DRAFT - INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

STATE MILITARY RESERVE Virginia Army National Guard

City of Virginia Beach, Virginia

Fiscal Years 2019-2023

Draft – July 2019

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Army National Guard – State Military Reserve

Integrated Natural Resource Management Plan and Environmental Assessment

FY2019 - FY2023

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Army National Guard – State Military Reserve

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U.S. Fish & Wildlife Service

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Army National Guard – State Military Reserve

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Army National Guard – State Military Reserve

Integrated Natural Resource Management Plan and Environmental Assessment

FY2019 - FY2023

National Oceanic and Atmospheric Administration, National Marine Fisheries Service

*See letter received May 6, 2019 in Appendix C: Correspondence

EXECUTIVE SUMMARY

The State Military Reserve (SMR) Integrated Natural Resources Management Plan (INRMP) covers fiscal year (FY) 2019 through 2023. Various federal laws, Department of Defense (DoD) directives, and Army regulations (AR) require the preparation of an INRMP for SMR. The Sikes Act Improvement Act of 1979 (SAIA; 16 U.S.C. 670 *et seq*.), at the discretion of the respective Secretary of the Military Service, requires the preparation of an INRMP for all military installations with significant natural resources and SMR has been identified as such an installation. Section 101(b)(2) of the SAIA [16 U.S.C. 670a(b)(2)] states that each INRMP "must be reviewed as to operation and effect by the parties thereto on a regular basis, but not less often than every 5 years." The National Environmental Policy Act (NEPA) of 1969 dictates that planners of public actions using federal monies, such as those on military installations, shall consider the environmental impacts and effects of "major federal actions." Section 1508.18 in the Council for Environmental Quality (CEQ) regulations lists the adoption of a formal INRMP as a major federal action. The INRMP has been prepared in cooperation with the U.S. Fish and Wildlife Service (USFWS), the Virginia Department of Game and Inland Fisheries (VDGIF) and the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS). The required elements of an INRMP include natural resources management; goals, objectives and specific projects with implementation dates; habitat enhancement; integration of activities; public access and sustainable use. An Environmental Assessment (EA) to support the adoption of the SMR INRMP is included in Appendix A.

INRMPs are planning documents that allow DoD installations to implement integrated landscape management of their natural resources, while coordinating with various stakeholders. They help ensure military operations and natural resources conservation are integrated and consistent with stewardship and legal requirements.

The objective of the INRMP is the planned, deliberate management of natural resources to support the installation and operational mission objectives in order to meet Army stewardship objectives. The SMR INRMP will serve as the principal management plan governing all natural resource activities on the installation and is based upon ecosystem management principles. In accordance with the SAIA, the INRMP will ensure that no net loss in the capability of the installation lands to support the military mission will occur as a result of natural resource management practices.

In addition, the SMR INRMP describes how the natural ecosystem will be managed to enhance military training and preserve ecosystem function and integrity. Management planning for natural resources is conducted in accordance with Army regulations. Implementation of this INRMP is the responsibility of SMR and numerous internal and external stakeholders. Communication and cooperation amongst these organizations provides the framework for integrating natural resource management actions and the installation's military mission. For successful integration and implementation, the effectiveness of the INRMP management actions must be reviewed internally on an annual basis and by the USFWS, NOAA-NMFS and the VDGIF for operation and effect every five years.

The potential environmental impacts of proposed management actions were examined prior to their inclusion within the SMR INRMP. Thus, all management actions were designed to

not only mitigate potential negative environmental effects but improve the overall SMR environment.

The purpose of the plan is to ensure that all natural resources activities are integrated to prevent the redundancy of effort and to allow for the management of SMR on an ecosystem basis. In addition, natural resource activities will be integrated with military training requirements. The integration of natural resources and training requirements will allow the Virginia Air National Guard (VAANG) and SMR to fulfill the military mission while conserving and protecting valuable natural resources.

Implementation of the SMR INRMP successfully meets ecosystem management objectives. If this INRMP is not implemented, then the Virginia Army Reserve National Guard (VAARNG) would need to complete a costly reassessment of current goals and objectives of natural resource management at SMR. Implementation of the individual projects in the SMR INRMP is subject to the availability of funding. Projects that are deemed necessary to support mission sustainability and ensure compliance with applicable laws and regulations have highest priority for available funding. The INRMP will also help the installation commander manage natural resources more effectively so as to ensure that installation lands remain available and in good condition to support the installation's military mission.

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1.1 INTRODUCTION

The State Military Reserve (SMR) is a 332-acre installation that hosts multiple military tenants and community programs. SMR was previously known as Camp Pendleton SMR and most of the documents associated with this plan reference it as such. SMR's primary purpose is the on-site training of Virginia National Guard personnel. National Guard units from other states, components of the U.S. Armed Forces, and state and local agencies also train at the site. In support of the statewide planning efforts of the Virginia Department of Military Affairs (VDMA), the planning process at SMR defines the potential future mission uses of SMR and provides a framework for future land use and facilities decisions (Vision Plan 2012). The Sikes Act Improvement Act of 1979 (SAIA) requires Integrated Natural Resource Management Plans (INRMPs) for all Department of Defense (DoD) lands and waters that have significant natural resources. The INRMP is to be prepared in cooperation with the United States Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and the Virginia Department of Game and Inland Fisheries (VDGIF).

The SMR, Virginia Beach, Virginia INRMP covers management actions from fiscal year (FY) 2019 through FY 2023. The principal purpose in developing an INRMP at SMR is to ensure that Army activities on mission land are integrated and consistent with federal land stewardship objectives. The SMR INRMP will serve as the principal management plan governing all natural resource activities on the installation. INRMPs are planning documents that allow DoD installations to implement integrated landscape management of their natural resources, while coordinating with various stakeholders. They help ensure military operations and natural resources conservation are integrated and consistent with stewardship and legal requirements.

The objectives of the INRMP are the planned, deliberate management of natural resources to support the installation operational mission objectives, meet Army stewardship objectives, protect cultural and historic resources, and enhance the quality of life for DoD personnel.

1.2 NATURAL RESOURCE GOALS AND OBJECTIVES

The overall goal of the INRMP is to ensure sound environmental stewardship of the public lands managed at SMR. The following table includes all of the goals and objectives for each management program along with the corresponding INRMP section. The projects proposed for the implementation of the listed objectives are included in Appendix B: *Natural Resource Project List for State Military Reserve FY 2019-2023*.

35 **Table 1. Goals and Objectives.**

	GOALS	OBJECTIVES	INRMP SECTION
1.	**FISH AND WILDLIFE MANAGEMENT**		**5.2**
	Manage game and non-game species and their habitats to maintain biodiversity.	Maintain an inventory of all species that exist on the installation, wildlife habitat management, biodiversity, and recreational fishing.	
2.	**RARE, THREATENED AND ENDANGERED SPECIES AND HABITAT MANAGEMENT**		**5.3**
	Promote the potential utilization of site resources by threatened or endangered species.	To maintain habitat for potential utilization by rare species.	
		To monitor species on a regular basis to ensure that any rare species are identified and protected.	
3.	**WATER QUALITY MANAGEMENT**		**5.4**
	Maintain and protect Lake Christine as an asset to SMR and the surrounding community.	Protect surface waters from pollution as required under the Clean Water Act (CWA).	
		Ensure that the water quality in surface waters is maintained.	
		Enhance the potential of Lake Christine as a recreational resource for the VAARNG.	
4.	**WETLAND CONSERVATION**		**5.5**
	Protect and enhance existing wetlands.	Ensure compliance with federal and state wetland regulations.	
		Enhance wetlands through restoration activities.	
5.	**POLLINATOR HABITAT**		**5.6**
	Protect, create and maintain pollinator habitat.	Manage lands to increase pollinator habitat where possible.	
6.	**FOREST MANAGEMENT**		**5.7**
	Maintain biological diversity in forested systems.	Maintain forest areas through monitoring, surveys and the exclusion of specific uses.	
7.	**INTEGRATED PEST MANAGEMENT**		**5.8**
	Reduce pest populations through use of integrated combination of techniques.	Identify, prioritize, monitor, and control invasive and noxious species and feral animals on its installations whenever feasible.	

	GOALS	OBJECTIVES	INRMP SECTION
8.	**OUTDOOR RECREATION**		**5.9**
	Allow the use of State Military Reserve for natural resources-based activities in a manner that does not interfere with mission activities.	Encourage outdoor recreation for military personnel and associated persons.	
9.	**COASTAL ZONE MANAGEMENT**		**5.10**
	Consistency with the CZM Program.	Compliance with provisions and permit requirements under enforceable laws, regulations, and advisory policies.	
		Identify and implement sound natural resources strategies that provide benefits to the ecosystem.	
10.	**PUBLIC OUTREACH**		**5.11**
	Increase the public's awareness of environmental programs on SMR.	Educate the public through informational publications, presentations and encouraging public participation in special events.	
11.	**CLIMATE CHANGE**		**5.12**
	Undertake adaptation and resilience planning in order to incorporate potential climate change impacts in future plans and projects.	Develop potential alternatives that may be used to address the physical impacts of climate change to both existing infrastructure and the natural environment.	
12.	**ENFORCEMENT**		**5.13**
	Enforce applicable natural resource laws and regulations which are critical to the successful implementation of ecosystem management.	Maintain compliance with all required environmental regulations.	

1.3 MISSION

The mission of SMR is to command, operate, manage, and administer the use of resources to facilitate training across the spectrum from first responder through joint operations. On order, expand and operate mobilization platform to support activities for reserve component units.

As an integrated part of the Virginia training centers capability, SMR provides individual training opportunities from first responder through joint operations utilizing enduring, resource efficient facilities, all while supporting regional sustainment.

1.4 POLICIES

SMR aims to sustain training lands' natural resource base in quantity, quality, and configuration to meet current and future requirements following the Army's Sustainability Drivers & Regulations. These include:

- Executive Order 13693
- Army Sustainability Campaign Plan (ASCP) (2010)
- ARNG Sustainability Policy (June 2014)
- Energy Policy Act of 2005
- Energy Independence & Security Act of 2007
- DoD Strategic Sustainability Performance Plan
- Army Strategy for the Environment
- AR 200-1 (28 August 2007)
- ARNG Environmental Division (ARNG-ILE)
- DoDM 4715.03 (November 2013)
- DoDI 4715.03 (March 2011)

The National Environmental Policy Act (NEPA) of 1969 dictates that federal agency actions be assessed through submittal and approval of an environmental analysis document prior to the implementation of the action using federal monies, such as those on military installations, and shall consider the environmental impacts and effects on the natural system (air, water, soil, flora, and fauna) and human health. Section 1508.18 in the Council for Environmental Quality (CEQ) Regulations lists the adoption of a formal INRMP as a major federal action.

The potential environmental impacts of proposed management actions have been assessed prior to the implementation of the SMR INRMP. Thus, all management actions were designed not only to mitigate potential negative environmental effects but to improve the SMR environment. An Environmental Assessment (EA) is being completed concurrently with the INRMP in order to support its implementation and is included in Appendix A.

The SAIA recognizes the importance and value of military lands to natural resources. The SAIA seeks to ensure that these ecosystems are protected and enhanced while allowing the military lands to continue to meet the needs of military operations. Accordingly, the SAIA requires the DoD to develop and implement INRMPs for military installations across the United States and the plans must be reviewed for operation and effect at least every 5 years, with major revisions as required. The DoD INRMP Implementation Manual (DoDM 4715.03) provides procedures for the preparation of the INRMP. INRMPs are prepared in cooperation with the USFWS and state fish and wildlife agencies to ensure proper consideration of fish, wildlife, and habitat needs. These plans are reviewed every year by the military installation.

In general, natural resource constraints to land use at SMR are related to activities regulated by federal and state agencies pursuant to environmental legislation. As such, compliance with these mandates is an important part of the natural resources planning process for SMR. Furthermore, a thorough understanding of environmental regulations and how they are

implemented is necessary to ensure that mission land use requirements are met on a sustainable basis. Both federal and state laws require the assessment of potential environmental impacts associated with implementing major programs or activities at SMR. The relevant federal laws and regulations include:

- Executive Order 11990
- Endangered Species Act (16 U.S.C. 1531-1542, 1982-1987)
- Migratory Bird Treaty Act (16 U.S.C. 703-712, 1918-1998)
- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)
- Coastal Zone Management Act (CZMA, 1972 & 1990)
- Clean Water Act (33 U.S.C. 1251 et. seq.)
- Clean Air Act (40 CFR part 50)
- AR 200-1: Environmental Protection and Enhancement (28 August 2007)
- AR 350-19: The Army Sustainable Range Program (30 August 2005)
- SAIA, as amended (16 U.S.C. § 670a-670o, 1960 & 1989)
- National Environmental Policy Act (NEPA Pub. L. 91-190, 42 U.S.C. 4321-4347)

On the state level these include:

- Endangered Species Law (§ 29.1-563 through § 29.1-570 of the Code of Virginia)
- Virginia State Water Control Law (§62.1-44.15.5 of the Code of Virginia)
- Air Pollution Control Law of Virginia (§10.1-1301 of the Code of Virginia).
- Tidal Wetlands Program (§28.2-1300 through 28.2-1320 of the Code of Virginia)
- Coastal Primary Sand Dunes and Beaches (§28.2-1400 through §28.2-1420 of the Code of Virginia)

The INRMP is designed to organize and consolidate data and technical information required to manage natural resources into a single document, and to serve as the basis for ecosystem management at SMR in support of the training mission. There are four key ideas that permeate most definitions of ecosystem management: (1) humans are integral parts of the ecosystem; (2) an ecosystem is composed of both abiotic and biotic constituents; (3) management actions and decisions must take into account effects upon all constituents of an ecosystem, and (4) long term sustainability is the ultimate goal of ecosystem management.

1.5 THE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP)

This INRMP is a plan needed to effectively manage natural resources at SMR as required under the SAIA. Per the DoD INRMP Implementation Manual (DoDM 4715.03), an INRMP includes sections on:

1. Mission sustainability

2. Managing Threatened and Endangered Species
3. Implementation
4. Accommodating Public Access

Inherent in the INRMP process is the identification of policies and desired future directions of SMR natural resources programs to reinforce sustainable use of military training at the installation. The intent of the INRMP is to:

1. Support the overall SMR operational mission (military objective);
2. Meet stewardship requirements (conservation and sustainability objectives); and
3. Enhance the quality of life (combined military, natural resource conservation, community outreach, and recreation objectives).

1.6 RESPONSIBILITIES

Responsible and Interested Parties

Full implementation of this INRMP requires collaboration and coordination with many internal and external parties. Based on the SAIA, the INRMP is to be prepared in cooperation with the USFWS, NOAA-NMFS and the VDGIF.

Internal Stakeholders

- The Adjutant General of Virginia

  The Adjutant General is responsible for reviewing and endorsing environmental documents, to include the INRMP, prior to final approval by the National Guard Bureau (NGB).

- Commander, State Military Reserve

  All aspects of installation operations at SMR including the implementation of this INRMP and management of natural resources fall within the responsibilities of the Installation Commander or designate.

- Natural Resources Program Manager, VA Dept. of Military Affairs (VDMA) - MTC Fort Pickett

  The Natural Resources Program Manager is responsible for environmental oversight and the implementation of programs within the the INRMP.

- Army National Guard Installations and Environment (ARNG I&E)

  The ARNG I&E department is responsible for the oversight and implementation of specific projects included within the the INRMP, such as the Integrated Pest Management Program (IPMP).

Cooperative Stakeholders

- U.S. Fish and Wildlife Service (USFWS)

  The INRMP is developed and will be implemented in coordination with the USFWS, which is a signatory on the document in accordance with the SAIA. The USFWS works with

others in order to conserve, protect, and enhance the habitat of fish, wildlife, and plants. The USFWS also provides guidance on the implementation of several federal acts, such as the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), CWA, and the Fish and Wildlife Coordination Act (FWCA).

SMR is in USFWS Region 5 which has headquarters in Hadley, Massachusetts. The Regional Office in Virginia is located in Gloucester and the position of SAIA Coordinator/Military Liaison for Region 5 is currently vacant.

- Virginia Department of Game and Inland Fisheries (VDGIF)

The INRMP is developed and will be implemented in coordination with the VDGIF, which is a signatory on the document in accordance with the SAIA. VDGIF is responsible for the management of inland fisheries and wildlife in Virginia. SMR is in VDGIF Region I which has an office in Charles City.

- National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS)

NOAA - NMFS is responsible for the protection, conservation, and recovery of endangered and threatened marine and anadromous species under the ESA. The property boundary of SMR is located at mean low water along the Atlantic Ocean, therefore the NMFS must be consulted to ensure actions within these jurisdictional waters do not jeopardize the continued existence of species or adversely modify the designated critical habitat of ESA listed species.

- Tribal Governments

DoD Instruction 4710.02 requires that consultations be conducted with tribal governments when there are tribal rights to natural resources or when natural resources management affects tribal treaty rights. The VAARNG Cultural Resources Program Manager is responsible for tribal consultation.

  - *Federally recognized tribes in Virginia*
    - Pamunkey Indian Tribe
    - Chickahominy Tribe – Eastern Division
    - Monacan Indian Nation
    - Upper Mattaponi Indian Tribe
    - Chickahominy Indian Tribe
    - Nansemond Indian Tribe
    - Rappahannock Tribe
  - *Federally recognized tribes outside of Virginia*
    - Catawba Indian Nation
    - Cherokee Nation of Oklahoma
    - Cayuga Nation of Indians
    - Eastern Band of Cherokee Indians

- United Keetoowah Band of Cherokee Indians
- Tuscarora Nation of New York

External Stakeholders

- Virginia Department of Environmental Quality (DEQ)

  The Virginia DEQ regulates development in wetland areas under Section 401 of the CWA (state certification) and applicable state regulations (Section 62.1-3 of the Code of Virginia). State agencies are required to submit environmental reports on any major projects to DEQ for review and approval (Section 10.1-1188 of the Code of Virginia).

  The discharge of pollutants into surface waters of the Virginia Commonwealth from a point source must apply for a Virginia Pollution Discharge Elimination System (VPDES) permit through the DEQ. Virginia Pollution Abatement (VPA) permits from DEQ are required for the land application of biosolids. Further, general construction and land disturbance activities require a Virginia Stormwater Management Program (VSMP) from the DEQ.

- Virginia Marine Resources Commission (VMRC)

  VMRC has jurisdiction over impacts to State-owned subaqueous bottom, coastal primary sand dunes, beaches and tidal wetlands under Sections 28.2-1200, 28.2-1300 and 28.2-1400 of the Code of Virginia. The property boundary of SMR is located at mean low water along the Atlantic Ocean. There are jurisdictional sand dunes, beach and inter-tidal areas under VMRC's purview.

- Virginia Department of Conservation and Recreation (DCR)

  The DCR Natural Heritage Program identifies, inventories and protects rare plants, animals and communities across the Commonwealth of Virginia. Primary department for coordination with respect to threatened and endangered animals and plants.

SECTION 2: INSTALLATION OVERVIEW

2.1 LOCATION AND AREA

The SMR, a state-owned facility, is located on General Booth Boulevard in the City of Virginia Beach, Virginia (Figure 1). The approximately 332-acre installation is bordered by the Atlantic Ocean to the east, General Booth Boulevard to the west, Bird Neck Road to the south, and the Croatan residential neighborhoods to the north. The SMR property includes approximately 1,203 linear feet of beach front which extends to the mean low waterline. The SMR is located on the U.S. Geological Survey (USGS) 7.5 Minute Quadrangle Map for Virginia Beach, Virginia (1986 revision), directly south of Lake Rudee and Lake Wesley (Figure 2).

2.2 INSTALLATION HISTORY

The initiative to establish a state rifle range was begun in 1908 by the General Assembly for the purchase of a permanent range and facilities for the Virginia National Guard. Chosen among various sites under consideration, the location in Princess Anne County (now the City of Virginia Beach) was an undeveloped parcel of land with access to a freshwater lake, Lake Christine, and the Atlantic Ocean. The area south of Rudee Inlet was largely in agricultural production and sparsely populated. Prior to the commencement of construction in 1912, extensive plowing and leveling, tree and stump removal, and grass planting was required to prepare the site for actual construction of the rifle range. In addition to this preparation, requirements for the rifle range necessitated receiving permission from adjoining owners to fire over their properties during target practice.

SMR has been in operation since 1910 when it was established as a training ground for Virginia militia regiments. From 1917 to 1920, SMR was leased to the U.S. Navy for its mobilization and demobilization efforts during World War I. After the war, the Commonwealth allocated the training site to the Virginia National Guard. It was during these interwar years that the Civilian Conservation Corps (CCC) constructed approximately 30 buildings at SMR. The largest building boom, however, occurred during World War II, when the U.S. Army leased SMR (1940-1946) to train and billet various organizations, including coast and field artillery units. It was during this time that the majority of the facilities at SMR were constructed. Until the late 1990s, the installation was comprised of 874 total acres on five major tracts. Since that time, tracts totaling 567 acres were conveyed to the City of Virginia Beach for municipal and recreational uses. Today SMR includes approximately 340 acres of land with 27 acres being leased from the federal government and 37.2 acres leased out to the City of Virginia Beach.

Figure 1. State Military Reserve location.

Figure 2. State Military Reserve property boundary.

2.3 FUTURE LAND USE

The master plan for the base entitled the "Vision Plan" (2012) states that VAARNG evaluated natural and man-made environmental conditions with a particular focus on those elements that affect operation or development of buildings, roadways, utility systems, training ranges, and other facilities. These factors were combined to analyze preferable development zones (Figure 3). The areas most likely to contain the species of significance are included within the natural resources and recreation area, where minimal impacts are proposed.

2.4 FACILITIES

SMR provides a training and support area for the VAARNG, VAANG, out-of-state National Guard units, DoD units, and non-DoD customers (i.e. public safety, reserve officer training corps [ROTC]) and other community partners. Firing range training at SMR is only performed between Labor Day and Memorial Day due to its close proximity to Virginia Beach, a popular summer tourist location. All other training, such as simulation training and the Commonwealth ChalleNGe Program, occur 365 days a year. The installation is available to other military units as well as community service and professional groups when not in active use by the National Guard. The post supports the federal and state military mission by providing opportunities for meeting training requirements of assigned missions. These include weapons firing certification, classroom training, field artillery drivers training and, for the Air Guard, construction equipment drivers training.

Table 2. Facilities at State Military Reserve.

Rifle and Pistol Range	Military Only Beach
Firearms Training Simulator	Training Fields
Engagement Training Simulator 2000	Amphibious Landing Area
Virtual Interactive Combat Environment	P.T. Course
Humvee Egress Assistance Trainer	Dining Facilities
Laser Marksmanship Trainer Simulator	Hurt Hall
Call for Fire	MOUT Training
Classrooms	Helipad
Administrative Buildings	Canine Course
Barracks/Billeting	Wooded Areas
Fentress Airfield (200 leased acres with Airfield)	Conference Buildings
Dam Neck (341 leased acres)	

The facility consists of approximately 100 buildings of various administrative, residential, service, and storage uses (Figure 3). Other land uses consist of parade grounds, firing ranges, helicopter pad, Military Operations on Urban Terrain (MOUT) training area, and a chapel. Other than small weapons at the known distance range (556 rounds, 9mm, .38 caliber, and 12-gauge shotgun), large-scale training activities with weapons firing are not conducted at SMR. SMR also serves as an intermediate staging base which is a temporary location used to

stage forces prior to and after deployment. Live fire crew-served weapons and maneuver training are not performed at SMR.

In addition to the core training mission, SMR also supports additional tenants through lease agreements:

- The City of Virginia Beach leases three areas for parking and storage.
- The U.S. Navy uses the ranges area for training of personnel and dogs.
- The VAANG lease area is home to the 203rd RED HORSE Squadron.
- The Federal Bureau of Investigations (FBI) leases a building in the northwest portion of the installation.
- The U.S. Army's Community Based Warrior Transition Unit-Virginia (CBWTU-VA) leases a cluster of buildings for administrative purposes.
- The Commonwealth ChalleNGe Program leases a group of buildings to run a state youth program.

2.5 SURROUNDING COMMUNITIES

The land immediately surrounding SMR is owned by a mix of federal, state, city and private entities. To the south of the installation is the NAS Oceana's Dam Neck Annex and private housing communities. The private Croatan housing community shares SMR's northern boundary. West of the installation, across General Booth Boulevard, are the city-owned Owl Creek Tennis Center and Park and the state-owned Virginia Aquarium and Marine Science Center. The U.S. Naval Amphibious Base and Navy Family Housing are located to the south across Birdneck Road from the SMR main gate. The Atlantic Ocean abuts the eastern boundary, usually attended by recreational beach-goers during the summer months.

Although SMR is relatively small, it is a part of a larger area along the eastern coast of Virginia with regards to active military training operations and potential overall impacts to the environment.

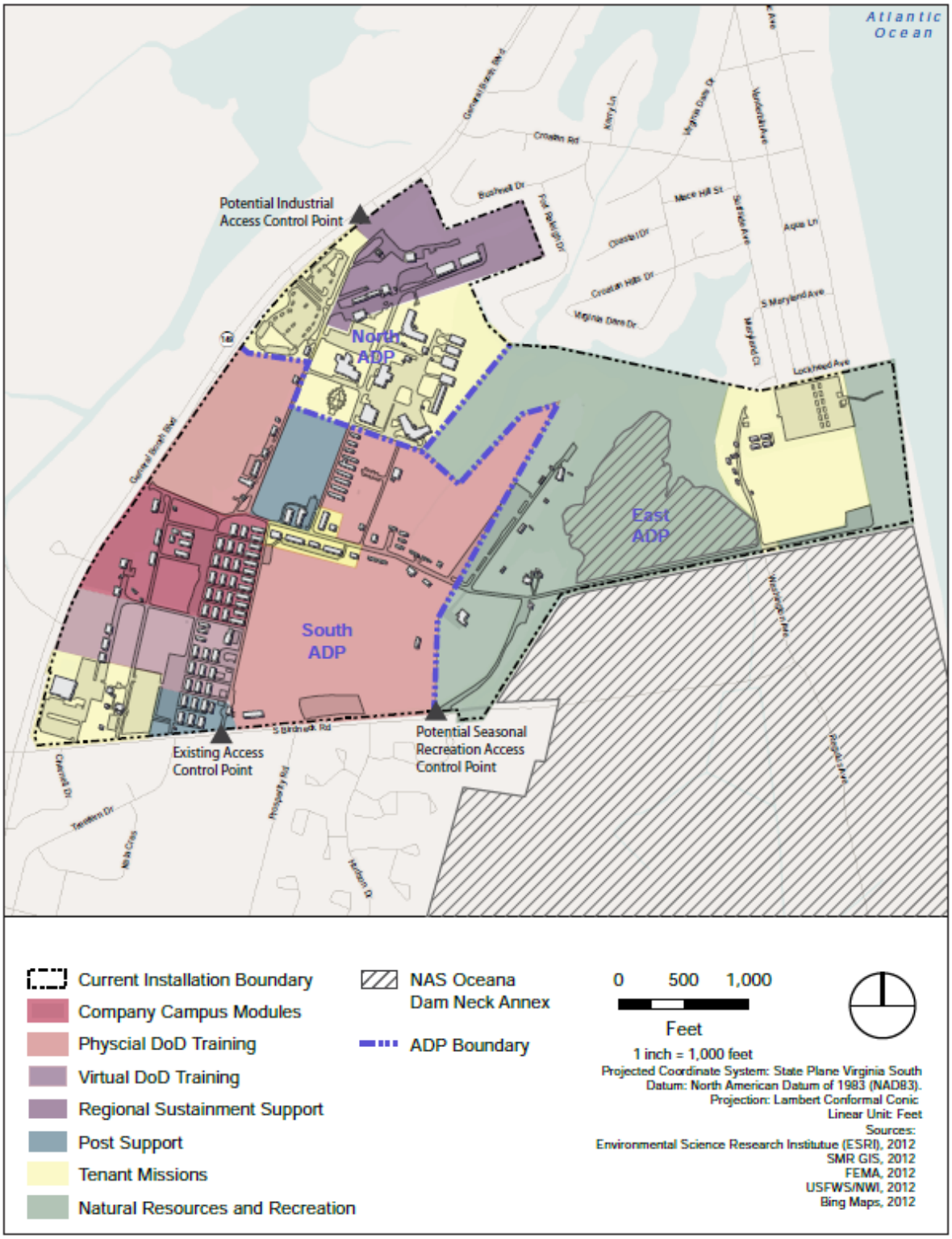

Figure 3. State Military Reserve [formerly known as Camp Pendleton] land use (Vision Plan 2012).

SECTION 3: PHYSICAL ENVIRONMENT

3.1 CLIMATE

Virginia Beach has a moderate climate throughout the year with an extended spring and fall. Average daily temperatures range from an average of 48° Fahrenheit (8.8 degrees Celsius) in January to approximately 88 degrees Fahrenheit (31 degrees Celsius) in July. The average annual precipitation is 45.79 inches, while August on average receives more rainfall than any other month, at 5.52 inches. The area receives very little snow accumulation per year.

3.2 LANDFORMS

The topography on SMR is characterized by relatively level ground that fluctuates around the 10-foot contour (Figure 4). The most prominent topographic features are the sand ridges and dunes that parallel the Atlantic Ocean for the entire 1,200 linear feet of beachfront on the facility. The dominant sand ridge is approximately 20 feet above mean sea level (msl) and extends to the south beyond the facility along the Virginia and North Carolina coast. The main post is characterized by relatively flat terrain that slopes gently from the southwest corner to the northeast corner. Elevations in this area range from approximately 15 feet msl to mean tide (0 feet msl) in the tidal wetlands near General Booth Boulevard.

3.3 GEOLOGY AND SOILS

SMR is located in the Atlantic Coastal Plain Physiographic Province. The Coastal Plain is underlain by layers of Cretaceous (65 to 146 million years ago) and younger clay, sand, and gravel that dip gently eastward (Frye 1986). Cretaceous sediments were deposited by rivers carrying sediment from the eroding Appalachian Mountains to the west. A layer of tertiary age (65 to 1.6 million years ago) marine sands approximately 1,000 feet thick overlays the older strata. The youngest deposits on the Coastal Plain are sand, silt, and mud presently being deposited in bays and along beaches (VDMA 2000).

A reconnaissance-level soil survey was conducted to confirm mapping units described in the Soil Survey of Virginia Beach, Virginia (USDA 1985). Professional soil scientists visited the site to extract soil borings and confirm series descriptions. Based on this analysis, the dominant mapping units are shown accurately in USDA (1985) and VDMA (2002) (Figure 5). Brief descriptions of soils and field observations are provided in Appendix D.

Soil erodibility within the interior portions of Camp Pendleton is of minimal concern. The sandy soils along the primary dune and beachfront areas are subject to severe erosion hazard, but the dunes are stabilized by vegetation, and the beach sands are subject to natural longshore transport and replenishment processes. However, storm events hold the potential to create high-intensity erosion events due to wave and wind action.

Figure 4. Topography of State Military Reserve (USGS Virginia Beach Quad)

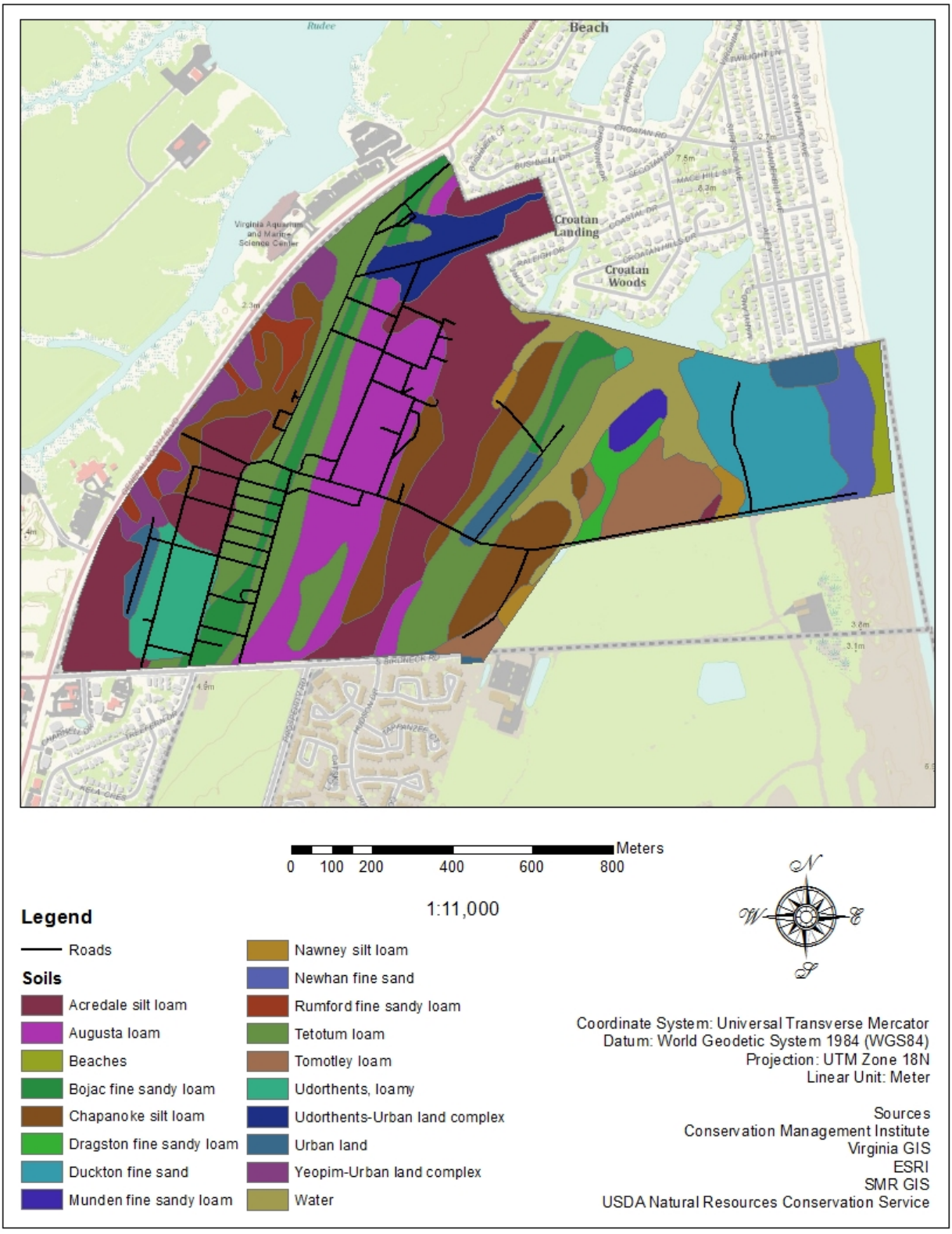

Figure 5. Soil types of State Military Reserve, Virginia Beach, VA.

3.4 HYDROLOGY

3.4.1 Surface Water

SMR is bordered on its eastern boundary by the Atlantic Ocean. Approximately 1,200 linear feet of the eastern boundary consists of beachfront. Lake Christine, a shallow, freshwater lake, comprises the largest water body occurring within the boundary of the installation. The total area of Lake Christine is nearly 40 acres with approximately 26 acres of the lake lying within the installation boundary. An 0.2-acre stormwater retention pond is located near the southwest corner of the facility.

Storm drainage on SMR consists of a combination of natural surface drainage courses and man-made systems. Storm drainage is by sheet flow, swale collection, piping, and percolation. Low, twin-rounded ridges divided by a shallow, broad swale characterize the general physiography on the base (VDMA 2000). Stormwater drainage to the north flows into Lake Christine as a primary collection point. Runoff from areas drained between the eastern and western ridges, and from streets on the inner face of the eastern ridge, also flow into Lake Christine. A total of eight inlets drain directly into Lake Christine.

Stormwater from the western section of the facility flows toward Owl Creek via General Booth Boulevard. The Boulevard redirects flow to catch basins that eventually feed into Owl Creek. Owl Creek flows into Rudee Inlet, which flows into the Atlantic Ocean (VDMA 2000). The western ridge, paralleling Headquarters Road and cresting along the centerline of the parade field and southward along C Street, directs flow into drains that outfall into the woods bordering General Booth Boulevard (VDMA 2002). Stormwater improvements have been made on the west side of the installation that includes a new stormwater retention basin and drainage ditches to better handle the stormwater on site. A number of new stormwater best management practices (BMP) are currently proposed to be installed to treat stowm water before it reaches Lake Christine.

Williamsburg Environmental Group (WEG; now Stantec) conducted a water quality study in 2013 which included an analysis of the water quality of the lake. The study revealed that the nutrient concentration classifies the lake as hyper-eutrophic. This is mainly due to its continued use as a stormwater management BMP by the City of Virginia Beach and the DoD including the VAARNG and the US Navy.

Non-point source pollution associated with runoff from surrounding land uses has adversely impacted water quality in Lake Christine. Eutrophication is associated with runoff and results in excessive algae and adventive submerged aquatic vegetation (SAV) growth brought about by heavy nutrient loading (Figure 6). Eutrophication refers to a process by which too many nutrients enter a waterbody which leads rapid growth of plant life and this causes a lack of oxygen in the water.

Figure 6. Eutrophication

The study also included an assessment of sediment contributions and potential controls, and recommendations for fisheries management, aquatic habitat, and for structural and non-structural controls to protect and restore the lake quality. Overall, the water quality testing demonstrated a variety of problems and suggested that the lake is too shallow, nutrient and bacterial inputs were too high, and accumulated organic matter has become problematic.

3.4.2 Groundwater

SMR is underlain by several aquifers of variable depth separated by semi-confining units. The uppermost water table unit is the Columbia aquifer, which occurs at varying depths ranging from 20 feet to 120 feet below the ground surface (BGS). The Columbia aquifer has been used as a domestic water supply source at various locations in the Virginia Beach area (VDMA 2002).

Other aquifers underlying SMR include the Yorktown-Eastover aquifer (approximately 140 to 400 feet BGS), the Chickahominy-Piney Point aquifer (approximately 800 to 950 feet BGS), the Upper Potomac aquifer (approximately 1,100 to 1,200 feet BGS), the Middle Potomac aquifer (approximately 1,400 feet BGS), and the lower Potomac aquifer (approximately 1,900 feet BGS) (VDMA 2002). Saltwater intrusion, both natural and induced, has affected some of the aquifers (VDMA 2000).

The boundary between the Upper and Middle Potomac aquifers occurs at approximately 1,200 feet BGS. Both aquifers are artesian. The Upper Potomac aquifer consists of fresh and saltwater with the fresh water occurring in the upper layer of the aquifer, which makes it a source of potable water. The Middle Potomac unit is saltwater, thus limiting its use as a source of potable water (VDMA 2002).

The Yorktown-Eastover Aquifer is the major source of groundwater in the area. The water in the upper aquifer is generally good but has high iron content. The lower section of the

aquifer contains brackish water, which could contaminate the freshwater layer if extensive pumping occurs. City water supply for the Virginia Beach area comes from surface reservoirs. Some residential, agricultural, commercial, and industrial activities in Virginia Beach rely on groundwater for irrigation and other processes. The City of Virginia Beach supplies potable water to SMR (VDMA 2002).

3.5 FLOODPLAINS

Executive Order (EO) 11988 (Floodplain Management) requires that federal agencies take action to minimize occupancy and modification of the floodplain. Specifically, EO 11988 prohibits federal agencies from funding construction in the 100-year floodplain unless there are no practicable alternatives. The original floodplain determinations for SMR were developed by the Federal Emergency Management Agency (FEMA) in September of 1998 and the floodplain panels were updated and became effective on January 16 of 2015. SMR is located within three flood panels of the flood insurance rate maps (FIRM) for the City of Virginia Beach: 0128G, 0129G, and 0136G (Figure 7). The majority of SMR is located outside the 100- and 500-year floodplains, however Lake Christine and areas directly adjacent are located within a 100-year floodplain where base flood elevations have been determined. Floodplains located along the western boundary of SMR are associated with tributaries of Owl Creek. Floodplains associated with the Atlantic Ocean are defined by FEMA as 100-year floodplain with velocity hazards (wave action) where base flood elevations have been determined.

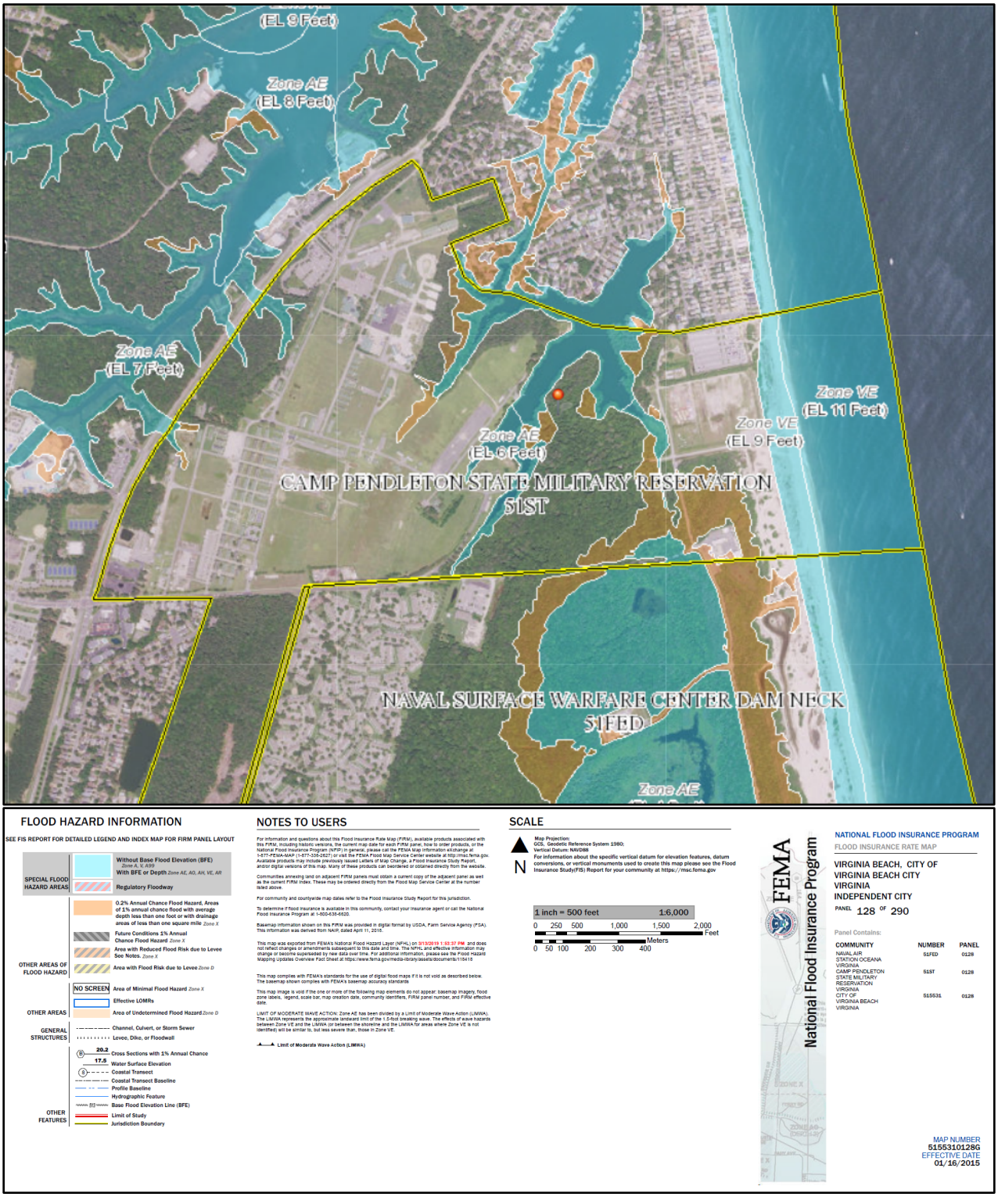

Figure 7. FEMA Designated Floodplain on SMR, Virginia Beach, VA.

3.6 WETLANDS

The base is positioned in the outer Coastal Plain of Virginia, a setting characterized by numerous wetlands and surface water systems of varying characteristic (Figure 8). Field investigations by WEG (now Stantec) in 2004 confirmed the presence of various wetland resources, and the detailed delineation defined the specific wetland boundary. The locations of wetlands outside of Lake Christine were re-delineated by Stantec in 2017 and verified by the U.S. Army Corps of Engineers in 2018 (Figure 9). Of the features identified, marine, estuarine, lacustrine, and palustrine ecological systems are present on the SMR property (Table 3). In addition, small stream segments were identified in three areas. Wetland features are shown on Figures 8 and 9.

Table 3. Wetland Types located on SMR

Wetland Type	Acres and/or Linear Feet
Marine	ac varies*/1,203 lf
Estuarine	0.40 ac
Lacustrine	18.42 ac
Palustrine	21.95 ac
Streams	0.26 ac/3,245 lf
Total Acreage	41.03 ac

*Acreage dependant on dynamic beach area between mean high and mean low water.

The following paragraphs describe the features present within the four wetland types as classified under the Cowardin Classification (letter/numerical codes in parentheses correlate with those found in Cowardin et al. 1979), as well as the stream systems.

3.6.1 Marine

Marine systems are found along the Atlantic Ocean coastline. The SMR property line runs along the mean low tide mark along 1,203 linear feet of shoreline. The open water is classified as marine, subtidal-unconsolidated bottom-which is continuously covered by tidal saltwater (M1UBL). Marine-intertidal-unconsolidated sandy shore that is regularly flooded (M2US2N) classifies the portion of the coastline below the mean low-tide elevation. Marine-lintertidal-unconsolidated sandy shore that is irrregularly flooded (M2US2P) classifies the jurisdictional feature extending from the mean high tide line to the subtidal zone. Both marine zones are non-vegetated within the SMR property and are subject to high salt levels and increased wind and wave action. Due to wind and wave action, the shoreline is a dynamic system which is constantly changing.

3.6.2 Estuarine

Estuarine wetland systems encompass 0.40 acres on SMR and are found within one topographical drainageway along the western property boundary. Estuarine-intertidal-emergent-persistent-irregularly flooded-oligohaline-organic (E2EM1P6n) wetlands are located at the property boundary adjacent to General Booth Boulevard and extend up the

drainageway to the east. Located just east of the E2EM1P6n system, estuarine-intertidal-scrub shrub-deciduous-irregularly flooded-oligohaline-organic (E2SS6P6n) marsh is present to the point where tidal influence ceases and transitions to freshwater environments. These systems receive irregular tidal inputs from Owl Creek (located west of General Booth Boulevard) with vegetative communities characterized by oligohaline marsh vegetation (Fleming et al. 2001).

3.6.3 Lacustrine

Lake Christine encompasses 18.42 acres of SMR and is a lacustrine, freshwater impoundment retaining three types of littoral (< 6.6 feet deep) systems. The body of the lake is classified as lacustrine-littoral-open water-permanently flooded-fresh (L2OWH0). Lacustrine-littoral-aquatic bed-rooted vascular-permanently flooded-fresh wetlands (L2AB1H0) occur near the tips of the "fingers" formed by Lake Christine, most predominantly near the tip of the eastern-most finger adjacent to the firing range. Wetlands within this classification are typified by rooted, persistent and non-persistent herbaceous vegetation. The final type of wetland associated with Lake Christine is lacustrine-littoral-unconsolidated shore-vegetated-fresh (L2US50). This type composes the fringe around the lake, which is semi-permanently saturated and/or flooded following high precipitation events. Depending on land-use, this fringe consists of shrub or herbaceous vegetation and, less often, forest communities. The open freshwater component supports various types of aquatic vegetation, but most notably is the aquatic pest species alligatorweed (*Alternanthera philoxeroides*).

3.6.4 Palustrine

Palustrine wetlands occupy the largest area of the wetland types on SMR, with 21.95 acres. They are dispersed across the installation. Palustrine-forested-broad leaved deciduous-seasonally flooded/saturated (PFO1C) wetlands are located in various regions, but usually occur at the heads of small drainageways and between Lake Christine and the access road to the firing range. Palustrine-forested-needle leaved evergreen-semi-permanently flooded (PFO4F) wetland is situated immediately east of Lake Christine and along the northern property line. Palustrine-emergent-persistent-seasonally flooded/saturated (PEM1C) wetlands were identified in areas where vegetation has been cleared. This latter wetland type represents a minor component of the palustrine wetland area on SMR.

