding years. For each project, a project number, description, timeframe for implementation, and lead organization are identified. The work plans provide all the necessary information for building a budget within the ANG framework.

Installation Supplement:

The goals and objectives in this updated INRMP are a consolidation and continuation of the goals and objectives in the 2007 INRMP. In some cases, previous goals and objectives have been combined to avoid repetition and some previous projects are now designated as ongoing activities. A number of objectives and projects were discontinued because the MAANG no longer manages the land associated with them. The goals and objectives are supported by projects (subject to funding availability) and recurring natural resources management activities, which will allow the MAANG to achieve the management goals. Recurring activities are in the Recurring Natural Resource Management Activities table and planned projects are summarized in the Projects Identified to Implement this INRMP table in this section. Note that the implementation of some projects or activities will allow the MAANG to meet multiple goals and objectives. In other words, a project or activity may occur under more than one objective. The consolidated goals, objectives, and resulting projects and recurring activities are listed below.

GOAL PM: Manage natural resources in a manner that is compatible with and supports the military mission while complying with applicable federal and state laws and USAF regulations and policies.

OBJECTIVE PM1: Initiate and/or continue programs and projects, in compliance with environmental laws, that enhance the land and military mission and result in no net loss of land availability.

- Activities: 1-4, 8-17, 21, 24, 27 Projects: 1, 2

OBJECTIVE PM2: Use adaptive, ecosystem management as the primary natural resources management paradigm.

- Activities: 2, 3, 6-8, 20, 23-26 Projects: 1-9, 12-16

OBJECTIVE PM3: Continue internal environmental awareness activities to minimize impacts to natural resources from MAANG and visiting personnel.

- Activities: 4 Projects: None

OBJECTIVE PM4: Continue public outreach in coordination with other regional entities as appropriate.

- Activities: 5 Projects: None

OBJECTIVE PM5: Continue to cooperate with other agencies and local landowners on regional land and natural resources management efforts.

- Activities: 2, 3, 8, 9, 11, 13-16, 18-20, 25, 26
- Projects: 1, 5-7, 9, 10, 13-16

OBJECTIVE PM6: Maintain and improve Geographic Information System (GIS) data and access to that data by MAANG personnel.

- Activities: None Projects: 2, 3, 5-7, 13

GOAL FW: Maintain fish and wildlife populations by providing healthy, diverse habitat types and corridors for wildlife movement between those habitats while minimizing potential impacts to the military mission.

OBJECTIVE FW1: Improve understanding of wildlife occurring on Otis ANGB, in conjunction with other DoD and non-DoD agencies conducting wildlife surveys on JBCC.

- Activities: 18 Projects: 6

OBJECTIVE FW2: Ensure other management activities do not cause impacts to nesting migratory birds or listed species.

- Activities: 17, 27 Projects: 5, 8, 9, 12, 16

OBJECTIVE FW3: Maintain existing grasslands and forests to protect priority habitat and rare species.

- Activities: 19, 20 Projects: 5, 8-16

GOAL OR: Provide opportunities for outdoor recreation to members of the public and the military while maintaining ecosystem integrity and function as well as the safety of the public and employees.

OBJECTIVE OR1: Evaluate outdoor recreation and other public use activities to ensure compliance with environmental laws and long-term sustainability of the activity.

- Activities: 17 Projects: None

OBJECTIVE OR2: Identify sustainable, safe outdoor recreation and areas that may be used for outdoor recreation without impacting the mission.

- Activities: 17 Projects: None

GOAL TE: Manage threatened and endangered listed species using an ecosystem approach, while supporting the military mission.

OBJECTIVE TE1: Monitor the presence of federally listed species on Otis ANGB, in conjunction with other monitoring on JBCC by other agencies.

- Activities: 13-16, 18 Projects: 6

OBJECTIVE TE2: Survey specifically for potential and documented listed species, as well as monitor for these species during other natural resources activities.

- Activities: 13-15 Projects: 6, 7

OBJECTIVE TE3: Manage for northern long-eared bats, if listed, by limiting potential habitat disturbance and cooperating with other agencies.

- Activities: 13-17, 20, 27 Projects: 5, 9, 12-16

OBJECTIVE TE4: Manage for grassland-dependent state-listed species by maintaining existing grasslands and limiting woody encroachment.

- Activities: 13-15, 17, 19, 23, 26 Projects: 5, 7-11, 13-15

OBJECTIVE TE5: Manage for forest-dependent state-listed species by implementing sound forestry practices.

- Activities: 13-15, 17, 20, 25-27 Projects: 5, 7, 12-16

GOAL WA: Manage stormwater and soils to protect water quality and manage water resources, including wetlands, so they remain resilient and with no net loss of acreage or functions and values.

OBJECTIVE WA1: Minimize impacts to water resources, including wetlands, and comply with all laws and regulations pertaining to wetlands, streams, floodplains and regulated water bodies.

- Activities: 6-9, 17 Projects: 3, 4

OBJECTIVE WA2: Maintain or enhance vegetated buffers around water resources, including buffers at least 100 feet wide around wetlands.

- Activities: 8, 9, 12 Projects: 3, 4

OBJECTIVE WA3: Implement the SWPPP and SPCCP to improve water quality by reducing pollutants in stormwater discharges.

- Activities: 7, 8, 10 Projects: None

OBJECTIVE WA4: Protect quality and quantity of groundwater and recharge areas for existing water supply wells, which includes complying with laws and regulations pertaining to water supply, the JBCC Groundwater Protection Policy Plan and other JBCC groundwater programs.

- Activities: 8, 10, 11 Projects: None

OBJECTIVE WA5: Manage slopes and soils to minimize erosion and sediment loss.

- Activities: 6, 8 Projects: None

GOAL VE: Manage vegetation to promote native species using cost effective and sustainable methods, while also minimizing the risk of uncontrollable wildfires.

OBJECTIVE VE1: Improve understanding of vegetation and plant species occurring on Otis ANGB, in conjunction with other DoD and non-DoD agencies conducting vegetation surveys on JBCC.

- Activities: 18 Projects: 5, 7, 13

OBJECTIVE VE2: Maintain grasslands by removing encroaching trees, implementing prescribed fires when possible and strategic mowing.

- Activities: 19, 20, 23, 26 Projects: 8-11, 13-15

OBJECTIVE VE3: Maintain forests by using sustainable forestry practices and limiting additional fragmentation.

- Activities: 20, 26, 27 Projects: 12-16

OBJECTIVE VE4: Implement wildland fire program by cooperating with other JBCC and regional agencies.

- Activities: 19, 20 Projects: 9

OBJECTIVE VE5: Maximize native plants and avoid invasive non-native plants in landscaping and other areas.

- Activities: 21 Projects: 13, 15, 16

GOAL IN: Minimize impacts of invasive and pest species by utilizing an integrated pest management approach while minimizing use of chemicals to manage those species.

OBJECTIVE IN1: Prevent the spread of invasive aquatic species by ensuring all equipment (e.g., vehicles and clothing) is clean before and after use.

- Activities: 24, 26 Projects: 15

OBJECTIVE IN2: Manage terrestrial invasive species by maintaining existing native vegetation, monitoring invasive species density and spread, and implementing control efforts when needed.

- Activities: 21 Projects: 7, 9, 13-15

OBJECTIVE IN3: Monitor for forests pests and consult with local foresters if needed.