3.6.5 Streams

Six low-gradient stream systems totaling 2,345 linear feet (0.26 acres) in length are located within SMR boundaries. There are 244 linear feet (0.01 acres) of perennial stream channel; 272 linear feet (0.02 acres) of intermittent stream channel; and 2,729 linear feet of ditched channels.

Along General Booth Drive there are three stream sytems, including perennial, intermittent and ditched channels. The northernmost intermittent stream and the perennial stream to the south are located within palustrine forested wetlands; are dependent on groundwater input, and are significantly enhanced by excessive precipitation events, as some of the surface hydrology is provided by stormwater runoff and overland runoff from the cleared/developed interior of the installation. The ditched system's hydrology is provided by stormwater runoff.

A second stream system is located in the northern portion of the property. There are three ditched stream segments within palustrine forested wetlands that convey overland stormwater flow from an area around Warehouse Road and flow into an offsite stormdrain inlet. A fourth ditch appears to receive stormwater flow from an offsite stormwater outfall.

The final stream segment is located in the central region of the installation, to the east of E Street. The entire system has been altered by ditching as evidenced by an adjacent spoil berm. Flow is minimal, with hydrology supported by contributions from the shallow groundwater table. This stream receives significant stormwater and overland contributions.

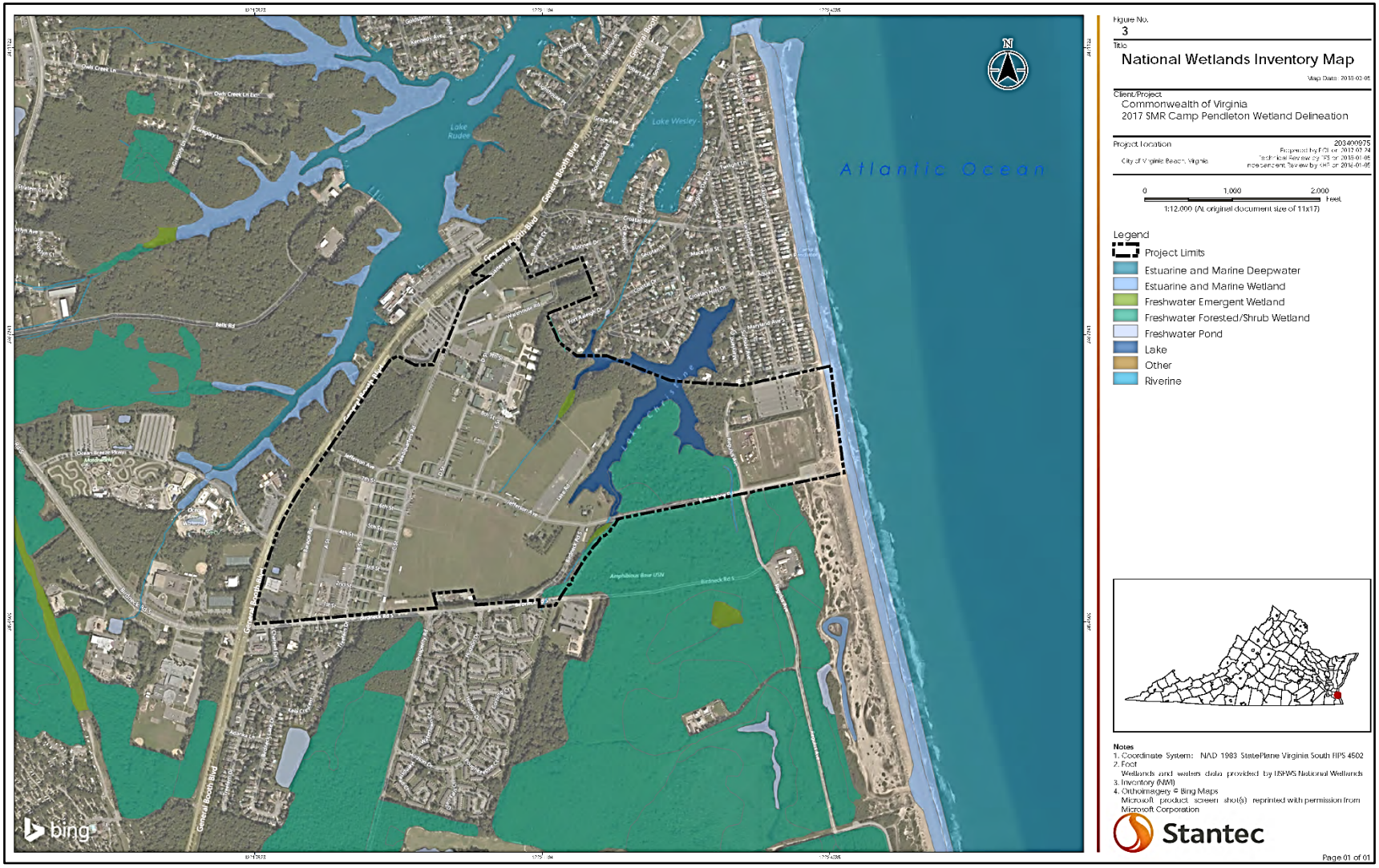

Figure 8. Wetlands and surface water near State Military Reserve, Virginia Beach, VA.

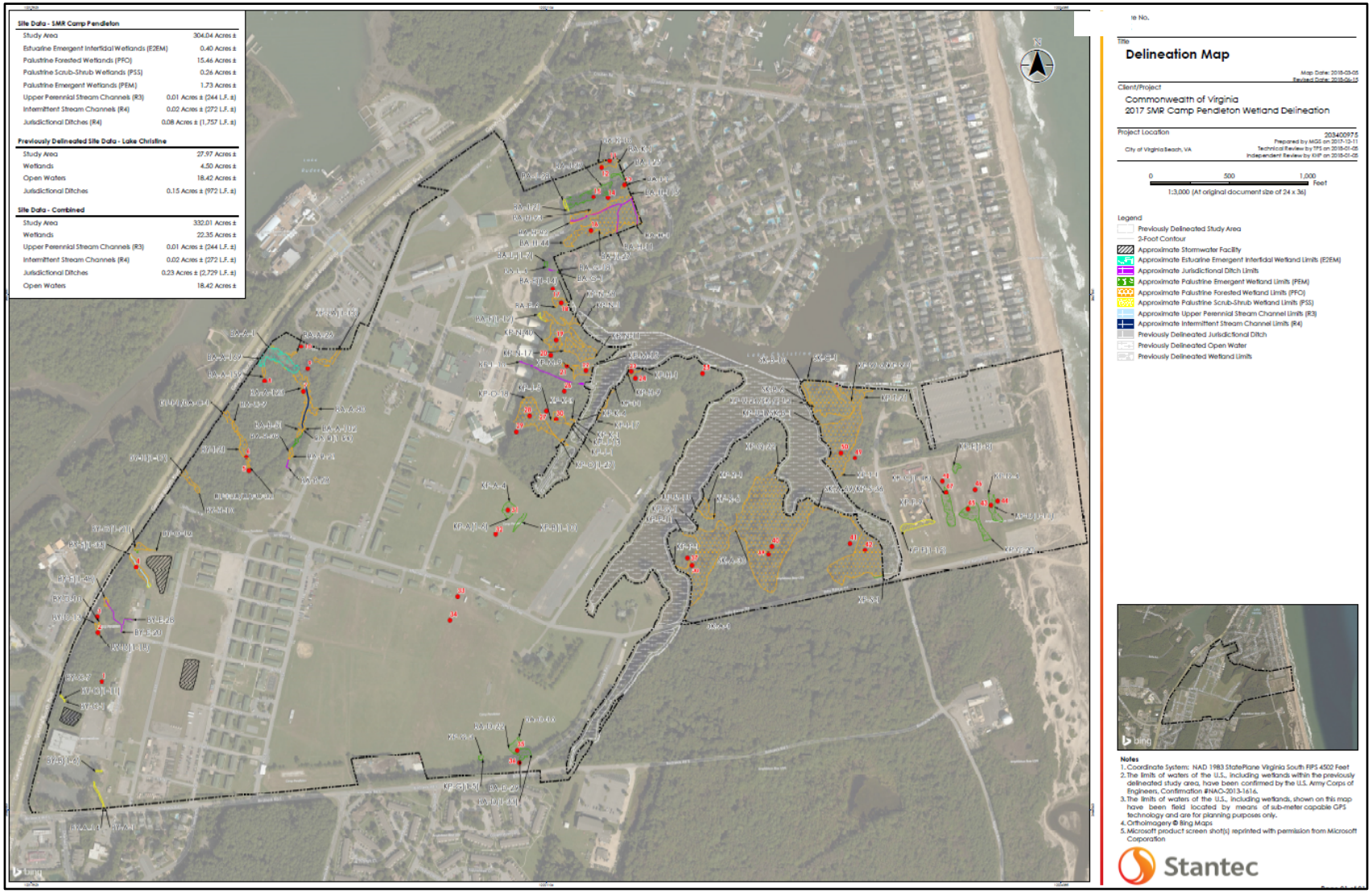

Figure 9. Delineated wetlands on State Military Reserve (Stantec 2018).

SECTION 4: BIOTIC ENVIRONMENT

4.1 HISTORIC VEGETATIVE COVER

When the site was established in 1912, Virginia Beach was a relatively remote and sparsely populated area. The original construction for the range involved clearing trees and stumps, plowing, planting grass, and site preparation. Due to development and utilization of the base for military housing/training purposes, much of SMR's landscape has been altered and is currently composed of artificial landscapes (e.g. grass plots, cultivated beds, planted hedgerows, etc.) or various development conditions (e.g. buildings, roadways, parking lots, etc.) which reduce habitat quality for sensitive species.

Pre-development conditions within SMR and the surrounding environment likely would have included marine systems, maritime zone communities, estuarine zones, non-tidal maritime wetlands, non-alluvial wetlands, palustrine wetlands, and maritime forests (Fleming et al. 2001). Also, because the Atlantic Coastal Plain abounds with nearly level terrain underlain by fertile soils, these community types would have existed in a matrix of agricultural land-use prior to the regional economic boom of the late 1900s. Due to the ensuing landscape alteration associated with coastline urbanization in the surrounding City of Virginia Beach area, as well as alterations on SMR, many natural communities previously expected have either been removed or altered beyond a natural state.

4.2 CURRENT VEGETATIVE COVER

SMR was surveyed in 2004 to identify the major cover types and plant communities occurring throughout the 330-acre facility. The Conservation Management Institute (CMI) at Virginia Tech identified eight different habitat types (both natural and manmade) using a combination of aerial imagery and field verification. Of these, six have been separated into vegetative cover types, which are listed with corresponding coverage in Table 4 and shown on Figure 10.

In another survey in 2004, WEG identified 14 natural vegetation communities from a combination of vegetation sampling, and map/color-infrared aerial photography (CIR) interpretation. These vegetation types have been used to further characterize the vegetation cover types. In addition to identifying habitat and vegetation types, vegetation surveys were conducted by botanists from WEG in late July 2004, and a dune botanical survey was conducted by CMI in 2008 (Emrick 2008). An updated all taxa survey was completed in 2013 by CMI (Wolf 2013). A total of 261 different plant species were identified and are listed in Appendix E. An updated all taxa survey was completed in 2018 and the information in the INRMP will be updated when the survey results are available.

In the 2004 survey, three species were found to occur within SMR that have been determined to be of special state significance according to the Department of Conservation and Recreation Division of Natural Heritage (DNH) (Townsend 2004). *Juncus megacephalus* (big-headed rush) is found in wetlands and is considered very rare and imperiled in Virginia (S2) but is not federally threatened. Big headed rush was not identified in subsequent surveys performed by CMI (Emrick 2008 and Wolf 2013). *Quercus virginiana* (live oak) are found in forested areas and *Uniola paniculata* (sea oats) grow on dunes at SMR.

Live oak was identified by CMI in the 2008 survey and sea oats were identified in 2013(Emrick 2008 and Wolf 2013). Both are considered rare to uncommon in Virginia (S3) and are subsequently on the DNH watch list. Both are considered rare to uncommon in Virginia (S3) and are subsequently on the DNH watch list.

Table 4. Habitat types identified at State Military Reserve.

Cover Type	Acres	Hectares	Plant Communities[1]
Lawn	149.99	60.70	None
Wet (Mesic) Forest	43.13	17.46	Lowland Hardwood Forest, Pine/Mixed Hardwood Lowland Forest
Dry (Xeric) Forest	28.89	11.67	Upland Pine/Mixed Hardwood Forest, Upland Mixed Hardwood Forest
Emergent Wetlands and Open Freshwater	20.86	8.44	Emergent Wetlands
Dune System and Backshore	8.80	3.56	Dune-Swale Complex, Emergent Intertidal Wetland, Intertidal Beach
Saturated Forest	7.70	3.11	Shrub Wetland Lowland Forest, Shrub Wetland/ Littoral-fringe Forest, Forested Wetland Swale
TOTAL	332.05	134.37	

[1] Identified by the Conservation Management Institute for State Military Reserve in 2004. Habitat types were differentiated using a combination of aerial imagery and field verification. Plant communities identified by the WEG (now Stantec).

4.2.1 Lawn

The most common vegetation type at SMR is maintained lawn. This area is composed of planted grass species, and weedy pests and holds little ecological significance. There is approximately 150 acres of lawn at SMR. The area is ideal for the resident Canada geese (B*ranta canadensis*) population, which have become pests around Lake Christine.

4.2.2 Forests

The wet (mesic) forests at SMR include pine and hardwood mixed tree species with seasonally wet soils. They predominantly occur around Lake Christine, in the northern sections of SMR. Plant communities associated with this cover type are lowland hardwood forest and pine/mixed hardwood lowland forest. Overstory species include loblolly pine (*Pinus taeda*), sweetgum (*Liquidambar styraciflua*), white oak (*Quercus alba*), laurel oak (*Quercus laurifolia*), and red maple (*Acer rubrum*). Wet (mesic) forest represents the largest forested areas of SMR covering over 40 acres.

Dry (xeric) forests tend to have sandy and well drained soils with a high pine component (*Pinus taeda*) in the over-story. Other overstory tree species in the dry forests are sweetgum, red maple, American beech *(Fagus grandifolia*), tulip poplar (*Liriodendron tulipifera)*, and mockernut hickory (*Carya tomentosa)*. These forests occur in the western part of SMR and cover nearly 30 acres.

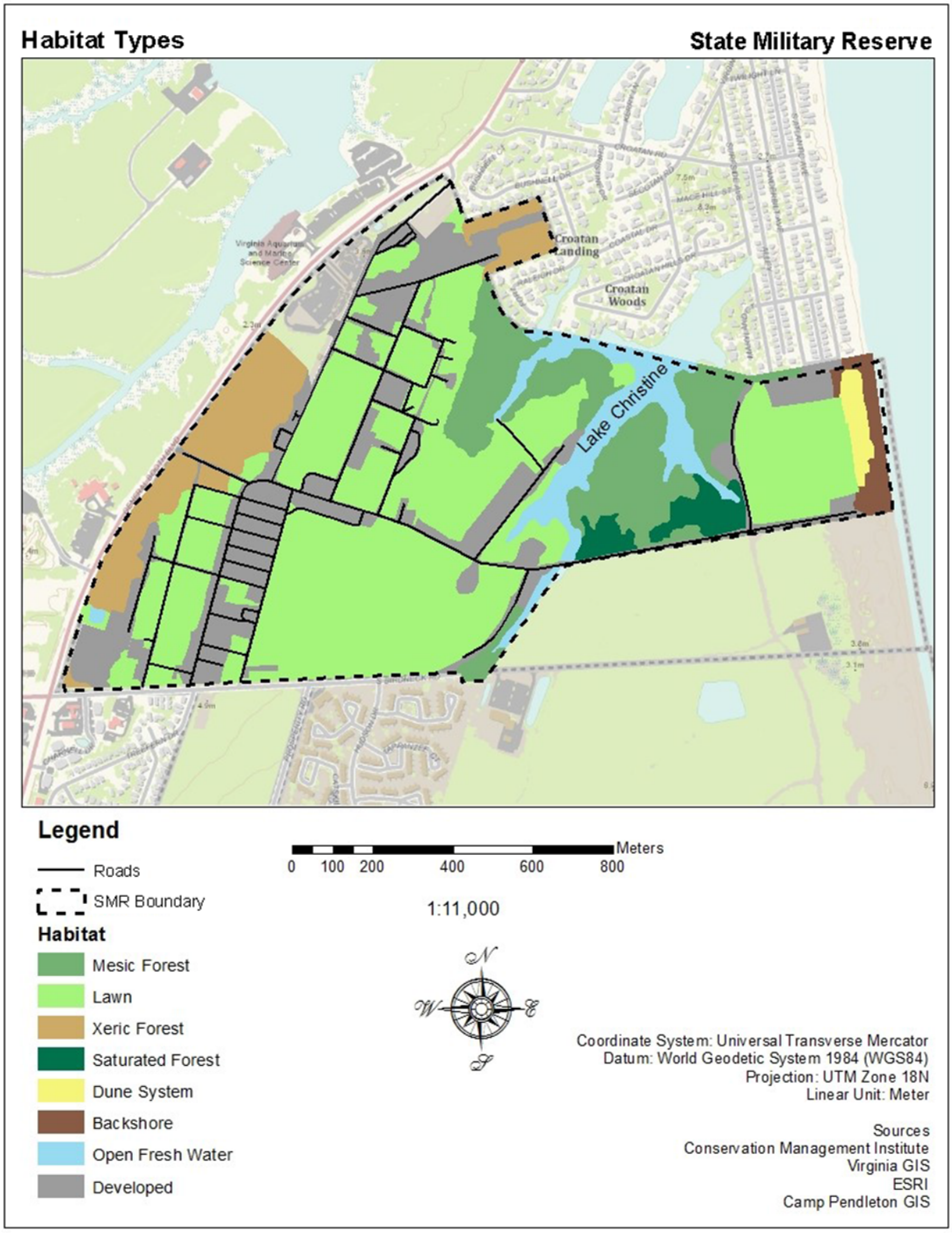

Figure 10. General habitat map of Virginia State Military Reserve (CMI 2004).

583

584 The saturated forest and wetland cover type has poorly drained soils, remaining saturated
585 for much of the year. The vegetation ranges from primarily scrub/shrub to more mature
586 forested communities. This cover type can support rich understory diversity. Tree species
587 include red maple, black gum (*Nyssa sylvatica)*, and sweetgum. Many understory species
588 occurring in this cover type are indicative of wetland plant communities. This cover type is
589 relatively small (approximately 8 acres), clinging to drainages and edges of Lake Christine.

590 **4.2.3 Backshore**

591 The backshore is the area of shore lying between the high tide mark and dune system
592 containing vegetation (Figure 11). The area is usually separated from the foreshore with a
593 distinct berm formed from where the waves reach and does not usually support vegetation.

594

595 **Figure 11. Backshore and Dunes on SMR**

596 **4.2.4 Dunes**

597 The dune system supports a wide range of plant species. This cover type is located between
598 the backshore and the SMR firing range, and includes the primary dune, a xeric swale, a
599 secondary dune, and portions of the swale at the landward base of the secondary swale.
600 Vegetation is primarily a maritime dune grassland complex, although some woody shrubs
601 and vines are found within portions of the secondary dune system. This type supports two
602 plant species of special state significance: live oaks and sea oats.

603 An updated dune survey is currently being completed (2019). The original 2008 dune
604 botanical survey consisted of three sampling periods spanning from spring to early fall and
605 was supplemented by the 2013 all taxa survey performed by CMI (Emrick 2008 and Wolf

2013.) A total of 58 plant species were identified across the three coastal graminoid communities occurring on SMR (Appendix E). There were no federally threatened or endangered species identified during the survey. Nine of the species identified are considered invasive.

Following the dune botanical survey, CMI began to rebuild degraded areas of the dunes and discourage foot and vehicular traffic through use of sand fence barriers. The sand fences trapped a significant amount of wind-borne sand (aeolian sand) and were effective in reducing the amount of traffic through the dunes. To further enhance the conditions of the dunes, 1,625 native beach grasses were planted in April 2009. Four different species of dune grass were planted: sea oats (*Uniola paniculata*), American beachgrass (*Ammophila breviligulata*), bitter panicum (*Panicum amarum*), and saltmeadow cordgrass (*Spartina patens*). Some plantings were impacted by vehicle and foot traffic, but overall the planting was very successful. The dunes are monitored for invasive plant species such as Japanese sedge (*Carex morrowii*) and treated on a yearly basis to control invasives.

4.2.5 Wetlands

Wetlands are among the most ecologically important habitats in the world. Properly functioning wetlands improve water quality by removing nutrients, pesticides, sediments, organic materials, toxic metals, biological pathogens, and other pollutants from the water. Wetlands help maintain water quantity within a watershed and can limit the erosion damage caused by floods. Wetlands provide unique habitats for a variety of aquatic and terrestrial species. Wetlands are natural biological systems that are characterized by the unique physical and chemical relationships of landform, soil, and water, as well as the plants and animals that reside within. Refer to Section 3.6 for detailed description of wetland types on SMR.

4.3 FISH AND WILDLIFE

Forest, wetland, and open water habitats on SMR are conducive to the occurrence of a variety of wildlife. Small mammals are abundant in the forested areas. Reptiles and amphibians occur in association with wetlands, Lake Christine, and the woods and fields on the facility. Lake Christine also supports a variety of fish and provides habitat for waterfowl.

The CMI at Virginia Tech started conducting taxa surveys at SMR in 2004 and subsequently performed surveys in 2008 and 2013 (Wolf 2013). The initial survey was aimed at developing a habitat map, as well as producing a preliminary species list for avian species occurring at SMR. An all taxa survey was completed in 2018 and the INRMP will be updated with the 2018 survey information when it becomes available.

4.3.1 Mammals

In the 2013 mammal survey across SMR, mammals were sampled using a combination of live trapping, camera trapping, and acoustic monitoring units. Acoustic monitoring units (Anabat units) record ultrasonic calls made by bats, and species-specific call signatures make it possible to identify bat species from recordings of passing bats. A total of 22 mammal species was identified from the survey including Virginia opossum (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), southern flying squirrel (*Glaucomys volans*), gray fox (*Vulpes vulpes*), and five bat species. There is a resident deer population on SMR due to a large block of undeveloped land that exists between the eastern shore of Lake Christine and Lake Redwing approximately two miles to the south. A complete list of mammals found is located in Appendix E on Table E-1.

A new bat survey was completed by CMI in 2016. Emrick, *et al.* stated that the primary objective of the survey was to assess the distribution and abundance of federally and/or state listed threatened and endangered bat species on SMR. None of the bat species identified are currently designated as federally threatened or endangered, although the state endangered tri-colored bat (*Perimyotis subflavus*) and the little brown bat (*Myotis lucifugus*) were acoustically detected. The Rafinesque's eastern big-eared bat (*Corynorhinus rafinesquii*) was identified acoustically in a prior survey conducted in 2013 but not in the 2016 study. Rafinesque's eastern big-eared bat is currently designation as federally sensitive, state endangered, and is included in the Virginia Wildlife Action Plan (WAP) as a Tier I species reflecting a critical conservation need (VDGIF 2015).

4.3.2 Fish

In 2008, Lake Christine was surveyed using boat-based electrofishing techniques to document freshwater fish species. A total of 432 individuals were captured, representing 15 fish species. The most common fish species were bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), and pumpkinseed (*Lepomis gibbosus*). These three species represent over half of the fish captured. Overall, Lake Christine showed a relatively balanced population, but an abundance of small prey species may be an indication of stunted prey. An overabundance of prey species can cause stunted growth resulting from an increase in competition for food. Implementing slot limits for large-mouth bass (*Micropterus salmoides*) would reduce the abundance of prey, and potentially produce

bigger bass. Another potential problem associated with Lake Christine is dealing with exotic species, including common carp (*Cyprinus carpio)* and alligatorweed (*Alternanthera philoxeroides*). Common carp feed on and uproot shallowly rooted vegetation which has the potential to destroy aquatic habitat and increase turbidity. A complete list of fish found is located in Appendix E on Table E-2.

4.3.3 Avifauna

A variety of bird species occur within SMR's boundaries, foraging in the grassed and forested areas and utilizing dune and beach habitats. Surveys for avian species were performed in 2004 and as part of an all-taxa survey which was completed in 2013 (Wolf 2013). Each identified habitat type was visited and thoroughly searched. Avian species were identified visually and by song. A total of 101 avian species were documented utilizing the habitats at SMR. A complete taxonomic list of the avifauna species encountered is provided in Appendix E on Table E-3.

A number of the bird species identified in the 2013 CMI survey utilize beaches for nesting sites and are included as species of conservation concern in the Virginia WAP. These include the black-bellied plover (*Pluvialis squatarola*), sanderling (*Calidris alba*), Forster's tern (*Sterna forsteri*), royal tern (*Thalasseus maximus*) and common tern (*Sterna hirundo*). Of these, the common tern is considered to have the highest conservation need (Tier II) and most of the known breeding sites are under permanent protection from development. Numerous other bird species may use beach areas for foraging. A monitoring program within the existing wildlife habitat zones on the base to document wildlife species currently utilizing the base will allow the avoidance of any potential nesting sites. The beaches and dunes are already protected from normal activity, as access to the beachfront is "channeled" through a narrow gap in the dunes, thus focusing foot traffic away from the vegetated portions of the primary and secondary dune systems. Recreational vehicular traffic is prohibited along the beachfront and in the dune-swale system. If military training is planned to take place on or near the beaches and dunes, monitoring for birds and animals will be completed in advance in order to determine if further action is needed.

Migratory birds are protected under the MBTA and the 2006 Memorandum of Understanding (MoU) between the DoD and USFWS to "*Promote the Conservation of Migratory Birds*" in accordance with Executive Order 13186 "*Responsibilities of Federal Agencies to Protect Migratory Birds.*" A copy of the MoU is included in Appendix F. The MoU provides information on coordination between the DoD and USFWS for specific activities in order to reduce stressors and aid in the conservation of migratory birds as well as their habitats. A guide entitled *Coordinated Bird Monitoring: Technical Recommendations for Military Lands* (USGS 2012) is also included in Appendix F. A list of the birds of conservation concern in USFWS Region 5, and Bird Conservation Regions (BCR) 27 and 30 is included in Appendix E on Table E-8. There are five bird species on the list which were identified in the 2013 CMI survey. The prothonotary warbler (*Protonotaria citrea*) and common nighthawk (*Chordeiles minor*) were identified in the spring; the semipalmated plover (*Charadrius semipalmatus*) and the sandwich tern (*Thalasseus sandvicensis*) were identified in the spring and the worm-eating warbler (*Helmitheros vermivorum*) was identified in the fall. The prothonotary warbler may be breeding on base as they breed in May and June and their nests are usually located in a

natural cavity always near or in water. The worm-eating warbler may also breed on base as they arrive in the spring and their nesting habitat includes sand dunes and beaches. The sandwich tern has been identified frequently on SMR and breeds on beaches and in dunes during the summer months. The worm-eating warbler passes through Virginia while migrating south in the fall.

The 2013 CMI survey identified a large variation of migratory birds. All of the birds identified are migratory birds protected under the MBTA except for the European starling (*Sturnus vulgaris*). These included raptors such as Cooper's hawk (*Megaceryle alcyon*) in the summer and bald eagles on base during the summer, fall and winter months; shorebirds such as the black-bellied plover and ruddy turnstone (*Arenaria interpres*) in the spring; the common tern and belted kingfisher (*Megaceryle alcyon*) in the spring, summer and fall; and the prothonotary warbler (*Protonotaria citrea*) was identified in the summer. The potential exists for additional migratory birds to use the base for nesting and wintering or for food while migrating through the area, such as the peregrine falcon (*Falco peregrinus*) which is known to have nests within two miles of SMR. Bald eagles were noted on base during the summer, fall, and winter months and the prothonotary warbler and the sandwich tern were identified in the summer and the worm-eating warbler was identified in the fall. There are currently three bald eagle's nests within two miles of SMR. Two are located 1.25 miles to the south on the shores of Lake Redwing and the third is located 0.25 miles to the north.

4.3.4 Reptiles and Amphibians

In 2013 CRI completed an all-taxa survey of SMR. Amphibians identified included the American bullfrog (*Lithobates catesbeianus*), southern leopard frog (*Lithobates sphenocephalus*), eastern red-backed salamander (*Plethodon cinereus*) and the northern coal skink (*Plestiodon anthracinus anthracinus*). Reptiles included the eastern six-lined racerunner (*Aspidoscelis sexlineata sexlineata*) as well as a number of turtles such as the eastern painted turtle (*Chrysemys picta picta*) and the northern red-bellied cooter (*Pseudemys rubriventris*). The eastern box turtle (*Terrapene carolina*) was also identified and is considered to have a high conservation need in Virginia's Wildlife Action Plan. A complete list of reptiles and amphibians found is located in Appendix E on Table E-4.

4.3.5 Nuisance Wildlife

4.3.5.1 Canada Geese

Canada geese are protected by the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711). This act made it illegal to harvest waterfowl or other migratory birds except during the hunting season or by permit from the USFWS. In addition to federal permits, the VDGIF requires permits to destroy eggs or nests, capture, translocate, disturb, or harvest Canada geese. The United States Department of Agriculture (USDA) describes the Canada Goose Nest and Egg Depredation Order (50 CFR 21.50) as authorizing landowners and local governments who register with the USFWS to destroy resident Canada goose nests and eggs on their property from March 1 through June 30, when necessary, to resolve or prevent injury to people, property, agricultural crops, or other interests. In order to conduct these activities, landowners must register online anytime between January 1 and June 30 of the year in which the activity will take place. Geese may not be taken using hunting methods such as decoys and calls. Permit holders must keep a log of their control activities and must submit a

report by September 30 of each year detailing the number of birds taken. Registration is required and can be completed at the USFWS website created for the program: https://epermits.fws.gov/eRCGR/geSI.aspx?ReturnUrl=%2feRCGR

4.3.5.2 Nutria

The nutria (*Myocastor coypus*), or coypu, is listed as a nuisance species in Virginia and has been identified to the south of SMR, on the NASO-DNA facility. Nutria are a large, stout-bodied rodent, grayish-brown, with a long round tail. Adult nutria can weigh in excess of 20 pounds. The current distribution of nutria in Virginia is unknown. At a minimum, nutria are considered established in an area bounded by the intersection of Route 13 and Interstate 264 south to the North Carolina state line and east to the Atlantic Ocean. Nutria present a significant threat to native wildlife and to humans. They damage native wetland habitats, predate crops, destroy impoundments and flood control structures, and can carry harmful diseases.

4.3.6 Threatened and Endangered Species

The USFWS Information for Planning and Consultation (IPaC) database was searched for threatened and endangered species in the project vicinity and eight potential species were identified. No critical habitats were found within the project area. A NOAA -NMFS endangered species act (ESA) Section 7 map search included two potential species of sturgeon and four sea turtles along the shoreline. A search of the VDGIF database returned a comparable list of results, and also included two state endangered bat species. VDGIF records indicate that the loggerhead sea turtle has been documented in 2017 within one mile to the south of the project area. The endangered and threatened species that may potentially be found at SMR are listed in Table 5 below.

Table 5. Threatened and Endangered Species

Common Name	Scientific Name	Federal Status	State Status
Responsible Agency: USFWS (Federal) or VDGIF (State)			
Northern long-eared bat	*Myotis septentrionalis*	Threatened	Threatened
Little brown bat	*Myotis lucifugus*	N/A	Endangered
Tri-colored bat	*Perimyotis subflavus*	N/A	Endangered
Piping Plover	*Charadrius melodus*	Threatened	Threatened
Red Knot	*Calidris canutus rufa*	Threatened	Threatened
Roseate Tern	*Sterna dougallii dougallii*	Endangered	Endangered
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened

Responsible Agency: NOAA-NMFS			
Green Sea Turtle	*Chelonia mydas*	Endangered	Threatened
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered
Atlantic Sturgeon	*Charadrius melodus*	Endangered	Endangered
Shortnose Sturgeon	*Calidris canutus rufa*	Endangered	Endangered

Additionally, the USFWS and the Center for Conservation Biology (CCB) indicated that the bald eagle has been noted within the City of Virginia Beach, with the closest nest on Naval Air Station Oceana at Owl Creek, 0.25 miles from SMR. The bald eagle has not been observed on SMR.

According to the DNH, SMR is located within the SMR - Dam Neck Dune and Swale Conservation Site. This site has been given a biodiversity significance ranking of B3, which represents a site of high significance. While the Virginia Department of Agriculture and Consumer Services (VDACS) retains legal authority for the protection of all plants and listed insects, threatened and endangered species coordination is initiated through DNH. Table 6 summarizes the results of an DNH database search for the natural heritage resources of concern potentially found near SMR.

Table 6. Natural heritage resources potentially found near State Military Reserve.

Common Name/Natural Community	Scientific Name	Rank*
Coleoptera (Beetles)		
Tiger Beetle	*Cicindela trifasciata*	G5/S1/NL/NL
Lepidoptera (Butterflies & Moths)		
Little Metalmark	*Calephelis virginiensis*	G4/SH/NL/NL
Southeastern Cane Borer Moth	*Papaipema sp. 3*	G4/S2S3/NL/NL
Non-Vascular Plants		
Soft Peatmoss	*Sphagnum molle*	G4 /SH/NL/NL
Vascular Plants		
Sandhill thistle	*Cirsium repandum*	G5/SH/NL/NL
Baldwin's spikerush	*Eleocharis baldwinii*	G4G5/S/NL/NL
Viviparous Spikerush	*Eleocharis vivipara*	G5/S1/NL/NL
White-top Fleabane	*Erigeron vernus*	G5/S2/NL/NL
Southern seaside spurge	*Euphorbia bombensis*	G4G5/S2/NL/NL
Sea-beach Sandwort	*Honckenya peploides ssp. robusta*	G5T5/SH/NL/NL
Glossy-seed yellow stargrass	*Hypoxis sessilis*	G4/SH/NL/NL

Common Name/Natural Community	Scientific Name	Rank*
Dune marsh-elder	*Iva imbricata*	G5/S1/NL/NL
Bog Rush	*Juncus elliottii*	G4G5/S1/NL/NL
American halfchaff sedge	*Lipocarpha maculata*	G5/S1/NL/NL
Long Beach Seedbox	*Ludwigia brevipes*	G2G3/S2/NL/NL
Wild Olive	*Osmanthus americanus*	G5/S1/NL/NL
Longleaf pine	*Pinus palustris*	G5/S1/NL/NL
Sand laurel oak	*Quercus hemisphaerica*	G5/S1/NL/NL
Bluejack oak	*Quercus incana*	G5/S2/NL/NL
Fasciculate Beakrush	*Rhynchospora fascicularis*	G5/S2/NL/NL
Freshwater Cordgrass	*Spartina pectinata*	G5/S2/NL/NL
Eaton's Ladies'-tresses	*Spiranthes eatonii*	G2G4/SH/NL/NL
Spanish-moss	*Tillandsia usneoides*	G5/S1S2/NL/NL
American Wisteria	*Wisteria frutescens*	G5/S1/NL/NL
Carolina yellow-eyed grass	*Xyris caroliniana*	G4G5/S1/NL/NL
Terrestrial Natural Community		
Interdune Pond	*Interdune Pond*	G2/S2/NL/NL
Loblolly Pine / Sand Heather Dune Woodland	*Pinus taeda / Hudsonia tomentosa*	G1G2/S1S2/NL/NL
Maritime Mixed Deciduous Forest	*Quercus nigra - Pinus taeda - Carya pallida - (Fagus grandifolia) / Symplocos tinctoria / Gelsemium sempervirens Forest*	G1/S1/NL/NL
Live Oak Dune Scrub	*Quercus virginiana - (Morella pensylvanica) Shrubland*	G3/S1//NL/NL

*Global and State Ranks: G/S1 - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically, 5 or fewer populations or occurrences; or very few remaining individuals (<1000). G/S2 - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically, 6 to 20 populations or occurrences or few remaining individuals (1,000 to 0). G/S3-Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically, 21 to 100 populations or occurrences (1,000 to 0). G/S4 - Apparently secure; Uncommon but not rare, and usually widespread in the state. Possible cause of long-term concern. Usually>100 populations or occurrences and more than 10,000 individuals. G/S5 - Secure; Common, widespread and abundant in the state. Essentially ineradicable under present conditions. Typically, with considerably more than 100 populations or occurrences and more than 10,000 individuals.

Surveys for rare vascular plant species or sensitive habitats were conducted by WEG (now Stantec) on SMR in 2004. No federally-listed threatened or endangered plant species were encountered during this survey. However, three species of special state significance (Townsend 2004) were found. These included big-headed rush, which is considered very rare and imperiled in Virginia (S2), and sea oats and live oak. All three species were found in the

dune/swale complex along eastern rim of the installation, and live oak was also found just west of the firing range on the upland fringe adjacent to the backwater reaches of Lake Christine. The survey completed in 2013 by CMI also identified sea oats (Figure 12) and live oak on SMR, however the big-headed rush was not found. An all taxa survey was completed in 2013 and again in 2018. The INRMP will be updated with 2018 survey information when it becomes available.

Figure 12. Sea oats

The eastern box turtle was identified by CMI (Wolf 2013) and is considered to have a high conservation need in Virginia's Wildlife Action Plan. The federally sensitive, state endangered Rafinesque's eastern big-eared bat was identified during a CMI mammal survey of SMR in 2008 but was not found during the 2016 all taxa survey. The state endangered little brown bat (*Myotis lucifugus*) was acoustically detected on SMR in 2016. Potential habitat also exists for the northern long-eared bat (*Myotis septentrionalis*, NLEB), which was listed by the USFWS on April 2, 2015, as threatened throughout its range under the ESA.

4.3.6.1 Bats

Northern Long-Eared Bat (NLEB) (Myotis septentrionalis)

NLEB is a threatened species found in the eastern and northern forests of the U.S. and southern Canada. The NLEB is a medium size bat, with medium to dark brown fur on the back and pale-brown on the underside. The total body length ranges from 76 mm to 94 mmwith a wingspan of 228 mm to 254 mm. As its name suggests, this bat is distinguished by

its long ears, particularly as compared to other bats in its genus, Myotis. These bats have a typical lifespan of up to eighteen years in the wild. NLEB mate in the late summer to early fall and they employ delayed fertilization. After fertilization, pregnant bats migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30 to 60 bats although larger maternity colonies have also been observed. Young bats start flying by 18 to 21 days after birth. Northern long-eared bats emerge at dusk to feed. They primarily fly through forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles.

The hibernacula of the NLEB include caves and mines. During the summer months the NLEB roosts singly or in colonies in trees either underneath bark, in cavities, or in crevices of trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. They rarely roost in human structures like barns and sheds.

The NLEB has not been detected on SMR, however, habitat is likely present. Specifically, those areas providing semi-mature to mature forests are considered to be preferred habitat for the NLEB. Smaller fragmented areas of forest and individual trees may provide suitable roosting habitat. However, it should be noted that according to the VDGIF-NLEB habitat and roost trees application mapper, no known hibernacula are present in the vicinity of the site. The nearest known occupied maternity roosts (summer habitat) are located approximately 9.5 miles to the southwest.

Little Brown Bat (Myotis lucifugus)

The little brown bat is found in abundance throughout the northern U.S. and into Canada. It is present in lesser numbers in southern states and is absent from the southern Great Plains. Little brown bats are also found in high elevation forests in Mexico. The little brown bat was acoustically detected, during the bat survey conducted on SMR by CMI in 2016 (Emrick et al. 2017).

The little brown bat is a small size Myotis, with glossy fur that is a dark yellow-brown to olive brown. The face, ears, and membranes are dark, with the membranes sparsely or not furred. The total length ranges from 60-102 millimeters with a wingspan from 222-269 millimeters. The little brown bat has a weight of 5-14 grams and the female is slightly larger than the male. The little brown bat has a life expectancy of six to seven years.

Little brown bats may choose hibernacula and summer roosts such as caves, buildings, rocks and trees, wood piles, under bridges, mines, and tunnels. They may migrate hundreds of miles to get from their summer habitats to their hibernacula.

The mating season usually starts in August and pups are born approximately two months later. At about one month of age, they can fly and catch insects on their own. Each mother has one pup per year. When not hibernating, these bats emerge to forage at late dusk. Moths, midges, mayflies, and aquatic insects are a major part of the little brown bats diet.

Tri-colored Bat (Perimyotis subflavus)

The tri-colored bat is found in abundance throughout the eastern forests of U.S. and the eastern coast of Mexico as well as Northern Central America. The tri-colored bat was acoustically detected during the bat survey conducted on Fort Pickett by CMI in 2016 (Emrick et al. 2017).

The tri-colored bat is a small bat. The dorsal color varies from yellowish or grayish brown to reddish brown, with a paler underside. The tri-colored bat can be distinguished from Myotis species by its tri-colored fur, the bases and tips of individual hairs are dark while the middle sections are light. The total length ranges from 75-90 mm with a wingspan from 210-260 mm. It has a weight of 4-8 grams. These bats have a typical lifespan of four to eight years in the wild.

Tri-colored bats hibernate in caves, mines, and tunnels. While this species is often found hibernating in the same sites as large populations of other bats tri-colored bats generally roost singly, often in trees, but some males and non-reproductive females also roost in their winter hibernaculum. Maternity are commonly found in trees, rock crevices, barns, and other buildings.

Tri-colored bats mate in the fall, and females give birth to litters, usually of two young, in the spring. While the young are growing, the mothers roost in small maternity colonies. They hibernate from October into April. During this time, they enter a state of torpor in which their body temperature drops to that of the surrounding air temperature. Tri-colored bats forage early in the evening and forage mainly over water and near forest edges tending to avoid deep woods or open fields. They eat moths, flies, beetles, ants, and other insects.

4.3.6.2 Migratory Birds

Piping Plover (Charadrius melodus)

The beaches and dunes along the mid-Atlantic shoreline offer potential habitat for a number of migratory birds. The piping plover has been listed as a federally threatened species in in the northeast (USFWS 2018). Piping plovers are about nine inches long with orange legs and a sandy colored back with a white breast and belly (Figure 13).

Figure 13. Piping plover walking on the beach.

They have a short bill colored orange and black and orange legs. They breed in areas of Canada and along the east coast of the United States, from Maine to Virginia. They arrive

887 around mid-April and then migrate south in mid to late August. In Virginia, nesting piping
888 plovers are most prevalent on the barrier islands of the eastern shore. They nest above the
889 high water mark in areas with sparse vegetation on sandy beaches with shell fragments in
890 order to camouflage their nests. The nest consists of two to four eggs in slight depressions on
891 the sand (Kaufman 2005). Few of the eggs hatch as the nests offer easy access to predators
892 and may be washed away by a high tide (USFWS 2018).

893 *Red Knot (Calidris canutus rufa)*

894 The red knot (*Calidris canutus rufa)* has been listed as a federally threatened species since
895 2015 (USFWS 2019) (Figure 14). The red knot is approximately nine inches long with a russet-
896 colored breast and belly during the breeding season. At other times of the year the breast is
897 gray, and the belly is off-white with some streaking. They have a black bill which is short and
898 straight and dark colored legs.

899 They nest far north in the Arctic Circle and migrate to South America in the winter, stopping
900 along both the Pacific and Atlantic coastlines during the spring. In the Mid-Atlantic the red
901 knot arrives in mid-May and will be gone by the first week in June. The red knot forages for
902 food in tidal flats and eats mollusks, insects, grasses and seeds. In the winter their diet consists
903 mainly of small invertebrates in the interdidal zone (Kaufman, 2005). The piping plover and
904 the red knot are known to occur on the Back Bay National Wildlife Refuge (BBNWR), just nine
905 miles to the south of SMR.

906

907 **Figure 14. Red knot on coast, Mispillion Harbor.**

908 *Roseate Tern (Sterna dougallii)*

909 The roseate tern (*Sterna dougallii*) has been listed as a federally endangered species along
910 the Atlantic Coast form North Carolina northwards and in Bermuda since 1987 (USFWS 2019).
911 They are approximately nine inches long and are difficult to identify during the non-breeding
912 season as they have few distinguishing features that separate them from common terns.

913 During the breeding season the roseate tern has silver-gray feathers and a pink chest (Figure
914 15).

915 Roseate terns are most common in the northeastern states from New York to Massachusetts
916 where they nest on small islands with other tern species during the months of April through
917 late August. Their nests are hidden from predators and usually contain one to two eggs. They
918 pass through Virginia when they migrate to the Caribbean and the northern portion of South
919 America, from the Columbian to the Brazilian coastlines during the winter. The roseate tern
920 feeds on small fish in shallow waters or by plunge diving in deeper water.

921

922 **Figure 15. Roseate Tern at Nantucket National Wildlife Refuge, MA.**

923 ***4.3.6.3 Sea Turtles***

924 SMR's location along the Atlantic shoreline in southeastern Virginia makes it a potential nest
925 location for the loggerhead sea turtle and recently the Kemp's ridley sea turtle (*Lepidochelys*
926 *kempii*), the most critically endangered sea turtle in U.S. waters (Corillo 2012, Gitschlag 1996).
927 The loggerhead is an International Union for Conservation of Nature (IUCN) endangered,
928 federally threatened, and state threatened species and the Kemp's ridley sea turtle is an
929 IUCN critically endangered, federally endangered, and state endangered species (IUCN
930 2019, VDGIF 2011). Three other protected marine turtles are known to inhabit or forage in
931 Virginia waters: the Atlantic green (*Chelonia mydas mydas*), leatherback (*Dermochelys*
932 *coreacea*), and hawksbill (*Eretmochelys imbricate*). While the habitat exists for all of these
933 turtle species, the loggerhead, Kemp's ridley and green sea turtles are the three most
934 common and the only known sea turtles to nest in Virginia (Figures 16, 17 and 18) (Coles
935 1999, Corillo 2012, VDGIF 2019).

936 *Hawksbill Sea Turtle (Eretmochelys imbricate)*

937 Hawksbill sea turtles were hunted almost to extinction for their shell and have been listed as
938 federally endangered since 1970. Today the primary threat to their existence is the loss of
939 coral reefs because their diet consists mainly of sponges that live on them. Hawksbill sea

turtles are found worldwide in the Atlantc Ocean, the Pacific Ocean and the Indian Ocean. In the U.S. they are found in American Samoa, in the Gulf of Mexico and along the east coast from the Caribbean to Florida to Maine. They breed exclusively on isolated beaches in tropical areas and their migration patterns are not well studied. Hawksbills are not expected to be seen in Virginia waters.

Hawksbills are on the smaller side with a length of 30 to 36 inches and a weight between 100 and 200 pounds. They have overlapping scutes that are thicker than other sea turtle shells which enable them to live around coral reefs without being damaged in storm events. The name refers the hawksbill's large hooked beak. They breed exclusively on isolated beaches in tropical areas and their migration patterns are not well studied. Hawksbills are rarely seen in Virginia waters.

Figure 16. Hawksbill Sea Turtle

Kemp's Ridley Turtle (Lepidochelys kempii)

Kemp's ridley is the second most abundant sea turtle in the Chesapeake Bay which serves as an important developmental location for juveniles that forage for blue crabs (*Callinectes sapidus*) and other crabs in shallow habitats during the summer. Conservative population estimates of these summer populations range from 200 to over 1000 individuals (Musick and Limpus 1997). Kemp's ridley distribution ranges from the Gulf of Mexico, where adults reside, to the Atlantic Coast of North America where juvenile migratory patterns include Florida to as far north as Maine (Coyne 2000). Kemp's ridley typically arrives at the Virginia coast in May and June and leaves in September and November. They then migrate down the east coast passing Cape Hatteras in January and December where they are joined by juveniles from North Carolina sounds and smaller juveniles from New York and New England to winter (Musick and Limpus 1997).

The Kemp's ridley breeding takes place the spring and summer and occurs almost exclusively on a single beach in Rancho Nuevo, Mexico (Gitschlag 1996). In August 2012, a Kemp's ridley nest was recorded at the Dam Neck Annex to the Oceana Naval Air Station, Virginia Beach, Virginia and hatched 73 turtles (Corillo 2012). This was the first Kemp's ridley nest recorded in Virginia. As this nest was discovered less than five miles from SMR, personnel

should be aware of its occurrence and remain alert of future nesting of this extremely endangered species.

Figure 17. Kemp's ridley sea turtle (left: adult; right: hatchlings).