- Activities: 24, 26 Projects: 6, 12 OBJECTIVE IN4: Implement the IPMP.
- Activities: 24 Projects: 15, 16

Recurring Natural Resources Managment Activities				
Activity		**Priority**	**Objective(s) in Section 8.0**	**Timing**
1	Prepare budget to implement the natural resources management program and program projects into ACES	1	PM1	Annual
2	Complete annual review of INRMP, in conjunction with MAARNG, USCG and USAF INRMPs and update if needed	1	PM1, PM2, PM5	Annual
3	Complete review for operation and effect at least every 5 years with INRMP Task Force. Initiate update or revision as appropriate (see Projects for update/revision)	1	PM1, PM2, PM5	2019
4	Provide environmental and natural resources training to Otis ANGB personnel	1	PM1, PM3	As Needed
5	Include environmental issues in public outreach efforts, in conjunction with other agencies	1	PM4	As Needed
6	Evaluate effectiveness of erosion and sediment control measures	1	PM2, WA1, WA5	As Needed
7	Monitor at-risk construction sites to ensure erosion and sediment control measure are effective	1	PM2, WA1, WA3	As Needed
8	102 IW/EM will review activities for potential to impact water resources	1	PM1, PM2, PM5, WA1 - WA5	As Needed
9	If an activity will impact a wetland or other water resource, coordination with USACE will be completed and mitigation options identified	1	PM1, PM5, WA1, WA2	As Needed
10	Implement SWPPP and SPCCP to protect water quality	1	PM1, WA3, WA4	Annually
11	Comply with JBCC groundwater protection policy	1	PM1, PM5, WA4	As Needed
12	Maintain 100 foot buffers around wetlands, as required by Massachusetts law	1	PM1, WA2	As Needed
13	When new activities are undertaken at Otis ANGB, 102 IW/EM and NGB/A7AM should review for impacts to listed species and their habitat to determine potential impacts and identify options to minimize impacts	1	PM1, PM5, TE1 - TE5	As Needed
14	Monitor new species listings under	1	PM1, PM5, TE1 - TE5	As Needed

	the ESA, particularly with respect to bats and the New England cottontail			
15	Consult with NHESP program when implementing activities and projects within NHESP priority habitat	1	PM1, PM5, TE1-TE5	As Needed
16	Participate in regional efforts to identify rare species habitats	1	PM1, PM5, TE1, TE3	As Needed
17	Ensure public use and outdoor recreation do not adversely affect natural resources	1	PM1, OR1, OR2, FW2, WA1, TE3-TE5	As Needed
18	Coordinate with MAARNG, USCG, and USAF when conducting species surveys	1	PM5, FW1, TE1, VE1	As Needed
19	Cooperate with the MAARNG with respect to wildland fire management	1	PM5, FW3, TE4, VE2, VE4	As Needed
20	Coordinate with MAARNG, USCG, and USAF to monitor mowing and prescribed fire as vegetation management tools	1	PM2, PM5, FW3, TE3-TE5, VE2-VE4	As Needed
21	Use native plant species and materials for landscaping activities	1	PM1, VE5, IN2	As Needed
22	Support management activities at Francis Crane WMA, when feasible	2	PM5	As Needed
23	Coordinate with Roads and Grounds to ensure mowing regimes are appropriate for the Management Unit	1	PM2, VE2, TE4	As Needed
24	Implement IPMP, including methods for control and reporting requirements	1	PM1, PM2, IN1-IN4	Annually
25	Coordinate with state foresters to monitor for forest pests	1	PM2, PM5, TE5, IN3	As Needed
26	Monitor regularly for new invasive species or sudden increases in density of existing invasive species, in conjunction with MAARNG	1	PM2, PM5, TE4, TE5, VE2, VE3, IN1-IN3	As Needed
27	Conduct any tree management to minimize impacts to migratory birds and bats	1	PM1, VE3, FW2, FW3, TE3, TE5	As Needed

This table is also presented in Appendix D with details of labor hours and estimated costs.
Priority Codes: 1 = High; 2 = Medium; 3 = Low.
Priority codes are roughly equivalent to funding priorities as described in DoDI 4715.03 and AFI 32-7064

Projects Identified to Implement the INRMP (Subject to Funding Availability)				
Project		**Priority**	**Objective(s) in Section 4.0**	**Projected Date**
1	Revise INRMP as determined by INRMP Task Force meeting during review for operation and effect	1	PM1, PM2, PM5	As Needed
2	Incorporate new GIS data from ANG and contractors into the master GIS dataset	1	PM1, PM2, PM6	As Needed
3	Identify all required riparian and wetland buffers and compile into GIS data	1	PM2, PM6, WA1, WA2	2016

4	Monitor condition of wetlands regularly	1	PM2, WA1, WA2	As Needed
5	Develop comprehensive vegetation community data using NVCS classifications, remote sensing techniques and groundtruthing in conjunction with MAARNG and USCG	1	PM2, PM5, PM6, VE1, FW2, FW3, TE3-TE5	2017
6	Conduct wildlife survey(s) with an emphasis on federal and state-listed and rare animals; in conjunction MAARNG, USCG, and other local partners	1	PM2, PM5, PM6, FW1, TE1, Te2, in3	2018
7	Conduct plant survey with an emphasis on federal and state-listed and rare plants, in conjunction with MAARNG and USCG	1	PM2, PM5, PM6, VE1, TE2m TE4, TE5, IN2	2018
8	Update Grassland Management Plan, with an emphasis on moving regimes*	1	PM2, TE4, FW2, FW3, VE2	2015
9	Implement prescribed fire for habitat management, either by coordinating with the MAARNG or through a local contractor*	1	PM2, PM5, FW2, FW3, VE2, VE4, TE3, TE4, IN2	As Needed
10	Develop an Integrated Wildland Fire Management Plan and coordinate with MAARNG and USCG during its development	1	PM2, PM5, FW3, VE2, VE4, TE4	As Needed
11	Reduce woody encroachment into grassland areas	1	PM5, FW3, TE4, VE2	As Needed
12	Implement forest management projects necessary to maintain forest health and diverse age structure to support listed species	1	PM2, FW2, FW3, VE3, TE3, TE5, IN3	As Needed
13	Conduct an invasive plant survey	1	PM2, PM5, PM6, FW3, VE1-VE3, VE5, IN2, TE3-TE5	2018
14	Monitor status of priority invasive species, once identified	1	PM2, PM5, FW3, VE2, VE3, TE3-TE5, IN2	As Needed
15	Implement control projects for hazardous and invasive species, possibly in conjunction with MAARNG, USCG, local government or non-profits	1	PM2, PM5, FW3, VE2, VE3, VE5, TE4, TE5, IN1-IN4	As Needed
16	Implement management necessary to control forest pests, in particular non-native ones, and to mitigate damage	2	PM2, PM5, FW2, FW3, VE3, VE5, TE3, TE5, IN3, IN4	As Needed

*These projects apply until the Solar Field Mitigation begins in Unit K. The MAANG will no longer be the responsible agency for this land and will no longer have any legal authority to implement projects there.
This table is also presented in Appendix D with details of labor hours and estimated costs.
Priority Codes: 1 = High; 2 = Medium; 3 = Low.
Priority codes are roughly equivalent to funding priorities as described in DoDI 4715.03 and AFI 32-7064.