Loggerhead Sea Turtle (Caretta caretta)

The loggerhead is the most abundant sea turtle in the Chesapeake Bay and surrounding waters where it is estimated 3,000-10,000 juveniles spend summers (Coles 1999, Breunderman and Terwilliger 1994). Adult and juvenile loggerheads use the Chesapeake Bay and surrounding areas as summer feeding grounds from May to November and migrate to wintering areas off the Florida coast similar to the Kemp's ridley (Coles 1999).

Figure 18. The loggerhead turtle (left: adult; right: hatchling).

Virginia Beach represents the northern extent of loggerhead nesting activity along the Atlantic seaboard, although occasional nests have been reported from the Eastern Shore (Jones 1998), most nesting activity occurs on Back Bay National Wildlife Refuge (BBNWR) approximately 10 miles south of SMR (Shepherd 1994).

Figure 19. Loggerhead Turtle Nest on SMR 2015

A loggerhead nest was identified within the fenced off area of the beach on SMR in August 2015 (Figure 19). The eggs appeared to have been predated prior to discovery of the nest and the nest was subsequently washed out to sea during a storm in October of that year. Studies from the 1990s have implicated the nesting activity north of Cape Hatteras, NC region as critically important to the survival of the Atlantic populations.

Green Sea Turtle (Chelonia mydas)

The North Atlantic green sea turtle Distinct Populations Segment has been designated federally threatened by the USFWS. They are between three and four feet in length and weigh up to 450 pounds (Figure 20). Green sea turtles are named for the color of their fat.

Green sea turtles are rarely seen in Virginia waters and all verified sightings have been of juveniles. They only nest in tropical areas, in nests on beaches or behind a dune line. The female nests on the same beach every two years and has been reported to nest up to eight times in a season.

Adult green sea turtles are vegetarian who feed on sea grasses and algae while juveniles are omnivorous, feeding on both aquatic plants and animals. These turtles are commercially harvested for their eggs and meat.

Figure 20. Green sea turtle

Leatherback Sea Turtle (Dermochelys coriacea)

Leatherback turtles are widely distributed, migrating across the Atlantic and Pacific oceans. They are the largest species of turtle, with a length between four and six feet, and have thick, leathery skin with tiny bone plates in the place of a hard shell or scales (Figure 21). They can weigh up to 1,000 pounds. Leatherback turtles feed on jelly fish because they have more delicate jaws than other turtles.

Nesting season in the United States lasts from March through July. The female will leave the water to lay eggs in a large pit that they dig on a beach. They nest multiple times a season laying approximately 100 eggs each time. Hatchlings incubate for approximately two months before they leave the nest. Females return to nesting sites every 2 to 3 years.

Figure 21. Leatherback sea turtle

Leatherback turtles have been recorded diving to nearly 4,000 feet in depth and can swim up to 10,000 miles a year. All populations are listed as endangered due to harvesting of their eggs on nesting beaches and being accidentally captured in fishing apparatus. Adult and juvenile leatherbacks migrate and forage along the coast between Massachusetts and Virginia from May through November.

Turtle Habitat on SMR

As areas near the shoreline have been developed, protection of infrastructure has been in the forefront and has led to shoreline hardening in many areas (Figure 22). This has led to a dynamically unstable system, where there is a decrease in natural sediment supplied to the beaches and dunes in the City of Virginia Beach, which explains why natural turtle nest sites are rare. The widespread destruction of dunes in the 1930s destabilized the beach face, decreasing habitats required to support nesting grounds (Jones 1998).

In more recent years, beach nourishment projects have been undertaken to stabilize the shoreline, protect infrastructure and recreational uses of the beaches and dunes in and around Virginia Beach (Moffat & Nichol 2017). Beach nourishment has occurred to the south of SMR at the Naval Air Station Oceana – Dam Neck Annex (NASO-DNA) in 2013, with the placement of 700,000 cy of sand along the shoreline. The City of Virginia Beach contracted Moffat & Nichol to conduct a "*Croatan Beach Shoreline Protection Assessment*" in 2017 which included conceptual plans for future beach nourishment. Beach nourishment activities ensure that there is enough sediment in the system to maintain the existing beaches and dunes, thereby protecting habitat for the sea turtles and other species.

Figure 22. Intertidal beach along the oceanfront.

Several factors may prohibit loggerhead, Kemp's ridley and green sea turtle nesting on the beaches of SMR: 1) the nesting season (summer) coincides with popular tourist season, and the beachfront is actively used by beachgoers during this timeframe; 2) the beachfront is relatively short (ca. 1,200 feet), and immediately adjacent to a heavily populated region of Virginia Beach (Croatan) to the north; and, 3) the most appropriate location for nest sites is

within the sheltered foredune area (Jones 1998), which is inaccessible along the northern half of the beach due to exclusion fencing at the base of the dune, which was put in place to protect the dunes from pedestrian and vehicle traffic.

Sea turtle management efforts currently underway include daily patrols from May through August; nest management, including relocation of nests and lighting inspections. Management efforts are discussed in more detail in Section 5.3.

4.3.6.4 Fish

Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus)

The Atlantic sturgeon Chesapeake Bay Distinct Populations Segment has been designated federally endangered by the USFWS. Atlantic sturgeon are large, with a span of up to 14 feet and can weigh up to 800 pounds. They are identified by the five rows of scutes running along the body and four barbels that project from their mouths.

The Atlantic sturgeon spends most of its lifecycle in marine environments but spawns in freshwater rivers of the Chesapeake Bay region from April to June every three to five years. They migrate and forage along the Atlantic coast all year. Juveniles remain in freshwater for up to six years before moving into the open waters of the Bay. All of the Chesapeake Bay's large rivers once supported spawning populations however Atlantic sturgeon eggs were collected for sale as caviar in the late 1800s and this caused a collapse of the fishery. Today all five U.S. populations are listed as endangered or threatened. Any potential activities within the Atlantic Ocean should follow Virginia's time of year restriction (TOYR) in order to avoid any potential impacts to this species.

Shortnose sturgeon (Acipenser brevirostrum)

Shortnose sturgeon is extremely rare and federally listed as Endangered since 1967. They have a span of upto 4.5 feet and can weigh up to 60 pounds. They also have five rows of scutes running along the body which lend the appearance of body armor. They remain in the lower reaches of spawning rivers with low-salinity for most of the year, only moving to the open waters of the Chesapeake Bay in winter. They migrate and forage along the Atlantic coast from April through November, staying close to shore. Spawning occurs from April to May in the mid-atlantic in fast-flowing freshwater, where the shortnose sturgeon lays eggs on rocky bottom substrates. Two weeks after hatching, juveniles are carried downstream to the lower reaches of large streams to join adults.

Primary threats to the shortnose sturgeon include water withdrawals, habitat degradation and habitat impediments such as dams. Some populations have been trapped behind dams.

SECTION 5: NATURAL RESOURCE PROGRAM MANAGEMENT

5.1 INTRODUCTION

The purpose of this section is to present the natural resources program structure at SMR and discuss management issues as well as concerns. The goals and objectives for each program are listed here, and the projects proposed to reach them are included in the Resource programs at SMR are discussed below and include the following:

- Fish and Wildlife Management
- Rare, Threatened and Endangered Species and Habitat Management
- Water Quality Management
- Wetland Conservation
- Grounds Maintenance
- Pollinator Habitat
- Forest Management
- Integrated Pest Management
- Outdoor Recreation
- Coastal Zone Management
- Public Outreach

5.2 FISH AND WILDLIFE MANAGEMENT

Goals and objectives:

Goal: Manage game and non-game species and their habitats to maintain biodiversity.

Objective: Minimize the impacts of military training.

Objective: Maintain an inventory of all species that exist on the installation, wildlife habitat management, biodiversity, and recreational fishing.

Objective: Conserve habitat, through protection, restoration and enhancement.

Objective: Outreach to the public should be considered where appropriate.

Program Description

The Fish and Wildlife Management Program addresses issues related to the management of game and non-game species and their habitats, as well as biodiversity. This program is geared mostly toward maintaining an inventory of all species that exist on the installation, wildlife habitat management, biodiversity, and recreational fishing. Information collected from flora and fauna inventories will be used to create programs for wildlife management, habitat protection, and biodiversity. Although hunting, fishing, and trapping activities are

allowed on military lands within the guidelines established in AR 200-1, hunting and trapping are not allowed at SMR due to size constraints and the limited resources available to support such activities. Therefore, no game harvest management program is currently in operation at SMR. Fishing in Lake Christine is allowed for military personnel and associated persons on a limited basis with a valid Freshwater Fishing License from the VDGIF and is administered under authority of the installation commander.

Program Status and Description

Training Operations

SMR will continue to focus training efforts in non-sensitive habitats, including fields, developed areas, and upland forests. The extent of maintained areas not required for training operations will be minimized. Where practicable, this will include a reduction in the amount of area currently mowed along the forest perimeter in all forest management units. Areas removed from the regular maintenance schedule should be allowed to revegetate naturally.

Wildlife Surveys

A monitoring program will be established at fixed-point monitoring stations stratified within the existing wildlife habitat zones on the base. The goal of the program will be to document wildlife species currently utilizing the base.

An updated mammal survey is currently being completed (2019). A seasonal survey of flora and fauna found on SMR was last completed in 2013. Although the relatively small size of the installation and the on-base and adjacent land uses limit the diversity of native fauna, the presence of SMR as an open space in the highly-urbanized setting of Virginia Beach underscores the importance of monitoring wildlife populations to direct future land use decisions.

Turtle and Marine Mammal Monitoring

Seasonal monitoring of the beachfront and dune system will be conducted for sea turtle nests and stranded marine mammals. Turtle monitoring is described in detail in Section 5.3. and additional information is located in Appendix G.

The potential for marine mammals to be stranded on the beach exists. These recommendations apply to any stranded marine mammal that appears to be injured, disoriented, or dead:

- The Installation Commander will immediately contact the NMFS Regional Stranding Coordinator in the event of a live or dead marine mammal stranding at the Installation. The NMFS Regional Stranding Coordinator for the Greater Atlantic Region, including Virginia, is Mendy Garron, who can be reached at (978) 282-8478, or Sara McNulty (978) 281-9351.
- In addition, the Northeast Region Stranding Network Marine Mammal and Sea Turtle Stranding and Entanglement Hotline will be contacted at (866) 755-6622. The members of this network are authorized by federal law to respond to marine mammal and sea turtle strandings. The Virginia Aquarium and Marine Science Center responds to most strandings in the vicinity of SMR and should be contacted

immediately in the case of a stranding. The Virginia Marine Resources Commission contact information has been provided as an alternate contact, if necessary.

Virginia Aquarium and Marine Science Center
Virginia Beach, VA
(757) 385-7575 (dead)
(757) 385-7576 (alive)

Virginia Marine Resources Commission
Newport News, VA
(757) 247-2200

- Monitor the animal from a safe distance. Remain a minimum of 100 yards (274 m) from the stranded animal. Crowding the animal is unsafe for the observer as well as the animal. Do not touch the animal, alive or dead, as wild animals can carry many diseases, parasites, and bacteria, some of which can be transmitted to humans. Do not attempt to push the animal back into the water and if it goes back into the water on its own, do not attempt to follow after or swim with it.
- Carefully observe the animal. Observe the position of the alive or dead animal and monitor its breathing. Wait for responders from NMFS and or the Northeast Stranding Network to arrive and direct them to the animal. Relay all observations to the responders so that they can provide the best possible care for the stranded mammal or sea turtle.

To report a stranded marine animal to the Virginia Aquarium's Stranding Response Team, call (757) 385-7575 (dead animals) or (757) 385-7576 (alive animals). These lines are open 24 hours a day. More information is available on the Virginia Aquarium website: http://www.virginiaaquarium.com/research-conservation/pages/report-a-stranding.aspx.

Fish

Fish surveys will be conducted in Lake Christine to determine the effect of allowable fishing effort on this minor recreational fishery. Consultation with USFWS and VDGIF is encouraged to maintain consistency with federal and state management objectives.

Migratory Birds

The conservation of migratory birds will be managed through the implementation of conservation measures, as feasible, to ensure management of military lands is carried out in a manner that benefits migratory birds and so impacts to migratory birds are minimal. Bird species will be surveyed during larger mammal surveys, however SMR does not have a stand-alone bird monitoring program. NASO-DNA has monitoring projects on beaches just to the south of SMR. NASO-DNA monitoring projects include annual bird monitoring studies to develop a comprehensive list of observed bird species, and a checklist of potentially occurring bird species, both of which would be applicable to SMR.

The 2013 CMI survey results consisted entirely of migratory birds protected under the MBTA, with the exception of the European starling. European starlings are one of the few avian species which are not protected under the MBTA that can be controlled without permits from the USFWS. A list of bird species found on SMR in 2013 is located in Appendix E in Table E-3.

The DoD program "Partners in Flight" provides lists of species of concern included within a group of priority lists in different regions, as well as guidance on integrating bird conservation strategies into INRMPs. The common nighthawk, prothonotary warbler, sandwich tern, worm-eating warbler and semipalmated plover have been identified on SMR and are all listed as species of conservation concern in the region. The common nighthawk, prothonotary warbler, sandwich tern and semipalmated plover breed on base during the spring and summer and the worm-eating warbler passes through while migrating in the fall. These five species will be given priority for monitoring.

The VAARNG takes the following important steps in avian management on SMR:

1. Inventories and monitoring of migratory bird species and populations on the installation, with a focus on birds of conservation concern.
2. Conserving habitat, through protection, restoration and enhancement. This includes:
    a. Protection and restoration of wetlands (Section 5.5).
    b. Maintenance and restoration of other habitats, such as wooded areas (Section 5.7) and the dunes.
    c. Vegetation clearing will be minimized during the spring to early summer in order to avoid impacts to nesting birds.
    d. Invasive species control (see Section 5.8)
3. Outreach to the public should be considered where appropriate, such as on Earth Day, through the creation of checklists of bird species present on the installation, displays, educational handouts and outdoor recreation opportunities if possible.
4. Avian monitoring efforts will comply with the requirements listed in the *Coordinated Bird Monitoring: Technical Recommendations for Military Lands* report created by the United States Geological Service (USGS) with partner organizations in 2010 (Appendix F).

5.3 RARE, THREATENED AND ENDANGERED SPECIES HABITAT MANAGEMENT

Goals and Objectives:

Goal: Promote the continued existence of federal and/or state rare species and the potential utilization of site resources by threatened or endangered species.

Objective: Maintain habitat for potential utilization by rare species.

Objective: Monitor species on a regular basis to ensure that any rare species are identified and protected.

Program Description

The Threatened and Endangered Species Program focuses on the protection and management of federal and state protected areas and species. These include federally-listed endangered and threatened species and state species of special concern. Currently,

there are no plans for mission changes or development projects that would be expected to impact rare species or habitat.

Program Status and Issues

No federal and only one state threatened, or endangered plant or animal species is thought to occur on SMR. The state endangered little brown bat was acoustically detected on SMR in 2016.

To promote the continued existence of state rare species and/or the potential utilization of site resources by threatened or endangered species potential habitat will be maintained and species will be monitored to ensure prompt identification of rare species.

Northern Long-Eared Bat (NLEB)

The NLEB has been identified as potentially being present on SMR. On April 2, 2015, the USFWS listed the NLEB as threatened throughout its range under the ESA. The final 4(d) rule (81 Federal Register 1900-1922), was issued on January 14, 2016 and became effective February 16, 2016. At the same time, an Intra-Service Programmatic Biological Opinion on the issuance of the final 4(d) rule was released that provides a mechanism for achieving section 7 compliance for many Federal actions. The final 4(d) rule prohibits incidental take within a hibernaculum and as the result of tree removal within 0.25 miles of a known hibernaculum, or within 150 feet of a known occupied maternity roost tree between June 1 and July 31.

Due to the potential presence of the NLEB in the summer months within many forested areas in Virginia, there are two options to be in compliance with the ESA with regards to NLEB.

1. Implement a time of year restriction (TOYR) of tree removal within the April 15 through September 15 timeframe or a survey for the NLEB that has negative results will allow streamlined consultation with the USFWS. The TOYR will also benefit migratory birds and other declining bat species.
2. Implement the formal programmatic biological opinion for the final 4(d) rule when option 1 is not possible.

Per the VDGIF NLEB maps, the nearest recorded maternity roosting area to the installation is nine miles to the southwest. Implementation of these guidelines will also offer protection to the state endangered tri-colored and little brown bats.

Migratory Birds

Piping plovers breed along the east coast of the United States, from Maine to Virginia and are present from mid-April until mid to late August. In Virginia, nesting piping plovers are most prevalent on the barrier islands of the eastern shore. They nest above the high water mark in areas with sparse vegetation. A TOYR exists from March 15 through August 31 and TOYR ends when last brood fledges, which is determined during most recent monitoring activity. This TOYR also applies to all beach-nesting birds as a group.

The red knot arrives in the Mid-Atlantic in mid-May and is gone by the first week in June. If present, they will most likely be foraging for food in tidal flats.

The roseate tern passes through Virginia in the fall on their migration the Caribbean and the northern portion of South America.

Sea Turtles

The potential exists for the stranding and nesting of federally threatened and endangered turtle species on SMR. With the beachfront and dunes on SMR, there is habitat for the Hawksbill Sea Turtle, Kemp's Ridley Sea Turtle, Loggerhead Sea Turtle, Green Sea Turtle, and Leatherback Sea Turtle. In October of 2016 the USFWS issued a biological opinion on sea turtle management efforts at the NASO-DNA and VAARNG – SMR (CP). The conclusion states that:

> "The proposed and ongoing sea turtle management is anticipated to benefit stranded and nesting sea turtles and sea turtle nests vs. conducting training and recreational activities at NASO-DNA and VAARNG-CP without such a program in place."

Sea turtle management efforts include:

1. Staff from SMR will conduct sea turtle patrols in conjunction with Natural Resources staff from Naval Air Station Oceana - Dam Neck Annex (NASO-DNA) staff daily from May through August. Patrols will monitor for crawling sea turtles, stranded sea turtles and potential nests. If sea turtle nests are located, the 2016 Sea Turtle Nesting Communication Plan will be followed (see Appendix G).
2. Nest management, including relocation of nests. Decisions are made by the VAARNG Natural Resources Manager in consultation with USFWS, VDGIF and Virginia Aquarium Stranding Team (VAST) and follow the guidelines in the *Virginia Sea Turtle Nesting Handbook* (VDGIF 2015). A copy of the handbook is included in Appendix G.
3. Lighting inspections are conducted by SMR staff per the protocol included in Appendix G in order to control the negative effects that lighting can have on sea turtles by locating and identifying the owner of a light source in order to modify or turn it off.

The sea turtle management guidelines are included in Appendix G.

Fish

With regards to the Atlantic sturgeon and the short-nose sturgeon, while they do not spawn in the Atlantic Ocean, any potential VAARNG activities offshore, such as fishing and boating, should be monitored in order to avoid any potential impacts to these species, such as accidental catch or vessel stikes.

5.4 WATER QUALITY MANAGEMENT

Goals and objectives

Goal: Maintain and protect Lake Christine as an asset to SMR and the surrounding community.

Objective: Protect surface waters from pollution as required under the CWA.

Objective: Ensure that the water quality in surface waters is maintained.

Objective: Enhance the potential of Lake Christine as a recreational resource for the VAARNG.

Program Description

The Water Quality Management Program for SMR deals with surface water quality and stormwater issues at the installation, including ponds and oceanfront areas that are on the property. Water quality is managed to ensure compliance with the CWA requirements and is enforced by the VAARNG Natural Resources Program Manager under authority of installation command. As described in Section 5.13, DEQ has oversight of non-point source pollution control through stormwater management and erosion and sedimaent control regulations, as well as point source pollution control through Virginia Pollutant Discharge Elimination System (VPDES) and Virginia Pollution Abatement (VPA) permit regulations.

Program Status and Issues

VAARNG funded construction projects are currently underway which include improvements to the stormwater management on SMR through dredging of the lake with the approval of adjoining property owners and three BMP retrofits on SMR which will treat stormwater before it enters Lake Christine.

Alligatorweed has become a water quality issue at SMR. It is a particularly aggressive aquatic plant which will readily spread and take over areas of shallow water. In 2010, the Natural Resources Program Manager began annual treatment of alligatorweed, duckweed, and pondweed using approved herbicides in Lake Christine in cooperation with the Croatan development to the north. The project is funded by the VAARNG and implemented with permission from adjoining property owners.

5.5 WETLAND CONSERVATION

Goals and objectives

Goal: Protect and enhance wetlands.

Objective: Ensure compliance with federal and state wetland regulations.

Objective: Enhance wetlands through restoration activities.

Program Description

The focus of the Wetland Management program is to protect and enhance wetlands and to ensure compliance with federal and state wetland regulations. In addition, wetland inventories, monitoring, limited restoration, and compliance issues are addressed under this program. The non-tidal waters of the United States, including wetlands, found throughout the site are regulated by the federal government under Section 404 of the Clean Water Act. The U.S. Army Corps of Engineers administers this program locally and has the responsibility of enforcing compliance with wetland regulations (33 CFR Part 320 et seq.). Virginia's non-tidal

wetland program is coordinated by the DEQ under authority of Section 401 of the Clean Water Act and applicable state law. In addition, activities within tidal wetlands are reviewed by the Corps, DEQ, and the VMRC under Title 28.2 of the Code of Virginia.

Program Status and Issues

Wetland areas on SMR are maintained through invasive species monitoring and removal projects and monitored to ensure that no unauthorized activities occur. No additional restrictions have been placed on the wetlands, as they are generally located in tclose proximity to Lake Christine and are not impacted by training.

5.6 POLLINATOR HABITAT

Goals and Objectives

Goal: Protect, create and maintain pollinator habitat.

Objective: Manage lands to increase pollinator habitat where possible.

Program Description

The health of the pollinator population has been declining in recent years and poses a threat to agriculture and the diversity of ecosystems. Increasing pollinator habitat will be integrated with existing programs.

Program Status and Issues

Grounds maintenance is required to use native plants in landscaping. When replacing existing or creating new landscaped areas the plants chosen will be ecologically appropriate and well-adapted to the region. When buffers are established, native plants that create pollinator habitat will be incorporated.

5.7 FOREST MANAGEMENT

Goals and Objectives:

Goal: Maintain biological diversity in forested systems.

Objective: Maintain forest areas through monitoring, surveys and the exclusion of specific uses.

Program Description

The Forest Management Program addresses military training needs, forest protection and reforestation. The Forest Management Program at SMR does not include the management of commercial timber resources, as the forested areas are generally located within the wetland areas.

Program Status and Issues

In accordance with AR 200.1, a forest management plan is not required for installations containing less than 100 acres of commercial forestland. Less than 100 acres of SMR is forested and the timber in these areas is not currently merchantable. The Department of the

Army's policy to maintain, restore, and manage its forested lands on an ecosystem basis still applies to SMR. The forested areas will be monitored and surveyed annually, and vehicular traffic will be excluded.

5.8 INTEGRATED PEST MANAGEMENT PROGRAM

Goals and Objectives

Goal: Reduce pest populations through use of an integrated combination of techniques.

Objective: Identify, prioritize, monitor, and control invasive and noxious species and feral animals on the installation whenever feasible.

Program Description

The Integrated Pest Management Program (IPMP) at SMR is performed by the Grounds Maintenance Program and covers all areas of the installation. This program focuses on preventative control of invasive and exotic species which, if left unchecked, could alter the natural habitat and biodiversity of the installation.

Program Status and Issues

Routine pesticide applications are conducted during maintenance of firing ranges, maneuver trails, rights of way, and other facilities on SMR in accordance with the Integrated Pest Management Plan (2017). Such pesticide applications are performed to control various species of vegetation to maintain line of site to the targets on firing ranges; maintain maneuver trails; control vegetation along right of ways; maintain access to lakes and ponds; and control unwanted vegetation in permitted storm water management basins in accordance with the Integrated Training Area Management (ITAM) Plan and the needs of the training mission. The applications must be performed by a licensed pesticide applicator in the appropriate class for the type of work being performed. The installation's ITAM and DPW will coordinate such actions with the Integrated Pest Management Coordinator and report all applications with a Pesticide Use Form. Non-standard applications of pesticides, to include aerial applications, applications around wetlands or into surface waters, use of restricted use chemistries, large herbicide applications over one acre, or projects that may affect an endangered species will require NEPA analysis and consultation with the USFWS. All aerial pesticide applications must be approved by the NGB Pest Consultant with an Aerial Spray Statement of Need in addition to NEPA analysis.

Pest management practices at SMR typically involve routine treatment for termites on the buildings located within the cantonment area, annual control for alligatorweed, duckweed, and pondweed in Lake Christine, minor spraying for weeds, and control of nuisance wildlife (see Section 5.3.5 for more information).

Invasive and exotic plant species control may entail herbicide applications. Any such programs will be consistent with *The Virginia Army National Guard Integrated Pest Management Plan Field Guide 2018* (Appendix H), as well as *Memorandum, ARNG-ILE, 04*

February 2016, subject: Integrated Pest Management Program Policy, AR 200-1, Chapter 5 and DoD Instruction 4150.7.

5.9 OUTDOOR RECREATION

Goals and Objectives

Goal: Allow the use of SMR for natural resources-based activities in a manner that does not interfere with mission activities.

Objective: Encourage outdoor recreation for military personnel and associated persons.

Program Description

The focus of the Outdoor Recreation Program is to allow the use of SMR for natural resources-based activities in a manner that does not interfere with mission activities. Increasing outdoor recreation activities provides quality of life benefits to military personnel and their families and guests, which ultimately support military recruiting objectives. In addition, participation in these activities tends to increase natural resources awareness and foster good stewardship of the land.

Program Status and Issues

The recreational program supports installation readiness by providing a variety of community, soldier, and family activities. Morale, welfare, and recreation at SMR focuses on waterfront recreation at the Lake Christine shoreline and the Atlantic Ocean beachfront.

Public access is restricted at SMR. Civilians must obtain permission to access the beachfront from SMR property. This type of access is usually restricted to guests of military personnel. SMR leases about 600 feet of beachfront to the City of Virginia Beach for visitors to access the beachfront via the Croatan parking facilities to the north. Access is prohibited between Labor Day and Memorial Day due to potential safety and training mission conflicts associated with the live firing range adjacent to the beach.

Fishing in Lake Christine is allowed for military personnel and associated persons on a limited basis with a valid Freshwater Fishing License from the VDGIF. The recreational activities at SMR pose little threat to the maintenance of functioning ecosystems on the base. Access to the beachfront is "channeled" through a narrow gap in the dunes, thus focusing foot traffic away from the vegetated portions of the primary and secondary dune systems. Further, recreational vehicular traffic is prohibited along the beachfront and in the dune-swale system.

Because recreational access to the beach might inhibit sea turtle nesting habitat, personnel are encouraged to keep a vigilant watch for turtle activity.

5.10 COASTAL ZONE MANAGEMENT

Goals and Objectives

Goal: Consistency with the CZM Program.

Objective: Compliance with provisions and permit requirements under enforceable laws, regulations, and advisory policies.

Objective: Identify and implement sound natural resources strategies that provide benefits to the ecosystem.

Program Description

The Coastal Zone Management Program focuses on resources that are unique to the coastal geographic setting at SMR. Included within this management program are shoreline resources (beach and dune/swale complex), and various physiographic and soil attributes related to the base's close proximity to the Atlantic Ocean.

SMR is located entirely within the coastal zone of Virginia, as established in the Commonwealth's Coastal Zone Management Act (CZMA). Activities conducted within the coastal zone are required to be consistent with the provisions established in the CZMA. Virginia's CZM Program, established under CZMA is a network of state agencies and local governments. Consistency with the CZM Program is based on compliance with provisions and permit requirements under enforceable laws, regulations, and advisory policies. The enforceable regulatory programs comprising CZM Program include regulations for the management of coastal lands, fisheries, subaqueous lands, wetlands, coastal primary sand dunes, point and non-point source pollution, shoreline sanitation, and air pollution. Consistency is based upon obtaining all applicable permits required by law. VAARNG in cooperation with other federal and state agencies (referenced in Section 5.12 below), enforces all applicable rules and regulations.

SMR is not within the Chesapeake Bay watershed and is not subject to requirements under the Chesapeake Bay Preservation Act.

Program Status

All projects are reviewed to ensure compliance with CZM regulations. Beaches and dunes are seasonally monitored, and the dunes will be maintained through a planting and enhancement plan. The Atlantic shoreline will be monitored to ensure all resources are protected.

5.11 PUBLIC OUTREACH

Goals and Objectives

Goal: Increase the public's awareness of environmental programs on SMR.

Objective: Educate the public through informational publications, presentations and encouraging public participation in special events.

Program Description

The Public Outreach Program is designed to improve the land user's and public's understanding of the impacts of mission training and other activities on the environment. This program not only targets units, leaders, soldiers, and installation staff, but also children from local organizations and schools.

Program Status and Issues

SMR has an ongoing Environmental Awareness Program that operates within the installation and has expanded to include local school children and the general public.

The purpose of the Environmental Awareness Program is to make soldiers and employees that train or use VAARNG lands or facilities aware of how training and normal operating activities have the potential to impact our environmental resources. The State Environmental Office within Joint Forces Headquarters (JFHQ), located at MTC Fort Pickett, worked together to produce environmental awareness training materials used to train soldiers and employees of the VAARNG and the VDMA. These are supplemented by additional material supplied by the NGB. These training materials help implement and maintain the Environmental Management System (EMS) to ensure continuity of environmental protection while maintaining mission readiness supported by the Adjutant General's Environmental Policy Statement. SMR partners with other branches of the military such as the U.S. Navy, Dam Neck to promote environmental stewardship and protection of our natural and cultural resources.

5.12 CLIMATE CHANGE

Goals and Objectives

Goal: Undertake adaptation and resilience planning in order to incorporate potential climate change impacts in future plans and projects.

Objective: Develop potential alternatives that may be used to address the physical impacts of climate change to both existing infrastructure and the natural environment.

Program Description

The VAARNG understands that there is a potential for climate change, on a local level, to impact the ability of the military to sustain the training of soldiers. Any adverse change to the vegetation of the training area could impact the training areas, promoting noxious weed infestations, or compromising wildlife habitat, such as loss of roosting sites supporting migratory birds. Sea level rise will affect the beach and dunes, which would also affect migratory birds, as well as sea turtles. VAARNG will support the development of a vulnerability assessment to better understand the potential impacts related to a changing climate.

Program Status and Issues

The Naval Facilities Engineering Command (NAVFAC) released the "Climate Change Planning Handbook Installation Adaptation and Resilience" in January of 2017 (Leidos, 2017). This handbook is being utilized by NASO-DNA facility to plan for climate change impacts. The handbook provides guidance on the preparation of installation plans which identify and

rank action alternatives that may be used to deal with different aspects of climate change, especially sea level rise. SMR will utilize the handbook to inform future planning and project decision making. The VAARNG will identify and implement sound natural resources strategies that provide benefits to the ecosystem, regardless of how climate changes occur.

5.13 ENFORCEMENT

Goals and Objectives

Goal: Enforce applicable natural resource laws and regulations which are critical to the successful implementation of ecosystem management.

Objective: Maintain compliance with all required environmental regulations.

There are four core environmental areas requiring enforcement by different parties on SMR which are listed in Table 7 below. Enforcement of each area is included as management tasks within the appropriate management section listed in Appendix B.

Table 7. Areas of enforcement and responsibility at SMR

AREA	RESPONSIBILITY
Federal Threatened and Endangered Species	The NGVA-FMO-ENV is the installation entity responsible for the enforcement of compliance with the ESA. If an action occurs, that potentially affects a species protected under the ESA; personnel with the NGVA-FMO-ENV will investigate the occurrence. If the action appears to have negatively impacted the species in question, the NGVA-FMO-ENV will officially report the incident to the appropriate regulatory agencies.
Wetland/Section 404 Regulations	The NGVA-FMO-ENV is responsible for the adherence to and enforcement of jurisdictional wetland regulations and permits. If a potential violation occurs or a permit is required, NGVA-FMO-ENV will inform in writing the appropriate personnel with the USACE.
Water Quality	The enforcement of water quality regulations is the responsibility of the NGVA-FMO-ENV. This enforcement includes spill responses and erosion control related to forestry, facilities, Department of Public Works (NGVA-MTC-PW), and Departments of Training and Security (NGVA-MTC-OP) by both military and civilian personnel.
Fish and Wildlife	There is no hunting on SMR. At SMR fishing regulations adhere to all Commonwealth of Virginia regulations. VDGIF is responsible for enforcement of the fishing regulations. In addition, VDGIF and USFWS are involved in sea turtle management activities.

Various state and federal agencies have oversight of the listed environmental areas and are listed, along with the applicable state and federal code and/or regulation. VAARNG in cooperation with other federal and state agencies (referenced below), enforces all applicable rules and regulations.

1539 **Table 8: Applicable Regulations.**

Resource	Agency	Applicable Law
Waters of the U.S. Tidal and Non-Tidal Wetlands	USACE	33 U.S.C. §403 33 U.S.C. §1344 33 U.S.C. §1413
Threatened and Endangered Species	USFWS/NMFS DGIF VDACS (plants and insects)	16 U.S.C. 1530-1544 §29.1-563 thru 570 of the Code of Virginia §3.2- 1000 thru 1011 of the Code of Virginia
CZM Programs:		
Fisheries	1. VDGIF 2. VMRC	§29.1-100 thru 29.1-570 of the Code of Virginia §28.2-200 thru 28.2-713 of the Code of Virginia
Subaqueous lands	VMRC	§28.2-1200 *et seq.* Code of Virginia
Tidal Wetlands	1.VMRC 2.City of Virginia Beach Wetlands Board	§28.2-1300 *et seq.* Code of Virginia Sections 1400 thru 1418 of the Zoning Ordinance City of Virginia Beach
Coastal Primary Sand Dunes and Beaches	1.VMRC 2.City of Virginia Beach Wetlands Board	§28.2-1400 *et seq.* Code of Virginia Sections 1600 thru 1419 of the Zoning Ordinance City of Virginia Beach
Non-tidal Wetlands	DEQ	§62.1-44.15:20 *et seq.* Code of Virginia

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SECTION 6: IMPLEMENTATION

The natural resources management goals for SMR were formulated from a number of components. A comprehensive analysis of regulatory requirements and a review of the current condition of the natural resources on the installation were completed. The value of these resources to the people who live and work on the installations and the surrounding community was considered, as well as NGB approval and funding opportunities and restrictions.

Each INRMP goal is supported by objectives that outline the strategy that will be used to achieve a stated goal. An objective supports a written goal by proclaiming more specifically the management actions that must occur to accomplish each goal. As a final step, the INRMP goals and objectives are put into action by formulating and implementing specific projects. Projects are the "steps" for achieving each objective. The goals and objectives become management targets that will allow for quantitatively tracking the progress towards implementation of the INRMP. The *Natural Resource Management Project List for State Military Reserve FY 2019- 2023* in Appendix B lists all of the proposed projects on SMR by program area with projected dates for completion.

6.1 FUNDING

The natural resources program receives funding through the implementation of the Status Tool for the Environmental Program (STEP). The VAARNG funding priorities are listed in the *Natural Resource Management Project List for State Military Reserve FY 2019- 2023* spreadsheet in Appendix B. Additional funding can be secured through grants from outside agencies such as the USFWS and through partnerships with other federal agencies or localities.

6.1.1 Status Tool for the Environmental Program (STEP)

The STEP was developed to support the project management functions of the State Environmental Offices as well as the resource responsibilities of the Environmental Division of the National Guard Bureau (NGB-ARE). The STEP tool includes the functionalities listed below.

- Facilitate State Project Identification
- Single electronic repository for environmental documents
- NGB-ARE Review/Validation of environmentally funded projects and NEPA
- Develop Environmental State Operating Budgets (ESOB)
- Determine appropriate distribution of funds to support must fund requirements across all 54 States and Territories
- List Unfunded Requirements

- Support accurate reimbursement through the Master Cooperative Agreement Appendix 2
- Ensure adherence to DA policy eligibility for environmental funding
- Provide analysis of budgeting and execution

6.1.2 STEP Tool Importance

Developing requirements for projects managed by the environmental branch is extremely important. Projects must be documented early and completely in STEP according to current policies to request and defending funds to manage and sustain the ARNG environmental program. Funds provided to the ARNG must be defended in the programming and budget processes; the quality of STEP projects impacts the degree of integrity the ARNG maintains with the DA, DoD and Congress.

The data maintained in STEP is used by NGB-ARE to support the functions listed below:

- Cooperative Agreement Appendix 2 submissions for accurate reimbursement
- Distribution of funds to support critical must funds between all 54 States and Territories
- Adherence to DA policy on what is eligible for environmental funding
- Analysis of execution to ensure that POM requirements are accurate

6.1.3 Operations and Maintenance Environmental Funds

Environmental funds are a special category of Operations and Maintenance (O&M) funds and are controlled by the STEP budget process. They are special in that they are restricted by the DOD solely for environmental purposes, but they are still subject to restrictions of O&M funds. Compliance with appropriate laws and regulations is the key to securing environmental funding. The program heavily favors funding high priority projects with a goal of achieving compliance with federal or state laws, especially if non-compliances are backed by Notices of Violation or other enforcement agency action.

Army National Guard (ARNG) is the primary source of funding that supports the management of natural resources. Environmental funds typically can be used for core natural resources activities and projects and guidance is provided in funding documents issued yearly. DoDI 4715.03 also describes activities and projects that may be funded with Environmental funds. Projects paid for with environmental funds should be submitted through the STEP maintained by the ARNG I&E.

In addition to Environmental funds, Installation and ITAM funds can be used to implement INRMP activities and projects. Installation funds support facilities operation and maintenance, including facility planning, maintenance of roads, vegetation management, wildfire management, pest management, construction, and master planning. All activities have an impact on natural resources. Installation funds can also be used for pest and noxious weed control, invasive species control, facilities vegetation control, and controlled burns to manage

vegetation and fuels on training areas and ranges. ITAM funds can be used for monitoring, maintenance of trails, vegetation restoration, land management, and water quality improvements related directly to military training.

The following natural resources management areas can be addressed with multiple funding sources:

- Erosion control,
- invasive species management, and
- wildland fire.

However, the type of funding used for these management areas depends on purpose. Current guidance should be referred to annually to determine the most appropriate source of funding for a specific activity or project.

6.2 IMPLEMENTATION SCHEDULE

The INRMP must be updated no later than five years from the initial approval. In addition, yearly reviews and updates must take place. The project implementation schedule for the FY2019-2023 INRMP is included as Appendix B.

6.3 COORDINATION WITH OUTSIDE ORGANIZATIONS

In many instances, implementation of natural resource management actions must be coordinated with outside government and non-government organizations. This section will discuss procedures through which this coordination will take place. In general, when there is an issue regarding natural resource management that requires coordination with outside organizations, the appropriate SMR administrator will either initiate the contact or designate personnel to do so.

Updates to the INRMP on a yearly and five-year basis must be completed with USFWS and VDGIF consultation.

The following management areas also require to some degree coordination with outside agencies:

- Federal and State Threatened and Endangered Species;
- Wetlands Management and Compliance;
- Fish and Game Management; and
- Stormwater, Erosion and Sediment Control.

6.3.1 Federally Threatened and Endangered Species

All federally threatened and endangered species management issues occurring on SMR are coordinated with the USFWS and NOAA NMFS.

6.3.2 Wetlands/Section 404 Compliance

Permits for the draining or filling of jurisdictional wetlands are obtained through the USACE. NGVA-FMO-ENV coordinates the request for permits with the USACE. Coordination often must also occur with DEQ and the VMRC.

6.3.3 Fish and Wildlife Management

The management of fish and wildlife resources at SMR requires coordination with the VDGIF and the USFWS. A MoU exists between the DoD and the USFWS to promote the conservation of migratory birds (Appendix F). The USFWS has also published a Biological Opinion (BO) with regards to sea turtle management on NASO-DNA and SMR that includes certain management requirements (Appendix G).

VDGIF is responsible for enforcement of state fish and game regulations on base with the exception of the shoreline area which is governed by agreements with U.S. Department of the Navy (Navy) NASO-DNA and the Virginia Aquarium Stranding Response Program for sea turtle management.

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APPENDIX A: ENVIRONMENTAL ASSESSMENT

APPENDIX B: NATURAL RESOURCE PROJECT LIST FOR STATE MILITARY RESERVE FY 2019- 2023

Goals and Objectives	Management Task	Responsible Entities	Funding Priority	Cycle	Years	INRMP Sections
	Updates to INRMP	Natural Resources Manager	3	Every 5 Years	2023	
1	**FISH AND WILDLIFE MANAGEMENT**					5.2
	Continue to focus training efforts in non-sensitive habitats, including fields, developed areas, and upland forests.	Natural Resources Manager	3	As Needed	2019, 2020, 2021, 2022, 2023	
	Minimize the extent of maintained areas not required for training operations. Where practicable, this will include a reduction in the amount of area currently mowed along the forest perimeter in all forest management units. Areas removed from the regular maintenance schedule should be allowed to revegetate naturally.		3	Every 3 Years		
	Undertake a monitoring program established at fixed-point monitoring stations stratified within the existing wildlife habitat zones on the base. The goal of the program will be to document wildlife species currently utilizing the base.		3	Every 5 Years		
	Conduct seasonal monitoring of the beachfront and dune system for stranded marine mammals. Coordinate efforts with USFWS to determine practicable alternatives for nest relocation (to BBNWR, for example) if applicable.		1	Annually	2019, 2020, 2021, 2022, 2023	
	Conduct fish surveys to determine the effect of allowable fishing effort on this minor recreational fishery. Consultation with USFWS and VDGIF is encouraged to maintain consistency with federal and state management objectives.		3	Every 5 Years		
	Inventory and monitor migratory bird species and populations on the installation, with a focus on birds of conservation concern.		1	Annually	2019, 2020, 2021, 2022, 2023	
	Manage the conservation of migratory birds – implement conservation measures, as feasible, to ensure management of military lands is carried out in a manner that benefits migratory birds and so impacts to migratory birds are minimal.		N/A	Continuous	2019, 2020, 2021, 2022, 2023	
	Coordinate with VDGIF to ensure Commonwealth of Virginia fishing regulations are being adhered to.		N/A	Continuous	2019, 2020, 2021, 2022, 2023	
2	**RARE, THREATENED AND ENDANGERED SPECIES HABITAT MANAGEMENT**					5.3
	Prohibit foot and vehicular traffic of any kind on sand dunes throughout the year.	Natural Resources Manager	N/A	Continuous	2019, 2020, 2021, 2022, 2023	
	Prohibit vehicular access to the beachfront from dusk until dawn during the months of May through August to maintain potential breeding habitat for sea turtles.		N/A	Continuous	2019, 2020, 2021, 2022, 2023	
	In conjunction with Naval Air Station Oceana - Dam Neck Annex (NASO-DNA)conduct daily monitoring of the beachfront and dune system for turtle nests and stranded turtles during the months of May through August. Follow the sea turtle communication protocol. Nest management activities will be conducted in accordance with the 2015 VDGIF Virginia Sea Turtle Nesting Handbook.		N/A	Annually May - October	2019, 2020, 2021, 2022, 2023	
	Lighting inspections are conducted to control the negative effects that lighting can have on sea turtles by locating and identifying the owner of a light source in order to modify or turn it off.		N/A	Annually May - October	2019, 2020, 2021, 2022, 2023	
	Conduct planning level survey's (PLS) every 5 years on the installation for threatened, endangered, or state rare species. Specific species surveys may be required at other times. Coordinate surveys with the Virginia Department of Conservation and Recreation Division of Natural Heritage and the U.S. Fish and Wildlife Service.		1	Every 5 Years	2018, 2022	
3	**WATER QUALITY MANAGEMENT AND WETLAND CONSERVATION**					5.4, 5.5
	Prohibit the discharge of dredge or fill material in waters of the United States, including wetlands, unless such prohibition is determined to be in direct conflict with the military mission.	Natural Resources Manager	N/A	As Needed	2019, 2020, 2021, 2022, 2023	
	Meet all Federal and State permitting requirements for any impacts to wetlands.		N/A	As Needed	2019, 2020, 2021, 2022, 2023	

	Monitor jurisdictional waters of the United States, including wetlands, on an annual basis to determine the extent of unauthorized activities, if any, including the discharge of dredge or fill material and/or training impacts.	Natural Resources Manager	1	As Needed	2019, 2020, 2021, 2022, 2023	
	Continue seasonal water quality monitoring using established sampling techniques and equipment for macro nutrients, dissolved oxygen, temperature, stratification, bacteria and sedimentation.		3	As Needed	2019, 2020, 2021, 2022, 2023	
	Minimize the use of pesticides near surface water features, and implement integrated pest management strategies.		2	Annually	2019, 2020, 2021, 2022, 2023	
	Re-establish the natural riparian buffer along the edges of Lake Christine to increase water quality and species habitat area while also decreasing pest species and allowing for the military mission of the installation to continue.		3	As Needed	2019, 2020, 2021, 2022, 2023	
	Monitor invasive aquatic weeds and algae April through October and use pesticides if needed to prevent further encroachment of these species throughout Lake Christine. Minimize the use of these chemicals near surface water features, and implement integrated pest management strategies where practicable.		1	Annually	2019, 2020, 2021, 2022, 2023	
	Continue partnering with the regional stakeholders in the area such as the natural resources staff at the U.S. Navy Dam Neck installation, the City of VA Beach Public Works and Environmental Planning Offices, USFWS, and the private citizens of the Croatan development to reduce and control the spread of invasive species of plants on State Military Reserve and throughout the region.		N/A	Continuous	2019, 2020, 2021, 2022, 2023	
4	**POLLINATOR HABITAT**					5.7
	Protect, create and maintain pollinator habitat.	DPW	N/A	N/A	2019, 2020, 2021, 2022, 2023	
5	**FOREST MANAGEMENT**					5.8
	On an annual basis, monitor forested areas for training impacts that could reduce vegetative diversity in the understory and/or woody overstory.	Natural Resources Manager	N/A	Annually	2019, 2020, 2021, 2022, 2023	
	Maintain off-road vehicular traffic exclusions in forested areas.		N/A	Continuous	2019, 2020, 2021, 2022, 2023	
	Conduct annual tree surveys to monitor stand density, tree health, and invasive or pest species.		N/A	Annually	2019, 2020, 2021, 2022, 2023	
6	**INTEGRATED PEST MANAGEMENT**					5.9
	Continue control measures for invasive species.	Natural Resources Manager	DPW	Annually	2019, 2020, 2021, 2022, 2023	
	Mapping and Monitoring the Effectiveness of Control Measures for Non-Native Species.	Natural Resources Manager	1	Annually	2019, 2020, 2021, 2022, 2023	
7	**OUTDOOR RECREATION**					5.10
	Provide a variety of outdoor activities.	DPW	N/A	Annually	2019, 2020, 2021, 2022, 2023	
8	**COASTAL ZONE MANAGEMENT**					5.11
	Review all projects to ensure compliance.	Natural Resources Manager	1	As Needed	2019, 2020, 2021, 2022, 2023	
	Beach / Dune Seasonal Monitoring		1	Annually	2019, 2020, 2021, 2022, 2023	
	Monitor Shoreline/ Routine Security Checks of Shoreline		N/A	Annually	2019, 2020, 2021, 2022, 2023	
	Implement the Dune/Swale Planting/Enhancement Plan		N/A	Annually	2019, 2020, 2021, 2022, 2023	
9	**PUBLIC OUTREACH**					5.12
	Institute an Environmental Education Program.	Natural ResourcesManager	N/A	As Needed	2019, 2020, 2021, 2022, 2023	

APPENDIX C: CORRESPONDENCE

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. Ken Oristaglio
Natural Resources Program Manager
MTC Fort Pickett
10th Street, Building 316, Environmental
Blackstone, VA 23824

Re: Integrated Natural Resources Management Plan, Virginia Army National Guard, State Military Preserve, Virginia Beach; Plan 2019-2024

Dear Mr. Oristaglio:

Thank you for the opportunity to review your Draft 2019-2023 Integrated Natural Resources Management Plan (INRMP) for the Virginia Air National Guard's, State Military Preserve (SMR), located immediately north of the US Navy's Dam Neck Military Installation in the City of Virginia Beach, Virginia.