9. INRMP Implementation, Update, and Revision Process

9.1. Natural Resources Management Staffing and Implementation

Installation Supplement:

INRMP Implementation

Project Development

Management goals and objectives for the INRMP were developed through a thorough evaluation of the natural resources present on Otis ANGB. In accordance with AFI 32-7064 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 Natural Resources Program Management section presents the preferred management alternatives based on the professional opinions of the Otis ANGB INRMP Task Force, including the 102 CES/CEV, NGB/A7AM Natural Resources Manager, USFWS, MDFW, and USDA-WS. Through these evaluations, a set of natural resources management goals have been established based on the current theories on adaptive ecosystem-based planning (see the Natural Resources Program Management section).

This INRMP will be implemented through the various policies and programs described throughout the document and accomplishment of the goals and objectives as described in the Management Goals and Objectives section. The implementation schedule, project and activity lists, and how the projects relate to INRMP implementation are detailed in the Recurring Natural Resources Management Activities and Project Identified to Implement the INRMP tables.

This INRMP is a living document that is based on short-, medium-, and long-term planning horizons. Short-term tasks include activities and projects that are planned to occur in 0 to 5 years, while medium-term tasks include activities and projects in a 6- to 10-year period. Long-term tasks are usually scheduled beyond 10 years. The majority of the tasks discussed in this INRMP are short and medium-term natural resources management tasks. Goals, objectives and tasks should be revised over time to reflect evolving environmental condition, adaptive management and the completion of tasks as the INRMP is implemented. In addition, medium- and long-term tasks should eventually become short-term tasks over time.

Project Implementation

In accordance with AFI 32-7064, an INRMP is considered implemented if an installation:

- Actively requests, receives, and uses funds for “must fund” projects and activities as defined by AFI 32-7001 (Environmental Quality Programming and Budgeting);
- Executes all “must fund” projects and activities in accordance with specific time frames identified in the INRMP;
- Ensures that sufficient numbers of professionally trained natural resources management personnel are available to perform the tasks required by the INRMP;
- Reviews the INRMP annually and coordinates annually with cooperating agencies; and,
- Documents specific INRMP action accomplishments undertaken each year.

Natural resource and land use management issues are not the only factors contributing to the development and implementation of the INRMP. Facility management and other seemingly unrelated issues affect implementation. It is important to the implementation of this INRMP that MAANG personnel take ownership of the INRMP to provide the necessary resources (i.e., personnel and equipment), and to utilize the appropriate funding allocated by the NGB/A7AM to enact the INRMP. It is extremely important that the INRMP Working Group continue to participate in the implementation of this INRMP. The INRMP Working Group is made up of the key Otis ANGB personnel, and has an oversight role to ensure the effective implementation of this INRMP. Top- and middle-level management representation, as well as representation from several individuals with day-to-day on-site experience will provide the INRMP Working Group with the leadership and structure necessary for the successful implementation of this INRMP.

The Recurring Natural Resources Management Activities table provides an overview of recurring natural resource management activities. These activities are generally performed by 102 CES/CEV, NGB/A7AM Natural Resources Manager and/or other Otis ANGB personnel. The implementation schedule and planned projects for this updated INRMP are detailed in the Projects Identified to Implement the INRMP table. The Projects Identified to Implement the INRMP table will be used to develop budget requests and schedule annual project requirements. Funding requests will be submitted in accordance with current NGB procedures for conservation projects.

Priorities and Scheduling

The Office of Management and Budget (OMB) 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. Therefore, projects need to be funded consistent with timely execution to meet future deadlines. Projects are generally prioritized with respect to compliance. Highest priority projects are projects related to recurring or current compliance, and these are generally scheduled earliest. As such, these projects have been placed into three priority-based categories: (1) high priority projects which are essential for maintaining compliance or for successful natural resources management, (2) medium priority projects with no immediate compliance requirement or less impact on the natural resources, and (3) low priority projects with a natural resources benefit but no legal driver. The prioritization of the projects is based on need, legal drivers, and ability to further implementation of the INRMP.

Recurring requirements include projects and activities needed to cover the recurring administrative, personnel and other costs that are necessary to meet applicable compliance requirements (federal and state laws, regulations, EOs, and DoD policies) or which are in direct support of the military mission. Recurring costs include manpower, training, supplies; hazardous waste disposal; operating recycling activities; permits and fees; testing, monitoring and/or sampling and analysis; reporting and record keeping; maintenance of environmental conservation equipment; and compliance self-assessments.

Current compliance includes projects and activities needed because an installation is currently or will be out of compliance if projects or activities are not implemented in the current program year. Examples include:

- Environmental analyses, monitoring, and studies required to assess and mitigate potential effects of the military mission on conservation resources;
- Planning documents;
- Baseline inventories and surveys of natural and cultural resources (historical and archaeological sites);
- Biological Assessments (BAs), surveys, or habitat protection for a specific listed species
- Mitigation to meet existing regulatory permit conditions or written agreements;
- Wetland delineations in support of subsequent jurisdictional determinations and consequent permitting;
- Efforts to achieve compliance with requirements that have deadlines that have already passed; and,
- Initial documenting and cataloging of archaeological materials.

Maintenance requirements include those projects and activities needed that are not currently out of compliance but shall be out of compliance if projects or activities are not implemented in time to meet an established deadline beyond the current program year. Examples include:

- Compliance with future requirements that have deadlines;
- Conservation and GIS mapping to be in compliance;
- Efforts undertaken in accordance with non-deadline specific compliance requirements of leadership initiatives;
- Wetlands enhancement, in order to achieve the executive order for "no net loss" or to achieve enhancement of existing degraded wetlands; and,
- Public education programs that educate the public on the importance of protecting natural resources.

Lower priority projects include those that enhance conservation resources of the installation mission, or are needed to address overall environmental goals and objectives, but are not specifically required under regulation or EO and are not of an immediate nature. These projects are generally funded after those of higher priority are funded. Examples include:

- Community outreach activities, such as "Earth Day" and "Historic Preservation Week" activities;
- Educational and public awareness projects, such as interpretive displays, oral histories, nature trails, wildlife checklists, and conservation teaching materials;
- BAs, biological surveys, or habitat protection for a non-listed species;
- Restoration or enhancement of cultural or natural resources when no specific compliance requirement dictates a course or timing of action; and,
- Management and execution of volunteer and partnership programs.

Funding

Implementation of this INRMP is subject to the availability of annual funding. Funding sources for specific projects can be grouped into three main categories by source: federal NGB/USAF funds, other federal funds, and non-federal funds. When projects identified in the plan are not implemented due to lack of funding, or other compelling circumstances, the installation will review the goals and objectives of this INRMP to determine whether adjustments are necessary. The following discussion of funding options is not all-inclusive of funding sources. Many funding sources rely on a variety of grant programs, award criteria and amounts can change considerably from one year to another. Funding through grant programs can occur on a one-time award, annually or in multiples of years.

The NGB is the primary source of funding to support the management of natural resources at Otis ANGB. This budget is managed by the MAANG Environmental Manager and the NGB/A7AM Natural Resources Manager. The NGB provides funding for natural resource surveys, environmental monitoring projects, and compliance-related projects.

The Legacy Resource Management Program provides financial assistance to DoD efforts to conserve natural and cultural resources on federal lands. Legacy projects could include regional ecosystem management initiatives, habitat preservation efforts, archeological investigations, invasive species control, and/or flora or fauna surveys. Project proposals are submitted to the Legacy program during their annual funding cycle.

There are also grant and assistance programs administered by other federal agencies that could be accessed for natural resources management at Otis ANGB. Examples include funds associated with the CWA and endangered species.