The INRMP has been prepared in accordance with the Sikes Act (as amended through P.L. 113-291, enacted December 19, 2014) with guidance from the Department of Defense (DoD) Instruction 4715.3. The purpose of the plan is to guide the integration of natural resources and training requirements, allowing the Virginia Air National Guard (VAANG) and SMR to fulfill the military mission while conserving and protecting valuable natural resources.

While we appreciate the invitation to be a cooperating and signatory agency to this document, our role and degree of involvement in INRMPs is dependent on existing staff and fiscal resources and our contribution to the process is typically limited to participating in meetings to review the INRMP and provide comments regarding our trust resources as appropriate. We do not have the staff resources available to participate at a higher level of involvement for INRMPs prepared for all DoD installations located in the Hampton Roads area and Commonwealth of Virginia as our staff and resources are fully committed to obligatory programs of NOAA Fisheries. However, we will participate in the INRMP process as resources allow, and will continue to provide technical information identifying aquatic species and habitats of concern, identification of issues to be considered and evaluated during the development of the INRMP and guidance on evaluating, avoiding, and minimizing project effects to our trust resources.

Please note that our involvement in the INRMP review process does not constitute our mutual agreement concerning the conservation, protection or management of terrestrial species and habitats for which we have no expertise, nor does it obviate the need for consultations required under the Magnuson-Stevens Fishery Conservation and Management Act, Fish and Wildlife Coordination Act, and the Endangered Species Act (ESA) for activities or projects you authorize, fund or undertake with the potential to adversely affect our trust resources. We look forward to our continued working relationship in the future. If you have any questions regarding this

matter, please contact David O'Brien (804-684-7828, david.l.obrien@noaa.gov) in our Virginia Field Office for information regarding essential fish habitat and other trust resources, or Brian Hopper (410-573-4592, brian.d.hopper @noaa.gov) regarding threatened and endangered species listed by us under the ESA.

Sincerely,

Louis A. Chiarella
Assistant Regional Administrator
for Habitat Conservation

cc: A. Forestier, STANTEC

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
OFFICE OF THE ADJUTANT GENERAL OF VIRGINIA
VIRGINIA NATIONAL GUARD
BUILDING 316, FORT PICKETT
BLACKSTONE, VIRGINIA 23824-6316

REPLY TO
ATTENTION OF

NGVA-FMO-ENV

20 Jun 2017

MEMORANDUM FOR RECORD

SUBJECT: Intergovernmental and Intergovernmental Coordination of Environmental Planning in support of Camp Pendleton's Integrated Natural Resources Management Plan Update and Environmental Assessment

1. Tribal consultation was initiated via formal letter submitted by the Virginia Army National Guard (VaARNG) to seven federally recognized tribes and ten state recognized tribes, recorded as having cultural affiliation and interest with the land area now comprising Camp Pendleton, on 2 May 2017. In accordance with the National Historic Preservation Act and the National Environmental Policy Act, the VaARNG notified the tribes of the preparation of an Integrated Natural Resources Management Plan for Camp Pendleton and initiated government-to-government consultation to solicit comments and/or requests for further information.

2. The tribes contacted are:

Federally recognized tribes:

Catawba Indian Nation
Cayuga Nation of Indians
Cayuga Nation Unity Council
Cherokee Nation (of Oklahoma)
Eastern Band of Cherokee Indians
Pamunkey Tribe
Tuscarora Nation (of New York)
United Keetoowah Band of Cherokee Indians in Oklahoma

State recognized tribes/tribal agencies:

Cheroenhaka (Nottoway) Indian Tribe
Chickahominy Indian Tribe
Chickahominy Indians – Eastern Division
Mattaponi Indian Tribe
Monacan Indian Nation
Nansemond Indian Tribe
Nottoway Indian Tribe of Virginia, Inc.
Patawomeck Indians of Virginia
Rappahannock Tribe
Upper Mattaponi Indian Tribe

3. The VaARNG received six responses:

a. The Cherokee Nation, United Keetoowah Band of Cherokee Indians in Oklahoma, Cheroenhaka (Nottoway) Indian Tribe, Monacan Indian Nation, Nansemond Indian Tribe, and the Rappahannock Tribe responded to the letter sent on 2 May 2017.

b. No additional tribes responded to follow up emails and telephone calls made on 31 May 2017 and 14 Jun 2017 to all tribes from which a response to the initial letter was not received.

4. Ms. Elizabeth Toombs of the Cherokee Nation emailed on 19 May 2017 to report that the tribe did not believe that the project would impact any of their cultural resources. She requested that the VaARNG consult further with the Cherokee Nation if additional cultural resources are identified in association with this project. On 31 May 2017, Mr. Dean Branham of the Monacan Nation emailed to report that implementing the INRMP would not adversely impact their cultural resources. He requested that the VaARNG contact the Monacan Nation if any artifacts or human remains are discovered during the project. On 14 Jun 2017, Mr. Walt Brown, III, of the Cheroenhaka (Nottoway) Indian Tribe emailed to report that the Tribe had no concerns regarding this project. On 14 Jun 2017, Mr. Lee Lockamy of the Nansemond Indian Tribe emailed to report that the Tribe had no concerns regarding this project. In all instances, Mrs. Susan Smead, the Cultural Resources Program Manager, confirmed to these tribes that the VaARNG will follow the *Standard Operating Procedure (SOP) for Inadvertent Discovery of Cultural Materials*, included in the *Integrated Cultural Resources Management Plan (ICRMP) for Facilities of the Virginia Army National Guard, Fiscal Years 2014-2018.* Representatives from both the United Keetoowah Band of Cherokee Indians in Oklahoma and the Rappahannock Tribe emailed on 31 May 2017 and 1 Jun 2017 to decline further consultation on this project.

5. Point of contact for this action is Susan Smead at 434-298-6411 or susan.e.smead.nfg@mail.mil.

CHARLTON T. DUNN
COL, EN, VaARNG
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and Management

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April 12, 2017

Ms. Valerie Fulcher
Department of Environmental Quality
Office of Environmental Impact Review
P.O. Box 1105
Richmond, VA 23218

Re: **Coastal Zone Management Act Consistency Certification -**Camp Pendleton State Military Reserve: Updated Integrated Natural Resource Management Plan, City of Virginia Beach, Virginia
Applicant: Virginia Department of Military Affairs

Stantec Project #203400748

Dear Ms. Fulcher:

On behalf of the applicant, Stantec Consulting Services Inc. (Stantec) submitted an Integrated Natural Resource Management Plan (INRMP) for Camp Pendleton State Military Reserve (SMR) in the City of Virginia Beach, Virginia. The project will and, as such, a Consistency Certification has been prepared to show that the project complies with and will be conducted in a manner that is consistent with the Virginia Coastal Zone Management Program. For your review, and a brief project description is provided below.

The Proposed Action consists of the implementation of the State Military Reserve (SMR) Camp Pendleton Integrated Natural Resources Management Plan (INRMP) which covers fiscal year (FY) 2017 through 2021). Various federal laws, Department of Defense (DoD) directives, and Army regulations require the preparation of an INRMP for Camp Pendleton. In accordance with Army policy, the Camp Pendleton INRMP will ensure that no net loss of natural or cultural resources will occur while maintaining the capability of military installation lands to support the military mission of Camp Pendleton. The Camp Pendleton INRMP will serve as the principal management plan governing all natural resource activities on the installation. Information on the potential impacts that environmental management activities may have on cultural resources at Camp Pendleton is also included in the INRMP and management guidance is provided. Army policy states that all installations must incorporate ecosystem management into their natural resources management strategy; the Camp Pendleton INRMP is the vehicle to implement this policy.

An Environmental Assessment is included as Appendix A of the INRMP and was prepared in accordance with the NEPA, ARNG NEPA Handbook (2011), regulations published by the Council on Environmental Quality (40CFR 1500-1508), and 32 CFR 651, Environmental Analysis of Army Actions (29 March 2002). The EA evaluates direct, indirect effects, and cumulative effects of implementing the proposed Camp Pendleton INRMP.

Reference: **Coastal Zone Management Act Consistency Certification -** Camp Pendleton State Military Reserve: Integrated Natural Resource Management Plan, City of Virginia Beach, Virginia

Based upon the following information, data, and analysis, the Virginia Army Reserve National Guard (VAARNG) finds that the implementation of the Camp Pendleton INRMP is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Zone Management Program.

The enclosed certification provides the Commonwealth of Virginia with Camp Pendleton's Consistency Certification and the necessary data and information under Coastal Zone Management Act (CZMA) §307(c)(3)(A) and 15 Code of Federal Regulations (See Appendix B – CZMA Consistency Certification). Additionally, a copy of the INRMP submittal is enclosed for your reference (See Appendix C – INRMP). If you have any questions or require additional information in order to issue the Commonwealth's concurrence, please advise me at your earliest convenience, mark.mcelroy@stantec.com or 757-220-6869.

Regards,

Stantec Consulting Services, Inc.

Mark McElroy
Senior Project Manager
Phone: 757-220-6869
Fax: 757-229-4507
mark.mcelroy@stantec.com

Attachments: Appendix A-CZMA Coastal Consistency Certification
Appendix B-Location and Vicinity Maps
Appendix C-Draft Update INRMP 2017-2021

cc. Mr. Kenneth Oristaglio, Natural Resources Program Manager

APPENDIX A:
CZMA COASTAL CONSISTENCY CERTIFICATION

BASIS OF DETERMINATION

The following provides the Commonwealth of Virginia with the necessary data and information under the Coastal Zone Management Act (CZMA) Section 307(c)(1) and (2), 16 U.S.C. § 1456(c)(1) and (2), and 15 CFR Part 930(C), for concurrence that the complies with the enforceable policies of the Virginia Coastal Zone Management Program (VCP).

ENFORCEABLE POLICIES COMPRISING VIRGINIA'S COASTAL ZONE MANAGEMENT PROGRAM

1. ***Fisheries Management****. The program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities. This program is administered by the Virginia Marine Resources Commission (VMRC) (Virginia Code §28.2-200 through §28.2-713) and the Department of Game and Inland Fisheries (DGIF) (Virginia Code §29.1-100 through §29.1-570). The VMRC, DGIF and Virginia Department of Agriculture and Consumer Services (VDACS) share enforcement responsibilities for the State Tributyltin (TBT) Regulatory Program (Virginia Code §3.1-249.59 through §3.1-249.62). This program monitors boating activities and boat painting activities to ensure compliance with TBT regulations.*

   The implementation of the INRMP and the associated EA would have a significant positive effect as well as minor negative impacts on the water resources present at State Military Reserve. Management strategies are discussed in the State Military Reserve INRMP EA, 4.3 Water Resources. The Proposed Action will not have a negative impact on fisheries management resources.

2. ***Subaqueous Lands Management.*** *The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by DEQ's Water Division. The program is administered by the VMRC (Virginia Code §28.2-1200 through §28.2-1213).*

   Proposed Action will have no foreseeable impact on subaqueous resources. The State Military Reserve Vision Plan (2012) included the waterfront area along the Atlantic Ocean within the natural resources and recreation area. Figure 3 of the INRMP depicts State Military Reserve land use per the 2012 Vision Plan.

3. ***Wetlands Management****. The purpose of the wetlands management program is to preserve tidal wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation. The tidal wetlands program is administered by the VMRC (Virginia Code §28.2-1301 through §28.2-1320). The Virginia Water Protection Permit program administered by the DEQ includes protection of wetlands --both tidal and non-tidal. This program is authorized by Virginia Code §62.1-44.15.5 and the Water Quality Certification requirements of §401 of the Clean Water Act of 1972.*

The Proposed Action promotes the preservation of existing wetlands on State Military Reserve. Please refer to INRMP Sections 4.6 and 6.5.

4. ***Dunes Management.*** *Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission (Virginia Code §28.2-1400 through §28.2-1420).*

   The Proposed Action would promote dune preservation through the implementation of a Coastal Zone Management Program that should reduce dune erosion at State Military Reserve, resulting in a beneficial impact to the dunes at State Military Reserve. For further information, please see Section 6.11 and the proposed maintenance and enhancement projects included in Section 7.3 in the INRMP.

5. ***Non-point Source Pollution Control***. *Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by DEQ (Virginia Code §62.1-44.15:51 et seq.).*

   The Proposed Action will not cause non-point source pollution. The INRMP ensures adequate erosion and sedimentation controls are in place during minor land disturbance activities associated with grounds maintenance, as discussed in Section 6.6. In addition, a Water Quality Management Plan for Lake Christine was completed in 2013 and includes additional measures to decrease runoff, as described in Section 6.4. The Proposed Action will conform to both the Erosion and Sediment Control Law (62.1-44.15:51 et seq. of the Code of Virginia) and the Stormwater Management Act (§ 62.1-44.15:24. *et seq*. of the Code of Virginia).

6. ***Point Source Pollution Control***. *The point source program is administered by the State Water Control Board pursuant to Virginia Code §62.1-44.15. Point source pollution control is accomplished through the implementation of the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to §402 of the federal Clean Water Act and administered in Virginia as the VPDES permit program. The Water Quality Certification requirements of §401 of the Clean Water Act of 1972 is administered under the Virginia Water Protection Permit program.*

   The Proposed Action is not expected to produce any point source pollution. The implementation of the INRMP would not cause new discharge or point source pollution.

7. ***Shoreline Sanitation***. *The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth. This program is administered by the Department of Health (Virginia Code §32.1-164 through §32.1-165).*

   The Proposed Action does not involve the construction of any septic systems. Therefore, the project will not affect shoreline sanitation.

8. ***Air Pollution Control***. *The program implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (Virginia Code §10.1-1300 through 10.1-1320).*

   The Proposed Action is not expected to create significant adverse impacts to air resources. Prescribed burning does not take place on this installation.

9. ***Coastal Lands Management***. *A state-local cooperative program administered by DEQ's Water Division and 84 localities that regulates activities in Chesapeake Bay Resource Management Areas and Resource Protection Areas in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act (Virginia Code § 62.1-44.15:67 through 62.1-44.15:79) and Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Administrative Code 9 VAC 25-830-10 et seq.).*

   The Proposed Action will have no impact on coastal lands management. State Military Reserve is not within the Chesapeake Bay watershed and is therefore not subject to requirements under the Chesapeake Bay Preservation Act.

ADVISORY POLICIES OF VIRGINIA'S COASTAL ZONE MANAGEMENT PROGRAM

Advisory Policies for Geographic Areas of Particular Concern

Although not required for the purposes of consistency, in accordance with 15 C.F.R. § 930.39 (c), the federal agency should consider the advisory policies (recommendations) of the Virginia Coastal Resources Management Program as well.

- ***Coastal Natural Resource Areas***. *These areas are vital to estuarine and marine ecosystems and/or are of great importance to areas immediately inland of the shoreline. Such areas receive special attention from the Commonwealth because of their conservation, recreational, ecological, and aesthetic values. These areas are worthy of special consideration in any planning or resources management process and include the following resources: a) Wetlands; b) Aquatic Spawning, Nursery, and Feeding Grounds; c) Coastal Primary Sand Dunes; d) Barrier Islands; e) Significant Wildlife Habitat Areas; f) Public Recreation Areas; g) Sand and Gravel Resources; and h) Underwater Historic Sites.*

  The Proposed Action would promote dune preservation through the implementation of a Coastal Zone Management Program that should reduce dune erosion at State Military Reserve, resulting in a beneficial impact to the dunes at State Military Reserve. With regards to recreational use, seasonal monitoring of the beach and the dunes will ensure that any sensitive flora and fauna are not negatively impacted by activity along the beachfront. Public access to the beach is restricted at State Military Reserve. For further information, please see Section 6.11 and Section 7.3 in the INRMP.

- ***Coastal Natural Hazard Areas***. *The policy covers areas vulnerable to continuing and severe erosion and areas susceptible to potential damage from wind, tidal and storm-related events including flooding. New buildings and other structures should be designed and sited to minimize the potential for property damage due to storms or shoreline erosion. The areas of concern are as follows: a) Highly Erodible Areas; and b) Coastal High Hazard Areas, including flood plains.*

  The Proposed Action does not propose any structures within the floodplain.

- ***Waterfront Development Areas***. *These areas are vital to the Commonwealth because of the limited number of areas suitable for waterfront activities. The areas of concern are as follows: a) Commercial Ports; b) Commercial Fishing Piers; and c) Community Waterfronts.*

  The Proposed Action includes the goal of providing additional outdoor recreational activities for military personnel and their visitors. Due to security requirements, public access to the beach is restricted at State Military Reserve.

Advisory Policies for Shorefront Access Planning and Protection

1. ***Virginia Public Beaches***- *Approximately 25 miles of public beaches are located in the cities, counties, and towns of Virginia exclusive of public beaches on state and federal land. These public shoreline areas will be maintained to allow public access to recreational resources.*

   There are no public beaches within the project limits. Based on the location, the Proposed Action is not expected to have a negative impact on public beaches and their accessibility.

2. ***Virginia Outdoors Plan***- *Planning for coastal access is provided by the Department of Conservation and Recreation in cooperation with other state and local government agencies. The Virginia Outdoors Plan (VOP), which is published by the Department, identifies recreational facilities in the Commonwealth that provide recreational access. The VOP also serves to identify future needs of the Commonwealth in relation to the provision of recreational opportunities and shoreline access. Prior to initiating any project, consideration should be given to the proximity of the project site to recreational resources identified in the VOP.*

   State Military Reserve is located on State owned property. Historic resources exist on the base and are listed as VDHR 134-0413: Camp Pendleton-National Guard Training Site, Camp Pendleton/ State Military Reservation Historic District (NRHP Listing). The Proposed Action will not affect cultural resources. A separate "Integrated Cultural Resources Management Plan (ICRMP) for Facilities of the Virginia Army National Guard, Fiscal Years 2014-2018," has previously been approved and is designed to support the military mission by meeting the legal compliance requirements of federal historic preservation laws and regulations in a manner consistent with the sound principles of cultural resources stewardship. For further information, please see Section 6.12 in the INRMP.

3. ***Parks, Natural Areas, and Wildlife Management Areas-*** *Parks, Wildlife Management Areas, and Natural Areas are provided for the recreational pleasure of the citizens of the Commonwealth and the nation by local, state, and federal agencies. The recreational values of these areas should be protected and maintained.*

   State Military Reserve is located on State owned property. The Proposed Action should have positive effects on the maintenance of environmental features. Access is limited due to the security requirements of maintaining and achieving the military mission.

4. ***Waterfront Recreational Land Acquisition-*** *It is the policy of the Commonwealth to protect areas, properties, lands, or any estate or interest therein, of scenic beauty, recreational utility, historical interest, or unusual features which may be acquired, preserved, and maintained for the citizens of the Commonwealth.*

   State Military Reserve is located on State owned property. The Proposed Action should have positive effects on the maintenance of environmental features including the shoreline and dunes along the waterfront.

5. ***Waterfront Recreational Facilities****- This policy applies to the provision of boat ramps, public landings, and bridges which provide water access to the citizens of the Commonwealth. These facilities shall be designed, constructed, and maintained to provide points of water access when and where practicable.*

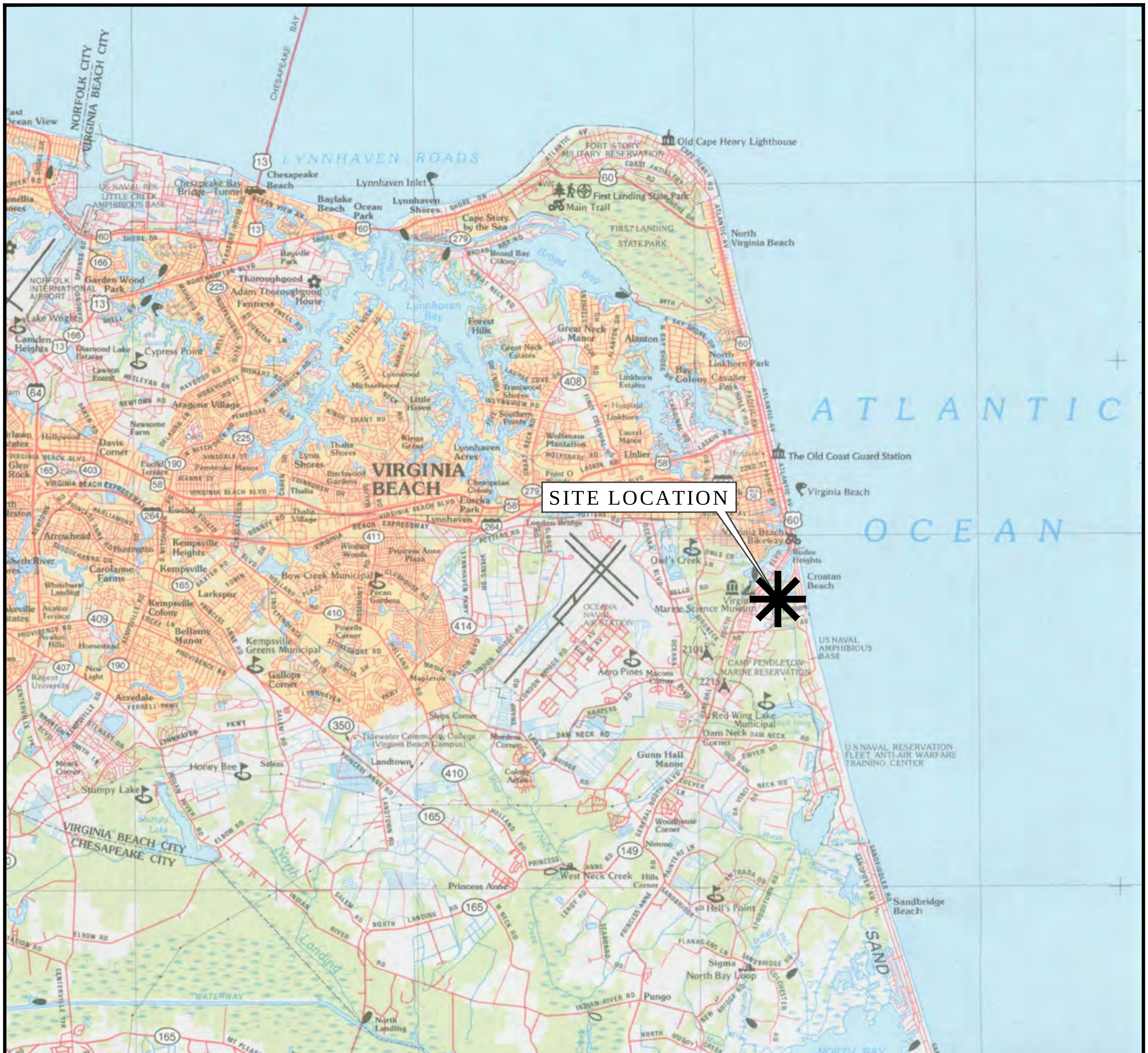
   Boat ramps and public landings are not located within State Military Reserve. Therefore, there will be no impacts to these facilities with the Proposed Action.

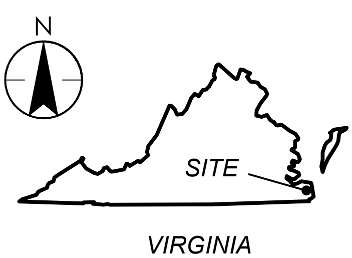
6. ***Waterfront Historical Properties****- The Commonwealth has a long history of settlement and development, and much of that history has involved both shorelines and near-shore areas. The protection and preservation of historic shorefront properties is primarily the responsibility of the Department of Historic Resources (DHR). Buildings, structures, and sites of historical, architectural, and/or archaeological interest are significant resources for the citizens of the Commonwealth. It is the policy of the Commonwealth and the VCRMP to enhance the protection of buildings, structures, and sites of historical, architectural, and archaeological significance from damage or destruction when practicable.*

   State Military Reserve is located on State owned property. Historic resources exist on the base and are listed as VDHR 134-0413: Camp Pendleton-National Guard Training Site, Camp Pendleton/ State Military Reservation Historic District (NRHP Listing). The Proposed Action will not affect cultural resources. A separate "Integrated Cultural Resources Management Plan (ICRMP) for Facilities of the Virginia Army National Guard, Fiscal Years 2014-2018," has previously been approved and is designed to support the military mission by meeting the legal compliance requirements of federal historic preservation laws and regulations in a manner

consistent with the sound principles of cultural resources stewardship. For further information, please see Section 6.12 in the INRMP.

APPENDIX B:
LOCATION AND VICINITY MAP





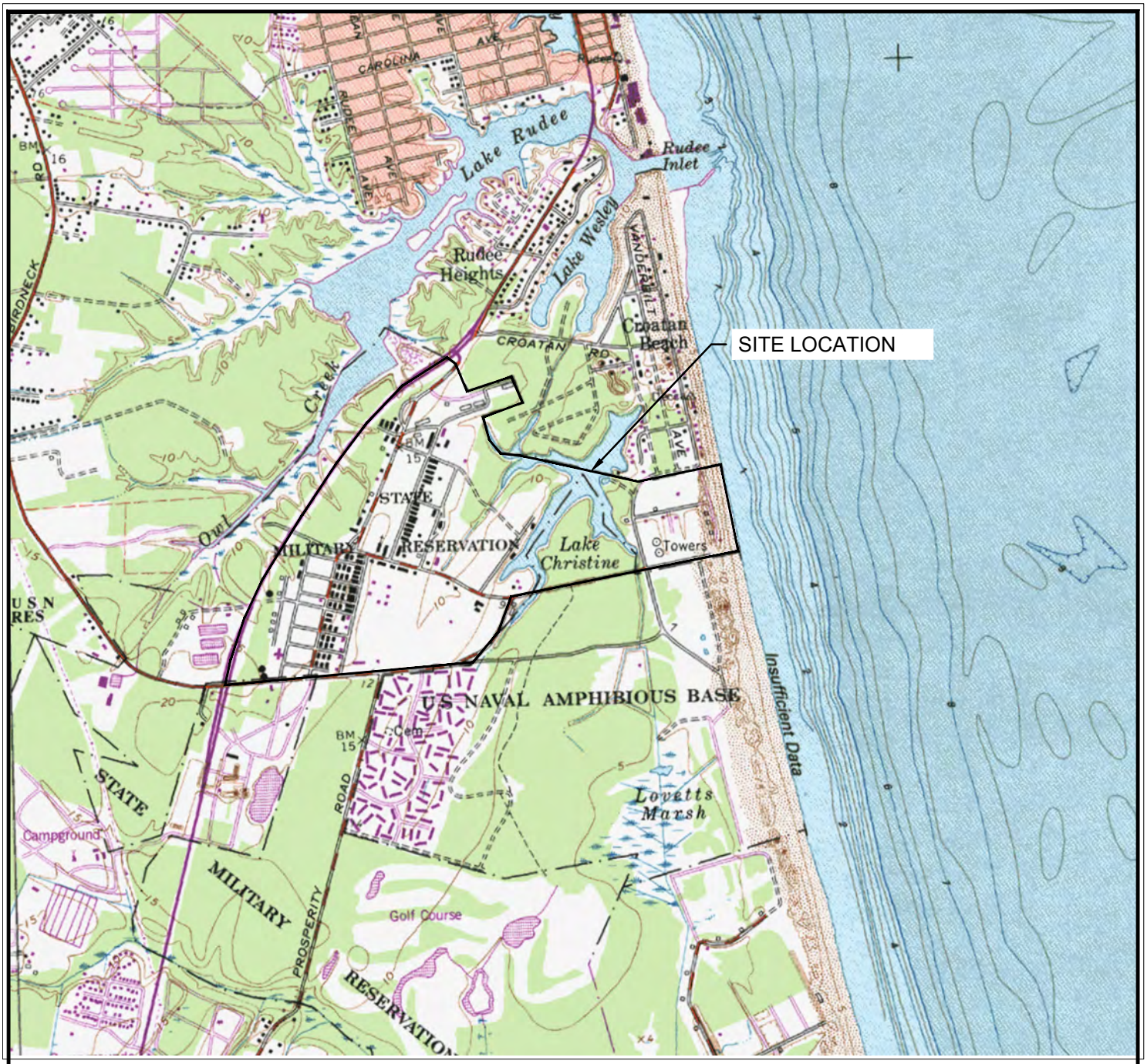
1.2 0 1.2 2.4 3.6 4.8 6 7.2 8.4

SCALE IN MILE

SOURCE: VA. ATLAS & GAZETEER & DELORME MAPPING CO., 1995.

Stantec	FOR: STATE MILITARY RESERVE EA AND INRMP VIRGINIA BEACH, VA		SITE VICINITY MAP		FIGURE: 1
5209 Center Street Williamsburg, VA 23188 PHONE: (757) 220-6869 FAX: (757) 229-4507	JOB NUMBER: 203400748	DRAWN BY: MGS	CHECKED BY: PAW	APPROVED BY: CRR	DATE: 03/09/2017

FILEPATH:U:\203400748\05_report_deliv\drawings_design\cad_fig\00748_locvic.dwg|pweser|Mar 09, 2017 at 9:37|Layout: SITE VICINITY MAP



LATITUDE: 36°49'05.14"N
LONGITUDE: 75°58'11.43"W
SOURCE: USGS 7.5 MINUTE QUADRANGLE VIRGINIA BEACH, VA 1965, Rev 1989

Stantec
5209 Center Street
Williamsburg, VA 23188
PHONE: (757) 220-6869 FAX: (757) 229-4507

FOR:			FIGURE:
STATE MILITARY RESERVE EA AND INRMP VIRGINIA BEACH, VA		SITE LOCATION MAP	2
JOB NUMBER: 203400748	DRAWN BY: MGS	CHECKED BY: PAW	APPROVED BY: CRR	DATE: 03/09/2017

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APPENDIX A

DETERMINATION OF CONSISTENCY WITH VIRGINIA'S COASTAL RESOURCES MANAGEMENT PROGRAM
STATE MILITARY RESERVE
City of Virginia Beach, Virginia

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Coastal Zone Management Act (CZMA) Consistency Determination

This document provides the Commonwealth of Virginia with the Virginia Army National Guard (VAARNG) Consistency Determination under CZMA section 307(c)(1) [or (2)] and 15 CFR Part 930, subpart C, for the implementation of the State Military Reserve (SMR) Integrated Natural Resources Management Plan (INRMP). The information in this Consistency Determination is provided pursuant to 15 CFR §930.39. This activity includes:

The Proposed Action
The Proposed Action is the implementation of the SMR INRMP for FY 2017-2021. The SMR INRMP is a document designed to integrate all aspects of natural resource management in order to accomplish military training and national environmental objectives. Furthermore, the INRMP also addresses the impact that natural resource management activities have on the cultural resources at SMR and provides management guidance. The philosophical basis of the SMR INRMP is ecosystem management. Army policy states that all installations must incorporate ecosystem management into their natural resources management strategy; the SMR INRMP is the vehicle to implement this policy.

Based upon the following information, data, and analysis, the VAARNG finds that the implementation of the SMR INRMP is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Zone Management Program.

The VAARNG has determined that the implementation of the SMR INRMP affects the land or water uses or natural resources of Virginia in the following manner:

Enforceable policies comprising Virginia's Coastal Zone Management Program:

1) Fisheries Management – The implementation of the INRMP would have a significant positive effect as well as minor negative impacts on the water resources present at SMR. Management strategies are discussed in the SMR INRMP EA, 4.3 Water Resources.

2) Subaqueous Lands Management – Implementation of the INRMP will have no foreseeable impact on subaqueous resources. The project complies with all federal and state regulations. For further illustration, Figure 3 of the INRMP depicts SMR land use per the 2012 Vision Plan.

3) ***Wetlands Management*** – Implementation of the INRMP promote the preservation of existing wetlands on SMR. Please refer to INRMP Sections 3.2 and 4.6.

4) ***Dunes Management*** – *This project* would promote dune preservation that should reduce dune erosion at SMR resulting in a beneficial impact to the dunes at SMR. For further information, please see Section 6.11 in the INRMP.

5) ***Non-point Source Pollution Control*** – The implementation of the INRMP would not cause non-point source pollution. The INRMP ensures adequate erosion and sedimentation controls are in place during minor land disturbance activities associated with grounds maintenance.

6) ***Point Source Pollution Control*** – The implementation of the INRMP would not cause new discharge or point source pollution.

7) ***Shoreline Sanitation*** – Implementation of the INRMP will have no impact on shoreline sanitation.

8) ***Air Pollution Control*** – Implementation of the SMR INRMP is not expected to create significant adverse impacts to air resources. *Air pollution control is not applicable to this project.* Prescribed burning does not take place on this installation.

9) ***Coastal Lands Management*** – The INRMP will have no impact on coastal lands management.

10) Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Administrative Code 4 VAC 50-90-10 *et seq*.) – The INRMP does not include any development activities on property designated a Resource Protection Area as defined by Chesapeake Bay Preservation Area Designation and Management Regulations *(Virginia Administrative Code 9 VAC 25-830-10 et seq*.).

Pursuant to 15 CFR Section 930.41, the Virginia Coastal Zone Management Program has 60 days from the receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under 15 CFR section 930.41(b). Virginia's concurrence will be presumed if its response is not received by the VAARNG on the 60th day from receipt of this determination. The State's response should be sent to:

Kenneth L. Oristaglio, NFG NG VAARNG
Natural Resources Program Manager
MTC Fort Pickett - Environmental
10th Street, Bldg. 316
Office: (434) 298-6416
Cell: (434) 264-4929
Email - Kenneth.l.oristaglionfg@mail.mil

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

June 28, 2017

Mr. Ken Oristaglio
Natural Resources Manager
Virginia Department of Military Affairs - Fort Pickett
MTC 10th Street, Bldg, 316 Environmental
Blackstone, VA 23824

RE: Virginia Department of Military Affairs, Virginia Army Reserve National Guard Draft Environmental Assessment and Federal Consistency Certification: Camp Pendleton Draft Integrated Natural Resources Management Plan (DEQ 17-055F).

Dear Mr. Oristaglio:

The Commonwealth of Virginia has completed its review of the draft Environmental Assessment (EA) and a federal consistency certification (FCC) for the above-referenced project. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. DEQ is also responsible for coordinating state reviews of FCCs submitted under the Coastal Zone Management Act. The following agencies and planning district commission participated in this review:

Department of Environmental Quality
Department of Conservation and Recreation
Department of Health
Department of Historic Resources
Marine Resources Commission
Hampton Roads Planning District Commission

The Department of Game and Inland Fisheries, Department of Forestry and the City of Virginia Beach also were invited to comment on the project.

PROJECT DESCRIPTION

Pursuant to requirements from the U.S. Department of the Army, the Virginia Army Reserve National Guard (VARNG), which is under the Virginia Department of Military Affairs, submitted a FCC and EA for the proposed implementation of the State Military Reserve Camp Pendleton Integrated Natural Resources Management Plan (INRMP) from 2017 through 2021. The implementation of the plan is the preferred alternative that is addressed in the EA and analyzed in the FCC. In accordance with Army policy, the Camp Pendleton INRMP will ensure that no net loss of natural or cultural resources will occur while maintaining the capability of military installation lands to support the military mission of Camp Pendleton. The Camp Pendleton INRMP will serve as the principal management plan governing all natural resource activities on the installation. The FCC states that the implementation of the INRMP would help preserve wetlands and dunes and would not have a negative effect on other resources.

ENVIRONMENTAL IMPACTS AND MITIGATION

1. Wetlands and Water Quality. The EA (page 17) states the preferred alternative would have a significant positive effect as well as minor negative impacts on the water resources present at Camp Pendleton. Management strategies such as: prohibiting the discharge of dredge or fil material in waters of the United States, including wetlands, unless such prohibition is determined to be in direct conflict with the military mission; construction of pre-treatment stormwater management basins at the Croatan and Camp Pendleton sites to trap pollutants prior to entering the lake; installation of aerators on the lake to improve levels of dissolved oxygen during the summer months; and reestablishing the natural riparian buffer along the edges of Lake Christine would allow for an increase in water quality as well as associated habitat biodiversity. Minor negative impacts may occur from pest management (mechanical/physical, biological, and chemical control) through runoff, leaching and/or accidental spill.

1(a) Agency Jurisdiction. The State Water Control Board promulgates Virginia's water regulations, covering a variety of permits to include Virginia Pollutant Discharge Elimination System Permit, Virginia Pollution Abatement Permit, Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit. The VWP Permit is a state permit which governs wetlands, surface water, and surface water withdrawals/impoundments. It also serves as § 401 certification of the federal Clean Water Act § 404 permits for dredge and fill activities in waters of the U.S. The VWP Program is under the Office of Wetlands and Stream Protection (OWSP).Tidal wetlands are regulated by VMRC under the authority of Virginia Code §28.2-1301 through §28.2-1320.

1(b) Agency Findings. The DEQ Tidewater Regional Office (TRO) states that projects involving impacts to surface waters, including wetlands, may require a permit.

1(c) Requirements. A Joint Permit Application (JPA) should be submitted for future projects that propose impacts to surface waters or wetlands. A Virginia Pollutant Discharge Elimination System (VPDES) Pesticide Discharges General Permit (9VAC25-800) may be applicable to the proposed pesticide activities.

1(d) Agency Recommendation. Contact the DEQ TRO to determine if the VPDES Pesticide Discharges General Permit (http://www.deq.virginia .gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/PermitsFees .aspx#pest) is applicable to the proposed activities.

1(e) Conclusion. Provided the project complies with applicable requirements, it would be consistent with the wetlands management enforceable policy of the Virginia CZM Program.

2. Subaqueous Lands. The EA (page 17) does not indicate that the proposed plan will have impacts to subaqueous lands.

2(a) Agency Jurisdiction. The Virginia Marine Resources Commission (VMRC) regulates encroachments in, on or over state-owned subaqueous beds as well as tidal wetlands pursuant to Virginia Code §28.2-1200 through 1400. For nontidal waterways, VMRC states that it has been the policy of the Habitat Management Division to exert jurisdiction only over the beds of perennial streams where the upstream drainage area is 5 square miles or greater. The beds of such waterways are considered public below the ordinary high water line.

2(b) Agency Finding. VMRC states that the plan does not appear to impact any state-owned submerged resources.

2(c) Conclusion. As proposed, the project is consistent with the subaqueous lands management enforceable policy of the Virginia CZM Program.

3. Air Pollution Control. The EA (page 2) states that the implementation of the plan is not expected to affect air quality.

3(a) Agency Jurisdiction. The DEQ Air Division, on behalf of the State Air Pollution Control Board, is responsible for developing regulations that implement Virginia's Air Pollution Control Law (Virginia Code §10.1-1300 et seq.). DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and

federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate DEQ regional office is directly responsible for the issuance of necessary permits to construct and operate all stationary sources in the region as well as monitoring emissions from these sources for compliance. As a part of this mandate, environmental impact reviews (EIRs) of projects to be undertaken in the state are also reviewed. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

The Air Division regulates emissions of air pollutants from industries and facilities and implements programs designed to ensure that Virginia meets national air quality standards. The most common regulations associated with projects are:

- Open burning: 9VAC5-130 et seq.
- Fugitive dust control: 9VAC5-50-60 et seq.
- Permits for fuel-burning equipment: 9VAC5-80-1100 et seq.

3(b) Ozone Attainment Area. According to the DEQ Air Division, the project site is located in an ozone attainment area and an emission control area for volatile organic compounds (VOCs) and oxides of nitrogen (NO_X), which are contributors to ozone pollution.

3(c) Requirements. The plan should ensure that the following requirements are satisfied during land-disturbing projects.

3(c)(i) Fugitive Dust. The plan should ensure that during future land-disturbing activities, fugitive dust is kept to a minimum by using control methods outlined in 9VAC5-50-60 et seq. of the Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, water or suitable chemicals for dust control during the proposed demolition and construction operations and from material stockpiles;
- Install and use of hoods, fans and fabric filters to enclose and vent the handling of dusty materials;
- Cover open equipment for conveying materials; and
- Promptly remove spilled or tracked dirt or other materials from paved streets and dried sediments resulting from soil erosion.

3(c)(ii) Fuel-Burning Equipment. Fuel-burning equipment (generators, compressors, etc.) or any other air-pollution-emitting equipment may be subject to registration or permitting requirements.

3(c)(iii) Open Burning. If project activities change to include the burning of vegetative debris, this activity must meet the requirements under 9VAC5-130 et seq. of the

regulations for open burning, and it may require a permit. The regulations provide for, but do not require, the local adoption of a model ordinance concerning open burning. Contact officials with the locality to determine what local requirements, if any, exist.

3(c)(iv) Asphalt Paving. In accordance with 9VAC5-45-760 et seq., there are limitations on the use of "cut-back" (liquefied asphalt cement, blended with petroleum solvents) that may apply to paving activities associated with the project. The asphalt must be "emulsified" (predominantly cement and water with a small amount of emulsifying agent) except when specified circumstances apply. Moreover, there are time-of-year restrictions on its use during the months of April through October in VOC emission control areas.

3(d) Agency Recommendation. For future land-disturbing projects, the plan should ensure that all necessary precautions taken to restrict the emissions of volatile organic compounds (VOC) and oxides of nitrogen (NOx).

3(e) Conclusion. Provided the project complies with applicable requirements, it would be consistent with the air pollution control enforceable policy of the Virginia CZM Program.

4. Chesapeake Bay Preservation Areas. The EA (page 21) states that Camp Pendleton is not within the Chesapeake Bay watershed and is therefore not subject to requirements under the Chesapeake Bay Preservation Act.

4(a) Agency Jurisdiction. The DEQ Office of Local Government Programs (OLGP) administers the Chesapeake Bay Preservation Act (Virginia Code §62.1-44.15:67 *et seq.*) (Bay Act) and Chesapeake Bay Preservation Area Designation and Management Regulations (9VAC25-830-10 *et seq.*). Each Tidewater locality must adopt a program based on the Chesapeake Bay Preservation Act and the Chesapeake Bay Preservation Area Designation and Management Regulations. The Act and regulations recognize local government responsibility for land use decisions and are designed to establish a framework for compliance without dictating precisely what local programs must look like. Local governments have flexibility to develop water quality preservation programs that reflect unique local characteristics and embody other community goals. Such flexibility also facilitates innovative and creative approaches in achieving program objectives. The regulations address nonpoint source pollution by identifying and protecting certain lands called Chesapeake Bay Preservation Areas. The regulations use a resource-based approach that recognizes differences between various land forms and treats them differently.

4(b) Agency Findings. The DEQ OLGP states that Camp Pendleton is located outside of the City of Virginia Beach's designated Chesapeake Bay Preservation Area because

it is in the Atlantic Ocean drainage basin. As such, there are no Chesapeake Bay Preservation Act requirements relevant to this project.

4(c) Conclusion. As proposed, the project is consistent with the coastal lands management enforceable policy of the Virginia CZM Program.

5. Nonpoint Pollution Control. According to the EA (page 16), the plan ensues that there are adequate erosion and sediment controls in place during any land disturbance associated with ground maintenance.

5(a) Agency Jurisdiction. The DEQ Office of Stormwater Management (OSM) administers the following laws and regulations governing construction activities:

- Virginia Erosion and Sediment Control Law (§ 62.1-44.15:51 et seq.) and Regulations (VESCL&R) (9VAC25-840);
- Virginia Stormwater Management Act (VSMA) (§ 62.1-44.15:24 et seq.);
- Virginia Stormwater Management Program (VSMP) regulation (9VAC25-870); and
- 2014 General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities (9VAC25-880).

In addition, DEQ is responsible for the VSMP General Permit for Stormwater Discharges from Construction Activities related to Municipal Separate Storm Sewer Systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program (9VAC25-890-40).

5(b) Requirements. The plan should protect water resources by ensuring that future land-disturbing projects incorporate appropriate erosion and sediment control and stormwater management requirements.

5(b)(i) Erosion and Sediment Control Project-Specific Plans. If the VARNG has no previously DEQ-approved Annual Standards and Specifications and the project results in a land-disturbing activity of equal to or greater than 10,000 square feet (or local thresholds when they are more stringent than state requirements), the applicant must prepare a project-specific erosion and sediment control (ESC) plan and submit it to DEQ for review and approval. The ESC plan must be approved prior to commencing land-disturbing activity at the project site. All regulated land-disturbing activities associated with the project, including on- and off-site access roads, staging areas, borrow areas, stockpiles, and soil transported from the project site, must be covered by the project-specific ESC plan. The ESC plan must be prepared in accordance with the VESCL and VESCR and the most current version of the *Virginia Erosion and Sediment Control Handbook*.

5(b)(ii) Stormwater Management Project-Specific Plans. For state-agency projects that involve a land-disturbing activity of equal to or greater than one acre and if the state agency has no previously DEQ-approved Annual Standards and Specifications the Applicant must prepare a project-specific stormwater management (SWM) plan for review and approval by DEQ. An approved plan is required prior to initiation of any regulated activities at the project site. The project-specific SWM plan must be prepared in accordance with the VSWML and the VSMP Permit Regulations.

5(b)(iii) General Permit for Stormwater Discharges from Construction Activities (VAR10). The operator or owner of a construction project involving land-disturbing activities equal to or greater than one acre is required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific stormwater pollution prevention plan (SWPPP). The SWPPP must be prepared prior to submission of the registration statement for coverage under the general permit and the SWPPP must address water quality and quantity in accordance with the VSMP Permit Regulations. General information and registration forms for the General Permit are available on DEQ's website at http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/ConstructionGeneralPermit.aspx (Reference: VSWML 62.1-44.15 et seq.; VSMP Permit Regulations 9VAC 25-870-10 et seq.).

5(c) Conclusion. As proposed, the project would be consistent with the nonpoint pollution control enforceable policy of the Virginia CZM Program.

6. Natural Heritage Resources. The EA (page 17) states that implementation of the plan could have a significant positive effect on the flora and fauna present at Camp Pendleton. The programs address issues related to the management of game and non-game species and their habitats, as well as biodiversity; work to prevent invasive species and pest incursions that would reduce habitat and biodiversity on Camp Pendleton; focus on monitoring and maintaining shoreline resources; and promote environmental awareness. The programs will ensure that migratory bird habitat will be conserved and maintained.

6(a) Agency Jurisdiction.

6(a)(i) The Virginia Department of Conservation and Recreation's (DCR) Division of Natural Heritage (DNH): DNH's mission is conserving Virginia's biodiversity through inventory, protection and stewardship. The Virginia Natural Area Preserves Act (Virginia Code §10.1-209 through 217), authorized DCR to maintain a statewide database for conservation planning and project review, protect land for the conservation of biodiversity, and to protect and ecologically manage the natural heritage resources of

Virginia (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

6(a)(ii) The Virginia Department of Agriculture and Consumer Services (VDACS): The Endangered Plant and Insect Species Act of 1979 (Virginia Code Chapter 39 §3.1-1020 through 1030) authorizes VDACS to conserve, protect and manage endangered and threatened species of plants and insects. Under a Memorandum of Agreement established between VDACS and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species.

6(b) Agency Findings – Natural Heritage Resources. According to the information currently in DCR DNH's files, the Camp Pendleton – Dam Neck Dune and Swale Conservation Site is located within the project site. The site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resources of concern at this site are:

- *Cicindela trifasciata*, S-banded tiger beetle, G5/S1/NL/NL
- *Quercus incana*, Bluejack oak, G5/S2/NL/NL

In addition, White-top fleabane (Erigeron vernus, G5/S2/NL/NL), Carolina yellow-eyed grass (Xyris caroliniana, G4G5/S1/NL/NL), Dune marsh-elder (Iva imbricata, G5?/S1/NL/NL), and Glossy-seed yellow stargrass (Hypoxis sessilis, G4/SH/NL/NL) have been historically documented within the project site. Finally, according to the DCR staff botanist, there is the potential for Eupatorium maritimum, G2?/S1/SOC/NL to occur within the property. Contact DCR for additional information about this species. Additional comments are in DCR's attached letter.

6(c) Agency Findings – Threatened and Endangered Plant and Insect Species. DCR states that the current activity will not affect any documented state-listed plants or insects.

6(d) Agency Findings – Natural Area Preserves. There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

6(e) Agency Recommendations. While specific recommendations can only be given after a survey of natural heritage resources has been completed, DCR generally supports the *Draft Update INRMP 2017 – 2021, Section 6: Natural Resource Program Management* ,including management items on page 45 as well as #2 to focus training in non-sensitive habitats, #3 minimize maintained areas, promoting native plant revegetation, monitoring and developing an exotic and invasive species management plan, and #4 managing the conservation of migratory species. DCR also supports 5-year surveys for rare, threatened and endangered species, monitoring beachfront and

dune systems, and restricting access during breeding season for sea turtles (as stated on page 46) and following U.S. Fish and Wildlife Service (FWS) guidelines for northern long-eared bat (pages 46-47), as well as the Grounds Maintenance, Forest Management sections and the Integrated Pest Management Program (pages 49 -52) recommendations.