Other non-federal funding sources that could be considered include The Public Lands Day Program, which coordinates volunteers to improve the public lands they use for recreation, education, and enjoyment, and the National Environmental Education and Training Foundation, which manages, coordinates, and generates financial support for the program.

State and local agencies are also a great source of additional resources. For example, the MAANG may consider entering into cooperative or mutual aid agreements with states, local governments, non-governmental organizations, and other individuals.

Natural Resources Management Staffing

The Natural Resources Program at Otis ANGB is administered by the MAANG and the ANG/A7AM. Responsibilities of the MAANG in regard to implementation of this INRMP include:

- Providing oversight and coordination with other agencies;
- Developing and implementing programs to ensure the inventory, delineation, classification, and management of all applicable natural resources to include: forests, wetlands, listed species, sensitive or unique habitats, and other natural resource areas of special interest;
- In cooperation with the NGB/A7AM, the MAANG will provide natural resources training for the environmental manager and other natural resources personnel including CECOS DoD Natural Resources Compliance course;
- Maintaining natural resources management records;
- Reviewing environmental documents (e.g., environmental impact assessments and remedial action plans) and construction designs and proposals to ensure adequate consideration of natural resources, while ensuring that technical guidance as presented in this INRMP is adequately considered;
- Evaluating impacts of military missions and providing guidance to military personnel regarding natural resources;
- Coordinating with the cultural resources program and Section 106 compliance;

- Coordinating with local, state, and federal governmental and civilian conservation organizations relative to the Otis ANGB natural resources management program; and,
- Implementing and executing AFI 32-7064.

The Otis ANGB Environmental Manager also receives support from the NGB/A7AM Natural Resources Manager and the Otis ANGB staff, each of whom has significant duties in addition to natural resources support. Additional labor resources may include:

- Federal agencies (e.g., USFWS, NRCS);
- State agencies;
- Local and regional universities;
- Scouting groups; or,
- Conservation groups (e.g., Audubon Society and sportsmen's clubs).

Currently, the primary responsibilities of Otis ANGB personnel are for implementing programs other than the natural resources management necessary to implement this INRMP. Additional sources of temporary labor, hired with term limitations, could be utilized to augment current staff, such as seasonal employees (e.g., grounds maintenance summer hires). Outside agency reimbursable hires and Guardsman, Reservists, or Active Duty USAF personnel assigned to Otis ANGB on temporary duty are another source of supplemental labor. Implementation of a number of projects discussed in this INRMP will require active outside assistance. The outside assistance 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 MOU and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements. The INRMP Working Group (including NGB/A7AM when funding is being determined) should assess the level of additional resources necessary to fully implement this INRMP during the annual review process (see the Annual INRMP Review and Coordination Requirements section), and determine the extent to which outside assistance will be required.

9.2. Monitoring INRMP Implementation

Installation Supplement:

Otis ANGB INRMP Implementation Monitoring

Monitoring of INRMP implementation is necessary to facilitate the legal requirements of the SAIA for review for operation and effect (see discussion above). These SAIA implementation criteria do not necessarily measure the effectiveness of an INRMP in facilitating mission accomplishment while conserving natural resources. The Otis ANGB INRMP implementation will be monitored for meeting the legal requirements of the SAIA as well as for other mission and biological measures of effectiveness.

The ultimate successful implementation of this INRMP is realized in no net loss in the capability of the Otis ANGB training lands to support the military mission while at the same time providing effective natural resources management. Initiation of projects is one measure that is used to monitor INRMP implementation, but it does not give the total picture of the effectiveness of the natural resources management program. Natural resources management is not the sum total of projects, interagency coordination or program funding and staffing. Natural resources management at the Otis ANGB is a program and a philosophy that guides the MAANG's approach to land use. A significant portion of INRMP implementation is done through internal coordination in regard to training site operations and land use decision making. This type of implementation cannot be measured by project implementation or funding levels. It is evidenced by such things as the ability to continually train, sustainable land use, ongoing regulatory compliance, retention of species diversity, retention of surface water quality, and the acknowledgement of sustainable natural resources management by partnering conservation agencies and other interested organizations and individuals.

In order to monitor and evaluate the effectiveness of the INRMP implementation the following will be reviewed as applicable and discussed within the context of the annual review and/or a formal review of operation and effect:

- Impacts to/from the military mission;
- Conservation program budget;
- Staff requirements;
- Program and project implementation;
- Trends in species and habitat diversity as evidenced by recurring biological surveys, land use changes, and opinions of natural resource experts;
- Compliance with regulatory requirements; and,
- Feedback from military trainers, the USFWS, the MDFW, and others.

Some of these areas may not be looked at every year due to lack of data or pertinent information. The effectiveness of the INRMP as a mission enabling conservation tool will be decided by mutual agreement of the USFWS, the MDFW, and the MAANG during annual reviews and/or reviews for operation and effect.

USAF and DoD INRMP Implementation Monitoring

The USAF uses the Defense Environmental Programs Annual Report to Congress (DEPARC) to monitor SAIA compliance. DEPARC is the automated system used to collect installation environmental information for reporting to DoD and Congress.

Established to fulfill an annual requirement to report the status of DoD's Environmental Quality program to Congress, DEPARC collects information on enforcement actions, inspections and other performance measures for high-level reports and quarterly reviews. DEPARC also helps the USAF track fulfillment of DoD Measures of Merit requirements.

The Deputy under Secretary of Defense (DUSD) Updated Guidance for Implementation of the SAIA updated Conservation Metrics for Preparing and Implementing INRMPs. Progress toward meeting these measures of merit is reported in the annual report to Congress. DEPARC reporting requirements currently include answers to these questions:

- The installation plans, programs and budgets for actions that support INRMP goals and objectives?
- Was the INRMP "fully-implemented" during previous execution year?

- Were all funds allocated for INRMP implementation (Environmental Quality [EQ], Reimbursable, and other) executed for the intended purpose?
- Is there adequate participation/collaboration from USFWS during Annual INRMP Review and major revisions?
- Is there adequate participation/collaboration from the state fish and wildlife agency during Annual INRMP Review and major revisions?
- Is the INRMP consistent with the goals of the state Wildlife Action Plan (WAP), Candidate Conservation Agreements, and other regional ecosystem management agreements for which DoD/USAF is signatory?
- Are communications with USFWS and state fish and wildlife agency documented?
- Does the installation have on-site USAF natural resources management staff employed in the GS-0400 Biological Sciences Job Series?
- Is there a sufficient number of natural resources staff to adequately implement INRMP goals and objectives?
- Are the capabilities of the USAF natural resources team enhanced through use of volunteers, cooperative agreements with non-governmental organizations, on-site contractor support, or Interagency Agreements with other federal or state agencies?
- Does the installation have adequate conservation law enforcement capability through employment of a credentialed conservation law enforcement officer, or through interagency agreement with another agency?
- Is there adequate participation/collaboration from the Operations Group, Range and Airspace managers, Community Planners, Tenant Organizations and other organizations in INRMP update and revision to ensure mission needs are addressed?
- Does the INRMP support unrestricted use of the installation?
- Has there been a net loss of operations area, airspace, or training lands? Is there a deficiency in capacity, size, or arrangement of the installation natural infrastructure to support the current mission and foreseeable future needs?
- Name the federally listed species present on the installation.
- List the state protected species present on the installation.
- Have surveys for the presence of potentially-occurring, federally-listed species, or suitable habitat within the historic range of a listed species, been conducted on the installation?
- Does the INRMP adequately address potentially-occurring listed species and/or potentially-suitable habitat within the historic range of a listed species?
- Have listed species locations, or potentially-suitable habitats within the historic range of a listed species, been mapped and included as part of the Environmental Functional Data Set and Geodatabase?
- Does the INRMP provide adequate conservation measures for identified listed species and their habitat, as mutually-agreed by USFWS and state fish and wildlife agency during the INRMP Annual Review or major revision coordination?
- Has Critical Habitat for listed species been designated on the installation?
- Have all major ecosystems (i.e., vegetative communities/habitats) been surveyed and mapped for the installation?
- Does the INRMP address the desired future condition for ecosystems, habitats and communities to sustain current and future mission activities and achieve natural resources management goals and objectives?
- Are native habitat restoration projects to support INRMP goals and objectives being planned, programmed, budgeted and executed?
- Does the INRMP provide for adequate control of invasive and exotic species?
  Does the INRMP address the availability of outdoor recreational opportunities (e.g., hunting, fishing, and other dispersed outdoor recreation) on the installation?
- Does the INRMP address the availability of outdoor recreation opportunities for the public, and establish access and usage categories for installation areas in accordance with mission and security requirements (i.e., Open, Restricted, Off-Limits)?
- For each outdoor recreation access category (Open, Restricted, Off-Limits), does the INRMP address and justify allowable access to those areas by category of participant (e.g., Active Duty Military, Military Dependents, DoD Civilians, Military Retirees, Defense Contractors, General Public)?
- Does the INRMP address program management for hunting, fishing and other outdoor recreation, and the role of the installation natural resources manager?

9.3. Annual INRMP Review and Update Requirements

Installation Supplement:

Per DoD policy, the MAANG will review the INRMP annually in cooperation with the USFWS and MDFW. On an annual basis, the MAANG will invite the USFWS Regional Office, the USFWS local field office, the MDFW, and NGB/A7AM to attend a meeting or participate in a conference call to review previous year INRMP implementation and discuss implementation of upcoming programs and projects. Invitations will be either by letter or email. Attendance is at the option of those invited, but at minimum the USFWS local field office and one representative of MDFW are expected to attend. The meeting will be documented with an agenda, meeting minutes and sign-in roster of attendees.

At this annual meeting the need for updates or revisions will be discussed. If updates are needed, the MAANG will initiate the updates and after agreement of all three parties they will be added to the INRMP. If it is determined that major changes are needed, all three parties will provide input and an INRMP revision will be initiated with MAANG acting as the lead coordinating agency. The annual meeting will be used to expedite the more formal review for operation and effect and if all parties agree and document their mutual agreement, it can fulfill the requirement to review the INRMP for operation and effect.

If not already determined in previous annual meetings, by the fourth year annual review a determination will be made jointly to continue implementation of the existing INRMP with updates or to proceed with a revision. If the parties feel that the annual reviews have not been sufficient to evaluate operation and effect and they cannot determine if the INRMP implementation should continue or be revised, a formal review for operation and effect will be initiated. The determination on how to proceed with INRMP implementation or revision will be made after the parties have had time to complete this review.

As part of the annual review, the MAANG will specifically:

- Invite feedback from USFWS and MDFW on the effectiveness of the INRMP;
- Inform USFWS and MDFW which INRMP projects and activities are required to meet current natural resources compliance needs; and,
- Document specific INRMP action accomplishments from the previous year.

Information for the annual reviews comes from the Otis ANGB environmental staff, the MAANG military leadership, cooperating agencies, project files, and NGB as applicable. Cooperating agencies may request a site visit or status update through 102 CES/CEV.

INRMP Update and Revision Process

Not less than every five years, the INRMP will be reviewed for operation and effect to determine if the INRMP is being implemented as required by the SAIA and contributing to the management of natural resources at Otis ANGB. The review will be conducted by the three cooperating parties to include the Commander responsible for the INRMP, the Regional Director of the USFWS, and Secretary of the MDFW. While these are the responsible parties, technical representatives generally are the personnel who actually conduct the review. The review for operation and effect will either conclude that the INRMP is meeting the intent of the SAIA and only needs an update and implementation can continue; or that it is not effective in meeting the intent of the SAIA and it must be revised. The conclusion of the review will be documented in a jointly executed memorandum, meeting minutes, or in some other way that reflects mutual agreement.

If only updates are needed, they will be completed in a manner agreed to by all parties. The updated INRMP will be reviewed by the local USFWS field office in Massachusetts and MDFW Secretary. Once concurrence letters or signatures are received from USFWS Regional Director and the MDFW Secretary, the update of the INRMP will be complete and implementation will continue. Generally, the environmental impact analysis will continue to be applicable to updated INRMPs, and a new analysis will not be required.

If a review of operation and effect concludes that an INRMP must be revised, there is no set time to complete the revision. The existing INRMP remains in effect until the revision is complete and USFWS and MDFW concurrence on the revised INRMP is received. The MAANG will endeavor to complete such revisions within 18 months depending upon funding availability. Revisions to the INRMP will go through a more detailed review process similar to development of the initial INRMP to ensure MAANG military mission, USFWS, and MDFW concerns are adequately addressed, and the INRMP meets the intent of the SAIA.

INRMP Implementation Analysis

The primary measure of INRMP effectiveness is whether it helps prevent net loss in the capability of military lands to support the military mission. The MAANG is preserving its ability to support the military mission through the natural resources management practices outlined in the 2007 INRMP and in this update. Long-term management effectiveness is also evaluated through periodic inventories of species populations, habitat quantity and quality, and habitat values through recurring planning level survey (PLS). Trends can be used to indicate the degree of success. The MAANG will evaluate these recurring data as they become available.

A practical evaluation of INRMP implementation includes reviewing whether planned projects and activities have been accomplished. An analysis of the 2007 INRMP projects and their implementation status is included in the Implementation of Proposed Actions from the 2007 Otis ANGB INRMP table.

Overall, Otis ANGB has benefited from the INRMP as a management tool. The program and goals in the 2007 INRMP were addressed through implementation of management actions. Most of the specific management actions have been implemented through in-house activities, while some have been projects. A large number of the projects and activities are recurring actions that are continued in this INRMP. However, several proposed management actions from the 2007 INRMP are no longer applicable and have been discontinued due to the transition from a flying mission to an intelligence mission and the overall reduction in acreage (i.e., transfer of the airfield to USCG). See the Management Goals and Objectives section for topic-specific goals, objectives and associated projects and activities proposed in this INRMP, and the Natural Resources Program Management section for a complete summary of the updated management recommendations and strategies.