- Contact DCR DNH to re-submit project information and a map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.
- Due to the potential for this site to support populations of natural heritage resources, contact an inventory for these resources in the study area and submit the results to DCR. With the survey results, DCR can offer specific protection recommendations for avoidance and minimization of potential impacts to documented resources. Contact DCR DNH (J. Christopher Ludwig, Natural Heritage Inventory Manager, at chris.ludwig@dcr.virginia.gov or 804-371-6206) to discuss arrangements for field work.
- Use native species similar to those found in surrounding areas when revegetating disturbed areas and plant native flowers that bloom throughout the spring and summer to support pollinator habitat.

7. Water Supply. The EA does not address impacts to water supplies.

7(a) Agency Jurisdiction. The Virginia Department of Health (VDH) Office of Drinking Water (ODW) reviews projects for the potential to impact public drinking water sources (groundwater wells, springs and surface water intakes). The VDH ODW administers both federal and state laws governing waterworks operation.

7(b) Agency Comment. VDH ODW states that no surface water intakes are located within a 5-mile radius of the project site. The project is not within the watershed of any public surface water intakes. The following public groundwater wells are located within a 1-mile radius of the project site:

PWS ID Number	City/County	System Name	Facility Name
3810250	VIRGINIA BEACH	HOLIDAY TRAV-L-PARK	DRILLED WELL NUMBER 4 INSIDE
3810250	VIRGINIA BEACH	HOLIDAY TRAV-L-PARK	DRILLED WELL NUMBER 3 OUTSIDE
3810530	VIRGINIA BEACH	RED WING GOLF COURSE	WELL - NEW

3810200	VIRGINIA BEACH	KOA CAMPGROUNDS-VIRGINIA BEACH	NEW WELL
3810108	VIRGINIA BEACH	KNIGHTS OF COLUMBUS	DEEP WELL

7(c) Requirement. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility according to VDH ODW.

8. Historic and Archaeological Resources. The EA (page 18) states that the implementation of the plan may result in minor negative impacts to cultural resources because Camp Pendleton is a historic district. However, the Integrated Cultural Resources Management Plan will be followed.

8(a) Agency Jurisdiction. The Virginia Department of Historic Resources (DHR) conducts reviews of both federal and state projects to determine their effect on historic properties. Under the federal process, DHR is the State Historic Preservation Office, and ensures that federal undertakings – including licenses, permits, or funding – comply with Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulation at 36 CFR Part 800. Section 106 requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. For state projects or activities on state lands, DHR is afforded an opportunity to review and comment on (1) the demolition of state property; (2) major state projects requiring an EIR; (3) archaeological investigations on state-controlled land; (4) projects that involve a landmark listed in the Virginia Landmarks Register; (5) the sale or lease of surplus state property; (6) exploration and recovery of underwater historic properties; and (7) excavation or removal of archaeological or historic features from caves. See DHR's website for more information about applicable state and federal laws and how to submit an application for review: http://www.dhr.virginia.gov/StateStewardship/Index.htm.

8(b) Agency Comments. DHR reviewed the draft updated INRMP for Camp Pendleton and states that the implementation of the plan will have no effect to historic properties.

9. Pollution Prevention. DEQ advocates that principles of pollution prevention and sustainability be used in all construction projects as well as in facility operations. Effective siting, planning, and on-site Best Management Practices (BMPs) will help to ensure that environmental impacts are minimized. However, pollution prevention and sustainability techniques also include decisions related to construction materials, design, and operational procedures that will facilitate the reduction of wastes at the source.

9(a) Recommendations. We have several pollution prevention recommendations that may be helpful in constructing or operating this facility:

- Consider development of an effective Environmental Management System (EMS). An effective EMS will ensure that the proposed facility is committed to complying with environmental regulations, reducing risk, minimizing environmental impacts, setting environmental goals, and achieving improvements in its environmental performance. DEQ offers EMS development assistance and recognizes facilities with effective Environmental Management Systems through its Virginia Environmental Excellence Program (VEEP). VEEP provides recognition, annual permit fee discounts, and the possibility for alternative compliance methods.
- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content, toxicity level, and amount of packaging should be considered and can be specified in purchasing contracts.
- Consider contractors' commitment to the environment when choosing contractors. Specifications regarding raw materials and construction practices can be included in contract documents and requests for proposals.
- Choose sustainable materials and practices for building construction and design.
- Integrate pollution prevention techniques into the facility maintenance and operation, to include inventory control for centralized storage of hazardous materials. Maintenance facilities should have sufficient and suitable space to allow for effective inventory control and preventive maintenance.

DEQ's Office of Pollution Prevention provides information and technical assistance relating to pollution prevention techniques and EMS. If interested, please contact DEQ (Meghann Quinn at 804-698-4021).

10. Pesticides and Herbicides. In general, when pesticides or herbicides must be used, their use should be strictly in accordance with manufacturers' recommendations. In addition, to the extent feasible, DEQ recommends that the responsible agent for the project use the least toxic pesticides or herbicides effective in controlling the target species. For more information on pesticide or herbicide use, please contact the Virginia Department of Agriculture and Consumer Services at (804) 786-3501.

11. Regional Review. As customary, DEQ invited the affected locality and planning district commission to comment.

11(a) Agency Jurisdiction. In accordance with the Virginia Code, §15.2-4207, planning district commissions encourage and facilitate local government cooperation and state-local cooperation in addressing, on a regional basis, problems of greater than local significance. The cooperation resulting from this is intended to facilitate the recognition and analysis of regional opportunities and take account of regional influences in

planning and implementing public policies and services. Planning district commissions promote the orderly and efficient development of the physical, social and economic elements of the districts by planning, and encouraging and assisting localities to plan, for the future.

11(b) Agency Comments. The Hampton Roads Regional Planning District Commission states that the proposed project appears to be consistent with local and regional plans and policies.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act (CZMA) of 1972, as amended (16 USC, CZMA § 307, § 1456(c)(3)(A)) and its implementing federal consistency regulations (15 CFR Part 930, subpart D), any applicant for a required listed federal license or permit to conduct an activity, in or outside of the coastal zone, affecting any land or water use or natural resource of the coastal zone of the Commonwealth, shall provide in the application to the licensing or permitting agency a certification that the proposed activity complies with the enforceable policies of the Virginia CZM Program and that such activity will be conducted in a manner consistent with the program. At the same time, the applicant shall furnish to DEQ a copy of the certification with all necessary information and data. The Commonwealth has six months after receipt of a complete FCC to concur or object to the applicant's finding of project consistency with the Virginia CZM Program. The Virginia CZM Program is comprised of a network of programs administered by several agencies. In order to be consistent with the Virginia CZM Program, all the applicable permits and approvals listed under the enforceable policies of the Virginia CZM Program must be obtained prior to commencing the project.

PUBLIC PARTICIPATION

In accordance with 15 CFR §930.2, a public notice of this proposed action with a public comment period from May 1, 2017 to May 19, 2017 was published in OEIR's Program Newsletter and on the DEQ website. No public comments were received in response to the notice.

FEDERAL CONSISTENCY CONCURRENCE

Based on a review of the FCC and the comments submitted by agencies administering the applicable enforceable policies of the Virginia CZM Program, DEQ concurs that the proposal is consistent with the Virginia CZM Program provided all applicable permits and approvals are obtained as described below. If, prior to construction, the project should change significantly and any of the enforceable policies of the Virginia CZM Program would be affected, pursuant to 15 CFR §930.66, the applicant must submit supplemental information to DEQ for review and approval. Other state approvals which

may apply to this project are not included in this FCC. Therefore, the applicant must ensure that this project is constructed and operated in accordance with all applicable federal, state, and local laws and regulations. In addition, in accordance with 15 CFR Part 930, subpart D, § 930.58(a) (3), the applicant considered the project's impacts on the Advisory Policies of the Virginia CZM Program and found the proposal consistent with those policies.

REGULATORY AND COORDINATION NEEDS

1. Wetlands and Water Quality. If future projects require impacts to wetlands or surface waters, plan to submit a JPA to VMRC (Tony Watkinson at Tony.Watkinson@vmrc.virginia.gov). Contact DEQ TRO (Bert Parolari at Bert.Parolari@deq.virginia.gov) for additional information on the VWP Permit Program. Contact DEQ (Janet Weyland at Janet.Weyland@deq.virginia.gov or 757-518-2151 to determine if the (VPDES) Pesticide Discharges General Permit is applicable to the proposed activities.

2. Air Quality. Contact officials with the appropriate locality for information on any local requirements pertaining to open burning. Contact DEQ TRO (Wayne Franklin at Wayne.Franklin@deq.virginia.gov or 757-518-2155) for additional information on air regulations if necessary.

3. Erosion and Sediment Control and Stormwater Management.

3(a) Erosion and Sediment Control Plan. If the VARNG has no previously DEQ-approved Annual Standards and Specifications and land disturbance results in a land-disturbing activity of equal to or greater than 10,000 square feet, the agency must receive approval for the project-specific ESC plan prior to initiation of any land-disturbing activity at the project site. Virginia Code 10.1-564 stipulates that state ESC plans for projects on state-owned lands must be consistent with local ESC requirements that are more stringent than the state program. Coordinate with the DEQ TRO (Janet Weyland at Janet.Weyland@deq.virginia.gov or 757-518-215) regarding applicable requirements if applicable (Reference: VESCL 62.1-44.15 et seq. and VESCR 9VAC25-840-30, 9VAC25-840-40 and 9VAC25-840-100).

3(b) Stormwater Management Plan. If the VARNG has no previously DEQ-approved Annual Standards and Specifications, a project-specific SWM plan must be reviewed and approved by DEQ for state agency projects that involve a land use conversion activity equal to or greater than one acre. The project-specific SWM plan must be prepared in accordance with the VSWML and the VSMP Permit Regulations. Questions should be directed to DEQ TRO (Janet Weyland at Janet.Weyland@deq.virginia.gov or 757-518-215) (Reference: VSML 62.1-44.15 et seq.; VSMP Permit Regulations 9VAC25-870-160).

3(c) General Permit for Stormwater Discharges from Construction Activities (VAR10). The owner/operator of projects involving land-disturbing activities of equal to or greater than one acre is required to apply for registration coverage under the General Permit for Discharges of Stormwater from Construction Activities. In accordance with 9VAC25-870-160, state projects must comply with the state regulation and, to the maximum extent practicable, with any local stormwater management program technical requirements adopted pursuant to the SWM Act. It is the responsibility of the state agency to demonstrate that the local program technical requirements are not practical for the project under consideration. The owner/operator must also develop a project-specific SWPPP. Specific questions regarding the Stormwater Management Program requirements should be directed to the DEQ Water Division (Holly Sepety at Holly.Sepety@deq.virginia.gov or 804-698-4039) (Reference: VSWML § 62.1-44.15 et seq.; VSMP 9VAC25-880 et seq.).

4. Solid and Hazardous Wastes. Contact DEQ TRO (Melinda Woodruff at Melinda.Woodruff@deq.virginia.gov) for additional information about waste management if necessary.

5. Natural Heritage Resources.

- Contact the DCR DNH (804-371-2708) to re-submit project information and a map for an update on natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.
- Coordinate with DCR DNH (Rene' Hypes, Natural Heritage Project Coordinator at 804-371-2708) for additional information on its comments and recommendations as necessary.

Thank you for the opportunity to comment on this EA and FCC. The detailed comments of reviewers are attached. If you have questions, please do not hesitate to call me at (804) 698-4204 or Julia Wellman at (804) 698-4326.

Sincerely,

Bettina Sullivan, Manager
Environmental Impact Review and Long Range Priorities Program

Enclosures

ec: Amy Ewing, DGIF
Robbie Rhur, DCR
Susan Douglas, VDH

Roger Kirchen, DHR
Tony Watkinson, VMRC
Greg Evans, DOF
Dave Hansen, Virginia Beach
Ben McFarlane, HRPDC
Mark McElroy, Stantec
Ken Oristaglio, DMA

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Rochelle Altholz
Deputy Director of Administration and Finance

David C. Dowling
Deputy Director of Soil and Water Conservation and Dam Safety

Thomas L. Smith
Deputy Director of Operations

MEMORANDUM

DATE: May 30, 2017

TO: Julia Wellman, DEQ

FROM: Roberta Rhur, Environmental Impact Review Coordinator

SUBJECT: DEQ 17-055F, Updated Integrated Natural Resource Management Plan, Camp Pendleton

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Camp Pendleton – Dam Neck Dune and Swale Conservation Site is located within the project site. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Camp Pendleton – Dam Neck Dune and Swale Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resources of concern at this site are:

Cicindela trifasciata,	S-banded tiger beetle	G5/S1/NL/NL
(*Quercus incana*	Bluejack oak	G5/S2/NL/NL

The S-banded tiger beetle, has a broad range, from southern California to central Chile and from Virginia south to Venezuela (NatureServe, 2009). In Virginia, it is known from the southern coastal plain and piedmont. It has a dark brown – blackish dorsal surface with a greenish hue (Knisely and Schulz, 1997). The dorsal surface is covered with shallow green punctures. The ventral surface of the thorax is coppery and the abdomen is metallic blue or greenish-blue (Knisely and Schulz, 1997). This tiger beetle occurs in a wide variety of water-edge habitats, including mudflats or swales in coastal areas, tidal estuaries, marshes and bays, and pond, river and stream edges (Knisely and Schultz, 1997). Threats to this and other tiger beetles include habitat destruction from development or conversion to agricultural or timber operations.

Bluejack oak is a small evergreen tree with dark brown to gray bark that is broken into squares; it also has elliptical leaves with a bluish hue. This tree is found in dry sandy soil (sandhills) (Radford et al, 1968). Bluejack oak is currently known from 11 occurrences and historically known from 5 occurrences in Virginia's coastal plain.

In addition, White-top fleabane (*Erigeron vernus*, G5/S2/NL/NL), Carolina yellow-eyed grass (*Xyris caroliniana*, G4G5/S1/NL/NL), Dune marsh-elder (*Iva imbricata*, G5?/S1/NL/NL), and Glossy-seed yellow stargrass (*Hypoxis sessilis*, G4/SH/NL/NL) have been historically documented within the project site.

Finally, according to the DCR staff botanist, there is the potential for *Eupatorium maritimum*, G2?/S1/SOC/NL to occur within the property. (See attached paper for further information on this species)

Due to the potential for this site to support populations of natural heritage resources, DCR recommends an inventory for these resources in the study area. With the survey results we can more accurately evaluate potential impacts to natural heritage resources and offer specific protection recommendations for minimizing impacts to the documented resources.

DCR-Division of Natural Heritage biologists are qualified and available to conduct inventories for rare, threatened, and endangered species. Please contact J. Christopher Ludwig, Natural Heritage Inventory Manager, at chris.ludwig@dcr.virginia.gov or 804-371-6206 to discuss arrangements for field work.

While specific recommendations can only be given after a survey of natural heritage resources has been completed, DCR does generally support the *Draft Update INRMP 2017 – 2021, Section 6: Natural Resource Program Management* including management items on page 45, including #2 to focus training in non-sensitive habitats, #3 minimize maintained areas, promoting native plant revegetation, monitoring and developing an exotic and invasive species management plan, and #4 managing the conservation of migratory species. DCR also supports 5 year surveys for rare, threatened and endangered species, monitoring beachfront and dune systems and restricting access during breeding season for sea turtles (as stated on page 46) and following USFWS guidelines for northern long-eared bat. (pp 46-47), as well as the Grounds Maintenance, Forest Management sections and the Integrated Pest Management Program (pp49 - 52) recommendations. Furthermore, DCR also recommends the use of native species similar to those found in surrounding areas when revegetating disturbed areas and plant native flowers that bloom throughout the spring and summer to support pollinator habitat.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

Cc: Julia Wellman, DEQ

Literature Cited

Knisley, C.B. and T.D. Schulz. 1997. The Biology of Tiger Beetles and a Guide to the species of the South Atlantic States. Virginia Museum of Natural History, Special Publication Number 5, Martinsville, VA. p. 134.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 30, 2010).

Radford, A.E., H.A. Ahles, C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill. p. 385.

Wellman, Julia (DEQ)

From: Warren, Arlene (VDH)
Sent: Wednesday, April 19, 2017 4:50 PM
To: Wellman, Julia (DEQ)
Subject: RE: NEW PROJECT ARMY DMA INRMP 17-055F

Project Name: Updated Integrated Natural Resource Management Plan, Camp Pendleton State Military Reserve
Project #: 17-055F
UPC #: N/A
Location: City of Virginia Beach

VDH – Office of Drinking Water has reviewed the above project. Below are our comments as they relate to proximity to **public drinking water sources** (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems **must be verified by the local utility.**

The following public groundwater wells are located within a 1 mile radius of the project site:

PWS ID Number	City/County	System Name	Facility Name
3810250	VIRGINIA BEACH	HOLIDAY TRAV-L-PARK	DRILLED WELL NUMBER 4 INSIDE
3810250	VIRGINIA BEACH	HOLIDAY TRAV-L-PARK	DRILLED WELL NUMBER 3 OUTSIDE
3810530	VIRGINIA BEACH	RED WING GOLF COURSE	WELL - NEW
3810200	VIRGINIA BEACH	KOA CAMPGROUNDS- VIRGINIA BEACH	NEW WELL
3810108	VIRGINIA BEACH	KNIGHTS OF COLUMBUS	DEEP WELL

There are no surface water intakes located within a 5 mile radius of the project site.

The project is not within the watershed of any public surface water intakes.

Best Regards,

Arlene Fields Warren
GIS Program Support Technician
Office of Drinking Water
Virginia Department of Health
109 Governor Street
Richmond, VA 23220
(804) 864-7781

The Virginia Department of Health – Office of Drinking Water appreciates the opportunity to provide comments. If you have any questions, please let me know.

From: Fulcher, Valerie (DEQ)
Sent: Monday, April 17, 2017 1:41 PM
To: dgif-ESS Projects (DGIF); Rhur, Robbie (DCR); odwreview (VDH); Narasimhan, Kotur (DEQ); Gavan, Larry (DEQ); Moore, Daniel (DEQ); Sepety, Holly (DEQ); Robinson, Cindy (DEQ); Kirchen, Roger (DHR); Evans, Gregory (DOF); Watkinson, Tony (MRC); Ben McFarlane; jmcbride@hrpdcva.gov; plan@vbgov.com
Cc: Wellman, Julia (DEQ)
Subject: NEW PROJECT ARMY DMA INRMP 17-055F

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
Fax: 804-698-4019 - TDD (804) 698-4021
www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4020
1-800-592-5482

MEMORANDUM

TO: Daniel Moore

FROM: Shawn Smith, Chesapeake Bay Local Assistance

DATE: May 18, 2017

SUBJECT: DEQ 17-055F, Camp Pendleton-Integrated Natural Resource Management Plan, City of Virginia Beach

The project is an update to the Integrated Natural Resource Management Plan for Camp Pendleton in the City of Virginia Beach. Camp Pendleton is located outside of the City's designation CBPA, as it is in the Atlantic Ocean drainage basin. As such, there are no Bay Act requirements relevant to this project.

Wellman, Julia (DEQ)

From: Gavan, Larry (DEQ)
Sent: Tuesday, June 20, 2017 3:17 PM
To: Wellman, Julia (DEQ)
Cc: Zegler, Hannah (DEQ)
Subject: RE: NEW PROJECT ARMY DMA INRMP 17-055F

Ques.- Do we use the non-educational state agency statements or something else?
Ans.- Pls. use the non-educational state agency.
Hope this helps
Thx
L

From: Wellman, Julia (DEQ)
Sent: Tuesday, June 20, 2017 3:06 PM
To: Gavan, Larry (DEQ); Zegler, Hannah (DEQ)
Subject: FW: NEW PROJECT ARMY DMA INRMP 17-055F

What comments would apply to proposed land disturbance by the Virginia Department of Military Affairs on the state-owned Camp Pendleton AND the entities (including federal government and private entities) to which the state-owned land is leased?

Do we use the non-educational state agency statements or something else?

From: Fulcher, Valerie (DEQ)
Sent: Monday, April 17, 2017 1:41 PM
To: dgif-ESS Projects (DGIF); Rhur, Robbie (DCR); odwreview (VDH); Narasimhan, Kotur (DEQ); Gavan, Larry (DEQ); Moore, Daniel (DEQ); Sepety, Holly (DEQ); Robinson, Cindy (DEQ); Kirchen, Roger (DHR); Evans, Gregory (DOF); Watkinson, Tony (MRC); Ben McFarlane; jmcbride@hrpdcva.gov; plan@vbgov.com
Cc: Wellman, Julia (DEQ)
Subject: NEW PROJECT ARMY DMA INRMP 17-055F

Good afternoon - this is a new OEIR review request/project:

Document Type: Federal Consistency Certification
Project Sponsor: DOD/Department of the Army/Virginia Dept. of Military Affairs
Project Title: Updated Integrated Natural Resource Management Plan, Camp Pendleton State Military Reserve
Location: City of Virginia Beach
Project Number: DEQ #17-055F

The document is available at www.deq.virginia.gov/fileshare/oeir in the ARMY folder ("Camp Pendleton State Military Reserve").

The due date for comments is MAY 17, 2017. You can send your comments either directly to Julia by email (Julia.Wellman@deq.virginia.gov), or you can send your comments by regular interagency/U.S. mail to the Department of Environmental Quality, Office of Environmental Impact Review, 629 E. Main St., 6th Floor, Richmond, VA 23219.

DEPARTMENT OF ENVIRONMENTAL QUALITY
TIDEWATER REGIONAL OFFICE
ENVIRONMENTAL IMPACT REVIEW COMMENTS

June 28, 2017

PROJECT NUMBER: 17-055F

PROJECT TITLE: Updated Integrated Natural Resource Management Plan, Camp Pendleton State Military Reserve

As Requested, TRO staff has reviewed the supplied information and has the following comments:

Petroleum Storage Tank Cleanups:
No comments.

Petroleum Storage Tank Compliance/Inspections:
No comments.

Virginia Water Protection Permit Program (VWPP):
Projects involving impacts to surface waters, including wetlands, may require a permit from our program. Provided the applicant receives the proper authorization from our program, these projects will be consistent with our program.

Air Permit Program :
No air permitting issues identified.

Water Permit Program :
No comments.

Waste Permit Program :
No comments.

Storm Water Program:
No Comments.

DEPARTMENT OF ENVIRONMENTAL QUALITY
TIDEWATER REGIONAL OFFICE
ENVIRONMENTAL IMPACT REVIEW COMMENTS

June 28, 2017

PROJECT NUMBER: 17-055F

PROJECT TITLE: Updated Integrated Natural Resource Management Plan, Camp Pendleton State Military Reserve

The staff from the Tidewater Regional Office thanks you for the opportunity to provide comments.

Sincerely,

Cindy T. Robinson

Cindy Robinson
Environmental Specialist II
5636 Southern Blvd.
VA Beach, VA 23462
(757) 518-2167
Cindy.Robinson@deq.virginia.gov

Wellman, Julia (DEQ)

From: Worrell, Justin (MRC)
Sent: Thursday, May 04, 2017 11:21 AM
To: Wellman, Julia (DEQ)
Subject: FW: NEW PROJECT ARMY DMA INRMP 17-055F

VMRC has no comments regarding this project. It does not appear to impact any State-owned submerged resources.

Justin D. Worrell
Environmental Engineer, Sr.
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8063 telephone
(757) 247-8062 fax

From: Watkinson, Tony (MRC)
Sent: Monday, April 17, 2017 1:43 PM
To: Worrell, Justin (MRC) <Justin.Worrell@mrc.virginia.gov>
Subject: FW: NEW PROJECT ARMY DMA INRMP 17-055F

From: Fulcher, Valerie (DEQ)
Sent: Monday, April 17, 2017 1:41 PM
To: dgif-ESS Projects (DGIF) <rr.dgif-ESSProjects@dgif.virginia.gov>; Rhur, Robbie (DCR) <Robbie.Rhur@dcr.virginia.gov>; odwreview (VDH) <odwreview-VDH@cov.virginia.gov>; Narasimhan, Kotur (DEQ) <Kotur.Narasimhan@deq.virginia.gov>; Gavan, Larry (DEQ) <Larry.Gavan@deq.virginia.gov>; Moore, Daniel (DEQ) <Daniel.Moore@deq.virginia.gov>; Sepety, Holly (DEQ) <Holly.Sepety@deq.virginia.gov>; Robinson, Cindy (DEQ) <Cindy.Robinson@deq.virginia.gov>; Kirchen, Roger (DHR) <Roger.Kirchen@dhr.virginia.gov>; Evans, Gregory (DOF) <Gregory.Evans@dof.virginia.gov>; Watkinson, Tony (MRC) <Tony.Watkinson@mrc.virginia.gov>; Ben McFarlane <bmcfarlane@hrpdcva.gov>; jmcbride@hrpdcva.gov; plan@vbgov.com
Cc: Wellman, Julia (DEQ) <Julia.Wellman@deq.virginia.gov>
Subject: NEW PROJECT ARMY DMA INRMP 17-055F

Good afternoon - this is a new OEIR review request/project:

Document Type: Federal Consistency Certification
Project Sponsor: DOD/Department of the Army/Virginia Dept. of Military Affairs
Project Title: Updated Integrated Natural Resource Management Plan, Camp Pendleton State Military Reserve
Location: City of Virginia Beach
Project Number: DEQ #17-055F

The document is available at www.deq.virginia.gov/fileshare/oeir in the ARMY folder ("Camp Pendleton State Military Reserve").

Wellman, Julia (DEQ)

From: Holma, Marc (DHR)
Sent: Monday, April 24, 2017 10:13 AM
To: Wellman, Julia (DEQ)
Cc: Smead, Susan E NFG NG VAARNG (US)
Subject: updated Integrated National Resource Management Plan, Camp Pendleton, City of Virginia Beach (DHR #2017-0363; DEQ #17-055F)

Julia,

The DHR has reviewed the draft updated INRMP for Camp Pendleton and have no comment. We believe the implementation of the plan will have No Effect to historic properties.

Sincerely,
Marc Holma

Wellman, Julia (DEQ)

From: Ben McFarlane <bmcfarlane@hrpdcva.gov>
Sent: Friday, May 26, 2017 3:11 PM
To: Wellman, Julia (DEQ)
Cc: Sharon Lawrence
Subject: DEQ #17-055F - Updated INRMP, Camp Pendleton State Military Reserve

Ms. Wellman,

The HRPDC staff has reviewed the federal consistency certification for this project (DEQ #17-055F – Updated Integrated Natural Resource Management Plan, Camp Pendleton State Military Reserve). The proposal appears to be consistent with local and regional plans and policies.

We appreciate the opportunity to review this project. If you have any questions, please let me know.

Ben

Benjamin J. McFarlane, AICP
Senior Regional Planner
Hampton Roads Planning District Commission
723 Woodlake Drive
Chesapeake, VA 23320
Phone: 757-420-8300 | Fax: 757-420-9300

APPENDIX D: SOILS INFORMATION

Brief descriptions of soils on State Military Reserve:

Duckston Series – Soil borings taken within the Duckston series all display similar qualities of a shallow A-horizon preceding a deep sandy C-horizon. Overall, the soils extracted possess similar qualities of a typical Duckston soil pedon despite nominal differences in horizons. Inclusions among the consociation are minor enough that the differences should not affect current land management practices.

Newhan Series – Soil boring taken within the Newhan limits confirm the typical Newhan characteristics.

Beaches – Confirmed series.

Acredale Series – Soil borings taken within the Acredale series displayed a large degree of variability. Inclusions among the soil series are the result of disparate drainage and vegetation cover. All soil borings displayed some level of saturation within the soil profile and an increase in clay with increasing depth, characteristic of the typical Acredale series. Presently, differences noted within this map unit should not affect land management practices. Acredale is classified as a hydric soil (NRCS 1995).

Chapanoke Series – Most soil borings taken within the Chapanoke soil series confirm the typical Chapanoke characteristics. Inclusions among the soil borings are the result of disparate drainage due to urbanization.

Tetotum Series – Borings taken within the Tetotum unit displayed the most variability from profile to profile. Much of the variability can be attributed to the high levels of disturbance and change in drainage due to heavy foot traffic and urbanization. Most of the soil borings displayed sandy loam textures and an increase in clay through the B-horizons. Despite differences, inclusions within the soil matrix should not affect land management practices. Tetotum soils are classified as hydric by NRCS (1995).

Bojac Series – Half of the borings taken within the Bojac mapped limits confirm the typical Bojac characteristics. Inclusions among the soil borings are the result of disparate drainage due to urbanization.

Augusta Series – Profile descriptions within the Augusta limits confirm the typical Augusta characteristics.

Rumford Series – Several soil borings taken within the originally-mapped Rumford soil series suggests that the current mapping is no longer appropriate. Rumford series are typically well or excessively drained and have moderately rapid permeability. The soil descriptions taken onsite suggest poorly to somewhat poorly drained soils with low permeability. Land management practices should take these considerations into account.

Yeopim Series – Soil samples confirm Yeopim limits as mapped.

Other Series – Among the mapped soils series onsite that were not described above, Nawney and Tomotley soils are classified by NRCS as hydric. The remaining map units (Water, Urban Land, Udorthents, Udorthents-Urban land complex) were verified in the field.

APPENDIX E: RESULTS OF FLORA AND FAUNA PLANNING LEVEL SURVEYS AND MONITORING

Table E-1. Mammals (n=22) found on State Military Reserve, VA (CMI 2013) and *Bat Survey (CMI 2016).

Season detected: W = winter, S = spring, Su = summer, F= fall.

Common name	Scientific name	Season detected	Status[1]	Population trend [1]
SHREWS AND MOLES				
eastern mole	*Scalopus aquaticus*	S	Least Concern	Stable
southern short-tailed shrew	*Blarina carolinensis*	W,S,F	Least Concern	Stable
BATS				
big brown bat*	*Eptesicus fuscus*	S,F	Least Concern	Increasing
eastern pipistrelle	*Pipistrellus subflavus*	S,F	Least Concern	Stable
eastern red bat*	*Lasiurus borealis*	W,S,F	Least Concern	Stable
evening bat*	*Nycticeius humeralis*	S,F	Least Concern	Stable
little brown bat*	*Myotis lucifugus*	F	Least Concern[2]	Stable
Mexican free-tailed bat*	*Tadarida brasiliensis*	F	Least Concern	Stable
southeastern myotis*	*Myotis austroriparius*	F	Least Concern	Stable
tri-colored bat*	*Perimyotis subflavus*	F	Least Concern[2]	Stable
MICE AND RATS				
house mouse	*Mus musculus*	W,S,F	Least Concern	Stable
hispid cotton rat	*Sigmodon hispidus virginianus*	S,F	n/a	n/a
white-footed mouse	*Peromyscus leucopus*	W,S,F	Least Concern	Stable
VOLES				
woodland vole	*Microtus pinetorum*	S,F	Least Concern	Stable
SQUIRRELS				
gray squirrel	*Sciurus carolinensis*	W,S,Su,F	Least Concern	Increasing
southern flying squirrel	*Glaucomys volans*	W,S,F	Least Concern	Stable
RABBITS				
eastern cottontail	*Sylvilagus floridanus*	W,S	n/a	n/a

Common name	Scientific name	Season detected	Status[1]	Population trend [1]
LARGE RODENTS				
nutria	*Myocastor coypus*	W,S,Su,F	Least Concern	Decreasing
OPOSSUMS				
Virginia opossum	*Didelphis virginiana*	W,S,Su,F	Least Concern	Increasing
RACCOONS				
raccoon	*Procyon lotor*	W,S,Su,F	Least Concern	Increasing
SKUNKS				
striped skunk	*Mephitis mephitis*	S,F	Least Concern	Stable
CATS				
bobcat	*Lynx rufus*	W	Least Concern	Stable
FOXES				
eastern gray fox	*Urocyon cinereoargenteneus*	W,S,F	n/a	n/a
red fox	*Vulpes vulpes*	W,S,Su,F	Least Concern	Stable
HOOFED MAMMALS				
white-tailed deer	*Odocoileus virginianus*	W,S,Su,F	Least Concern	Stable

[1] IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <www.iucnredlist.org>. Downloaded on 22 January 2014; searched 5 November 2018.

[2] State threatened or endangered species.

Table E-2. Fish documented on State Military Reserve (CMI 2008).

Common Name	Scientific Name	Status
Bluegill	*Lepomis macrochirus*	Non-native
Black Crappie	*Pomoxis nigromaculatus*	Native
Pumpkinseed	*Lepomis gibbosus*	Native
White Perch	*Morone americana*	Native
Yellow Perch	*Perca flavescens*	Native
American Eel	*Anguilla rostrata*	Native
Largemouth Bass	*Micropterus salmoides*	Non-native
Common Carp	*Cyprinus carpio*	Invasive
Shiner	*Cyprinella sp.*	--
Yellow Bullhead	*Ameiurus natalis*	Native
Chain Pickerel	*Esox niger*	Native
Gizzard Shad	*Dorosoma cepedianum*	Native
Flier	*Centrarchus macropterus*	Native
Striped Mullet	*Mugil cephalus*	Native
Inland Silverside	*Menidia beryllina*	Native

Table E-3. Avian species (n=101) documented at State Military Reserve, VA, 2013.

Season detected: W = winter, S = spring, Su = summer, F= fall.

Common Name	Scientific Name	Season Detected	Status [1]	Population Trend[1]
LOONS				
common loon	*Gavia immer*	W,S	Least Concern	Decreasing
PELECANIFORMES				
brown pelican	*Pelecanus occidentalis*	W,S,Su,F	Least Concern	Increasing
CORMORANTSs				
double-crested cormorant	*Phalacrocorax auritus*	W,S,F	Least Concern	Increasing
WADING BIRDS				
great blue heron	*Ardea herodias*	W,S,Su	Least Concern	Increasing
great egret	*Ardea alba*	W,Su	Least Concern	Unknown
green heron	*Butorides virescens*	S,Su	Least Concern	Unknown
black-crowned night-heron	*Nycticorax nycticorax*	W	Least Concern	Decreasing
GEESE				
Canada goose	*Branta canadensis*	W,S,Su,F	Least Concern	Increasing
DIVING DUCKS				
wood duck	*Aix sponsa*	S	Least Concern	Increasing
mallard	*Anas platyrhynchos*	W,S,Su,F	Least Concern	Decreasing
gadwall	*Anas strepera*	W	Least Concern	Unknown
greater scaup	*Aythya marila*	W	Least Concern	Decreasing
ring-necked duck	*Aythya collaris*	W	Least Concern	Increasing
black scoter	*Melanitta americana*	W	Near Threatened	Decreasing
white-winged scoter	*Melanitta fusca*	W	Least Concern	Decreasing
red-breasted merganser	*Mergus serrator*	W	Least Concern	Stable
DIURNAL RAPTORS				
black vulture	*Coragyps atratus*	W	Least Concern	Increasing
turkey vulture	*Cathartes aura*	W,S,Su,F	Least Concern	Stable
osprey	*Pandion haliaetus*	W,S,Su,F	Least Concern	Increasing

Common Name	Scientific Name	Season Detected	Status [1]	Population Trend[1]
Cooper's hawk	*Accipiter cooperii*	W,F	Least Concern	Increasing
bald eagle	*Haliaeetus leucocephalus*	W,S,F	Least Concern	Increasing
GRUIFORMES				
American coot	*Fulica americana*	W,S	Least Concern	Decreasing
SHOREBIRDS				
black-bellied plover	*Pluvialis squatarola*	S	Least Concern	Decreasing
semipalmated plover [2]	*Charadrius semipalmatus*	Su	Least Concern	Stable
killdeer	*Charadrius vociferus*	W,F	Least Concern	Decreasing
willet	*Tringa semipalmata*	Su	Least Concern	Stable
spotted sandpiper	*Actitis macularius*	S	Least Concern	Decreasing
ruddy turnstone	*Arenaria interpres*	S	Least Concern	Decreasing
sanderling	*Calidris alba*	S,Su,F	Least Concern	Unknown
GULLS				
black-legged kittiwake	*Rissa tridactyla*	W	Least Concern	Decreasing
Bonaparte's gull	*Chroicocephalus philadelphia*	S,F	Least Concern	Increasing
great black-backed gull	*Larus marinus*	W,Su,F	Least Concern	Increasing
herring gull	*Larus argentatus*	W,S,F	Least Concern	Unknown
laughing gull	*Leucophaeus atricilla*	W,S,Su	Least Concern	Increasing
ring-billed gull	*Larus delawarensis*	Su,F	Least Concern	Increasing
TERNS				
common tern	*Sterna hirundo*	S,Su,F	Least Concern	Decreasing
Forster's tern	*Sterna forsteri*	F	Least Concern	Increasing
royal tern	*Thalasseus maximus*	Su,F	Least Concern	Stable
sandwich tern [2]	*Thalasseus sandvicensis*	Su	Least Concern	Stable
DOVES				
mourning dove	*Zenaida macroura*	W,S,Su,F	Least Concern	Increasing
GOATSUCKERS				
common nighthawk [2]	*Chordeiles minor*	S	Least Concern	Decreasing

Common Name	Scientific Name	Season Detected	Status [1]	Population Trend[1]
HUMMINGBIRDS				
ruby-throated hummingbird	*Archilochus colubris*	S	Least Concern	Increasing
KINGFISHERS				
belted kingfisher	*Megaceryle alcyon*	S,Su,F	Least Concern	Stable
WOODPECKERS				
downy woodpecker	*Picoides pubescens*	F	Least Concern	Stable
hairy woodpecker	*Picoides villosus*	Su	Least Concern	Increasing
red-bellied woodpecker	*Melanerpes carolinus*	W,S,F	Least Concern	Increasing
northern flicker	*Colaptes auratus*	W,Su	Least Concern	Decreasing
pileated woodpecker	*Dryocopus pileatus*	W,S,Su,F	Least Concern	Increasing
TYRANT FLYCATCHERS				
eastern wood-pewee	*Contopus virens*	S,F	Least Concern	Decreasing
eastern phoebe	*Sayornis phoebe*	Su,F	Least Concern	Increasing
eastern kingbird	*Tyrannus tyrannus*	S	Least Concern	Decreasing
VIREOS				
blue-headed vireo	*Vireo solitarius*	F	Least Concern	Increasing
red-eyed vireo	*Vireo olivaceus*	S	Least Concern	Increasing
white-eyed vireo	*Vireo griseus*	S,Su	Least Concern	Increasing
JAYS, CROWS, AND ALLIES				
blue jay	*Cyanocitta cristata*	W,S,Su,F	Least Concern	Stable
American crow	*Corvus brachyrhynchos*	W,S,Su,F	Least Concern	Increasing
fish crow	*Corvus ossifragus*	W,S,Su	Least Concern	Increasing
SWALLOWS				
bank swallow	*Riparia riparia*	Su	Least Concern	Decreasing
barn swallow	*Hirundo rustica*	S	Least Concern	Decreasing
cliff swallow	*Petrochelidon pyrrhonota*	Su	Least Concern	Increasing
tree swallow	*Tachycineta bicolor*	S,Su	Least Concern	Stable
CHICKADEES, NUTHATCHES, AND ALLIES				
Carolina chickadee	*Poecile carolinensis*	S,Su,F	Least Concern	Stable

Common Name	Scientific Name	Season Detected	Status [1]	Population Trend[1]
tufted titmouse	*Baeolophus bicolor*	W,S,Su,F	Least Concern	Increasing
white-breasted nuthatch	*Sitta carolinensis*	W,S,F	Least Concern	Increasing
WRENS				
Carolina wren	*Thryothorus ludovicianus*	W,S,Su	Least Concern	Increasing
THRUSHES				
eastern bluebird	*Sialia sialis*	W,S,Su,F	Least Concern	Increasing
hermit thrush	*Catharus guttatus*	W	Least Concern	Increasing
American robin	*Turdus migratorius*	W,S,F	Least Concern	Increasing
MIMIDS				
gray catbird	*Dumetella carolinensis*	S,F	Least Concern	Stable
northern mockingbird	*Mimus polyglottos*	W,S,Su,F	Least Concern	Stable
brown thrasher	*Toxostoma rufum*	W,S,F	Least Concern	Decreasing
WAXWINGS				
cedar waxwing	*Bombycilla cedrorum*	S	Least Concern	Increasing
European starling	*Sturnus vulgaris*	W,S,Su,F	Least Concern	Unknown
WOOD-WARBLERS				
American redstart	*Setophaga ruticilla*	S,F	Least Concern	Decreasing
black-and-white warbler	*Mniotilta varia*	F	Least Concern	Decreasing
blackpoll warbler	*Setophaga striata*	S	Least Concern	Decreasing
black-throated blue warbler	*Setophaga caerulescens*	S,F	Least Concern	Increasing
common yellowthroat	*Geothlypis trichas*	S,F	Least Concern	Stable
hooded warbler	*Setophaga citrina*	W,S	Least Concern	Increasing
magnolia warbler	*Setophaga magnolia*	S,F	Least Concern	Increasing
Nashville warbler	*Oreothlypis ruficapilla*	F	Least Concern	Increasing
pine warbler	*Setophaga pinus*	S	Least Concern	Increasing
prothonotary warbler [2]	*Protonotaria citrea*	S	Least Concern	Decreasing
ovenbird	*Seiurus aurocapilla*	S,Su	Least Concern	Stable
worm-eating warbler [2]	*Helmitheros vermivorum*	F	Least Concern	Increasing
yellow warbler	*Setophaga petechia*	S	Least Concern	Stable

Common Name	Scientific Name	Season Detected	Status [1]	Population Trend[1]
yellow-rumped warbler	*Setophaga coronata*	F	Least Concern	Increasing
TANAGERS, CARDINALS, AND ALLIES				
blue grosbeak	*Passerina caerulea*	S,Su	Least Concern	Increasing
rose-breasted grosbeak	*Pheucticus ludovicianus*	Su	Least Concern	Decreasing
northern cardinal	*Cardinalis cardinalis*	W,S,Su,F	Least Concern	Stable
EMBERIZINE SPARROWS AND ALLIES				
eastern towhee	*Pipilo erythrophthalmus*	S,Su	Least Concern	Stable
chipping sparrow	*Spizella passerina*	W,S,Su	Least Concern	Increasing
field sparrow	*Spizella pusilla*	S.Su	Least Concern	Decreasing
Savannah sparrow	*Passerculus sandwichensis*	W	Least Concern	Stable
song sparrow	*Melospiza melodia*	W	Least Concern	Stable
dark-eyed junco	*Junco hyemalis*	W,F	Least Concern	Stable
ICTERIDS				
Brewer's blackbird	*Euphagus cyanocephalus*	F	Least Concern	Decreasing
brown-headed cowbird	*Molothrus ater*	S,F	Least Concern	Decreasing
common grackle	*Quiscalus quiscula*	S,Su,F	Least Concern	Decreasing
FINCHES AND OLD WORLD SPARROWS				
American goldfinch	*Spinus tristis*	W,S,Su,F	Least Concern	Increasing
house finch	*Haemorhous mexicanus*	S,Su,F	Least Concern	Increasing

1 IUCN 2013. IUCN Red List of Threatened Species. Version 2013. <www.iucnredlist.org>. Downloaded on 22 January 2014.

2 Birds of Conservation Concern 2008 – Bird Conservation Regions 27, 30 & USFWS Region 5 (See Table E-8)

Table E-4. Reptiles and amphibians (n=23) documented at State Military Reserve, VA, 2013.

Season detected: W = winter, S = spring, Su = summer, F = fall.

Common Name	Scientific Name	Season detected	Status [1]	Population Trend [1]
FROGS AND TOADS				
American bullfrog	*Lithobates catesbeianus*	S,Su	Least Concern	Increasing
eastern American toad	*Anaxyrus americanus*	S,Su,F	Least Concern	Stable
northern green frog	*Lithobates clamitans melanota*	Su	Least Concern	Stable
spring peeper	*Pseudacris crucifer crucifer*	W,F	Least Concern	Stable
southern leopard frog	*Lithobates sphenocephalus*	S	Least Concern	Stable
southern toad	*Anaxyrus terrestris*	S	Least Concern	Stable
wood frog	*Lithobates sylvaticus*	Su	Least Concern	Stable
SALAMANDERS				
Atlantic Coast slimy salamander	*Plethodon chlorobryonis*	S	Least Concern	
eastern red-backed salamander	*Plethodon cinereus*	S,F	Least Concern	Stable
northern slimy salamander	*Plethodon glutinosus*	S,Su	Least Concern	Stable
SKINKS				
common five-lined skink	*Plestiodon fasciatus*	S	Least Concern	Stable
little brown skink	*Scincella lateralis*	S	Least Concern	Stable
northern coal skink	*Plestiodon anthracinus anthracinus*	S	Least Concern	Stable
SNAKES				
brown watersnake	*Nerodia taxispilota*	S	Least Concern	Stable
eastern six-lined racerunner	*Aspidoscelis sexlineata sexlineata*	S	Least Concern	Stable
northern rough greensnake	*Opheodrys aestivus aestivus*	S	Least Concern	Stable
TURTLES				
eastern box turtle	*Terrapene carolina*	Su	Vulnerable	Decreasing
eastern musk turtle (stinkpot)	*Sternotherus odoratus*	S,Su	Least Concern	Stable
eastern painted turtle	*Chrysemys picta picta*	W,S,Su,F	Least Concern	Stable
eastern snapping turtle	*Chelydra serpentina serpentina*	S	Least Concern	Stable

Common Name	Scientific Name	Season detected	Status [1]	Population Trend [1]
northern red-bellied cooter	*Pseudemys rubriventris*	W,S,Su,F	Near Threatened	Unknown
red-eared slider	*Trachemys scripta elegans*	F	Least Concern	Stable
yellow-bellied slider	*Trachemys scripta scripta*	W,S,Su,F	Least Concern	Stable

[1] IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <www.iucnredlist.org>. Downloaded on 22 January 2014.

Table E-5. Insect species (n=63) documented at State Military Reserve, VA, 2013.

Order	Family	Genus	Species	Common name
BLATTODEA *(cockroaches/ waterbugs)*	Blatellidae	*Parcoblatta*	*pennsylvanica*	wood cockroach
		Parcoblatta	*virginica*	wood cockroach
COLEOPTERA *(beetles)*	Carabidae	*Chlaenius*	sp.	vivid metallic ground beetle
		Harpalus	*pensylvanicus*	Pennsylvania ground beetle
		Pterostichus	sp.	common black ground beetle
		Pterostichus	sp.	common black ground beetle
	Cerambycidae	*Xylotrechus*	*sagittatus*	arrowhead borer
	Coccinellidae	*Harmonia*	*axyridis*	multicolored Asian lady beetle
	Dytiscidae	*Hydaticus*	sp.	predaceous diving beetle
	Elateridae	*Agriotes*	sp.	little brown click beetle
		Agriotes	sp.	little brown click beetle
		Melanotus	*communis-complex*	click beetle
	Haliplidae	*Peltodytes*	sp.	crawling water beetle
	Lampyridae	*Photinus*	sp.	small lightning bug
	Scarabaeidae	*Onthophagus*	*hecate*	scooped scarab beetle
		Phyllophaga	sp.	May/June beetle
		Phyllophaga	sp.	May/June beetle
	Silphidae	*Nicrophorus*	*orbicolis*	burying beetle
	Staphylinidae	*Unknown*	sp1	rove beetle
		Unknown	sp2	rove beetle
DERMAPTERA *(earwigs)*	Forficulidae	*Forficula*	*auricularia*	common earwig
DIPTERA *(true flies/mosquitoes/ gnats/midges)*	Calliphoridae	*Lucilia*	*sericata*	green bottle fly
	Tabanidae	*Tabanus*	*sulcrifrons*	spotted horse fly
		Tabanus	sp.	horse fly
HEMIPTERA *(true bugs)*	Acanaloniidae	*Acanalonia*	*servillei*	planthopper
	Cicadellidae	*Draeculacephala*	sp.	sharpshooter
	Cicadidae	*Tibicen*	*canicularis*	dog day cicada

Order	Family	Genus	Species	Common name
	Cydnidae	*Microporus*	*nigrita*	black ground bug
	Pentatomidae	*Nezara*	*viridula*	southern green stink bug
	Pentatomidae	*Oebalus*	*pugnax*	rice stink bug
HYMENOPTERA	Apidae	*Apis*	*mellifera*	honey bee
(bees, wasps, ants)	Ichneumonidae	*Ophion*	sp.	ichneumonid wasp
		Ophion	sp.	ichneumonid wasp
		Thyreodon	*atricolor*	sphinx moth wasp
	Pompilidae	*Episyron*	*quinquenotatus*	
	Sphecidae	*Eremnophila*	*aureonotata*	thread-waisted wasp
		Sphex	*habenus*	golden-reined wasp
LEPIDOPTERA	Hesperidae	*Pholisora*	*catullus*	common sootywing
(butterflies/moths)		*Polites*	*peckius*	Peck's skipper
	Nymphalidae	*Danaus*	*plexippus*	monarch
		Junonia	*coenia*	common buckeye
		Limenitis	*arthemis astyanax*	red-spotted purple
		Vanessa	*cardui*	painted lady
	Papilionidae	*Papilio*	*palamedes*	palamedes swallowtail
		Papilio	*glaucus*	eastern tiger swallowtail
		Papilio	*polyxenes*	black swallowtail
	Pieridae	*Colias*	*philodice*	clouded sulfur

Table E-6. Plant species identified growing within the dune ecosystem at State Military Reserve (CMI 2008).