Implementation of Proposed Actions from 2007 Otis ANGB INRMP				
Proposed Action		Management Units	Implementation	Included in Update
Airfield Safety				
1	Clear trees from the airfield clear zone to reduce risk to personnel and aircraft as per USAF regulations	A, C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No
2	Continue airfield mowing program and eliminate standing water near the runways to reduce the populations of bird species that pose an aircraft strike hazard	A, C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No
3	Over the entire perimeter of the airfield fence, check the integrity of the fence and, in the aparticular Units identified where deer have been an issue, install deer fencing and/or identify wooded areas that should be cleared to reduce cover and inhinit fence crossing.	A, C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No
4	Continue to record wildlife strikes and identify species involved. Seek operations funding to monitor populations of birds around the airfield. Communicate BASH data and wildlife monitoring information to USDA.	A, C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No
5	Clearing and Grubbing and Stump Removal Per Acre	A, C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No

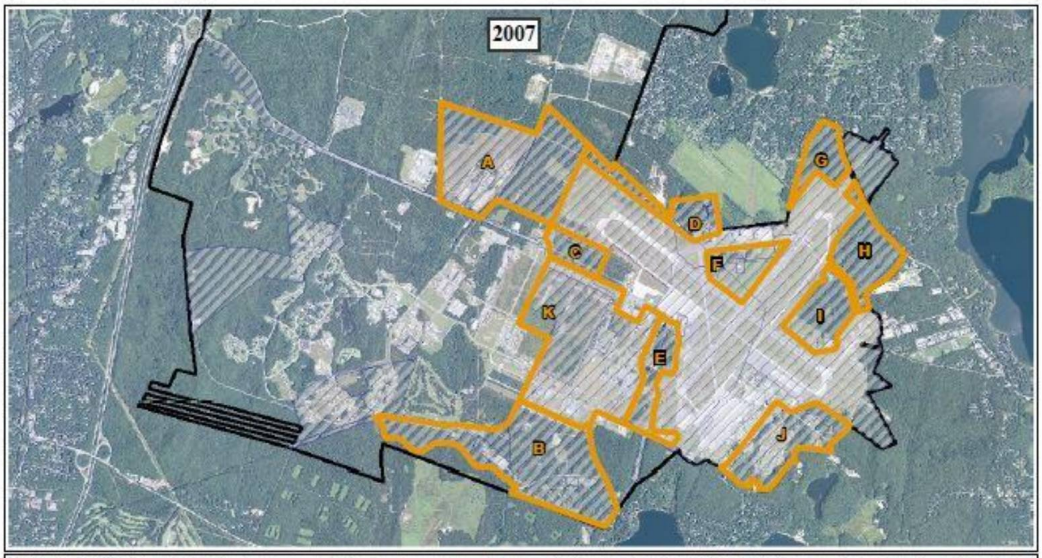
6	Seeding Per Acre	A, C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No
7	Monitoring and Reporting Per Year	A, C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No
Enhancement of Natural Resources				
8	In consultation with MDFW and managers of surrounding natural resources, increase the quality and expand the coverage of habitat for state-listed rare species.	All Units	Ongoing - Rephrased, included as Objectives TE4, TE5	Yes
9	Review BASH data and implement regular monitoring of birds that pose air strike hazards in order to more fully understand the air strike hazards at Otis ANGB and what maintenance needs to be done to reduce those hazards.	All Units	Discontinued - Airfield now managed by USCG	No
10	Avoid impacts to protected resources such as wetlands and state-listed rare species.	All Units	Ongoing - Included as Objectives WA1, TE4, TE5. Wetland Delineation and Habitat Management Plan for solar field mitigation are in process	Yes
11	Inventory flora and fauna in each of the ecological communities to determine the natural resources assets that occur at Otis ANGB in lieu of extrapolating data from recent surveys performed at Camp Edwards.	All Units	Ongoing - Modified project description in Table 17. Annual Bird Surveys were completed; Wetland Survey is in progess	Yes
12	Institute monitoring programs to understand the Otis ANGB populations and thier life history requirements. Develop creative partnerships to support these actions.	All Units	Ongoing - Modified activity description in Table 16.	Yes
13	Conduct Seasonal Plant Surveys/Year	All Units	Discontinued - project consolidated with other similar projects. See Item #11 above	No
14	Conduct Seasonal Wildlife Surveys/Year	All Units	Discontinued - project consolideated with other similar projects. See item #11 above	No
15	Training, Monitoring, and Data Management	All Units	Ongoing - Modified activity description in Table 16	Yes
Development of Management Plans				
16	Prepare Grasslands Management and Fire Management Plans	All Units	Habitat Management Plan for 183-acre grassland mitigation parcel is being developed for solar field project impacts.	No
17	Coordinate with respective natural resources agencies having experience dealing with fire management and natural resources conservation	All Units	Ongoing - Modified activity description in Table 16	Yes
18	Develop a controlled burn prescription guide	All Units	Discontinued - airfield now managed by USCG and Otis ANGB is reduced in size	No
19	The management plans will prioritize the management units	All Units	Discontinued - see Item #18 above	No

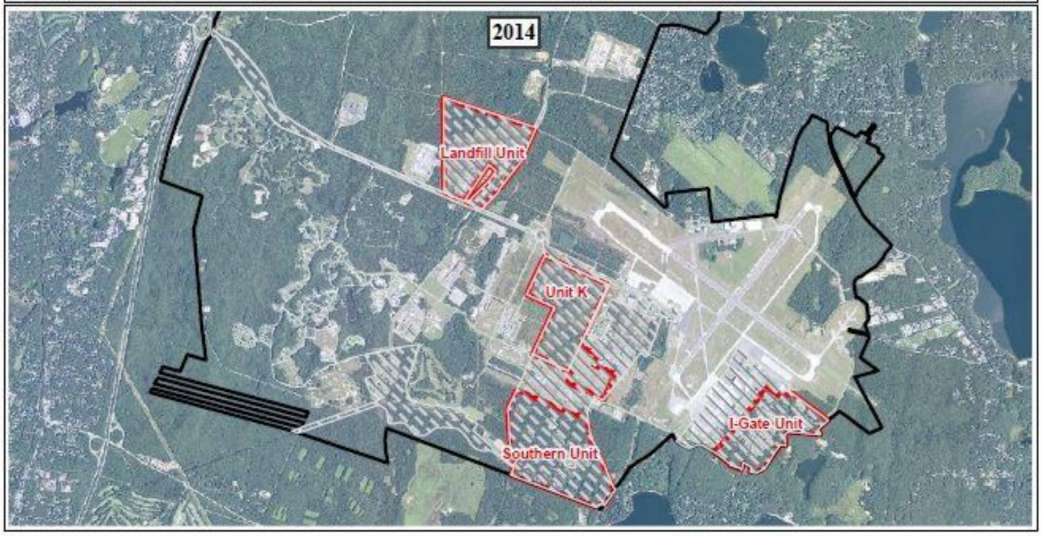
	in which controlled burns are most suited			
20	Conduct Grassland Vegetative Survey		Discontinued - project consolidated with other similar projects. See Item #11 above	No
21	Conduct Grassland Wildlife Survey		Discontinued - project consolidated with other similar projects. See Item #11 above	No
22	Prepare Grassland Management Plan		Discontinued - see Item #16 sabove	No
23	Conduct Forest Vegetation Survey		Discontinued - project consolidated with other similar projects. See Item #11 above	No
24	Conduct Forest Wildlife Survey		Discontinued - project consolidated with other porjects. See Item #11 above	No
25	Prepare Fire Management Plan		Discontinued - see Item #16 and #18 above	No
26	Fire Management Training		Discontinued - see Item #16 and #18 above	No
Monitoring of Munitions Wetlands				
27	Develop Monitoring Plan to evaluate whether erosion and sedimentation are actively contributing to despositional patterns observed in this wetland pond.	J	Ongoing - conducted quarterly in conjuction with stormwater BMPs. Activity has been modified in Table 16	Yes
28	Perform Sedimentation Monitoring	J	Ongoing - Activity has been consolidated with similar activities; see Item #27	Yes
29	Prepare Wetland Restoration Plan to return the wetland to historic conditions	J	Discontinued - Project is no longer needed.	No
30	Implement Wetland Restoration (Cost Per Acre)	J	Discontinued - Project is no longer needed.	No
Land Management Units				
29	Continue to maintain all open areas as grassland habitat. Mow to a height of 14 inches in order to provide habitat for state-listed bird species and prevent areas from returning to forested lands. (Priority 4 in 2007)	A, B, E, K	Ongoing - Included as Objective TE4. There are no longer height restrictions as this requirement was related to the airfield.	Yes
30	Continue to mow all open grassland area within the airfield fence to a height of 9 inches to minimized populations of flocking bird species that pose an aircraft strike hazard. (Priority 1 in 2007)	C, D, E, F, G, H, I, J	Discontinued - Airfield now managed by USCG	No
31	Mowing will be accomplished IAW the Grasslands Management Plan 2002.	A,B,K	Ongoing - 2002 Grassland Management Plan is no longer valid due to mission/land changes. See #16 above for more information	No
32	Install swinging metal gates to prevent additional illegal dumping. (Priority 7 in 2007)	A, B	Discontinued - Not applicable	No
33	When possible, undertake activities that support the management goals of the Francis Crane Wildlife Preserve. Directly	B	Ongoing - Included as Objective PM5	Yes

	south of Unit B, Francis Crane Wildlife Preserve has cleared areas to increase grassland habitat for upland sandpiper nesting.			
34	Recover grassland areas that are being colonized bypitch pine in order to reduce risk of deer strike hazards. (Priority 1 in 2007)	C, E	Discontinued - Land is no longer managed by ANG	No
35	Clear or thin the plantation area in order to reduce risk of deer strike hazards. Prior to clearing, offer Dr. Peter Garrett, Principal Forest Geneticist of the Forest Services' Northeatern Forest Experiment Station, the opportunity to collect data on the trees. (Priority 6 in 2007)	C	Discontinued - Land is no longer managed by ANG	No
36	Plant created open areas with native grasses and mow to 9 inches to minimize flocking bird populations within the airfield fence line.	C,D	Discontinued - Land is no longer managed by ANG	No
37	Clear trees from along Herbert Road in order to reduce risk of deer strike hazards. (Priority 1 in 2007)	D	Discontinued - Land is no longer managed by ANG	No
38	Clear area of trees and seed with native grasses if observations indicate that deer are using the forested area within the airfield fence line of cover. (Priority 3 in 2007)	E	Discontinued - Airfield now managed by USCG	No
39	Maintain vegetation in the swale area to minimize sedimentation	E	Ongoing - Activity modified in Table 16	Yes
40	Conduct a review of steps that could be undertaken to reduce the likelihood that deer can access the airfield from this unit (e.g., check integrity of fencing, install higher fences, clear trees along outer perimeter of fence line. (Priority 1 in 2007)	F,G,H,I	Discontinued - Airfield now managed by USCG	No
41	Develop a program to monitor for active sediment deposition in the munitions wetland. (Priority 2 in 2007)	J	Ongoing - Activity consolidated with similar activities; see Item #27	Yes
42	Clear grassland areas that are slowly succeeding to forest. Seed with native grasses and maintain as grasslands IAW the Grasslands Management Plan 2002, in order to provide habitat for state-listed bird species and prevent areas from returning to forested lands.	K	Ongoing - See #16 for more information on Unit K	Yes
43	Particularly in Unit K, consider use of controlled burns for grassland management.	K	Ongoing - See #16 for more information on Unit K	Yes
44	Continue to mow grassland within the airfield fence to minimize populations of bird species that pose an aircraft strike hazard.	Airfield & Developed	Discontinued - Airfield now managed by USCG	No
45	Evaluate need to clear wooded areas for compliance with AICUZ	E,F,G,H,I	Discontinued - Airfield now managed by USCG	No

	clear zones. (Priority 1 in 2007)			
46	Evaluate need to clear wooded areas within airfield fence line to minimize deer strike hazards. (Priority 1 in 2007)	D,E,F,G,H,I	Discontinued - Airfield now managed by USCG	No
47	Clear wooded areas within primary clear zone and seed with native grasses (based upon results of previous evaluations). (Priority 3 in 2007)	E,F,G,H,I	Discontinued - Airfield now managed by USCG	No
48	Clear additional wooded areas within airfield fence line to reduce deer strikes and seed with native grasses (based upon results of previous evaluations). (Priority 5 in 2007)	D,E,F,G,H,I	Discontinued - Airfield now managed by USCG	No
See Map 12 in Appendix K for 2007 Management Units * Once the property is transferred to new owner, MAANG will cease these activities.				

2007 - 2014 INRMP Comparison Map





Map Features

- 2007 Otis ANGB Boundary
- 2007 Management Units
- 2014 Otis ANGB Boundary
- 2014 Management Units
- JBCC Boundary

N

0 0.75 1.5 Km

Map 12
2007 - 2014 INRMP
COMPARISON MAP

Integrated Natural Resources
Management Plan
Otis ANGB

Date: 12/19/2013

A. Acronyms and References

Acronyms

AF	Air Force
AFI	Air Force Instruction
ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
DoD	Department of Defense
DoDI	Department of Defense Instruction
EM	Environmental Manager
IAW	In accordance with
INRMP	Integrated Natural Resources Management Plan
NRM	Natural Resource Manager
NOAA	National Oceanic and Atmospheric Administration
POC	Point of Contact
USFWS	United States Fish and Wildlife Service

References

- AFI 32-7001, Environmental Management
- AFI 32-7064, Integrated Natural Resources Management
- Sikes Act
- VEMO Natural Resources Program Page

Installation Supplement:

Appendix A.pdf

B. Annotated Summary of Key Legislation Related to Design and Implementation of INRMP

Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
Executive Order (EO) 11514, Protection and Enhancement of Environmental Quality	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, Protection and Enhancement of the Cultural Environment	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, Exotic Organisms	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
EO 11988, Floodplain Management	Provides direction regarding actions of Federal agencies in floodplains, and requires permits from state, territory and Federal review agencies for any construction within a 100-year floodplain and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing and disposing of Federal lands and facilities.
EO 11989, Off-Road vehicles on Public Lands	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.
EO 11990, Protection of Wetlands	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, Federal Compliance With Pollution Control Standards	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the EPA authority to conduct reviews and inspections to monitor Federal facility compliance with pollution control standards.
EO 12898, Environmental Justice	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, Exotic and Invasive Species	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet Federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no Federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides Federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the EPA.

Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires Federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires Federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a Federal Permit. Installations should coordinate with the United States Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L.	Installations shall coordinate with the Secretary of Agriculture to appraise, on a

95-193)	continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other Federal and local programs.
Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of DoD, the Departments of the Interior (e.g., USFWS), and the State Fish and Game Department in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an INRMP and public access to natural resources, and allows collection of nominal hunting and fishing fees. NOTE: AFI 32-7064 sec 3.9. Staffing. As defined in DoDI 4715.03, use professionally trained natural resources management personnel with a degree in the natural sciences to develop and implement the installation INRMP. (T-0). 3.9.1. Outsourcing Natural Resources Management. As stipulated in the Sikes Act, 16 U.S.C. § 670 et. seq., the Office of Management and Budget Circular No. A-76, Performance of Commercial Activities, August 4, 1983 (Revised May 29, 2003) does not apply to the development, implementation and enforcement of INRMPs. Activities that require the exercise of discretion in making decisions regarding the management and disposition of government owned natural resources are inherently governmental. When it is not practicable to utilize DoD personnel to perform inherently governmental natural resources management duties, obtain these services from federal agencies having responsibilities for the conservation and management of natural resources.
DoD Policy, Directives, and Instructions	
DoD Instruction 4150.07 DoD Pest Management Program dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, Environmental Security	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoD Instruction (DODI) 4715.03, Natural Resources Conservation Program	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.
OSD Policy Memorandum – 17 May 2005 – Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum – 1 November 2004 – Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum – 10 October 2002 – Implementation of Sikes Act Improvement Act: Updated Guidance	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
Air Force Instructions and Directives	

32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-7062, Air Force Comprehensive Planning	Provides guidance and responsibilities related to the USAF comprehensive planning process on all USAF-controlled lands.
AFI 32-7064, Integrated Natural Resources Management	Implements AFPD 32-70, Environmental Quality; DODI 4715.03, Natural Resources Conservation Program; and DODI 7310.5, Accounting for Sale of Forest Products. It explains how to manage natural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 32-7065, Cultural Resources Management	This instruction implements AFPD 32-70 and DoDI 4710.1, Archaeological and Historic Resources Management. It explains how to manage cultural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFPD 32-70, Environmental Quality	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office USAF/ILEV) on January 29, 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.

Installation Supplement:

State Laws and Regulations

Cape Cod Commission Act of 1990 – Established as a regional planning and regulatory agency to prepare and implement a regional land use policy plan for all of Cape Cod, review and regulate Developments of Regional Impact, and recommend designation of certain areas as Districts of Critical Planning Concern.

Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, §§ 61-62H) – Projects requiring a state environmental license or permit, or funding that meet one of the following thresholds is subject to this act: alteration of 25 or more acres of land; alteration of designated significant habitat, and/or taking of endangered or threatened species or species of special concern; alteration of coastal dunes, barrier beaches, or coastal banks; alteration of 500 ft. of fish run or inland bank; alteration of 1,000 s.f. of salt marsh or outstanding resource waters; alteration of 5,000 s.f. of bordering or isolated vegetated wetlands; new or expanded fill or structure in a velocity zone or regulatory floodway; alteration of one-half acre of other wetlands; or projects proposed within an Area of Critical Environmental Concern (ACEC).

MEPA Regulations (301 CMR 11.00) – Promulgated to create a uniform system for compliance with the Massachusetts Environmental Policy Act, M.G.L. c. 30, sections 61 through 62H. The purpose of MEPA and 301 CMR 11.00 is to provide meaningful opportunities for public review of the potential environmental impacts.

Rare Species Protection

Massachusetts Endangered Species Act (M.G.L. c. 131A) – Provides for listing of endangered or threatened species or species of concern, and of their habitat. Once listed, the Act prohibits the taking, possession, transport, export, processing, sale or purchase of such species and any other species listed under the federal Endangered Species Act. The Act prohibits any alteration of significant habitat of any protected species that may reduce the viability of the habitat. The Act is administered by NHESP within the Massachusetts Department of Fish and Game.

State List of Endangered and Threatened Species (321 CMR 8.00) – In accordance with MESA, the official state list of endangered, threatened and special concern species of plants and animals shall be that list appearing at 321 CMR 10.90. Regulations concerning endangered, threatened, and special concern species pursuant to the MEPA are located at 321 CMR 10.00.

Delineation of and Review of Projects and Activities within Priority Habitat (321 CMR 10.10) – Establishes the criteria for the delineation of Priority Habitat, establishes standards and procedures for determining which Projects or Activities are located, or will take place, in Priority Habitat, review procedures and performance standards for determination of whether a Project or Activity will result in a Take, and requirements necessary to obtain a Conservation and Management Permit from the Director, and appeal procedures.

Vegetation Management

Massachusetts Forest Cutting Practices Regulations (304 CMR 11.00) – Requires a review of forest cutting plans and potential impacts on rare species pursuen to M.G.L. c. 132, §§ 40 through 46, which establishes the State Forestry Committee to develop minimum forest cutting practices through promulgation of regulations.

Massachusetts Open Burning (310 CMR 7.07) – Regulations that define the allowable and unallowable open burning practices in the State.

Water Resources

Federal Consistency Review (301 CMR 21.00) – Requires any project proposal that is above certain thresholds (generally, the Massachusetts Environmental Policy Act thresholds) and that requires a federal license or permit must be found to be consistent with Massachusetts Office of Coastal Zone Management's coastal policies.

Massachusetts 401 Water Quality Certification (314 CMR 9.00) – Applies to the discharge of dredged or fill material, dredging, and dredged material disposal activities in waters of the United States within the Commonwealth which require federal licenses or permits and which are subject to state water quality certification under 33 U.S.C. 1251, et seq.. The federal agency issuing a permit initially determines the scope of geographic and activity jurisdiction. 314 CMR 9.07 also applies to any dredging project and the management of dredged material within the marine boundaries and at upland locations within the Commonwealth.

Massachusetts Clean Water Act (MCWA; M.G.L. c. 21, §§ 26-53) – The Act authorizes the Department of Environmental Protection to adopt standards of minimum water quality and prescribe effluent limitations, permit programs and procedures applicable to the management and disposal of pollutants, including, where appropriate, prohibition of discharges. Permits

Massachusetts Coastal Zone Management Act (M.G.L. c. 21A, §§ 2, 4) – Establishes a coastal zone management program for Massachusetts to secure for the inhabitants of the Commonwealth the objectives and benefits of the federal Coastal Zone Management Act.

Massachusetts Drinking Water and Wellhead Protection Regulations (310 CMR 22.00 and 310 CMR 22.21) – Requires public water systems to protect Zone II recharge areas with municipal controls (bylaws, ordinances, health regulations) that meet MassDEP Wellhead Protection Regulations 310 CMR 22.21.

Massachusetts Executive Order No. 149 (1978) – Designates the Massachusetts Department of Conservation and Recreation as the state coordinating agency to assist in the implementation of the National Flood Insurance Program. Requires all state agencies to consider potential flood hazards to state facilities and, to the extent possible, avoid construction of state funded projects in floodplains.

Massachusetts Surface Water Discharge Permit Program (314 CMR 3.00) – Discharges to the navigable waters of the United States are subject to the National Pollutant Discharge Elimination System (NPDES) permit program. Massachusetts is a non-delegated NPDES permit state; however, the permits are jointly issued by USEPA and MDEP and are equally and separately enforceable by both agencies.

Massachusetts Surface Water Quality Standards (314 CMR 4.00) – regulations which designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.

Massachusetts Water Management Act (MWMA; M.G.L. c. 21G) – Authorizes the MDEP to regulate the quantity of water withdrawn from both surface and groundwater supplies.

Massachusetts Wetlands Protection Act (MWPA; M.G.L. c. 131, § 40) – provides protection to any wetland, including: any bank, freshwater wetland, coastal wetland, beach, dune, tidal flat, marsh or swamp bordering on the ocean, any estuary, creek, river, stream, pond, lake, or certified vernal pool; land under any of the water bodies listed; land subject to tidal action, coastal storm flowage, or flooding; and; riverfront areas in the Commonwealth of Massachusetts; and a 100-foot buffer zone around any fresh water or coastal resource listed above is subject to jurisdiction.

Massachusetts Wetlands Regulations (310 CMR 10.00) – Defines and clarifies the process by which conservation commissions and MDEP may carry out their responsibilities under M.G.L. c. 131, § 40.