Common name	Genus and Species	Family	Status	Life Form
Black cherry	*Prunus serotina*	Rosaceae	Native	Woody
Live oak (S3)	*Quercus virginiana*	Fagaceae	Native	Woody
Groundsel Tree, Saltmarsh elder	*Baccharis halimifolia*	Asteraceae	Native	Woody
Sweetgum	*Liquidambar styraciflua*	Hamamelidaceae	Native	Woody
Winged sumac	*Rhus copallinum*	Anacardiaceae	Native	Woody
Sassafras	*Sassafrass albidum*	Lauraceae	Native	Woody
Persimmon	*Diospyrus virginiana*	Ebenaceae	Native	Woody
Northern bayberry	*Morella pensylvanica*	Myricaceae	Native	Woody
Loblolly pine	*Pinus taeda*	Pinaceae	Native	Woody
Red mulberry	*Morus rubra*	Moraceae	Native	Woody
Northern dewberry	*Rubus flagellaris*	Rosaceae	Native	Vine
Grape	*Vitis rotundifolia*	Vitaceae	Native	Vine
Virginia creeper	*Parthenocissus quinquefolia*	Vitaceae	Native	Vine
Trumpet creeper	*Campsis radicans*	Bignoniaceae	Native	Vine
Passion flower/maypop	*Passiflora incarnata*	Passifloraceaea	Native	Vine
Summer grape	*Vitis aestivalis*	Vitaceae	Native	Vine
Trumpet honeysuckle	*Lonicera sempervirens*	Caprifoliacaeae	Native	Vine
Saw greenbrier	*Smilax bona-nox*	Smilacaceae	Native	Vine
Cat's ear	*Hypochaeris radicata*	Asteraceae	Non-Native/Invasive	Herbaceous
Yellow wood sorrel	*Oxalis stricta*	Oxalidaceae	Native	Herbaceous
Spring vetch	*Vicia sativa*	Fabaceae	Non-Native/Invasive	Herbaceous
Nuttalls lobelia	*Lobelia nuttallii*	Campanulaceae	Native	Herbaceous
Honeysuckle	*Lonicera japonica*	Caprifoliacaeae	Non-Native/Invasive	Herbaceous
Sand bitter cress	*Cardamine parviflora*	Brassicaeae	Native	Herbaceous
Evening primrose	*Oenothera parviflora*	Onagraceae	Native	Herbaceous
Wild lettuce	*Lactuca canadensis*	Asteraceae	Native	Herbaceous
Wild garlic	*Alium vineale*	Liliaceae	Native	Herbaceous

Common name	Genus and Species	Family	Status	Life Form
Queen Anne's lace	*Daucus carota*	Apiaceae	Non-Native/Invasive	Herbaceous
Creeping lespedeza	*Lespedeza repens*	Fabaceae	Native	Herbaceous
White thoroughwort	*Eupatorium album*	Asteraceae	Native	Herbaceous
Bitterweed	*Helenium amarum*	Asteraceae	Native	Herbaceous
English plantain	*Plantago lanceolata*	Plantaginaceae	Non-Native/Invasive	Herbaceous
Wild sorrel	*Rumex hastatulus*	Polygonaceae	Native	Herbaceous
Curly dock	*Rumex crispus*	Polygonaceae	Native	Herbaceous
Southern sandbur	*Cenchrus echinatus*	Poaceae	Native	Herbaceous
Rabbit tobacco, pussytoes	*Antennaria plantaginofolia*	Asteraceae	Native	Herbaceous
Buttonweed, poor joe	*Diodia teres*	Rubiaceae	Native	Herbaceous
Dune evening primrose	*Oenothera humifusa*	Onagraceae	Native	Herbaceous
Seaside spurge	*Chamaesyce polygonifolia*	Euphorbiaceae	Native	Herbaceous
Seaside goldenrod	*Solidago sempervirens*	Asteraceae	Native	Herbaceous

Table E-7. Plant species identified within the boundaries of State Military Reserve (WEG 2004 and CMI 2008/2013).

Common name	Genus and Species	Status	Life Form
Red maple	*Acer rubrum*	Native	Woody
Yarrow	*Achillea millefolium*	Native	Herbaceous
Wild garlic	*Alium vineale*	Native	Herbaceous
Alligatorweed	*Alternanthera philoxeroides*	Non-native/Invasive	Herbaceous
Downy serviceberry	*Amelanchier arborea*	Native	Woody
Eastern serviceberry	*Amelanchier canadensis*	Native	Woody
American beach grass	*Ammophila brevigulata*	Native	Graminoid
Broomsedge bluestem	*Andropogon virginicus*	Native	Graminoid
Rabbit tobacco, pussytoes	*Antennaria plantaginofolia*	Native	Herbaceous
Common ground-nut	*Apios americana*	Native	Vine
Devil's walking stick	*Aralia spinosa*	Native	Woody
Jack-in-the-pulpit	*Arisaema triphyllum*	Native	Herbaceous
Giant cane	*Arundinaria gigantea*	Native	Graminoid
Paw paw	*Asimina triloba*	Native	Woody
Ebony spleenwort	*Asplenium platyneuron*	Native	Herbaceous
Lady fern	*Athyrium filix-femina*	Native	Herbaceous
Spearscale	*Atriplex patula*	Non-native/Invasive	Herbaceous
Groundsel Tree, saltmarsh elder	*Baccharis halimifolia*	Native	Woody
Alabama supplejack	*Berchemia scandens*	Native	Vine
Devil's beggar-ticks	*Bidens frondosa*	Native	Herbaceous
Crossvine	*Bignonia capreolata*	Native	Vine
False nettle	*Boehmeria cylindrica*	Native	Herbaceous
Southern grapefern	*Botrychium biternatum*	Native	Herbaceous
Lace-frond grape-fern	*Botrychium dissectum*	Native	Herbaceous
Sea rocket	*Cakile edentula*	Native	Herbaceous
American beauty berry	*Callicarpa americana*	Native	Woody
Trumpet creeper	*Campsis radicans*	Native	Vine

Common name	Genus and Species	Status	Life Form
Sand bitter cress	*Cardamine parviflora*	Native	Herbaceous
Greenwhite sedge	*Carex albolutescens*	Native	Graminoid
Eastern narrowleaf sedge	*Carex amphibola*	Native	Graminoid
Thinfruit sedge	*Carex flaccosperma*	Native	Graminoid
Shallow sedge	*Carex lurida*	Native	Graminoid
Sedge	*Carex sp.*	Native	Graminoid
Swan's sedge	*Carex swanii*	Native	Graminoid
American hornbeam	*Carpinus caroliniana virginiana*	Native	Woody
Pignut hickory	*Carya glabra*	Native	Woody
Mockernut-hickory	*Carya tomentosa*	Native	Woody
Partridge pea	*Cassia fasciculata*	Native	Herbaceous
American sand bur	*Cenchrus echinatus*	Native	Graminoid
Sand dune sandbur	*Cenchrus tribuloides*	Native	Graminoid
Buttonbush	*Cephalanthus occidentalis*	Native	Woody
Seaside spurge	*Chamaesyce polygonifolia*	Native	Herbaceous
Long-leaf spikegrass	*Chasmanthium laxum*	Native	Graminoid
Cottony Golden Aster	*Chrysopsis gossypina*	Native	Herbaceous
Common water-hemlock	*Cicuta maculata*	Native	Herbaceous
Common woodreed	*Cinna arundinacea*	Native	Graminoid
Thistle	*Cirsium spp.*	Native	Herbaceous
Coast white alder	*Clethra alnifolia*	Native	Woody
Asiatic dayflower	*Commelina communis*	Non-Native/Invasive	Herbaceous
Horseweed	*Conyza canadensis*	Native	Herbaceous
One-flower hawthorn	*Crataegus uniflora*	Native	Woody
Common dodder	*Cuscuta gronovii*	Native	Vine
Bermuda grass	*Cynodon dactylon*	Non-Native/Invasive	Graminoid
Globe flatsedge	*Cyperus echinatus*	Native	Graminoid
Fern flatsedge	*Cyperus filicinus*	Native	Graminoid

Common name	Genus and Species	Status	Life Form
Rice-field flatsedge	*Cyperus iria*	Non-native	Graminoid
Green flatsedge	*Cyperus pseudovegetus*	Native	Graminoid
False nutsedge	*Cyperus strigosus*	Native	Graminoid
Moccasin Flower	*Cypripedium acaule*	Native	Herbaceous
Orchard grass	*Dactylis glomerata*	Non-Native	Graminoid
Queen Anne's lace	*Daucus carota*	Non-Native	Herbaceous
Water-willow	*Decodon verticillatus*	Native	Herbaceous
Panicledleaf ticktrefoil	*Desmodium paniculatum*	Native	Herbaceous
Bosc's panic grass	*Dichanthelium boscii*	Native	Graminoid
Cypress panicgrass	*Dichanthelium dichotomum*	Native	Graminoid
Eggleaf rosette grass	*Dichanthelium ovale*	Native	Graminoid
Velvet panic grass	*Dichanthelium scoparium*	Native	Graminoid
Roughhair rosette grass	*Dichanthelium strigosum*	Native	Graminoid
Crabgrass	*Digitaria sp.*	Both	Graminoid
Buttonweed, poor joe	*Diodia teres*	Native	Herbaceous
Virginia buttonweed	*Diodia virginiana*	Native	Herbaceous
Persimmon	*Diospyrus virginiana*	Native	Woody
Salt-grass	*Distichlis spicata*	Native	Graminoid
Barnyard grass	*Echinochloa muricata*	Native	Graminoid
Coast cockspur-grass	*Echinochloa walteri*	Native	Graminoid
Autumn olive	*Elaeagnus umbellata*	Non-Native/Invasive	Woody
Slender spikerush	*Eleocharis tenuis*	Native	Graminoid
Goose grass	*Elusine indica*	Non-Native	Graminoid
Virginia wild rye	*Elymus virginicus*	Native	Graminoid
Purple lovegrass	*Eragrostis spectabilis*	Native	Graminoid
Fireweed	*Erechtites hieraciifolia*	Native	Herbaceous
Strawberry-bush	*Euonymus americanus*	Native	Herbaceous
White thoroughwort	*Eupatorium album*	Native	Herbaceous

Common name	Genus and Species	Status	Life Form
Dogfennel	*Eupatorium capillifolium*	Native	Herbaceous
Three-nerved joe-pye weed	*Eupatorium dubium*	Native	Herbaceous
Hyssop-leaved thoroughwort	*Eupatorium hyssopifolium*	Native	Herbaceous
Hairy thoroughwort	*Eupatorium pubescens*	Native	Herbaceous
Common flat-topped goldenrod	*Euthamia graminifolia*	Native	Herbaceous
American beech	*Fagus grandifolia*	Native	Woody
Wild strawberry	*Fragaria virginiana*	Native	Herbaceous
Southern three-lobed bedstraw	*Galium tinctorium*	Native	Herbaceous
Berry bedstraw	*Galium uniflorum*	Native	Herbaceous
Yellow jessamine	*Gelsemium sempervirens*	Native	Vine
English ivy	*Hedera helix*	Non-Native/Invasive	Vine
Bitterweed	*Helenium amarum*	Native	Herbaceous
Rose-mallow	*Hibiscus moscheutos*	Native	Herbaceous
Buttercup pennywort	*Hydrocotyle ranunculoides*	Native	Herbaceous
Water-pennywort	*Hydrocotyle umbellata*	Native	Herbaceous
St. Peter's wort	*Hypericum crux-andreae*	Native	Herbaceous
Dwarf St. John's wort	*Hypericum mutilum*	Native	Herbaceous
Cat's ear	*Hypochaeris radicata*	Non-Native/Invasive	Herbaceous
Inkberry	*Ilex glabra*	Native	Woody
American holly	*Ilex opaca*	Native	Woody
Yaupon	*Ilex vomitoria*	Native	Woody
Sharp-fruited rush	*Juncus acuminatus*	Native	Graminoid
Weak rush	*Juncus debilis*	Native	Graminoid
Soft rush	*Juncus effusus*	Native	Graminoid
Grass-leaf rush	*Juncus marginatus*	Native	Graminoid
Big-headed rush (S2)	*Juncus megacephalus*	Native	Graminoid
Needlepod rush	*Juncus scirpoides*	Native	Graminoid
Path rush	*Juncu tenuis*	Native	Graminoid

Common name	Genus and Species	Status	Life Form
Eastern red cedar	*Juniperus virginiana*	Native	Graminoid
June grass	*Koeleria macrantha*	Native	Herbaceous
Seashore-mallow	*Kosteletzkya virginica*	Native	Herbaceous
Wild lettuce	*Lactuca canadensis*	Native	Graminoid
Purple Dead Nettle	*Lamium purpureum*	Non-Native	Herbaceous
Rice cut-grass	*Leersia oryzoides*	Native	Graminoid
White grass	*Leersia virginica*	Native	Herbaceous
Chinese lespedeza	*Lespedeza cuneata*	Non-Native	Herbaceous
Downy trailing lespedeza	*Lespedeza procumbens*	Native	Herbaceous
Creeping lespedeza	*Lespedeza repens*	Native	Herbaceous
Bush clover	*Lespedeza sp.*	Native	Herbaceous
Virginia lespedeza	*Lespedeza virginica*	Native	Woody
Deciduous swamp-fetterbush	*Leucothoe racemosa*	Non-native	Woody
Chinese privet	*Ligustrum sinense*	Non-native	Woody
Japanese Privet	*Ligustrum japonicum*	Non-native	Woody
Common privet	*Ligustrum vulgare*	Native	Woody
Sweetgum	*Liquidambar styraciflua*	Native	Woody
Tulip-tree	*Liriodendron tulipifera*	Native	Herbaceous
Cardinal-flower	*Lobelia cardinalis*	Native	Herbaceous
Nuttalls lobelia	*Lobelia nuttallii*	Native	Vine
Japanese honeysuckle	*Lonicera japonica*	Non-native/Invasive	Vine
Trumpet honeysuckle	*Lonicera sempervirens*	Native	Herbaceous
Square-pod water-primrose	*Ludwigia alternifolia*	Native	Herbaceous
Common water-purslane	*Ludwigia palustris*	Native	Herbaceous
American water-horehound	*Lycopus americanus*	Native	Herbaceous
Stalked water-horehound	*Lycopus rubellus*	Native	Herbaceous
Virginia water-horehound	*Lycopus virginicus*	Native	Graminoid
Japanese stilt-grass	*Microstegium vimineum*	Non-native/Invasive	Graminoid

Common name	Genus and Species	Status	Life Form
Climbing hempweed	*Mikania scandens*	Native	Vine
Partridge-berry	*Mitchella repens*	Native	Herbaceous
Wax myrtle	*Morella cerifera*	Native	Woody
Northern bayberry	*Morella pensylvanica*	Native	Woody
White mulberry	*Morus alba*	Native	Woody
Red mulberry	*Morus rubra*	Native	Woody
Water tupelo	*Nyssa aquatica*	Native	Woody
Black gum	*Nyssa sylvatica*	Native	Woody
Sea-beach evening primrose	*Oenothera humifusa*	Native	Herbaceous
Evening primrose	*Oenothera parviflora*	Native	Herbaceous
Sensitive fern	*Onoclea sensibilis*	Native	Herbaceous
Prickly pear cactus	*Opuntia compressa*	Native	Cactus
Eastern prickly pear	*Opuntia humifusa*	Native	Cactus
Cinnamon-fern	*Osmunda cinnamomea*	Native	Herbaceous
Royal fern	*Osmunda regalis*	Native	Herbaceous
Yellow wood sorrel	*Oxalis stricta*	Native	Herbaceous
Violet Woodsorrel	*Oxalis violacea*	Native	Herbaceous
Bitter seabeach grass	*Panicum amarum*	Native	Herbaceous
Beaked panicgrass	*Panicum anceps*	Native	Graminoid
Panic grass	*Panicum spp.*	Native	Graminoid
Switchgrass	*Panicum virgatum*	Native	Graminoid
Virgina creeper	*Parthenocissus quinquefolia*	Non-native/Invasive	Vine
Dallis-grass	*Paspalum dilatatum*	Native	Graminoid
Crown grass	*Paspalum sp.*	Both	Graminoid
Passion flower/maypop	*Passiflora incarnata*	Non-native/Invasive	Vine
Pearl millet	*Pennisetum glaucum*	Native	Graminoid
Red bay	*Persea borbonia*	Native	Woody
Broad beech fern	*Phegopteris hexagonoptera*	Native	Herbaceous

Common name	Genus and Species	Status	Life Form
Red chokeberry	*Photinia pyrifolia*	Native	Woody
Pokeweed	*Phytolacca americana*	Native	Herbaceous
Loblolly pine	*Pinus taeda*	Native	Woody
narrowleaf silkgrass	*Pityopsis graminifolia*	Non-native/Invasive	Herbaceous
English plantain	*Plantago lanceolata*	Native	Herbaceous
Sweetscent	*Pluchea odorata*	Native	Herbaceous
Mayapple	*Podophyllum peltatum*	Native	Herbaceous
False water pepper	*Polygonum hydropiperoides*	Native	Herbaceous
Pennsylvania smartweed	*Polygonum pensylvanicum*	Non-native/Invasive	Herbaceous
Lady's thumb	*Polygonum persicaria*	Native	Herbaceous
Arrow-leaved tearthumb	*Polygonum sagittatum*	Native	Herbaceous
Bog smartweed	*Polygonum setaceum*	Native	Herbaceous
Jumpseed	*Polygonum virginianum*	Native	Herbaceous
Christmas fern	*Polystichum acrostichoides*	Native	Herbaceous
Slender pondweed	*Potamogeton pusillus*	Native	Herbaceous
Black cherry	*Prunus serotina*	Native	Woody
Bracken fern	*Pteridium aquilinum*	Native	Herbaceous
White oak	*Quercus alba*	Native	Woody
Southern red oak	*Quercus falcata*	Native	Woody
Laurel oak	*Quercus laurifolia*	Native	Woody
Water oak	*Quercus nigra*	Native	Woody
Cherrybark oak	*Quercus pagoda*	Native	Woody
Willow oak	*Quercus phellos*	Native	Woody
Post oak	*Quercus stellata*	Native	Woody
Black oak	*Quercus velutina*	Native	Woody
Live oak	*Quercus virginiana*	Native	Woody
Maryland meadow beauty	*Rhexia mariana*	Native	Herbaceous
Pink azalea	*Rhododendron periclymenoides*	Native	Woody

Common name	Genus and Species	Status	Life Form
Winged sumac	*Rhus copallinum*	Native	Woody
Multiflora Rose	*Rosa multiflora*	Non-native/Invasive	Woody
Swamp rose	*Rosa palustris*	Native	Woody
Himalayan berry	*Rubus bifrons*	Non-native/Invasive	Woody
Northern Dewberry	*Rubus flagellaris*	Native	Woody
Common sheep sorrel	*Rumex acetosella*	Native	Herbaceous
Curly dock	*Rumex crispus*	Native	Herbaceous
Wild sorrel	*Rumex hastatulus*	Native	Herbaceous
Water-dock	*Rumex verticillatus*	Native	Herbaceous
Common arrow-head	*Sagittaria latifolia*	Native	Herbaceous
Black willow	*Salix nigra Marshall*	Native	Woody
Lyrefleaf Sage	*Salvia lyrata*	Native	Herbaceous
Common elderberry	*Sambucus nigra*	Native	Woody
Canadian blacksnakeroot	*Sanicula canadensis*	Native	Herbaceous
Sassafrass	*Sassafrass albidum*	Native	Woody
Lizard's tail	*Saururus cernuus*	Non-Native/Invasive	Herbaceous
Tall fescue	*Schedonorus phoenix*	Native	Graminoid
Seaside little bluestem	*Schizachyrium scoparium var. littoralle*	Native	Graminoid
Saltmarsh-bulrush	*Schoenoplectus robustus*	Native	Graminoid
Softstem bulrush	*Schoenoplectus tabernaemontani*	Native	Graminoid
Wool-grass	*Scirpus cyperinus*	Non-native/Invasive	Graminoid
Nodding bristlegrass	*Setaria faberi*	Non-native/Invasive	Graminoid
Yellow bristlegrass	*Setaria pumila*	Non-native/Invasive	Graminoid
Bristle grass	*Setaria viridis*	Native	Graminoid
Eastern Blue-eyed Grass	*Sisyrinchium atlanticum*	Native	Herbaceous
Saw greenbrier	*Smilax bona-nox*	Native	Vine
Cat greenbrier	*Smilax glauca*	Native	Vine
Laurel-leaf greenbrier	*Smilax laurifolia*	Native	Vine

Common name	Genus and Species	Status	Life Form
Common greenbrier	*Smilax rotundifolia*	Native	Vine
Horsenettle	*Solanum carolinense*		Herbaceous
Dusty goldenrod	*Solidago puberula*	Native	Herbaceous
Wrinkle-leaved goldenrod	*Solidago rugosa*	Native	Herbaceous
Seaside goldenrod	*Solidago sempervirens*	Non-native/Invasive	Herbaceous
Johnson grass	*Sorghum halepense*	Native	Graminoid
Big cord-grass	*Spartina cynosuroides*	Native	Graminoid
Saltmeadow cordgrass	*Spartina patens*	Native	Graminoid
Annual wooly bean	*Strophostyles helvula*	Native	Vine
Small-headed aster	*Symphyotrichum racemosum*	Native	Herbaceous
Dandelion	*Taraxacum officinale*		Herbaceous
Bald cypress	*Taxodium distichum*		
New York fern	*Thelypteris noveboracensis*	Native	Herbaceous
Crane-fly orchid	*Tipularia discolor*	Native	Herbaceous
Common poison ivy	*Toxicodendron radicans*	Native	Vine
Virginia marsh St. John's wort	*Triadenum virginicum*	Non-native/Invasive	Herbaceous
Purple top	*Tridens flavus*	Native	Graminoid
Red clover	*Trifolium pratense*	Native	Herbaceous
White clover	*Trifolium repens*	Non-native/Invasive	Herbaceous
Common cattail	*Typha latifolia*	Non-native/Invasive	Woody
American elm	*Ulmus americana*	Native	Woody
Sea oats (S3)	*Uniola paniculata*	Native	Graminoid
Highbush blueberry	*Vaccinium corymbosum*	Native	Woody
High-bush blueberry	*Vaccinium stamineum*	Native	Herbaceous
New York ironweed	*Vernonia noveboracensis*	Native	Herbaceous
Black haw	*Viburnum prunifolium*	Non-Native/Invasive	Woody
Spring vetch	*Vicia sativa*	Native	Herbaceous
A violet	*Viola primulifolia*	Native	Herbaceous

Common name	Genus and Species	Status	Life Form
Summer grape	*Vitis aestivalis*	Native	Vine
Fox grape	*Vitis labrusca*	Native	Vine
Muscadine grape	*Vitis rotundifolia*	Native	Vine
Six weeks fescue	*Vulpia octoflora*	Native	Graminoid
Netted chain fern	*Woodwardia areolata*	Native	Herbaceous

Table E-8. Birds of Conservation Concern 2008 – Bird Conservation Regions 27, 30 & USFWS Region 5 (a - ESA candidate, b – breeding, c- non-listed subspecies or population of Threatened or Endangered species, nb- non-breeding in BCR)

American Bittern (nb)	Long-billed Curlew (nb)
American Kestrel (paulus ssp.)	Marbled Godwit (nb)
American Oystercatcher	Nelson's Sharp-tailed Sparrow (nb)
Arctic Tern	Olive-sided Flycatcher
Audubon's Shearwater (nb)	Painted Bunting
Bachman's Sparrow	Peregrine Falcon (b)
Bald Eagle (b)	Pied-billed Grebe
Bay-breasted Warbler	Prairie Warbler
Bewick's Wren (bewickii ssp.)	Prothonotary Warbler
Bicknell's Thrush	Purple Sandpiper (nb)
Black Rail	Red Knot (rufa ssp.) (a) (nb)
Black Skimmer	Red-headed Woodpecker
Black-capped Petrel (nb)	Red-throated Loon (nb)
Black-throated Green Warbler	Roseate Spoonbill (nb)
Blue-winged Warbler	Rusty Blackbird (nb)
Brown-headed Nuthatch	Saltmarsh Sharp-tailed Sparrow (nb)
Buff-breasted Sandpiper (nb)	Sandwich Tern
Canada Warbler	Seaside Sparrow (c)
Cerulean Warbler	Sedge Wren (nb)
Chuck-will's-widow	Semipalmated Sandpiper (Eastern) (nb)
Common Ground-Dove	Short-billed Dowitcher (nb)
Golden-winged Warbler	Short-eared Owl (nb)
Greater Shearwater (nb)	Snowy Egret
Gull-billed Tern	Snowy Plover (c)
Henslow's Sparrow	Solitary Sandpiper (nb)
Horned Grebe (nb)	Swainson's Warbler
Hudsonian Godwit (nb)	Swallow-tailed Kite
Kentucky Warbler	Upland Sandpiper (nb)
Least Bittern	Whimbrel (nb)
Least Tern (c)	Whip-poor-will
LeConte's Sparrow (nb)	Wilson's Plover
Lesser Yellowlegs (nb)	Wood Thrush
Limpkin	Worm-eating Warbler
Loggerhead Shrike	Yellow Rail (nb)

APPENDIX F: COORDINATED BIRD MONITORING: TECHNICAL RECOMMENDATIONS FOR MILITARY LANDS

USGS
science for a changing world

Prepared in cooperation with the DoD Natural Resources Program, Arlington, Virginia; Great Basin Bird Observatory, Reno, Nevada; U.S. Army Engineer Research and Development Center, Environmental Laboratory, Vicksburg, Mississippi; DoD Partners in Flight, Warrenton, Virginia

Coordinated Bird Monitoring: Technical Recommendations for Military Lands

Open-File Report 2010–1078

U.S. Department of the Interior
U.S. Geological Survey

Coordinated Bird Monitoring: Technical Recommendations for Military Lands

By Jonathan Bart and Ann Manning, U.S. Geological Survey; Leah Dunn, Great Basin Bird Observatory; Richard Fischer and Chris Eberly, Department of Defense Partners in Flight

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A Report Prepared for the Department of Defense Legacy Resource Management Program
Legacy Project # 05-246, 06-246, 07-246

Open-File Report 2010–1078

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2012

The DoD Legacy Resource Management Program funded this project. For more information, visit *https://www.dodlegacy.org*

For more information on the DoD Natural Resources Conservation Program, visit http://www.dodnaturalresources.net. For more information on the DoD Partners in Flight Program, visit http://www.dodpif.orgSuggested citation:
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Conversion Factors

Multiply	By	To obtain
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)
	Length	
centimeter (cm)	0.3937	inch (in.)
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)
meter (m)	1.094	yard (yd)

Abbreviations and Acronyms

AAL	above antenna level
ABC	American Bird Conservancy
APA	Administrative Procedures Act
AKN	Avian Knowledge Network
ARU	autonomous recording units
BASH	Bird/Animal Aircraft Strike Hazard
BBIRD	Breeding Bird Research and Monitoring Database
BBS	North American Breeding Bird Survey
BMDE	Bird Monitoring Data Exchange
CBC	Christmas Bird Count
CBM	Coordinated Bird Monitoring
CBMD	Coordinated Bird Monitoring Database
CI	confidence interval
CV	coefficient of variation
DoD	Department of Defense
DoD PIF	DoD Partners in Flight
FOIA	Freedom of Information Act
FRESC	Forest and Rangeland Ecosystems Science Center
GBIF	Global Biodiversity Information Facility
GPS	Global Positioning System
IBP	The Institute for Bird Populations
INRMP	Integrated Natural Resources Management Plan
Legacy	DoD Legacy Resource Management Program

Abbreviations and Acronyms—Continued

MAPS	Monitoring Avian Productivity and Survivorship
MAWS	Monitoring Avian Winter Survival
MBTA	Migratory Bird Treaty Act
MoSI	Monitoreo de Sobrevivencia Invernal
MOU	Memorandum of Understanding
NABCI	North American Bird Conservation Initiative
NBII	USGS National Biological Information Infrastructure program
NE CBM Plan	Northeast Coordinated Bird Monitoring Plan
NEPA	National Environmental Policy Act
NEXRAD	NEXt generation RADar
NOAA	National Oceanic and Atmospheric Administration
NRMP	Natural Resources Monitoring Partnership
NWS	National Weather Service
PIF	Partners in Flight
PRISM	Program for Regional and International Shorebird Monitoring
RF	radio frequency
SE	standard error
SERDP	Strategic Environmental Research and Development Program
SOC	species of concern
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WSR-88D	Weather Surveillance Radar, 1988-Doppler

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Coordinated Bird Monitoring: Technical Recommendations for Military Lands

By Jonathan Bart and Ann Manning, U.S. Geological Survey; Leah Dunn, Great Basin Bird Observatory; Richard Fischer and Chris Eberly, Department of Defense Partners in Flight

Executive Summary

The Department of Defense (DoD) is subject to several rules and regulations establishing responsibilities for monitoring migratory birds. The Sikes Act requires all military installations with significant natural resources to prepare and implement Integrated Natural Resources Management Plans (INRMPs). These plans guide the conservation and long-term management of natural resources on military lands in a manner that is compatible with and sustains the military mission. An INRMP also supports compliance with all legal requirements and guides the military in fulfilling its obligation to be a good steward of public land.

The management and conservation of migratory birds is addressed in installation INRMPs. The National Environmental Policy Act (NEPA) requires federal agencies to evaluate and disclose the potential environmental impacts of their proposed actions. More recently, DoD signed an MOU (*http://www.dodpif.org/downloads/EO13186_MOU-DoD.pdf*) for migratory birds, under Executive Order 13186, with the US Fish and Wildlife Service (USFWS) in July 2006 and a Migratory Bird Rule (*http://www.dodpif.org/downloads/MigBirdFINALRule_FRFeb2007.pdf*) was passed by Congress in February 2007. The Migratory Bird Rule addresses the potential impacts of military readiness activities on populations of migratory birds and establishes a process to implement conservation measures if and when a military readiness activity is expected to have a significant adverse impact on a population of migratory bird species (as determined through the NEPA process). The MOU states that for non-military readiness activities, prior to initiating any activity likely to affect populations of migratory birds DoD shall (1) identify the migratory bird species likely to occur in the area of the proposed action and determine if any species of concern could be affected by the activity, and (2) assess and document, using NEPA when applicable, the effect of the proposed action on species of concern. By following these procedures, DoD will minimize the possibility for a proposed action to unintentionally take migratory birds at a level that would violate any of the migratory bird treaties and potentially impact mission activities. In addition, implementing conservation and monitoring programs for migratory birds supports the ecosystem integrity necessary to sustain DoD's natural resources for the military mission.

Non-compliance with the procedural requirements of the MBTA could result in a private party lawsuit under the Administrative Procedures Act (APA). A lawsuit filed under APA involving a Navy bombing range is the basis for a court ruling that unintentional take of migratory birds applies to federal actions. Ensuring the necessary data is available to adequately assess impacts of a proposed action will help avoid lawsuits or help ensure such lawsuits have no grounds. The data gathered in a bird monitoring program will provide the best scientific data available to assess the expected impacts of a proposed action on migratory bird species through the NEPA process.

This report presents recommendations developed by the U.S. Geological Survey (USGS) for the Department of Defense (DoD) on establishing a "Coordinated Bird Monitoring (CBM) Plan." The CBM Plan is intended to ensure that DoD meets its conservation and regulatory responsibilities for monitoring birds (Chapter 1). The report relies heavily on recommendations in the report, "Opportunities for improving avian monitoring" (*http://www.nabci-us.org/aboutnabci/monitoringreportfinal0307.pdf*), by the U.S. North American Bird Conservation Initiative (U.S. NABCI Monitoring Subcommittee, 2007) and on a review of 358 current DoD bird monitoring programs carried out as part of this project (Chapter 2).

This report contains 12 recommendations which, if followed, would result in a comprehensive, efficient, and useful approach to bird monitoring. The recommendations are based on the entire report but are presented together at the end of Chapter 1. DoD has agreed to consider implementing these recommendations; however, final decisions will be based upon such factors as the availability of resources and military mission considerations. These recommendations from USGS can be summarized into 6 major themes:

1. A major report on monitoring was released in 2007 by the U.S. North American Bird Conservation Initiative (*http://www.nabci-us.org/main2.html*). DoD can be consistent with this report by establishing policy that monitoring will be explicitly acknowledged as an integral element of bird management and conservation (Recommendation 1).
2. The design of monitoring and assessment programs for birds should include the following steps:
    a. Preparation of a document describing the program's goals, objectives, and methods similar to a format we provide (Recommendation 2, Chapter 4).
    b. Selection of field methods using an "expert system" developed in this project (Recommendation 3, Chapter 5) or another well-documented system.
    c. Preparation and storage of metadata describing the monitoring program in the Natural Resources Monitoring Partnership (NRMP), and other appropriate databases (Recommendation 4, Chapter 6).
    d. Entry of the survey data using eBird (*http://ebird.org/content/dod*) or the Coordinated Bird Monitoring Database (CBMD) and long-term storage of the data in the CBMD and the Avian Knowledge Network (AKN; Recommendation 5, Chapter 6; *http://www.avianknowledge.net/*).
    e. Submission of major results from the monitoring program for publication in a peer-reviewed journal (Recommendation 6).
3. The DoD Legacy Resource Management Program (Legacy; *https://www.dodlegacy.org*), Environmental Security Technology Certification Program (ESTCP; *http://www.serdp.org/*), and Strategic Environmental Research and Development Program (SERDP; *http://www.serdp.org/*) should be encouraged to continue their significant contributions to the foundations of bird monitoring (Recommendation 7, Chapters 1 and 3).

4. Appropriate monitoring should be conducted to identify species of concern on installations. A year-round, one-time survey of birds on installations with habitat for migratory birds would provide the most information to assist compliance with the MOU, the Final Rule, and the NEPA analyses of proposed actions. However, less intensive survey efforts can still be conducted to yield useful information. We describe how various levels of survey effort might be organized and conducted. In addition, continuing surveys, as feasible, would further assist in documenting effects of military readiness and non-readiness activities on species of concern (SOC) (Recommendation 8, Chapter 7).
5. Participation in well-designed, large-scale surveys [(e.g., North American Breeding Bird Survey (BBS; *http://www.pwrc.usgs.gov/bbs/*), Monitoring Avian Productivity and Survivorship (MAPS; *http://www.birdpop.org/maps.htm*)] on land that DoD manages or on lands where the results will be of high interest to DoD, will provide DoD and other NABCI members with information important to bird conservation (Recommendation 9, Chapter 8).
6. Review and implementation of the CBM Plan should involve both higher level management and installation-level natural resources managers (Recommendation 11), be implemented through cooperative partnerships (Recommendation 12), and be followed on U.S territory lands and Army Corps of Engineers projects (Recommendation 10).

Additional recommendations that pertain to implementing the DoD CBM Plan are discussed in Chapter 9.

Chapter 1: Project Summary

This document is the final report under a contract between the Department of Defense (DoD) and the U.S. Geological Survey (USGS). The report describes an approach for bird monitoring, termed the DoD Coordinated Bird Monitoring (CBM) Plan that is intended to ensure that DoD meets its legal requirements for monitoring birds in the most efficient manner possible. The motivation for the report was a determination within DoD that their monitoring programs could be made more efficient and effective through improved coordination, better specification of goals, advice on selection of field and analytic methods, and improved methods for storing and managing the data. Our review showed that the goals and objectives of many DoD monitoring programs are unclear or at least not specified in writing, little rationale is provided for field or analytic methods, and data are usually not contributed to a central repository. In addition, there has heretofore been no agreement on the role of DoD in large-scale, well-designed monitoring programs, nor has there been any specific guidance on how natural resources managers can fulfill DoD's responsibilities under the 2006 Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS; as required under Executive Order 13186) or the Final Rule regarding migratory birds. The DoD CBM Plan is intended to help DoD address these problems.

Major findings and recommendations are presented in this Chapter. The document then presents a review of current bird monitoring on DoD installations (Chapter 2) and of emerging technologies useful in bird monitoring that DoD has helped support (Chapter 3). These chapters describe the current state of bird monitoring and research on bird monitoring in DoD. The next three chapters are intended for those who conduct or directly supervise bird monitoring programs. They include suggestions for designing short-term monitoring or assessment programs (Chapter 4), selection of field methods (Chapter 5), and storage of monitoring data in long-term repositories (Chapter 6). The final three chapters are intended for policy makers who must make decisions about the general approach DoD will take in bird monitoring. They include a discussion of appropriate monitoring programs for species of concern (Chapter 7), DoD's participation in large-scale bird monitoring programs (Chapter 8), and suggestions for how to implement the CBM Plan throughout DoD (Chapter 9). In the next section below, we describe several recent developments with major implications for how DoD conducts bird monitoring programs.

The U.S. NABCI Report on Bird Monitoring

In February 2007, the Monitoring Subcommittee of the U.S. North American Bird Conservation Initiative (NABCI) released its report "Opportunities for improving avian monitoring" (U.S. NABCI Monitoring Subcommittee, 2007). The report, which was prepared by a distinguished panel of 16 experts in bird monitoring, emphasized the importance of clearly understanding the management questions that monitoring can address before initiating new surveys. The report established four goals and contained four recommendations to achieve these goals (table 1). It also presented a series of action items by which the recommendations and goals could be achieved. DoD, along with the other members of the U.S. NABCI Committee, signed an MOU (U.S. NABCI Committee, 2007) to adopt the goals, recommendations, and action items in the 2007 NABCI Monitoring Subcommittee report that, among other things, states that signatories will "use their best efforts to":

> *Support and promote broad scale bird monitoring programs such as the USGS Breeding Bird Survey (BBS), Monitoring Avian Productivity and Survivorship (MAPS), the Program for Regional and International Shorebird Monitoring (PRISM), and others.*

Table 1. Goals and recommendations in the U.S. NABCI report, "Opportunities for improving avian monitoring."

[U.S. NABCI Monitoring Subcommittee, 2007]

Goal 1. Fully integrate monitoring into bird management and conservation practices and ensure that monitoring is aligned with management and conservation priorities.
Recommendation 1. Establish a policy level expectation that monitoring will be explicitly acknowledged as an integral element of bird management and conservation.
Goal 2. Coordinate monitoring programs among organizations and integrate them across spatial scales to solve conservation or management problems effectively.
Recommendation 2. Take specific steps to increase the appropriate coordination of monitoring programs.
Goal 3. Increase the value of monitoring information by improving statistical design.
Recommendation 3. Every monitoring program should be designed and periodically reviewed in consultation with administrators, managers, and statisticians familiar with bird conservation and survey design.
Goal 4. Maintain bird population monitoring data in modern data management systems. Recognizing legal, institutional, proprietary, and other constraints provide greater availability of raw data, associated metadata, and summary data from bird monitoring programs.
Recommendation 4. Develop a comprehensive plan for integrating and managing bird population monitoring data.

Making DoD monitoring activities consistent with recommendations in the report will ensure that DoD complies with the MOU and follows the best available science. Two other notable recent events in bird monitoring were the signing of an MOU between DoD and the USFWS "to promote the conservation of migratory birds" and the adoption of a Final Rule pertaining to "take of migratory birds by the Armed Forces." The MOU became effective on August 30, 2006; the final rule became effective on March 30, 2007. Both measures include compelling language on the importance of monitoring bird populations. Such monitoring will be critical in assessing the overall impacts of proposed actions on populations of migratory birds, as required per the MBTA (Migratory Bird Treaty Act) /DoD Final Rule and NEPA.

Under the 2006 MOU (table 2), DoD agrees to collaborate with the USFWS and other groups involved in bird monitoring efforts to:

- assess the status and trends of bird populations and habitats,
- use national standards and protocols to the extent appropriate,
- deposit monitoring and inventory data it collects in national repositories, and
- promote participation in national inventory and monitoring programs, such as the BBS.

DoD also agrees that prior to starting any activity that is likely to affect populations of migratory birds it will identify species likely to occur in the area and determine whether any species of concern "could be affected by the activity." Furthermore, DoD agrees to "evaluate the effectiveness of conservation measures to minimize or mitigate take of migratory birds" and to review Integrated Natural Resources Management Plans (INRMPs) to determine whether updates or revisions are needed "to avoid or minimize take of migratory birds."

Table 2. Selected passages from the MOU between DoD and the U.S. Fish and Wildlife Service to promote the conservation of migratory birds.

[Department of Defense, 2006]

D. Responsibilities

1. Each Party shall:

d. Promote collaborative projects such as:

(1) Developing or using existing inventory and monitoring programs, at appropriate scales, with national or regional standardized protocols, to assess the status and trends of bird populations and habitats, including migrating, breeding, and wintering birds;

(2) Designing management studies and research projects using national or regional standardized protocols and programs, such as MAPS, to identify the habitat conditions needed by applicable species of concern, to understand interrelationships of co-existing species, and to evaluate the effects of management activities on habitat and populations of migratory birds;

(3) Sharing inventory, monitoring, research, and study data for breeding, migrating, and wintering bird populations and habitats in a timely fashion with national data repositories such as Breeding Bird Research and Monitoring Database (BBIRD), National Point Count Database, National Biological Information Infrastructure, and MAPS;

[(4) Intentionally excluded]

(5) Participating in or promoting the implementation of existing regional or national inventory and monitoring programs such Breeding Bird Survey (BBS), BBIRD, Christmas Counts, bird atlas projects, or game bird surveys (e.g., mid-winter waterfowl surveys) on DoD lands where practical and feasible.

(6) Using existing partnerships and exploring opportunities for expanding and creating new partnerships to facilitate combined funding for inventory, monitoring, management studies, and research.

2. The Department of Defense shall:

d. Consistent with imperatives of safety and security, allow the USFWS and other partners reasonable access to military lands for conducting sampling or survey programs such as MAPS, BBS, BBIRD, International Shorebird Survey, and breeding bird atlases.

e. Prior to starting any activity that is likely to affect populations of migratory birds:

(1) Identify the migratory bird species likely to occur in the area of the proposed action and determine if any species of concern could be affected by the activity;

(2) Assess and document, using NEPA when applicable, the effect of the proposed action on species of concern.

g. Develop and implement new and/or existing inventory and monitoring programs, at appropriate scales, using national standardized protocols, to evaluate the effectiveness of conservation measures to minimize or mitigate take of migratory birds, with emphasis on those actions that have the potential to significantly impact species of concern.

i. In accordance with DoD INRMP guidance, promote timely and effective review of INRMPs with respect to migratory bird issues with the USFWS and respective state agencies. During The INRMP review process, evaluate and coordinate with USFWS on any potential revisions to migratory bird conservation measures taken to avoid or minimize take of migratory birds.

Under the Final Rule (table 3), DoD may take migratory birds during military readiness activities, but if DoD concludes that the take may result in a "significant adverse effect on a population" then it must confer with the USFWS "to develop and implement appropriate conservation measures to minimize or mitigate" the effects. If the actions taken include monitoring, then the data collected must be retained for 5 years. If monitoring mutually agreed to by the parties is not implemented, then the Secretary of the Interior can withdraw the take authorization, which would arguably make the military readiness activity in violation of the MBTA when a migratory bird is incidentally taken by the activity.

Table 3. Selected passages from the Final Rule by the USFWS pertaining to "take of migratory birds by the Armed Forces."

[U.S. Fish and Wildlife Service, 2007]

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§ 21.15 Authorization of take incidental to military readiness activities.

(a) Take authorization and monitoring

(1) …the Armed Forces may take migratory birds incidental to military readiness activities provided that, for those ongoing or proposed activities that the Armed Forces determine may result in a significant adverse effect on a population of a migratory species, the Armed Forces must confer and cooperate with the Service to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects.

(2) When conservation measures implemented under paragraph (a)(1) of this section {§21.15} require monitoring, the Armed Forces must retain records of any monitoring data for five years from the date the Armed Forces commence their action.

(b) Suspension or withdrawal of take authorization

(2) The Secretary may … withdraw …authorization for take… if the Secretary determines that a proposed military readiness activity is likely to result in a significant adverse effect on the population of a migratory bird species and one or more of the following circumstances exists:

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

From the discussion in the NEPA portion of the Required Determinations section of the rule (Federal Register, p. 8949):

Furthermore, we [USFWS] expect that military readiness activities will rarely, if ever, have the broad impact that would lead to a significant adverse effect on a population of a migratory bird species, even absent the conservation measures that the Armed Forces undertake voluntarily or pursuant to another statue.

The implementation of DoD monitoring programs will provide essential information needed for assessing the impacts of proposed military actions on migratory birds, as required per NEPA. The information obtained would help guide DoD towards more effective and efficient management and conservation of migratory birds, which would reduce the potential for USFWS invoking their prosecutorial discretion in seeking a MBTA violation and protect from possible third party litigation. In support of this effort, DoD has agreed to participate appropriately in regional and national monitoring programs, to assess effects of military readiness activities on bird populations and, if those effects are significant, to undertake various actions including monitoring. When required by the Final Rule, failure to carry out appropriate monitoring could result in suspension of authorization to take migratory birds. In the rest of this report, we make frequent reference to the MOU and Rule and propose numerous measures to ensure that DoD meets its obligations under them.

CBM Plan for the Northeastern United States

The Northeast Coordinated Bird Monitoring (NE CBM; *http://www.nebirdmonitor.org/*) Partnership recently released their "Northeast Bird Monitoring Handbook" (Lambert and others, 2009; *http://www.nebirdmonitor.org/handbook*) featuring "Ten steps to successful bird conservation through improved monitoring" (table 4). Their steps are consistent with the recommendations in this report. For example, steps 1 through 6 are similar to the recommendations in Chapters 4 and 5 of this report, although they contain a number of useful new ideas, such as their emphasis on how the target population relates to "other ecosystem elements, processes, and stressors." Step 7, on data management, contains material similar to the recommendations in Chapter 6. Their steps 8-10 focus on implementation that we cover only briefly (Chapter 9). Overall, the NE CBM Plan provides an excellent companion document to this one. Both can be used at all installations involved in bird monitoring.

Table 4. Ten steps to successful bird conservation through improved monitoring.

[From Lambert and others, 2009]

Step 1:	Establish a clear purpose.
Step 2:	Determine whether an existing program or protocol meets your needs.
Step 3:	Assemble a team of collaborators with complementary interests and skills.
Step 4:	Summarize the relationship of target populations to other ecosystem elements, process, and stressors.
Step 5:	Develop a sound approach to sampling and data analysis.
Step 6:	Design standardized protocols that minimize error and bias.
Step 7:	Identify or develop a data management system.
Step 8:	Implement the monitoring program.
Step 9:	Report results in a format that supports conservation decisions.
Step 10:	Use results to make better and more cost-effective management and conservation decisions.

Major Findings of this Study

This section briefly reviews the major findings of this study. More detailed accounts of each part of the study are contained in the remaining Chapters. The review of current monitoring programs (Chapter 2) was conducted by contacting 405 DoD military installations using telephone and email throughout the United States (but not in territories or other countries) and obtaining standardized descriptions of bird monitoring programs that were active during 2002–2004. Descriptions were obtained of 358 monitoring programs from 134 installations. The descriptions were deposited in repositories maintained by Bird Studies Canada, the Laboratory of Ornithology at Cornell University, and the USGS. Many surveys were undertaken as part of the Monitoring Avian Productivity and Survivorship program (MAPS; 29 surveys), the Bird/Animal Aircraft Strike Hazard program (BASH; 25 surveys), the Christmas Bird Count (CBC; 22 surveys), or the Breeding Bird Survey (BBS; 9 surveys). Landbirds were the most common species studied (74 surveys), although waterbirds (22 surveys) and raptors (25) also were often studied. Major conclusions from this project were that documentation of DoD efforts in bird monitoring is poor at present but can readily be improved by requiring that a description of each survey be deposited in the Natural Resources Monitoring Partnership (NRMP; see Recommendation 4 below for description) and by following additional recommendations below. Detailed results from this survey are presented in Chapter 2.

DoD has been a leader in supporting research on bird monitoring and this support has helped not only DoD but many other agencies and organizations carry out effective and efficient monitoring. A brief review of emerging technologies that will lead to additional improvements is provided in Chapter 3.

Guidelines for designing bird monitoring surveys (Chapter 4) included three separate products: a manuscript describing how projects should be planned, guidelines for selecting field methods, and a new USGS database to be used for data management. The manuscript was based on current views of how monitoring should be designed (e.g., Oakley and others, 2003; U.S. NABCI Monitoring Subcommittee, 2007) and stressed explicit identification of goals, objectives, and methods. The guidelines have been published (Bart, 2005) but a slightly modified version stressing DoD applications is presented in Chapter 4.

The guidelines for designing bird monitoring surveys (Chapter 4) and those for selecting survey methods (Chapter 5) were developed to provide DoD natural resources managers and biologists (both employees and contractors) with a single authoritative source that can easily be adapted to their needs and updated as new methods are introduced.

The CBM database (Chapter 6) was created because all existing databases that accept data from throughout the country require that users accept a standardized list of variables; none of them permit the managers of the survey to define their own variables. By contrast, the new “Coordinated Bird Monitoring Database” (CBMD) does permit the managers of each program to define their own variables. The CBMD is maintained by the USGS. The CBMD is meant to be used in combination with the eBird program (for entering fairly simple observations) and the AKN (for storing a reduced set of variables).

An extensive review of existing information on ranges of species of concern (SOC), specifically from the American Bird Conservancy (ABC)/ National Audubon Society (Audubon) Watch List (*http://www.abcbirds.org/abcprograms/science/watchlist/index.html*), was undertaken to identify installations that are used or may be used by these species, especially during the breeding season, or that are major concentration areas for groups of species during the non-breeding seasons (Chapter 7). The review identified 293 installations that probably are used by >70 SOC. We identified 35 installations that probably do not support SOC. This review did not include contacting installation biologists, many of whom undoubtedly know what SOC occur on their installations. The review does show, however, that no comprehensive analysis exists of which installations are important for which SOC. This information is needed for compliance with the MOU and Migratory Bird Rule and other rules and regulations (e.g., NEPA compliance). We provide recommendations for how to carry out brief surveys, partly by using the eBird program, to obtain the needed information.

The following criteria can be used to determine the level of DoD participation in large-scale surveys (Chapter 8): (1) if the lands to be surveyed are under DoD management and are very important to the focal species, then greater participation by DoD will have greater benefits for both the resource and to DoD; (2) if the lands to be surveyed are not under DoD management, but are still very important to the focal species (e.g., on migration or wintering areas), then greater participation by DoD also will have greater benefits for both the resource and DoD.

Recommendations

This section summarizes our recommendations and provides brief explanations and justifications for them. The section is meant to serve as a short, stand-alone summary of the study that provides more detail than is in the Executive Summary.

1. The recent recommendation by the U.S. NABCI Committee (U.S. NABCI Monitoring Subcommittee, 2007) to "establish a policy level expectation that monitoring will be explicitly acknowledged as an integral element of bird management and conservation" offers a useful policy commitment to achieve scientifically based management throughout DoD.

   Although many federal and non-federal programs that influence birds do include monitoring efforts, the NABCI Subcommittee's review indicates that many other programs do not. The recommendations in this report will help ensure that monitoring is appropriately incorporated into all DoD activities. An MOU endorsing the NABCI report was signed by members of the U.S. NABCI Committee, including DoD. Formal DoD policy endorsing the NABCI Subcommittee recommendation and this Plan would be appropriate and beneficial in implementing the goals of this Plan.

2. DoD monitoring programs will maximize scientific validity and success by following the 'Guidelines' presented in Chapter 4.

   A detailed description of what management issue the monitoring program will address, what quantities (e.g., individuals, breeding males, nests) need to be estimated, and what methods will be used — including the sampling plan, data management strategy, and reporting, as well as field methods — is now viewed as an essential component of planning any monitoring program (U.S. NABCI Monitoring Subcommittee, 2007). Following the Guidelines described in this report will ensure that all these topics are adequately addressed.

3. We recommend that DoD natural resources managers consider using the guidelines presented in this report for selecting field methods and contribute to improving them as needed.

   Using of the key presented in Chapter 5, and continually improving it, will ensure that state-of-the-art field methods are selected in DoD bird monitoring programs. This will both ensure that data collection is efficient and will provide a measure of assurance that others cannot successfully challenge the program's results on the basis that the methods used were inappropriate.

4. Preparation of metadata for all DoD monitoring programs and entry into permanent repositories, such as the NRMP database maintained by the USGS Status and Trends Program, will enhance the value and utility of the information collected.

   Metadata is a standardized format for describing datasets including who collected the data and how, what information the dataset contains, and numerous details about the data. The NRMP was developed through collaboration by numerous organizations involved in ecological monitoring and is now recognized as the primary repository for descriptions of monitoring programs and metadata. Entering the description of a program requires only a few minutes by someone familiar with the monitoring program. The information provided makes it possible to quickly and easily retrieve all programs within the database related to a given issue, area, or set of species. DoD participation in the NRMP would be consistent with the MOU and Migratory Bird Rule.

5. Using eBird or the CBMD for data entry and the CBMD and the AKN for permanent data storage will maximize efficiency of processing and guarantee future access to the information collected (see fig. 2 in Chapter 6).

   The eBird program, managed by the Cornell Laboratory of Ornithology, provides a convenient Internet-based method for recording observations made by birders, and steps are being taken to ensure that eBird is available to all DoD personnel. [For more information on eBird, see page 39]. For more complex surveys, we recommend use of the CBMD, which was developed during this project. Virtually any information collected on a "counts survey" (times and places were selected and something was counted) can be stored in the CBMD. The CBMD is a permanent USGS repository so information stored in it will not be lost. The data can be made available by password only (because it would be subject to a Freedom of Information Act (FOIA) request, highly sensitive data should not be stored in the CBMD). If the data owner chooses, core variables will be uploaded from the CBMD to the AKN at Cornell University on a regular basis. The Cornell Laboratory of Ornithology also has offered to make digital or paper copies of all DoD survey datasets and to store them until they are entered into eBird, the CBMD, or the AKN. Accepting this offer from the Cornell Lab would ensure that datasets are not lost. Chapter 6 provides details on how data entry can be accomplished efficiently.

   Having detailed data from DoD installations is important for assessing the population status of migratory birds and will permit assessment of the impacts of proposed military (both readiness and non-readiness) activities on migratory birds, especially at the population level, as required per the MBTA/DoD rule. An accurate assessment will reduce the installation's vulnerability to lawsuits filed under the Administrative Procedures Act (APA).

6. Publishing the results from major monitoring efforts in the peer-reviewed literature will enhance their credibility.

   When awarding contracts or making other arrangements for monitoring projects, DoD may choose to encourage publication of major results. This will help establish their reliability and will help discourage challenges to decisions based on the results.

7. Continuation by DoD of its SERDP and Legacy programs will accomplish a wide variety of avian conservation efforts.

   The Legacy and SERDP programs are widely recognized as making important contributions to bird conservation and bird monitoring in particular. For example, funds from these programs were used by USGS to develop the CBMD and by Cornell University to develop new monitoring techniques based on sophisticated sound recording systems. DoD, as well as the general research and management communities, should consider Legacy and SERDP as important programs that can provide funds to answer DoD-specific questions about bird conservation, and these programs should be considered an essential component of the overall DoD CBM Plan. An increase in Legacy funding to cover unfunded monitoring and other bird-related needs would provide significant benefit to DoD in sustaining its training mission.

8. Appropriate monitoring should be conducted to identify species of concern on installations. A year-round, one-time survey of birds on installations with habitat for migratory birds would provide the most information to assist compliance with the MOU, the Final Rule, and NEPA analyses of proposed actions. However, less intensive survey efforts can still be conducted to yield useful information. In addition, continuing surveys, as feasible, would further assist in documenting effects of military readiness and non-readiness activities on species of concern.

   The Final Rule makes it clear that DoD must determine the impact of military readiness training on migratory birds. This seems to require documentation of what birds are present, in what areas, and at what times of year. Without such information, collected using appropriate methods and archived in a permanent database, DoD cannot show that it has met this requirement, nor can it accurately assess the level of impacts that proposed actions may have on migratory birds. These datasets also will provide the appropriate basis for developing continuing programs to monitor migratory birds that are considered to be at risk from military readiness activities. Installations that have already completed surveys within an appropriate timeframe, and with a standardized sampling methodology, may not need to repeat this. We currently are assessing what is considered “an appropriate timeframe” and the CBM Implementation Plan will provide more guidelines for this topic. Chapter 7 provides suggestions for how to obtain the needed information with different protocols for different levels of available support and existing information on species of concern.

9. Participation in well-designed, large-scale surveys (e.g., BBS, MAPS) on land that DoD manages or on lands where the results will be of high interest to DoD, will provide DoD and other NABCI members with information important to bird conservation (Chapter 8).

   DoD may choose to participate in well-designed, extensive surveys by carrying out the recommended surveys on its own land. However, it might not choose to survey other lands, to

participate in poorly designed surveys, or to take the lead in establishing surveys except when it has responsibility for a substantial fraction of the bird populations in question (e.g., some endangered species). For example, DoD might participate in the Intermountain West Aquatic Bird Survey and in the east coast surveys of migrating shorebirds because these are both well-designed, widely endorsed surveys and DoD manages some important wetlands in both of these areas. But DoD should not be expected to take the lead in extending these surveys to other areas. Other agencies (e.g., the USFWS) probably would take the lead in such efforts. It also is becoming increasingly clear that many bird populations are limited by events occurring outside of the breeding season and outside of the United States and that only by studying birds at these times can effective conservation plans be designed. It thus may be cost effective to study species of concern during migration and at wintering areas, as well as outside the U.S., especially in the neotropics. DoD support for such work has been critical in the past. Recommendations on DoD's participation in specific large-scale surveys are discussed in Chapter 8.

10. Implementing the CBM Plan on U.S. territories and other units within DoD may be useful.

    Installations on U.S. territories may benefit by following the DoD CBM Plan. In addition, the U.S. Army Corps of Engineers, which administers approximately 12 million acres of land and water, has done relatively little inventory or monitoring to develop even baseline bird lists (except for some isolated projects that have trained personnel). The U.S. Army Engineer Research and Development Center, Environmental Laboratory, has taken steps (see Guilfoyle and Fischer, 2007) to improve that coordination, but more work in the monitoring arena would be useful.

11. Review of the recommendations in the DoD CBM Plan by upper level management in DoD would be useful with subsequent implementation, as appropriate, on DoD lands.

    At present, most decisions about when, where, and how to carry out bird monitoring activities are made at the installation level. This complicates coordination of bird monitoring activities as required by the MOU and Final Rule. For example, many months were required in this project to conduct the inventory of current bird monitoring and assessment activities whereas it could have been done in a few minutes if descriptions of these programs had been in the NRMP database. Many decisions about when, where, and how to conduct monitoring will remain at the installation level, but decisions about how to design the programs and store the data and decisions about surveying species of concern and participating in large-scale surveys could be made at a higher level (Chapter 9).

12. Following review and revision of these recommendations, as appropriate, the installation-level recommendations could be implemented through a cooperative partnership among DoD and other agencies (e.g., USGS) and non-governmental organizations.

    The recommendations include new procedures for designing short-term surveys, selecting field methods, and storing data in long-term repositories. These recommendations need to be presented, reviewed, and revised as appropriate through a series of consultations at individual installations and at regional meetings for DoD personnel. More detail about how these activities might be carried out is contained in Chapter 9.

Chapter 2: Review of DoD's Existing Bird Monitoring Programs

Many DoD installations across the country have current or recently completed bird monitoring studies. These studies originate from a variety of sources including INRMP documents, BASH programs, requirements under NEPA, state and federal requirements for threatened and endangered species monitoring, and agreements with university research programs. At the start of this project, no comprehensive survey of DoD's bird monitoring programs was available and, as a result, it was difficult to determine how many monitoring programs occur on DoD land, what their objectives are, whether they use appropriate methods, and where the data are stored. We were therefore asked to make a detailed inventory of DoD monitoring programs and to make recommendations for improving the overall value of these efforts. We also were asked to prepare metadata records for the programs, when feasible as recommended by the NBII.

Methods

Chris Eberly, the DoD Partners In Flight (DoD PIF) Program Coordinator, provided a list of installations and contacts from the National Military Fish and Wildlife Association Fish and Wildlife News subscribers list. We modified the list with updated and additional contacts, although there is a considerable amount of turnover and many contacts may no longer be accurate. Attempts to contact all installations were made by phone, email, or both. The following information was requested for each study project: study name, author/originator, brief abstract, purpose of study, years, brief methods, point of contact (name, mailing address, phone, and email). Initially, David Kirk (a contractor for the USGS) gathered similar information by phone and email and entered the results (not including contact information) into the Bird Studies Canada North American Bird Monitoring Projects Database. Later, it was decided to store the information in the NBII Clearinghouse Gateway and still later that the metadata should be stored in the newly created Natural Resources Monitoring Partnership (NRMP) database also maintained by NBII. Metadata records were created using Metavist 2005 version 1.3 obtained from the United States Department of Agriculture (USDA) Forest Service Research & Development. Contact information for each installation will not be included in these publicly accessible records. Instead, the DoD PIF Program Coordinator will be listed as the point of contact and will maintain and distribute more detailed contact information as appropriate.

Results and Discussion

Contact was made with 207 of the 405 installations. Respondents provided information on 358 bird monitoring and/or assessment projects, both long-term and short-term, on 181 installations. We tried to find additional names or phone numbers for installations that did not respond to our request for information by using the Internet but this approach was not productive. We categorized studies into groups and found that most bird monitoring efforts focused on species of concern (SOC; table 5). Detailed data about each program are presented in appendix A.

The information obtained in the metadata records will be useful in many instances including the search for datasets to use in large-scale analyses, finding studies and methods that may be valuable to duplicate in other locations, and increasing interest and participation in future bird monitoring efforts across DoD lands. Considerable time and effort was expended in collecting the necessary information to create metadata records for this project, but it would be very easy for natural resources managers to enter and maintain bird monitoring records for their installation through the NRMP website. Such a database also could be used to answer many of the data calls that at present must be addressed at the installation level. This may provide impetus for managers to keep good records of work planned and completed with the associated datasets, making the data useful beyond the immediate needs of the study project.

Through many of the phone conversations with natural resources personnel, we learned of a widespread interest in having this database available for managers to see what kinds of monitoring other installations were conducting and how they might model their own studies after successful programs. Most data are stored at the point of collection and much is on paper in a file. Many of the biologists we interviewed also commented that they would like a place to store their data (which the NRMP does not do) and that they would like advice on design, selection of field methods, and analysis of data. These issues are addressed in Chapters 4–6.

Table 5. Types of bird monitoring and assessment projects on DoD lands, including projects completed during the last 10 years.

Number of installations	Category
25	Bird/Wildlife Aircraft Strike Hazard (BASH)
29	Monitoring Avian Productivity and Survivorship (MAPS)
9	Breeding Bird Survey (BBS)
22	Audubon Christmas Bird Count (CBC)
1	Breeding Bird Census (BBC)
4	Hawk Watch
29	Nest box monitoring
122	Species of Concern
20	Single species of interest
74	Landbird focus
22	Waterbird focus
25	Raptor focus
30	Other

Chapter 3. Emerging Technologies for Monitoring

As mentioned in Chapter 1, DoD has been a leader in supporting research on bird monitoring, primarily through the DoD Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP), and applied management through the DoD Legacy Resource Management Program . Many of these projects have led to the development of methods useful to DoD as well to the larger conservation community. Here, we highlight a few areas and some of the possibilities for further progress. The few topics discussed are by no means the only areas in which substantial progress is likely to occur soon, but they illustrate the breadth of work now being done to make monitoring more effective. It also should be noted that these sections are intended only to identify some exciting potential methods, not to provide a complete discussion of advantages and disadvantages (which in general are not yet well known) or of all cases in which the methods will or will not be suitable.

Acoustics

Acoustical methods have a prominent role in avian monitoring efforts because many birds can be heard more reliably and at much greater distances than they can be seen. Autonomous data collection using recording devices and automatic data processing and analysis using specially designed software have both revolutionized and expanded the capabilities and application of acoustic technology for monitoring birds. However, several factors impede translation of bird sound detections by humans into reliable estimates of abundance. Human listeners differ significantly in hearing thresholds and psychoacoustic acuity and in their ability to identify sounds, in coping with dense choruses, and in judging distances to bird sounds. Moreover, patterns of bird sound production are not well quantified.

These limitations apply to all acoustic monitoring methodologies, whether ground-based monitoring of diurnal birds or monitoring the flight vocalizations of vast numbers of nocturnal migrants. The best uses of acoustic technologies to address these limitations and to enhance biological and conservation understanding could perhaps best be summarized as the following opportunities:

- to monitor species acoustically that vocalize infrequently,
- to improve accuracy of existing census methods,
- to produce acoustic datasets for training purposes, and
- to monitor flight-calls of migrant birds for predicting migration and stopover use on DoD installations.

Autonomous data collection is critical for any remote or extensive acoustic survey, and digital autonomous recording units (ARUs) can record time-stamped files for months-long periods or longer. These units provide a fundamental and valuable extension to traditional acoustical studies because (1) they can easily detect species that are not efficiently censused by point-count methods because they vocalize infrequently, and (2) ARUs can be deployed in advance at many sites for long durations and programmed to record simultaneously. These devices improve our knowledge of the limiting factors of observers monitoring birds acoustically and of protocols for monitoring birds that may be missed by traditional observation methods. ARUs were used extensively at Fort Hood to monitor endangered Golden-cheeked Warblers (*Dendroica chrysoparia*) and Black-capped Vireos (*Vireo actricapillus*), under SERDP CS-1185, and at DoD facilities nationwide to monitor the species composition and migration phenology of nocturnally migrating birds under Legacy 05-245, 06-245, and 07-245.

Additionally, such devices played a prominent and critical role in the recent search for several rare species (including Ivory-billed Woodpecker, *Campephilus principalis*). Other work by the University of Puerto Rico (Legacy 07-345 and 08-345) is investigating wireless remote automated digital recording systems and community-level identification of species.

Advances during the past decade in processing and analysis methodology include increased computer processor speed, automated detection software, increased data storage capacities, and a comprehensive identification guide. For processing and analyzing audio data containing flight calls, these advances permit recording of the vocalizations of passing migrants over entire nights across seasons, thus yielding data on species composition, migration timing and routing, and the magnitude of migration traffic. Because many North American species of birds give distinctive flight calls during nocturnal migration (likely close to 450–500 species), monitoring flight calls of nocturnally migrating birds is critical for studying the timing and magnitude of migration, as well as for confirming the presence of individual species. A citizen-based project running from 1999 to 2001 used pre-amplified microphones and a Java application that enabled volunteers to automatically detect nocturnal flight calls using the sound card inputs on their personal computers. Nocturnal flight calls were uploaded over the Internet each morning, and logged in a database that hosted graphical tools for reviewing and labeling the sounds. Numbers of migrants detected at night were then compared directly with ground-based censuses from nearby sites to relate the composition of species that passed overhead with those that stopped to use habitats on the ground. These numbers also were compared with WSR-88D (Weather Surveillance Radar, 1988-Doppler; also known as NEXt generation RADar, or NEXRAD) radar imagery, providing information on the species composition of radar-detected migration events. Several recent studies also have used these methods to compare nocturnal flight calls and bird density as quantified by WSR-88D imagery (e.g., Farnsworth and others, 2004). However, numerous challenges still remain to be addressed, including: quantification of birds using acoustic data; relationships between acoustic and radar data; source levels on bird vocalizations; and localization of birds in an acoustic array.

DoD applications. DoD installations require accurate measurements of migratory landbird migration patterns and population sizes. Yet, at most DoD locations, complete year-round migratory bird community inventories have not been completed. ARUs provide solutions and sample data that enhance DoD's capacity to monitor avian resources on and around DoD lands and to analyze and summarize these data. This approach to monitoring provides numerous cost efficiencies for surveys across large, inaccessible or difficult-to-survey areas. The innovative acoustic monitoring network under evaluation in current SERDP and Legacy projects provides tools to monitor migratory activity by species, contribute towards more accurate population estimates for these species, and provide information for more accurate environmental risk assessments (for the MBTA, ESA, and NEPA). In addition to monitoring avian use of DoD lands, acoustic techniques allow monitoring of bird use of airspace at night over and around DoD installations. A network of acoustic monitoring sites documents migratory phenomena that are unobservable by other means, and enable studies that extend beyond the boundaries of DoD installations. These approaches address four challenges confronting DoD:

1. acquiring detailed information to help reduce bird-aircraft strike hazards,
2. supporting the military mission while meeting environmental stewardship and regulatory obligations,
3. engaging broader societal support and solutions for environmental problems, and
4. ensuring mission sustainability by avoiding mission restrictions, delays, and impacts.

Radar

Since the discovery 60 years ago that birds were responsible for some of the puzzling radar echoes dubbed “angels” by the British, radar has proven to be a useful tool for the detection, monitoring, and quantification of the movements of organisms in the atmosphere. Radar can be used to study the movements of birds in the atmosphere during the day and at night at very small spatial scales (1–10 km of a tracking or marine radar), at intermediate spatial scales (10–200 km or the surveillance area of a single weather radar), and at large spatial scales (continent-wide radar network surveillance). Although some new technology exists and is being field tested, most available radars cannot be used to identify birds to species. However, radar can provide information on flight speeds, and this can be used to discriminate different types of birds based on their airspeeds relative to wind speed and direction (e.g., waterfowl and shorebirds, songbirds).

Radar displays show echoes of targets in the radar beam, and a single echo may be produced by a single target or two or more targets in close proximity. Radar has been valuable not only for descriptive studies of daily and seasonal patterns of bird migration and the roosting behavior of birds, but the technique also has been used to answer important questions related to orientation, aerodynamics, and habitat selection of migrants. Within the last two decades, radar has been used increasingly in risk assessment studies related to projects that could potentially impact species that are migratory, endangered, threatened, or of special concern. Most studies have used high-resolution, short-range marine radar and long-range weather surveillance radar.

Marine Radar

Configurations of Small Mobile Radars. Most of the small, mobile radar units used in studies to date have been 5 kW to 60 kW incoherent pulse marine surveillance radars of 3- or 10-cm wave length (X-band or 9410 MHz ±30 MHz and S-band or 3050 MHz ±30 MHz, respectively). Many of the units are used without modification, and the open array antenna that comes with the unit when purchased projects a beam that is narrow (1.0–2.3°) in the horizontal dimension and wider (20–25°) in the vertical dimension. The exact beam dimensions depend on the length of the open array antenna. Because the open array antenna samples a range of altitudes when the radar is operated in a horizontal surveillance mode, the altitude of individual targets cannot be determined. Several approaches have been used to get around this limitation. One involves placing the transmitter/ receiver with the open array antenna on its side and rotating the antenna vertically instead of horizontally. In this configuration, accurate altitudes of targets can be measured, but target track information is limited to targets moving along the axis of the antenna sweep. In some cases, two units are used—one devoted to horizontal surveillance and the other to vertical altitudinal scans. It also is possible to replace the open array antenna with a rotating, parabolic antenna that projects a narrow (2.5–4°) conical beam. When the conical beam is elevated in the horizontal surveillance mode, the altitude of an echo is a trigonometric function of the range of the echo and the angle of antenna tilt. In other cases, a non-rotating parabolic dish can be mounted on top of the transmitter/receiver unit and directed to any elevation angle between horizontal and vertical to measure the altitude of targets.

Each of the above configurations has its advantages and shortcomings. The open array antenna samples a greater air space, but the range of detection is reduced and the altitude of a target in the vertical scan cannot be linked to the track of a target in the horizontal scan. The parabolic antenna samples a smaller volume of atmosphere but has a greater detection range and three-dimensional information on each target can be measured.

Innovations in Small High-Resolution Radars. In the last decade, capture of raw radar data from marine radar and subsequent digital processing enabled automatic tracking of targets detected by the radar while reducing echo return from ground clutter. This innovation has eliminated the time-consuming manual plotting of radar echoes on the radar display, and provides information on target strength, speed of target, direction of flight, and altitude if a parabolic reflector is used. Track histories of individual targets can be stored for additional analysis. However, small targets flying over strong ground clutter are rarely detected because of the clutter suppression.

The latest developments in marine radar represent a radical and innovative departure from current marine radar technology. The new units are monostatic pulse radars that use the Doppler effect to determine target velocities. This is achieved by resolving targets within particular velocity bands by processing received echoes in a bank of narrowband coherently integrating filters. Consequently, the new radar is able to separate targets of interest from clutter because of the targets' different radial velocities. Thus, small targets in clutter can be detected, quantified, and tracked. Although these units have not been evaluated for bird movement studies, this will occur soon as more and more units are produced.

DoD Applications. Small mobile radars are valuable technological tools for the DoD. They can be used to detect dangerous concentrations of birds in the atmosphere on and near military air fields and this information can be used to inform flight operations that serious BASH conditions exist. When this information is gathered over time, it can be used in the development of a BASH plan for the airfield and greatly improve flight safety.

These radars also can be used to assess the best habitats on military installation for migrant birds. Because most birds initiate migratory flights shortly after dark, the radars can provide information on the relative density of migrants departing from different types of habitat. This information combined with on the ground bird census data can be extremely valuable to natural resources managers interested in the conservation of migratory birds.

Weather Surveillance Radar

Doppler Weather Surveillance Radar. The WSR-88D (Weather Surveillance Radar-1988, Doppler)—also referred to as Next Generation Radar (NEXRAD) during the planning and development stages—is the backbone of the national network of weather radars in the United States operated by the National Weather Service (NWS) in the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, DoD (units at military bases), and non-CONUS Department of Transportation sites. There are 155 WSR-88D radars in the nation, including the U.S. Territory of Guam and the Commonwealth of Puerto Rico.

Biological targets in the atmosphere are readily detected by the WSR-88D, and several investigators have detailed its use for studying bird migration, bird roosts, bat colonies, and concentrations of insects aloft. The WSR-88D can be used to quantify the amount of bird migration aloft and has been applied to studies of regional patterns of migration (e.g., Great Lake Region, Northern Coast of the Gulf of Mexico).

The WSR-88D can be used to delimit important migration stopover areas within 60 km of the radar by measuring the density of birds in the beam as they begin a migratory movement (exodus). Within minutes of the onset of nocturnal migration, the distribution and density of echoes in the radar beam can provide information on geographical ground sources of the migrants (migration stopover areas), and satellite imagery can be used to identify the topography and habitat type that characterizes these areas. At a larger spatial scale (that of the surveillance area of a single Doppler weather radar—out to 240 km range), this approach also can be used to delimit locations of post-breeding, nocturnal roost

sites of birds, such as Purple Martins (*Progne subis*) and other species. Martins flying toward the roost late in the day generally do so at low altitudes and often fly under radar coverage, however, when they depart the roost near dawn they climb high into the sky and can be easily detected by Doppler.

At a continental scale, the national network of WSR-88D radars can be used to monitor bird migration over the United States on an hourly basis at different altitudes dependent on distance from the radar. The latter achievement is significant because it provides a means of monitoring the season-to-season and year-to-year variation in the patterns of migration at different altitudes for different geographical regions and the nation as a whole.

Because the radar pulse volumes of the WSR-88D are large (1º × 1 km for reflectivity and 1º × 250 m for velocity), a given pulse volume often contains birds, bats and insects, and one must use the mean air speeds of targets to discriminate between slow flying insects and foraging bats and faster-flying migrating birds and bats. The lowest tilt of the WSR-88D antenna averages 0.5º above the horizontal, and over most of the surveillance the base of the beam is too high to detect low flying birds. The beam width of the WSR-88D is 1º, and at a distance of 30 km, the base of the beam is 78 m above antenna level (AAL), the center of the beam is 321 m above AAL, and the top of the beam is 564 m AAL. At that distance, the beam width is 486 m wide. This eliminates the possibility of precise altitudinal measurements of targets.

Innovations to the WSR-88D. Beginning in 2008, WSR-88D technology was significantly upgraded. The radar will undergo a series of modifications that will greatly enhance the radar's capability to provide useful information for biologists who choose to study the distribution and abundance of organisms in the aerosphere. The azimuthal resolution of all three moments of data (reflectivity, radial velocity, and spectrum width) will change from 1° to 0.5°, and the range resolution of reflectivity will change from 1 to 0.25 km and match the existing resolution of radial velocity. Doppler data range will increase from 230 to 300 km, and the amount of data collected and transmitted during a volume scan will increase by a factor of about 2.3. In addition to the move toward super-resolution data, the radar will be upgraded to have a dual polarization capability. The latter upgrade provides additional information that can be used to discriminate between return from birds and return from insects.

DoD Applications. The WSR-88D is a valuable technological tool for the DoD. The radar can be used to detect dangerous concentrations of birds in the atmosphere over large geographical areas. This information is extremely valuable for alerting military flight operations of hazardous concentrations of birds along low-level training routes and near military air fields. Information on bird migration gathered with the WSR-88D is being used to develop migration forecast models that can be used to predict when hazardous concentrations of birds aloft will occur. This will allow flight operations at an airfield to schedule training flights when conditions are not favorable for bird migration.

The WSR-88D can be used to determine the locations of important migration stopover areas on or near military bases, and SERDP has funded a project that uses information from the WSR-88D to map important migration stopover areas on and near 50 military installations in the United States. The radar also can be used to determine when migrants are likely to be present on base so that natural resource personnel can census them in different habitats. The density of migration aloft at 10 p.m. local time measured with the WSR-88D correlates significantly with the number of migrant birds captured the next day at a banding station.

Telemetry

Telemetry devices, such as satellite and radio-frequency (RF) tags, play an increasingly important role in understanding bird movements across a spectrum of temporal and spatial scales. No other method for tracking birds can provide the detailed, individual information offered by these transmitters and data loggers. This technology addresses several fundamental questions about bird movements, such as the relationships between movements and energy budgets of individual birds, or understanding the exact location and condition of birds in multiple dimensions (e.g., time, space, biotelemetry). However, numerous challenges remain for implementing satellite and RF tag methods, including reducing tag size and mass, improving coverage for satellite and cellular providers, and increasing battery life. These issues aside, telemetry can be a powerful means of gathering specific and highly detailed information on birds on and away from DoD lands.

The array of different telemetry devices is growing, but the list is best summarized as: satellite-based systems, cellular tracking systems, direction finders, and data loggers. Previous DoD-supported research using some of these technologies includes Legacy projects 95-50100 (American White Pelican, *Pelecanus erythrorhynchos*; Peregrine Falcon, *Falco peregrinus*; Golden Eagle. *Aquila chrysaetos;* Swainson's Hawk, *Buteo swainsoni*; and Ferruginous Hawk, *Buteo regalis*), 95-10049 (Peregrine Falcon), 99-1874 (Broad-winged Hawk, *Buteo platypterus;* White-faced Ibis, *Plegadis chihi*), 00-1874 (Broad-winged Hawk), 03-1875 (White-faced Ibis), 06-292 and 07-292 (Osprey, *Pandion haliaetus*), and 05-243 and 06-243 (Burrowing Owl, *Athene cunicularia*) among others. In addition, SERDP funded research to develop Global Positioning System (GPS) satellite transmitters that were used in many of the Legacy-funded satellite projects.

Satellite-based tracking offers global coverage and rapid data availability, two significant improvements over previous technologies for studying animal behavior. The GPS (receiver) and Argos (transmitter) systems have been operational for over two decades and provide worldwide coverage. The high complexity and relatively rapid power consumption (i.e., a large battery typically is required) of these systems have led to relatively large tag masses (10 g range is the lowest presently available).

An alternative option for individual tracking is to use the global cellular network, also an attractive means to telemeter tag data. Their relatively high data rates enable RF tags to stream many types of data, including live GPS, audio, and video. Biotelemetry sensors even collect information about an animal's pulse, respiration, and wing beat. At least one manufacturer is developing a cellular tag based on commercially available radio components, and academic researchers are attempting to miniaturize such tags. Progress is impeded by the closed cellular system in North America, proprietary standards, and reluctant cellular providers. However, the potential is great: small size and low weight are necessary for deploying on animals too small for currently available satellite-based transmitters. This technology could be invaluable to DoD planners who need detailed information about the location and movements of species of interest. Application would benefit the military mission in numerous cases, particularly for understanding at what altitude and in what locations birds pass through flight training areas.

Traditional radio tracking with directional antennas and hand-held receivers is labor intensive. Automatic direction finding and automatic location finding receiver systems attempt to automate the process. Recent advances in digital signal processing technology have enabled application of sophisticated signal processing algorithms. Automatic tracking would remove the subjectivity of determining signal direction and reduce the amount of intensive field work inherent to radio tracking. Additionally, a new generation of tags, based on 802.15.4 and other low-power physical layer standards, is becoming available. These tags exploit generic capabilities of modern ultra-low power micro-

controllers and store data from a wide variety of onboard sensors. A tag can schedule transmission to a fixed base station once it receives that station's interrogating signal, and then rapidly offload its data to the base station when other tags are not transmitting. This system enables data recovery from animals that are difficult or impossible to recapture.

Because of the quality and quantity of information that can be gained and the potential for significant savings of time and effort, development and implementation of these tags warrants additional funding and research by the avian scientific community. A light-level sensor that, when coupled with an accurate clock, yields a system capable of geolocation, may be of particular interest. This approach, which uses the time of local noon and the day length to determine position, yields coarse position estimates, with typical accuracies of ±300 km. Despite its low accuracy, this information can be invaluable in determining the routes and schedules of small long-distance migrants, as there currently are no other means to obtain this information. A very simplified sensor tag with only onboard storage and light sensing could weigh as little as 0.5 g, a mass that would allow this approach to be used on 90 percent of terrestrial bird species and virtually all aquatic birds. This technology has several benefits both to the bird (a low mass transmitter is easier to carry, thus reducing the bias of the data collected) and to the DoD (low cost relative to quantity and quality of information obtained).

DoD applications. Land managers at DoD installations require spatially accurate data on avian habitat use and movement. Wildlife telemetry techniques provide high quality data about bird movements and their energetic condition, numerous cost efficiencies for surveys across large, inaccessible or difficult to survey areas, and, similar to acoustical methods, information for more accurate environmental risk assessments (for the MBTA, NEPA, and ESA) and INRMPs. Benefits to mission sustainability and readiness include:

- identifying movements of migrant and resident birds in time and space in order to reduce bird-aircraft strike hazards,
- meeting environmental stewardship obligations by identifying specific areas and types of habitat use, and
- engaging broader societal support and solutions for environmental problems.

Stable Isotopes

Recent technological advances in the use of stable isotopic signatures make it possible to determine the geographic origins and population connectivity of breeding and wintering populations of migratory birds. Stable isotopes are naturally occurring elements that vary in their atomic weights, and previous studies have shown that animal tissues reflect the isotopic composition of their supporting environment. For example, hydrogen isotope (δD) ratios correlate with the δD of local precipitation patterns. In birds, these δD signatures are incorporated into feathers on the breeding grounds when birds molt in their new plumage prior to migration. Because δD isotopes in bird feathers are metabolically inert after growth, individuals can be sampled during the winter to determine their breeding origin. Combining δD with other isotopes that vary over large geographic distances, such as carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$), can provide an accurate method to track migratory birds year-round.
Researchers at the Smithsonian Migratory Bird Center [Kirtland's Warbler (*Dendroica kirtlandii)* and other warblers] and USGS (Legacy project 05-241 focusing on shrubland birds) have worked with all of these isotopes previously and have published multiple papers regarding their utility and importance for understanding the ecology of migratory birds.

DoD applications. Department of Defense lands account for nearly 5 percent of Federal lands within the U.S. Managing and protecting populations of species, such as migratory birds, on these lands is challenging because such species spend different parts of the year in geographically disparate

localities. Land-use patterns and anthropogenic factors, such as hunting and chemical use at non-breeding grounds (non-DoD lands) and along migratory routes, can have important and profound effects on the year-round condition and survival of birds that breed on DoD lands. Yet, for many migratory birds, we do not know basic information such as the location of their non-breeding grounds or their migratory route. Essential to protecting and understanding fluctuations in the abundance of Neotropical migratory birds breeding on military lands is documenting where these birds spend the non-breeding season and identifying threats to these birds on their non-breeding grounds as well as along the length of their migratory routes. Closing the loop on conservation can help with the protection and sustainment of viable bird populations, thus reducing the potential for listing under the ESA and for military activities to have significant impacts on bird populations. In essence, the more secure bird populations are, the better DoD can avoid potential impacts on mission activities.

Capture-Recapture Modeling

Since 1992, the DoD has played a key role in the development of, and contribution of data to, the largest standardized avian capture-recapture dataset in North America—the MAPS program. Initial goals of MAPS were focused on two demographic parameters, productivity, as indexed from constant-effort capture data, and adult apparent survival rate (survival), as estimated from capture-recapture models. In the early days of MAPS, however, options for capture-recapture modeling were limited, and estimating survival required acceptance of unrealistic assumptions about homogeneity of capture probability and survival among individuals. Few methods existed for estimating population parameters other than survival, and there were no formal methods available for modeling relationships among population parameters or linking population parameters to environmental drivers.

Advances in capture-recapture modeling over the past two decades now make it possible to provide realistic inferences about various population parameters (including, but not limited to, productivity and survival) and links between these population parameters and the environment. These advances have increased the value and scope of the MAPS program for avian monitoring and conservation. Methods for accounting for ‘transients’ in capture-recapture data, developed in part through funding from DoD’s Legacy program, allow estimation of survival that is much closer to actual survival rates of resident birds. Reverse-time capture-recapture models allow estimation of recruitment and population growth rates. Robust-design models allow estimation of population size (which can be age-specific), as well as, temporary emigration and immigration rates.

Capture-recapture modeling continues to be one of the most rapidly evolving fields of statistical ecology. Bayesian hierarchical models that use Markov chain Monte Carlo parameter estimation show particular promise. These new methods make efficient use of sparse data and can be used to address various problems that were difficult or impossible to address using classical techniques. For example, hierarchical models can be used to model relationships between demographic parameters (for example, recruitment and survival), allow for incorporation of spatial or temporal effects, easily handle missing data, and allow inclusion of covariates or random (heterogeneity) effects at various levels. Continued development and application of hierarchical models to avian monitoring data, such as MAPS, should lend new insights into causes of population changes on DoD installations.

DoD Applications. MAPS data and analyses have been used on many installations to develop and refine management strategies for birds. The new methods, however, are providing much greater ability to tailor the findings to specific installations and management issues.

Chapter 4: Guidelines for Designing Short-Term Bird Monitoring Programs

Short-term monitoring, as used in this report, includes both one-time surveys designed to collect information on species composition, timing of use, and relative or absolute density, and monitoring designed to estimate a treatment effect such as the impact of training or habitat alteration on a species of concern. More specifically, short-term monitoring programs may be defined as any survey with a termination date (in contrast to surveys like the BBS that are intended to continue indefinitely). DoD conducts dozens to hundreds of short-term monitoring programs each year so their design must be addressed in any comprehensive approach to bird monitoring.

The guidelines in this Chapter are based on recent literature (Oakley and others, 2003; U.S. NABCI, 2007) that stresses the value of clearly identifying goals, objectives, and methods before field work begins. Some of the material in this chapter is technical. It is intended for specialists carrying out, or responsible for, program design and implementation. Guidelines for preparing each component of the project description (table 6) are described below. The identified elements are intended as suggestions only. Real examples, as indicated later in this report, usually differ somewhat in content and sequence. An example of the steps outlined below is provided at the end of this Chapter.

Table 6. Outline used to describe short-term bird monitoring projects.

A. Description of the Management Issue
B. Survey Objectives
1. Biological population
2. Information needed
3. Quantitative objectives
C. Methods
1. Brief description
2. Statistical population
3. Sampling plan
4. Training and field methods
5. Sample size requirements
6. Analytic methods
7. Data management
8. Reports
D. Roles and Responsibilities

Components of a Successful Short-term Bird Monitoring Program

Description of Management Issue

If this section is clear, and especially if only one or a few management decisions are the focus, then the rest of the survey description is relatively easy to complete. If the management issue is not clear, then the rest of the survey description is difficult to conceptualize and complete.

To begin, describe the management issue to be addressed or, preferably, the management decision that the monitoring will help managers make. Examples include what habitat management treatment to apply, minimizing bird-aircraft strikes, specific habitat restoration goals, and whether to grant a species increased or decreased protection. Next, explain the spatial and administrative level at which the project is being organized and why this is the right level. This information is important because it has a substantial impact on survey costs. Conclude with a clear, albeit qualitative, description of the product needed to address the management issue.

Survey Objectives

1. Biological population

   Describe the species to be studied (e.g., migrating shorebirds, breeding waterfowl). Specify which individuals are included (e.g., all birds, only breeders, only residents).

2. Information needed

   Provide as much detail as possible about the information to be obtained in the survey. Species, cohorts, times of year, and habitats of greatest interest should be identified, as should auxiliary information, such as level of disturbance, evidence of breeding, and habitat relationships. Identify the parameters to be estimated in precise, quantitative terms (e.g., density of pairs, trend in abundance, or habitat relationships expressed as regression coefficients).

3. Quantitative objectives

   Specify the accuracy target, expressed as power or as precision [for example, standard errors (SEs), confidence intervals (CIs), and coefficients of variation (CVs)] for each parameter, and discuss how it was chosen. This is frequently a difficult section to write, especially in the early phase of a project, and the target may change as work progresses. Having an accuracy target is important, however, because it provides the basis for calculating sample sizes and, in some projects, for choice of field methods. In some studies, resources are fixed so the objective is simply to maximize precision given the available resources. In such cases, simply acknowledge that this is the situation.

Survey Methods

1. Brief description

   Provide one or two sentences summarizing the survey methods.

2. Statistical population

   Identify the population unit and the statistical population. Population units are usually either individuals (e.g., birds), capture devices exposed for a given amount of time (e.g., a "mist net-hour"), or, most common of all, a location for a specified period (e.g., as in a 3-minute point count or a 30-minute area search). The statistical population is the set of population units about which we choose to make inferences (the population of interest), or from which we sample (the sampled population); these two should be distinguished if they are different. For example, in a point count project, the spatial dimension of the statistical population might be all forested locations on an installation, and the temporal dimension might be mornings without high winds or heavy rain. The population of interest probably would be all possible location-times in the population, but the spatial dimension in the sampled population might be locations along roads and trails.

3. Sampling plan

   Define the sampling plan using standard survey sampling terminology, as in the following example: "Two-stage sampling will be used, with stage one preceded by stratification by habitat. Three strata (probably woodlands, fields, other) will be delineated. Primary units will be locations (i.e., the set of possible survey times at a location), and secondary units will be survey times (at a given location). We anticipate that primary and secondary units will both be selected systematically." Assistance from a statistician familiar with survey sampling may be needed in this phase. (Arrangements are being made for USGS to provide this assistance to DoD personnel.)

4. Training and field methods

   Provide a detailed description of training and field methods. Try to foresee practical problems, how they can be addressed, and how seriously the sampling plan or data collection might be compromised by the problems.

5. Sample size requirements

   Use formulas for sample size estimation and allocation of effort, with multi-stage designs, to estimate the sample size needed to achieve the accuracy target for each parameter. Because minimum sample sizes will differ between parameters (e.g., number of pairs of a species), the final study design will usually be a compromise between costs and meeting most of the accuracy targets.

6. Analytic methods

   Describe the methods to be used identifying issues that may be especially difficult and how they are being addressed in the project design. Extremely detailed accounts are not needed, but demonstrate that careful thought has been given to where the analyses may lead and insuring, insofar as possible, that the data collection will support the most useful analyses.

7. Data management

   Describe how the data will be entered, organized, stored and retrieved. State if the data will be contributed to regional, national, or continental repositories (and if not, why not).

8. Reports

   Describe when reports will be prepared, what they will contain, to whom they will be provided, and by whom they will be reviewed.

Roles and Responsibilities

Describe who will have responsibility for detailed design, field work, data management, analysis, and communication. Also describe who will support/accomplish the project and how (e.g., contracts, in-house support).

Detailed Example of a Successful Program

Description of Management Issue

Recent surveys on barrier islands along the Florida Gulf Coast have revealed that some species of shorebirds are seldom found where beach nourishment projects have been carried out. This finding is a concern because many shorebirds are thought to be declining. Furthermore, the species using these beaches include a federally-listed species (Piping Plover, *Charadrius melodus*), a state-listed species (Snowy Plover, C. *alexandrinus*), and a subspecies of the Red Knot (*Calidris canutus*) determined to warrant federal listing as Threatened.

Due to these concerns, DoD, specifically the Army Corps of Engineers, consults with the USFWS on potential barrier beach projects in Florida to determine whether the project will affect shorebirds adversely and, if so, what might be done to reduce or mitigate the effects. In these discussions, estimates are needed of the number of shorebirds using the project's impact area. In this project, several contractors will use the protocol described below to estimate shorebird numbers in project areas. They also will provide information on behavior and habitat use of the focal species. This information will be useful in estimating impacts and discussing ways to reduce them. After experience is gained with the protocol it will be reviewed and revised as necessary. If appropriate, the revised protocol will be adopted as a standard approach for assessing shorebird numbers in project areas on Florida's barrier beaches. The goal of the project is thus:

> Provide scientifically-sound information on whether proposed beach nourishment projects on barrier islands in Florida will have adverse effects on shorebirds and, if so, how to avoid, minimize, or mitigate the effects.

Objective

Obtain estimates of the mean number of shorebirds present in proposed beach nourishment project areas. Collect data on habitat use and behavior of birds (e.g., roosting, foraging).

Selecting the needed number of surveys requires that we specify a quantitative objective for the estimate of mean numbers present. Because shorebird use differs substantially throughout the year, we suggest the surveys be designed to achieve the accuracy target during each of four seasons: winter, spring migration, breeding, fall migration. The coefficient of variation [CV, i.e., the standard error (SE) of the estimate divided by the estimate], is a reasonable metric (accuracy target) for this purpose.

Although no “standard values” for target CVs are available, we believe in this case that obtaining essentially unbiased estimates with CVs of no more than 0.20 is both desirable and feasible. If the CV for an estimate was 0.20 then the 95-percent confidence interval would be approximately the point estimator ±40 percent. For example, if the estimated mean number of birds present was 20 and the CV was 0.20, then the 95-percent confidence interval for the estimate would be approximately 12 to 28. The methods below are designed to produce essentially unbiased estimates of the mean number of birds present during one season with CVs <0.20. Other parameters will doubtless also be of interest, and many of them can be estimated from the survey data. To keep the sample size analysis from becoming too complex, however, the calculations below are based solely on achieving a CV of the estimated mean for one season <0.20.

Methods

Statistical Population

The statistical population includes the area within which shorebirds are likely to be affected by the proposed project at all times when surveys might be conducted. Potential survey times will be limited by darkness and practical factors. The survey times might thus be defined as weekdays between 9:00 a.m. and 5:00 p.m. throughout the season. This definition assumes the difference between the mean number present during these times and during all times of interest (which, e.g., might include weekends and nights) can be ignored. This assumption should be carefully evaluated. In the example given, excluding weekends might be questioned on the basis that human disturbance levels then might be higher, and the number of birds lower, than on weekdays. In other cases, the reverse might be true due to higher disturbance levels at other publicly accessible sites.

Sampling Plan

We assume that on any survey, the entire project area will be searched. The response variable is the number of birds “present” which we suggest defining as the number present at the start of the survey (i.e., birds that arrive during the survey should be excluded, perhaps by giving them a certain code and excluding them during the analysis). We assume that virtually all birds present will be detected and recorded so there is no need to estimate the detection ratio. Under this assumption, and assuming further that the specified sampling plan is followed, the estimate of mean number present is essentially unbiased using all common sampling plans and analytic methods.

Either systematic sampling or stratified random sampling could be used for selecting survey times. Stratified random sampling is appealing because conditions under which about the same number of birds would be present (e.g., low tide versus high tide) probably could be defined as strata. This would substantially reduce the unexplained variation and would result in smaller SEs compared to a systematic sample of the same size. On the other hand, assuming that covariates (e.g., tide height) are recorded, many of the same advantages could probably be obtained by using a model-based approach for the analysis. In the example given, tide height would be incorporated as a covariable that would help reduce residual variation in the model. The emergence during the past decade of “mixed models” offers an opportunity to gain advantages from both stratified sampling. By using mixed models, surveys can be concentrated in periods of highest use and additional covariables can be incorporated into statistical models. Both stratified sampling and use of mixed models in the analysis, however, require a greater degree of sophistication than employing systematic sampling to select times and treating the results as a

simple random sample (the usual approach with systematic samples). The lead investigator, perhaps with consultation from a statistician, should choose the sampling plan and analytic methods, with the requirement that a well-defined sampling plan be used and that the general analytic approach be identified before collecting the data.

Field Methods

As noted above, we assume that a simple area search will suffice to find all birds present. Consequently, no special methods are needed to estimate detection rates. It will be useful to collect habitat and behavior information during the surveys. To do this, the survey area should be partitioned into habitat compartments. We recommend classifying compartments by "landform" and "substrate." Review of the landform types will be needed and can vary if necessary between survey sites (although this will reduce ability to compare results across sites, and such comparisons are recommended).

A preliminary list of landforms is:

1. ocean beach
2. bay beach
3. inlet shorelines
4. spits
5. ebb shoals
6. flood shoals

A preliminary list of substrates is:

1. intertidal
2. mud and sand
3. dry beaches
4. fresh wrack
5. old wrack
6. ephemeral pools

Because some of these compartments will change with tide levels or other factors, maps will need to be updated periodically or separate maps will need to be prepared for each condition that affects locations of the compartments. During surveys, the compartment that each bird is in will be recorded along with its behavior. Preliminary behavior codes are roosting and non-roosting. Immediately after the survey, the surveyor will record disturbances during a specified period (e.g., 1 hour). A list of events that constitute a "disturbance" will be continuously developed along with a list of birds' responses to disturbances. The number of disturbances and responses, by type, will be recorded during the observation period.

Analytic Methods

As noted above, two general approaches for the analysis are available: "design-based" and "model-based" methods. The design-based methods require few assumptions and are straightforward applications of survey sampling theory. For example, if stratified sampling is used to select survey times then the estimate of the mean number present is:

$$\overline{y} = \sum_{h=1}^{L} w_h \overline{y}_h \ , \tag{1}$$

where $\overline{y}_h$ is the simple mean of the surveys in stratum *h*, w_h is the proportion of all times (not surveys) in stratum *h*, and *L* is the number of strata. The standard error of the estimate is:

$$SE(\overline{y}) = \left(\sum_{h=1}^{L} w_h^2 s^2(y_{hi}) / n_h \right)^{0.5} , \tag{2}$$

where y_{hi} is the number of birds recorded on the i^{th} survey in stratum *h*, $s^2(y_{hi})$ is the sample variance of the y_{hi}, and n_h is the number of surveys in the h^{th} stratum. Degrees of freedom (*df*) may calculated using Satterthwaite's method (Cochran, 1977). The 95-percent confidence interval is: $\overline{y} \pm t_{df,0.05} se(\overline{y})$.

Numerous model-based methods could be devised. The most obvious is to construct a multiple (mixed) linear regression model that predicts number present as a function of such factors as date, time of day, tide height, and perhaps other factors (e.g., disturbance, weather). The model would then be used to predict number present under average conditions or under a representative sample of conditions (and the outputs would be averaged).

Sample Size Requirements

Sample size requirements will be much easier to estimate after a few years of data have been collected. Estimates made now should be viewed as preliminary. These cautions notwithstanding, an effort was made to predict needed sample size using data collected in the International Shorebird Survey (ISS) in Florida. We assumed that simple random sampling was used. For this method,

$$CV(\overline{y}) = \frac{SD(y_i)}{\overline{y}\sqrt{n}} \tag{3}$$

Setting the CV equal to 0.2 and solving for *n* yields

$$n = \frac{1}{0.04} \left(\frac{SD(y_i)}{\overline{y}} \right)^2 \tag{4}$$

We used the ISS data to estimate the quantity $SD(y_i)/\overline{y}$ and then calculated the needed number of surveys using expression (4). The results were expressed as a function of mean number present. We used all species, years, and sites surveyed in Florida, and we analyzed four periods separately (November–March, April–May, June–July, August–October). Estimates of $SD(y_i)/\overline{y}$ were only calculated when at least six surveys had been conducted and the mean number present was >0.5 birds.

Results were analyzed by season and species. A typical result is shown in figure 1. It can be seen that the needed number of surveys increases rapidly as the mean number present drops below about three.

Figure 1 should be viewed with caution because the surveys probably were not made according to a well-defined sampling plan and it is difficult to assess how this affected $SD(y_i)/\overline{y}$. If there was little affect on $SD(y_i)/\overline{y}$, then figure 1 probably over-estimates sample size requirements both because stratified sampling probably will be more efficient than simple random sampling (as explained above) and/or because a model-based approach for estimating $\overline{y}$ will be more efficient than a design-based approach. Given these facts, and based on examining other graphs like figure 1, we suggest that 20 surveys probably will be sufficient to achieve the accuracy target in most cases and that 10 surveys per period might be sufficient. If very few birds are present, then more surveys (either more locations or more surveys/location) may be needed to achieve the accuracy target although it also might be argued that the target should be relaxed if hardly any birds are present (i.e., there is less "resource" at risk).

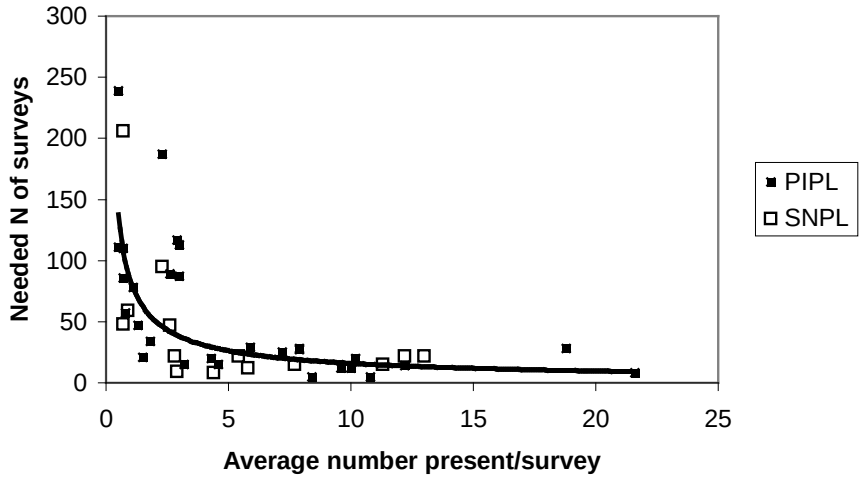

Figure 1. Estimates of the number of surveys needed for CV=0.2 based on surveys of piping plovers (PIPL, *Charadrius melodus*) and snowy plovers (SNPL, *C. alexandrinus*) in Florida during October–March.

Data Management

It is recommended that copies of the data be deposited in a permanent repository, such as the CBMD. This database offers password protection, if desired, query and analytic tools, and optional periodic uploading of core variables to the AKN.

Reports

We recommend brief, quarterly reports for project sponsors that state how many surveys were conducted and that the data have been deposited in a permanent repository, and that discuss preliminary findings as appropriate.

Roles and Responsibilities

The contractor will bear all responsibilities for the bird surveys. Oversight will be provided by DoD.

Concluding Comments

We believe that many project managers would have difficulty completing an example in the detail above. For this reason, a short-term, follow-up Legacy project has been initiated to investigate how best to implement the DoD CBM Plan. It involves providing free technical assistance to help project managers design their monitoring studies following the guidance above. Anyone interested in these services may contact the senior author at *jon_bart@usgs.gov* or (208) 426-5216. Following completion of the Legacy project, a decision will be made about whether to (1) continue the service on a DoD-wide basis (not using funds from Legacy),(2) maintain the service but have individual bases support it as needed, or (3) terminate the assistance program.

Chapter 5: Selecting a Survey Method

This Chapter describes a general approach for selecting field methods. Often, military natural resources managers contract out avian monitoring work and rely solely on the contractor to determine the appropriate type and level of sampling effort. It would be prudent to use this CBM plan as a tool to guide development of management objectives and sampling method and the terms of the contract specifying work to be accomplished.

We believe three objectives (i.e., reasons for conducting surveys) are especially common in DoD surveys: (1) preparing a bird checklist, (2) estimating the number of birds at colonies, and (3) estimating density or abundance of non-colonial birds. The user considers a series of questions until a reasonable method has been identified. The type of data needed depends entirely on the management issues being addressed. Identification of what parameter to estimate is covered in Chapter 4. Here, we assume this decision has already been made and that the answer is one of the three objectives above.

Readers will note that we do not include "estimate change in density (or abundance)" as a goal. Consistent with much of the current literature on bird monitoring (Northeast Coordinated Bird Monitoring Partnership, 2007), detection rates should be estimated as part of bird surveys rather than using index methods. Thus, estimating change in density (e.g., before and after a treatment) involves two efforts to estimate density and does not need to be identified as a separate parameter.

We have prepared these guidelines for wildlife biologists, particularly those in the Department of Defense, who are not specialists in bird monitoring methods. When a large or long-term project is being planned, we recommend consulting a specialist in bird monitoring. Many projects are small and short-term, however, and budget restrictions may hinder finding expert assistance. We hope the guidance in this chapter will be useful in these cases.

The questions below resemble a dichotomous key but there are a few differences in the numbering system. "Checklist" means a list of birds with indications of general abundance at each time of year. Checklists are often developed just with input from experienced birders rather than formal surveys.

1. Select Objective

   Prepare a bird checklist.....2
   Estimate number of birds at a colony 3
   Estimate density or abundance other than at a colony.....4

2. Prepare a bird checklist

   Based solely on birders' input 2.1
   Surveys.....2.2
   Birders input and surveys .....2.1 & 2.2

2.1 Prepare checklist based on birders' input

Good birders, knowledgeable about the area can be located through the American Birding Association (*http://www.americanbirding.org/*) or a local bird club or Audubon chapter.

2.2 Prepare checklist based on surveys

Area search surveys should be conducted in all parts of the area to which the checklist applies and at all times of year. Records should be kept of each area surveyed and results should be summarized by calculating the number of individuals recorded per unit time (e.g., 1 day = 8 hours) in appropriate habitat. Such data provide a good basis for defining the abundance categories and assigning birds to them in each season. These records also provide a good basis for describing habitat associations.

3. Estimate number of birds at a colony

Counts of nests are feasible 3.1
Counts of nest are not feasible.....3.2

3.1 Colony surveys where counting nests is feasible

Nesting is synchronous or is asynchronous but re-nesting is rare

- In this case making the count at a single time should give an essentially unbiased estimate with suitable precision, assuming resources are available to count the entire colony or a large enough sample from it. If a complete count is possible, then we recommend this approach. If detecting nests is relatively easy but the colony is too large to count completely, then a line transect approach with distance-sampling may be the method of choice. This method assumes that all nests on the transect line are detected; if the assumption is not valid, then it may be preferable to subdivide the colony into plots and count nests in randomly selected plots. These plots should then be searched thoroughly. If not all nests are detected in the random plots, then a method to estimate the detection rate of nests (e.g., double sampling) should be employed.

Nesting is asynchronous but re-nesting is common

- Accurate estimates of the number of nesting birds in the colony can only be made through repeated surveys and by marking some birds to estimate how many nests they initiate.

3.2 Colony surveys where counting nests is not feasible

Birds can best be counted when they leave the colony.

- Use “flightline counts” to obtain an index to colony size.

Birds can best be counted while they are at the colony.

- Count birds when they are at the colony.

4. Estimate density or abundance of non-colonial birds.

One of the methods in table 7 is suitable.....Use that method
None of the methods in table 7 is suitable .....See notes below

When no method in table 7 is suitable, then a form of double-sampling may be useful. In this approach, a rapid method is used to survey a large sample of locations and intensive methods are used on a subsample of the locations to obtain actual numbers present. The ratio of the estimate to the true number present, based on the subsample of locations, is then used as the detection rate on the rapid surveys. Advice from a specialist will normally be needed to design a double-sampling survey.

Table 7. Survey methods and required assumptions.

1. Area search

Plots are searched at least once. Surveyors are not constrained to survey pre-determined points or transect, but must search the entire plot. This method assumes all birds are detected or that the same fraction of birds present is detected in groups of plots being compared.

2. Fixed radius point counts

Points are randomly selected and surveyors spend a pre-determined amount of time at each point. Birds judged to be within a fixed distance (e.g., 50 m, 100 m) are recorded. The main assumptions are that (1) the points can be accessed, (2) birds are correctly classified as inside or outside the threshold distance, and (3) all birds within the threshold distance are recorded.

3. Distance

Randomly selected points or lines are selected and surveyed following a protocol that specifies time per point or speed in moving along the transect. For distance-based points counts (point-transects), record the difference from the observer to the detected bird(s). If using distance-based transects, perpendicular distances from the transect to detected birds are recorded, or are calculated using (1) the distance from the observer to the birds and (2) the angle between the compass bearing of the transect and the compass bearing to the bird(s). The main assumptions are that (1) points or transects can be accessed, (2) at least 75 detections will be made of each species, (3) all birds at the survey points or on the transects are detected (or that an unbiased estimate of the proportion of them detected can be obtained), (4) birds do not move prior to detection in response to the surveyors, and (5) distances and angles are accurately estimated. The last assumption means that birds or their locations must be seen by the surveyors.

4. Double observer

Surveyors work in pairs either independently or with detections made by one surveyor being revealed to the other surveyor. The main assumptions are that (1) points can be accessed, (2) any reduction in sample size due to surveyors working in pairs is acceptable, and (3) birds have the same detection probabilities (within surveyors). The last assumption is violated if some birds are quite obvious (e.g., due to persistent vocalizing or proximity to the surveyors) whereas others are hard to detect.

5. Removal methods

The survey period is divided into sub-periods and surveyors record which sub-period each bird is first recorded in. The main assumptions are that (1) points can be accessed and (2) detection events are independent in different sub-periods. The last assumption is often difficult to meet. It means, for example, that birds detected by ear do not sing in bouts.

6. Methods based on capture-recapture theory

The method is similar to the removal methods except that surveyors record every sub-period within which each bird is detected. The main assumptions are that (1) points can be accessed, (2) recording every bird detected in every sub-period is feasible, and (3) detection events for birds assigned to the same “cohort” are independent in different sub-periods. Approximately the same independence assumption is required (e.g., if many birds are detected by their vocalizations then birds must not sing in bouts).

Chapter 6: Data Management

As emphasized recently by the U.S. NABCI Committee and most specialists in avian monitoring, a critical need exists to ensure that monitoring datasets are collected and preserved in long-term repositories to prevent data loss. At a meeting to discuss the DoD CBM plan in Denver in early March 2008, a general approach was defined for insuring that DoD monitoring data are preserved and made available when appropriate (table 8). Table 8 presents a capsule summary of the process but more detail is provided in the section titled “Coordinated Bird Monitoring Database.”

eBird

What is eBird?

A real-time, online checklist program, eBird has revolutionized the way that the birding community reports and accesses information about birds. Launched in 2002 by the Cornell Laboratory of Ornithology and National Audubon Society, eBird provides rich data sources for basic information on bird abundance and distribution at various spatial and temporal scales. eBird's goal is to maximize the utility and accessibility of the vast numbers of bird observations made each year by recreational and professional bird watchers. It is amassing one of the largest and fastest growing biodiversity data resources in existence. For example, in 2006, participants reported more than 4.3 million bird observations across North America. The observations of each participant are combined with those of others in an international network of eBird users. eBird then shares these observations with a global community of educators, land managers, ornithologists, and conservation biologists. In time, these data will become the foundation for a better understanding of bird distribution across the western hemisphere and beyond.

How Does it Work?

eBird documents the presence or absence of species, as well as bird abundance through checklist data. A simple and intuitive web-interface engages tens of thousands of participants to submit their observations or view results through interactive queries into the eBird database. eBird encourages users to participate by providing Internet tools that maintain their personal bird records and enable them to visualize data with interactive maps, graphs, and bar charts. All these features are available in English, Spanish, and French.

A birder simply enters when, where, and how they went birding, then fills out a checklist of all the birds seen and heard during the outing. eBird provides various options for data gathering including point counts, transects, and area searches and bulk upload of large datasets. Automated data quality filters developed by regional bird experts review all submissions before they enter the database. Local experts review unusual records that are flagged by the filters. Installation bird checklists could be generated by doing year long surveys using point or area counts and entering data into eBird and generating a species frequency list.

Table 8. Recommendations to the Department of Defense (DoD) for management of historic records, inventory, and new monitoring projects.

[Data curation levels indicate a hierarchy of security, which increases as the level number increases]

1. **Data Curation**
   a. Level 1
      i. Identify and gather all existing DoD datasets (see following section for whom to contact regarding collection of data).
      ii. Archive the datasets (i.e., in their original format) at Cornell Lab of Ornithology.
      iii. Complete metadata descriptions of the Level 1 datasets
      iv. Enter metadata into NRMP (for many projects this is complete).
   b. Level 2
      i. Organize all existing DoD datasets into a single standardized data structure. Most of the existing datasets are stored in disparate data structures. Using the AKN Bird Monitoring Data Exchange (BMDE) all existing datasets will be brought into a single data framework.
      ii. A complete metadata description will be made available to the AKN.
      iii. Access to data will be restricted. Backups of the warehouse are made using persistent data archive techniques. AKN data managers will use all data backup options consistent with the goal of no data loss. Backups will undergo periodic data integrity testing. For each data set, a "data owner" will be established within DoD. No applications will access DoD data without specific consent from the data owner.
   c. Level 3
      i. With consent from DoD, Level 2 data will be made available for specific analyses.
      ii. The primary data warehouse serves as the Level 2 data archive, and no applications connect directly to the warehouse. Instead, with prior DoD approval, DoD data will be transferred to separate data views created specifically to optimize the performance of an application that connects to it.

2. **DoD Coordinated Bird Monitoring Database**
   a. Ongoing and new monitoring projects will use the DoD CBM data gathering applications and database.
   b. The DoD CBM database will provide a complete archive consistent with the goal of no data loss.
   c. Complete all metadata descriptions of the Level 1 datasets.
   d. Metadata will be entered into NRMP (for many projects this is complete).
   e. All DoD CBM data sets will be translated to BMDE format and added to the AKN primary data warehouse.

3. **DoD eBird**
   a. Bird inventory data will be collected through DoD eBird when appropriate
   b. The DoD eBird will be archived with the goal of no data loss.
   c. Complete all metadata descriptions of the Level 1 datasets.
   d. Metadata will be entered into NRMP (for many projects this is complete)
   e. All DoD eBird will be translated to BMDE format and added to the AKN primary data warehouse.

4. **DoD MAPS**
   a. Avian demographic data will be collected through DoD MAPS when appropriate
   b. The DoD MAPS will be archived with the goal of no data loss.
   c. Complete all metadata descriptions of the Level 1 datasets (recommendation is for Federal Geospatial Data Committee (FGDC) Biologic Data Profiler).
   d. Metadata will be entered into NRMP (for many projects this is complete)
   e. All DoD CBM MAPS will be translated to BMDE format and added to the AKN primary data warehouse.

Data Integration

eBird collects observations from birders through portals managed and maintained by local partner conservation organizations. In this way, eBird targets specific audiences with the highest level of local expertise, promotion, and project ownership. Portals may have a regional focus (aVerAves, eBird Puerto Rico) or they may have more specific goals and/or specific methodologies (Louisiana Winter Bird Atlas, Bird Conservation Network eBird). A DoD eBird portal is under development. Each eBird portal is fully integrated within the eBird database and application infrastructure so that data can be analyzed across political and geographic boundaries. For example, observers entering observations of Cape May Warbler (*Dendroica tigrina)* from Puerto Rico can view those data separately, or with the entire Cape May Warbler dataset gathered by eBird across the western hemisphere.

Data Accessibility

eBird data are stored in a secure facility and archived daily, and are accessible to anyone through the eBird web site and other applications developed by the global biodiversity information community. For example, eBird data are part of the AKN, which integrates observational data on bird populations across the western hemisphere. In turn, the AKN provides eBird data to international biodiversity data systems, such as the Global Biodiversity Information Facility (GBIF). In this way, any contribution made to eBird increases our understanding of the distribution and abundance of birds.

The Coordinated Bird Monitoring Database (CBMD)

The CBMD is a general "counts database" intended to hold data from a wide variety of surveys in which places and times were selected and then something was counted (fig. 2). The basic format involves a "surveys" table (description of the times and places), a "records" table (description of the things counted) and a "pedigree" table (optional description of the sampling plan). Core variables are defined, and their format is standardized (although the variables are optional). Each dataset has a "data owner." This person defines as many variables additional to the core variables as they choose and decides whether restrictions will be placed on distribution. The CBMD uses the same five levels of access as used by Cornell Laboratory of Ornithology for eBird.

The CBMD is maintained by the USGS Forest and Rangeland Ecosystem Science Center (FRESC) in Boise, Idaho, and made available to all interested parties free of charge. When someone is interested in using the database, they contact the CBMD whose staff then works with them to define their program-specific variables and their sampling plan (if any). If requested, CBMD staff also can produce a Microsoft© Excel spreadsheet for data entry. It usually resembles the field survey forms and contains all variables entered on the form. The spreadsheet has all error-checking rules built into it and programs to reformat the data into the tables ready for upload into the CBMD. The user enters data and then clicks a "Submit" button, which activates the error checking routine. If no errors are found, the data are re-arranged into a format suitable for inclusion in the "surveys," "records," and "pedigree" tables mentioned above and appended to these tables. Periodically, for example at the end of each field season, the spreadsheet is emailed to the CBMD staff who uploads the data into the CBMD.

People can access the data through the Internet. They sign on; choose their program, and enter a password if needed. The variables in the program are then displayed and the user can define a query by selecting any values on any subset of the variables. The user also can query for either a bulk download of all records meeting their query or can query for estimated densities and population sizes for any "level" in the sampling plan. For example, if a user signed on to the Intermountain West Aquatic Bird

Survey, they could query for estimated means and totals (for any subset of records) for each State, each BCR, each "Bird Conservation Subregion" (polygons formed by intersecting a BCR and States/Provinces layers), or each site. They also could query for estimates at the next level below the Site but this would be most useful if they had one or two sites in mind and therefore knew what were the next levels down. This ability to aggregate results in a statistically rigorous fashion, even though many different sampling plans were followed at different sites is, to the best of our knowledge, unique among databases.

The CBMD is a node of the AKN and uploads core variables to it periodically (if the data owner requests this free service). CBMD staff prepare metadata (using both the full FGDC standards and the reduced NRMP set of variables) and submit them to the appropriate permanent repositories maintained by the government and by the Cornell Laboratory of Ornithology. All services related to the CBMD are free. For more information, visit the CBMD web site, *http://cbmdms.dev4.fsr.com/Default.aspx*.

Data from designed DoD monitoring and assessment programs will be entered in the CBMD. Variables suitable for eBird and for the AKN will then be uploaded to these programs. Similar uploads can be made to other repositories if DoD chooses. Birders collecting data on DoD land are encouraged to submit their observations directly to eBird (see *http://ebird.org/content/dod*). Existing datasets should be archived to ensure they are not lost. The Cornell Laboratory of Ornithology has offered to perform this service.

A final comment is that all of these services require access to the eBird, AKN, and CBMD web sites. In addition, DoD pays for access to Birds of North America Online, which resides on the same system as eBird and AKN, for every installation with an INRMP. It is our understanding that some installations are blocked from being able to access these capabilities. Relaxing such restrictions would be helpful to the purposes to which this report is directed.

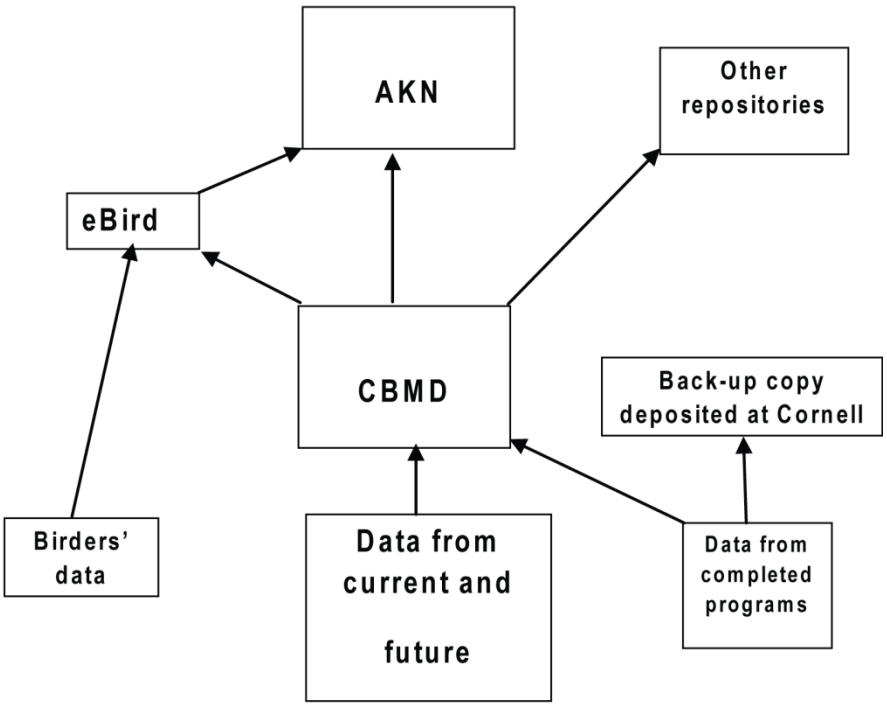

Figure 2. Data management in the DoD CBM program.

Chapter 7: Recommendations for Surveying Species of Concern

The third deliverable to be produced in this report was "a plan for monitoring bird Species of Concern on DoD land." We prepared this plan by identifying DoD installations that have—or may have—Species of Concern in substantial numbers for at least a part of the year. We then developed guidelines for deciding which of these locations should be surveyed and how these surveys might best be conducted.

Methods

For purposes of generating an initial list of focal species, we identified SOC using the ABC and Audubon Watch List (American Bird Conservancy and National Audubon Society, 2007) except that exceedingly rare species were excluded. We included DoD installations in the United States and its' territories and protectorates (e.g., Northern Mariana Islands).

The WatchList is representative of the SOC database on the DoD Partners in Flight web site (*http://www.dodpif.org/*), which was undergoing revisions due to changing assessments in several of the initiative or FWS lists. Regardless of the method used, this SOC identified in table 9 is only a subset of what occurs on DoD installations. In some cases, baseline surveys have not yet been completed, or baseline surveys that have been completed are filed away and not accessible for analysis or review. DoD can greatly advance its monitoring of bird species of concern by completing baseline surveys for all installations, and more importantly, by entering all survey, inventory, and monitoring data into an electronic repository so the data are accessible for such analyses. An initial estimate of the species occurring on each installation in the 50 U.S. States was made by intersecting maps of these installations with maps of each species' range as depicted by Ridgely and others (2007). We then revised these lists using the SOC database from the DoD Partners in Flight website, factsheets describing Important Bird Areas, bird checklists provided by the USGS (Igl, 1996), and important shorebird sites identified by the Western Hemisphere Shorebird Reserve Network (*http://www.whsrn.org/*).

SOC on installations in Hawaii were identified using a combination of bird checklists from the USGS (Igl, 1996), digitized range maps of forest, sea and Nene habitat maps obtained from the State of Hawaii (*http://hawaii.gov/)* and the Rim of the Pacific Programmatic Environmental Assessment of 2002 (*http://www.dtic.mil)*. Species of Concern on installations in Guam, Tinian, and Farallon de Medinilla were identified using the Final Environmental Impact Statement for Military Training in the Marianas Volumes One and Two (*http://www.dtic.mil*) and confirmed on guampedia (*http://www.guampedia.com)*. Data for one Puerto Rico base, U.S. Naval Security Group Activity Sabana Seca, were obtained from an environmental assessment (*http://www.dtic.mil*).

The draft species lists were sent to editors in the eBird Program for review and revision. We also asked them to identify concentration sites for groups of species during the non-breeding periods. The result was a comprehensive list of installations with species and groups of species that may occur on each.

Table 9. Number of DoD properties with significant concentrations of migratory birds for at least a part of the year and numbers of properties known to contain at least one Species of Concern (SOC).

DoD Entity	Number of Properties	Waterfowl	Shorebirds	Raptors	Herons, etc.	Landbirds	SOC
Air Force	71	22	30	18	8	9	49
Army	39	11	12	5	4	10	30
Army Corps[2]	48	29	19	21	20	26	39
ARNG	30	6	8	6	5	9	25
Joint Reserve Base	1	1	1	1	1	1	1
Marine Corps	17	7	5	0	0	0	13
Navy	87	51	48	1	19	14	53
Total[1]	293	127	123	52	57	69	210

[1]These data are not comprehensive since installation managers were not contacted directly. Many more SOC occur on installations than indicated in this table—this only serves as a cursory guide and suggests much more comprehensive work is necessary to complete this particular table.

[2]Army Corps of Engineers properties are shown to illustrate their potential contribution to bird monitoring efforts within DoD.

Results

We identified 245 military installations and 48 Army Corps civil works sites with suspected or known SOC or significant concentrations of birds of any species (table 9). We included concentrations at all times of year because the new MOU and Migratory Bird rule do not restrict consideration to any portion of the year. We determined that SOC probably do not occur on 35 installations. More than 70 species (or in a few cases other taxa) of special concern are known to occur on the 293 facilities we surveyed.

Discussion

We were unable to obtain completely reliable lists of the SOC and concentrations of migratory birds on each installation. Despite these uncertainties, however, the analysis showed that a great many DoD installations, probably >300, are used by SOC or significant concentrations of migratory birds. It appears that these installations are used by >70 SOC.

As discussed in Chapter 1 of this report, the MOU for migratory birds between DoD and the USFWS includes the following provision (see table 2).

> *Prior to starting any activity that is likely to affect populations of migratory birds [the Department of Defense shall]: (1) Identify the migratory bird species likely to occur in the area of the proposed action and determine if any species of concern could be affected by the activity; and (2) Assess and document, using NEPA when applicable, the effect of the proposed action on species of concern.*

Thus DoD is required to determine effects of its activities on SOC.

This requirement implies that DoD must identify installations (a) that may be used by SOC and (b) on which activities may occur that are likely to affect these species. The only credible way to

determine if activities do affect particular species is to have information about their status prior to the activity deemed likely to affect them. This, in turn, requires surveys to identify what species are present and to gather at least basic information on their abundance prior to carrying out the activities that may affect them. Two sorts of surveys (whose results could be combined) probably would be most efficient: initial surveys to determine what SOC, if any, are present on each installation and then follow-up surveys to determine the status of SOC.

It is our recommendation that initial surveys should be approached based on the ability of an installation to obtain funding and/or personnel to complete surveys. A description of survey efforts are described below in hierarchical order based on funding and other capabilities of individual installations.

1. **Year-Round Monthly Surveys**. The preferred method would be to conduct surveys throughout the year. This approach can be very rapid if conducted by an experienced bird surveyor. Although we have not conducted statistical power analyses, based on extensive experience with this sort of survey, we believe that about 12 surveys should suffice with increased intensity during periods when the birds are present or their behaviors are changing rapidly. One reasonable design under this first option would be 4 surveys during the breeding season; 3 surveys during the fall migration; 2 winter surveys (early and late-winter), and 3 surveys during the spring migration. Small installations should be covered completely because doing so will be relatively easy and inexpensive, but on larger installations stratification by habitat and perhaps accessibility will be needed. A few person-days per survey should suffice for small to medium-sized installations, although more effort may be needed on larger installations especially where SOC are known or suspected to be present. If surveys have already been conducted, then additional ones may not be needed. We recommend a simple area-search method, in which observers record estimated numbers of each species encountered. This method is easier for many surveyors than point counts and easier to fit into habitat-based sampling plans. Point counts, however, also could be used. On small to medium-sized installations design of the survey should be simple but on larger ones some detailed planning may be needed to ensure efficiency and that extrapolation to the entire installation is feasible.
2. **Four-season Surveys**. The next preferred level of effort would include a 4-season survey, with surveyors conducting point counts or area searches, as described above, once each during spring, summer, fall, and winter seasons. Point count surveys that are distributed throughout small to medium-sized installations, and stratified by habitat on larger installations, also are an effective method at least during the breeding season. This approach will give a relatively good indication of seasonal abundance and distribution of birds on the installation, but not as complete a picture as the effort described in (1) above.
3. **Two-season Surveys**. If 4-season surveys are not possible, efforts should be focused on the breeding and wintering seasons, with techniques similar to that described in (2) above. This will provide the best possible coverage for SOC on installations during times where bird communities are seasonally established and do not include transient migrants.
4. **Breeding-season Surveys**. If only a one-season survey is possible, that effort should typically be focused during the breeding season, with surveys conducted as widely as possible throughout the installation. Breeding birds will be vocal and will have established territories. Area searches or, perhaps, point-counts (similar to 2 above) are best suited to identify SOC and other species during this season.

If Species of Concern are detected during the baseline survey, installations may choose to develop specific monitoring programs for them. Since bird populations are changing constantly, DoD may also wish to repeat the entire baseline survey every 5-10 years. These additional surveys will also assist in supporting an installations INRMP.

Where SOC or significant concentrations of migratory birds are found a decision will have to be made about whether the numbers are large enough, and the likelihood of effects due to military activities is likely enough, that monitoring is warranted under the Migratory Bird MOU. This analysis will provide much of the information needed to decide what level of accuracy is needed in the monitoring and how to design the surveys to achieve the target accuracy. A few brief guidelines for design of these surveys can be offered, however.

If military activities are deemed unlikely to affect the species, but sufficient doubt remains to trigger the "may effect" clause in the MOU, then monitoring probably can be infrequent and rapid methods probably can be used. For example, if a landbird SOC breeds in a training area where few impacts on the bird are expected, but a decision is made to monitor its populations, then a few quick surveys while birds are establishing territories (and are easy to survey) and perhaps an assessment of reproductive success (e.g., nest-monitoring, late season mist-netting) may be appropriate. If direct, substantial effects are likely to occur, then more intensive methods may be needed. This was the case on Farallon de Medinilla (FDM), an island located approximately 150 miles north of Guam in the Pacific Ocean. FDM is an important island for both military training and nesting seabirds. The DoD has used FDM target ranges since 1976, and the island is an important nesting site for more than a dozen species of migratory seabirds. Conservationists expressed concern about effects of the training on the seabirds. A protracted legal battle followed. Monthly aerial surveys were initiated in 1997 and continue to the present time. They show that, since 1997, there have been no clear changes in the numbers of most species, and one species has increased (Vogt, unpub. data, 2008). This example clearly shows the value of obtaining monitoring data when military activities may affect species of concern.

On installations or parts of installations that are accessible to the public, one or both of the initial surveys described above might be augmented, or even replaced, by encouraging participation in the eBird program. This program permits easy recording of birds detected using various survey methods and the data, if collected by members of the public, would not cost DoD anything to obtain. Tens of thousands of observations from throughout the U.S. and beyond are recorded monthly through the eBird program. Recording data from installations in eBird has the advantage that assessing status near to—as well as on—the installations may be possible.

Given large sample sizes, it has proven possible to detect large changes in abundance across space or time with eBird (although the program is too new to have undergone formal, independent review in the refereed literature). Records entered in eBird usually are not selected randomly under a well-defined sampling plan so estimating density or population size is usually not possible, but trends in density may be more important to estimate. A particularly powerful approach would be to use eBird for initial identification of SOC and then to use designed surveys to monitor their status. The data collected from designed surveys, however, also should be entered in eBird both to support that program and to facilitate comparisons of populations on and off the installation. For more information on eBird, visit *www.ebird.org*.

Chapter 8: Recommendations for Participation in Large-Scale Surveys

As noted throughout this report, DoD has been a major supporter of avian monitoring, especially through its Legacy and SERDP programs. In the past, however, there was not a DoD-wide policy statement about the extent and kind of participation by DoD in regional and larger-scale monitoring programs. The bird monitoring MOU signed by NABCI members (table 1), the MOU with the USFWS (table 2), and the Migratory Bird Rule (table 3), all make it clear that DoD is a significant partner in and contributor to large-scale bird monitoring programs. Furthermore, the value of such programs is clear. Most management issues, in fact, are regional in scope and thus require regional-level data. This Chapter suggests ways for DoD to participate in regional and larger scale programs.

The following criteria can be used to determine the level of DoD participation in large-scale surveys: (1) if the lands to be surveyed are under DoD management and are very important to the focal species, then greater participation by DoD will have a greater benefits for both the resource and to DoD; (2) if the lands to be surveyed are not under DoD management, but are still very important to the focal species (e.g., on migration or wintering areas), then greater participation by DoD also will have greater benefits for both the resource and DoD. These guidelines are illustrated below by discussing appropriate DoD participation in the BBS and the MAPS program.

Breeding Bird Survey

The BBS is a well-established, widely-endorsed, long-term survey that provides some of the best evidence on the status of birds in North America (Sauer and others, 1997). Many BBS routes on DoD installations are surveyed by volunteers. DoD could help the survey the most—and could serve its own interests best—by encouraging coverage of routes that are on or near to its installations with installation personnel and partnerships with volunteers. Many such routes exist (table 10). For example, 30 routes that cross at least one DoD installation were surveyed on fewer than half of the years between 1995 and 2004 and the same was true of 109 routes that were within 10 km of one or more installations. The BBS office has indicated (Keith Pardieck, personal communications, February 2010) that they would be pleased to work with DoD on a plan for identifying those routes that are not surveyed regularly.

Table 10. Number of Breeding Bird Survey (BBS) routes classified by distance to a DoD installation and recent survey frequency.

Minimum distance (km) between installation and BBS route	Number of routes surveyed 1995–2004 during	
	0–4 years	5–10 years
0	30	150
5	82	568
10	109	854
25	210	1,718

Monitoring Avian Productivity and Survival (MAPS)

The MAPS monitoring protocol is a standardized breeding season mist-netting and banding protocol that is currently used by more than 450 monitoring stations continent-wide. The MAPS program (DeSante, 1999; DeSante and others, 2005a; Saracco and others, 2008) is more complex, and perhaps less well known, than the BBS so it is described in some detail below. Following the description, we suggest how the criteria above might be used to determine DoD's participation in this survey. Readers interested in learning more about the MAPS Program should contact The Institute for Bird Populations (IBP).

Since 1994, DoD has supported the operation of 135 MAPS landbird demographic monitoring stations on military lands (for one or more years) and the development of landbird management guidelines and management decision support tools. Overall, 99 stations were operated by IBP in one or more years. By 2007, a network of 58 long-term MAPS stations existed on 11 installations, strategically placed to monitor the demographics of landbird populations in the context of military mission-oriented land management.

Since 1994, the DoD Legacy Resource Management Program, Army Corps of Engineers, and Naval Facilities Engineering Command have provided logistical support and annual funding for:

a. The operation of MAPS stations on (or associated with) 22 military installations, of which 78 operated in any year between 1994 and 2002. Since 2003, 48 of those 78 stations were operated annually plus another 10 stations that were added to the network. This has resulted in more than 104,500 bird captures of 77,500 individual birds and 168 species, of which 23 species were captured >1,200 times.

b. Reorganization of the original monitoring network (78 stations) to better focus on species of conservation concern (since 2002). By 2007, 58 stations were active on 11 installations organized to monitor the management of species of conservation concern in response to land-management activities associated with Readiness and Range Sustainment (Nott and others, 2007, table 11). Clusters of stations were located in several Bird Conservation Regions: Central Hardwoods (24), Texas Oaks and Prairies (12), Edwards Plateau (6), Southeastern Coastal Plain (6), Appalachian Mountains (4), and Atlantic Northern Forest (6).

c. Calculation of landbird demographic variables (e.g., survival, productivity, population trend, body condition) from proofed and verified banding data (1994–2007).

d. Reporting of the results of demographic analyses to individual installations (or groups of installations) and the DoD Legacy Resource Management Program.

e. Construction of landscape-scale ecological models in which demographic variables for 10 species of conservation concern were used as response variables to landscape metrics derived from the National Land Cover Dataset (Nott and others, 2003).

f. Development of measures of population health or performance using a suite of demographic (and landscape) "performance measures" that allow managers to compare the within-installation demographic status of landbird populations with the status of populations in the surrounding region (Nott and others, 2007).

g. The formulation of species management guidelines and development of decision-support tools that help land managers predict the impact of alternate management scenarios on the demographic performance of multiple species of concern.

h. Analyses that have identified important relationships between avian demographics and a suite of spatio-temporal climate and weather variables. This is critical information to managers because the effects of weather and climate on environmental conditions, and in turn, on bird populations, must be accounted for when assessing the efficacy of management on landbird population demographics.

In addition, 38 MAPS stations operated independently of IBP on 23 DoD installations. However, only 20 of these stations were still operational in 2007. Data collected from these independent stations were analyzed to determine their efficacy in monitoring species of conservation concern (Nott and others, 2005). All publications relating to MAPS monitoring of landbird populations on military lands can be accessed through IBP's website.

Two additional programs from IBP contribute valuable demographic data during the non-breeding season to DoD managers. These winter monitoring projects include the MoSI (Monitoreo de Sobrevivencia Invernal) program across the northern Neotropics and the MAWS (Monitoring Avian Winter Survival) program in temperate North America. MoSI is designed to address monitoring, research, and management goals. The monitoring goal of MoSI is to provide estimates of monthly, overwintering, and annual survival rates and indices of late winter physical condition for a suite of 25 landbird species for various habitats and geographic regions.

Research goals of MoSI include:

- the statistical modeling of survival and physical condition as functions of age, sex, habitat, geographic location, and weather,
- linking winter population parameters with breeding season vital rates and population trends, and
- the development of predictive population models.

Management goals of MoSI are to

- use research results to develop strategies for reversing population declines and maintaining healthy populations, and
- evaluate management actions through an adaptive management framework.

Like MAPS, MoSI relies on the establishment of a geographically extensive network of mist-netting and banding stations to meet program goals. MoSI cooperators also contribute feather samples to the Center for Tropical Ecology at UCLA for molecular analyses aimed at linking breeding and wintering populations. The MAWS program was initiated in 2003 as a 4-year pilot project on four southeastern U.S. military installations. MAWS shares goals and protocols with MoSI but targets short-distance migrants and species that are year-round residents of temperate North America. In addition to the MAWS stations operated on military installations, several independent MAWS station operators have contributed data to the MAWS program.

As the material above indicates, MAPS is a well-established, widely endorsed large-scale survey. It has been specifically mentioned in various documents (see tables 1–3) as one of the surveys that DoD should support. MAPS stations are not located using a random sampling plan so an analysis, based on proximity of MAPS stations to DoD installation, like that carried out above for the BBS routes, could not be undertaken. DoD's participation in MAPS should be determined primarily by the extent to which the areas surveyed by MAPS stations will provide important information about the *populations* of concern, regardless of whether they are on DoD land. DoD thus may choose to participate in MAPS programs where their support will do the most good, even if this is far from DoD installations. Indeed, monitoring efforts on DoD installations may be most

Table 11. Current DoD-MAPS monitoring objectives relating to Readiness and Range Sustainment identifying DoD locations (number of MAPS stations) and target species (including two USFWS Focal Species—Wood Thrush and Painted Bunting).

[This work was funded by the DoD Legacy Resource Management Program (Project Number 00103). Scientific bird names in alphabetical order by common name: Acadian Flycatcher (*Empidonax virescens*), Blue-winged Warbler (*Vermivora pinus*), Cerulean Warbler (*Dendroica cerulean*), Field Sparrow (*Spizella pusilla*), Kentucky Warbler (*Oporornis formosus*), Louisiana Waterthrush (*Seiurus motacilla*), Painted Bunting (*Passerina ciris*), Prairie Warbler (*Dendroica discolor*), Red-cockaded Woodpecker (*Picoides borealis*), Wood Thrush (*Hylocichla mustelina*), Worm-eating Warbler (*Helmitheros vermivorum*)]

Installation	State	Monitoring objectives and target species
Fort Bragg (6)	NC	Effects of fire regimes intended to prevent wildfire and manage for Red-cockaded Woodpecker (USFWS Endangered Species status) on Prairie Warbler populations.
Jefferson Proving Ground (6)	IN	Effects of fire regimes and buffer forest thinning on populations of four forest species (Acadian Flycatcher, Wood Thrush, Worm-eating Warbler, Kentucky Warbler) and three successional species (Blue-winged Warbler, Prairie Warbler, and Field Sparrow).
Fort Knox (6)	KY	All monitored species in decline (including Wood Thrush). Effectiveness monitoring of powerline corridor management targeting Blue-winged Warbler
NWSC Crane (6)	IN	Effects of forest management relating to weapons storage on five forest species (Acadian Flycatcher, Wood Thrush, Worm-eating Warbler, Louisiana Waterthrush, and Kentucky Warbler) and three successional species(Blue-winged Warbler, Prairie Warbler, and Field Sparrow).
Fort Leonard Wood (6)	MO	Effects of forest management and fire regimes intended to reduce fuel loads and create fire breaks on five forest species and three successional species (same species as NWSC Crane). Also conduct annual Cerulean Warbler surveys.
Fort Hood (6)	TX	Monitoring of three successional species (including Painted Bunting) with intent to manage oak-prairie habitats for military drop zone using prescribed fire regimes.
Camp Bowie (6)	TX	Monitoring of three successional species (including Painted Bunting) under installation-wide restoration efforts including fire and cessation of cattle grazing (2007) intended to open TXARNG training areas.
Camp Swift (6)	TX	Effects of fire and habitat alteration used to manage military drop zone activities on performance measures of Painted Bunting populations.

effective if coupled with comparable monitoring efforts outside of installations (e.g., MAPS stations in the landscapes surrounding installations), or even during migration or on the Neotropical wintering grounds of SOC to DoD (e.g., as in the Monitoreo de Sobrevivencia Invernal [MoSI] program; DeSante and others, 2005b).

Chapter 9: Implementation

Implementation needs to be guided by DoD personnel. The NABCI Opportunities for Improving Avian Monitoring report (U.S. NABCI Monitoring Subcommittee, 2007), the Northeast Bird Monitoring Handbook (Lambert and others, 2009), this CBM Plan, and the subsequent implementation strategy provide guidance that DoD personnel may find helpful in implementing successful monitoring programs. Substantial work also will be needed to explain and refine the procedures for designing short-term projects (Chapter 4), selecting field methods (Chapter 5), and placing the data in appropriate repositories (Chapter 6). A proposal to do this work has been submitted to the DoD Legacy Program and was funded in 2009 and 2010. It includes the following description of the approach to be used:

> *The CBM Plan provides comprehensive guidance on how to design, conduct, and document bird monitoring programs and store the resulting data in national and international, password-protected, databases. Implementation of the CBM Plan will help insure that DoD carries out its responsibilities for bird monitoring under various federal rules and agreements, and that monitoring is conducted as efficiently as possible (e.g., that avian monitoring projects have a well-defined management focus and limited monitoring funds are placed where they will have most benefit to DoD). Although these changes are needed and will help DoD discharge its obligations to migratory birds, while at the same time saving money, implementation will not necessarily occur quickly or easily. In particular, DoD biologists will need assistance and encouragement in (a) design of monitoring programs including documentation, (b) selection of specific field methods to be used, (c) analysis of results, (d) preparation of metadata, and (e) submission of the data collected to data repositories. This project to help DoD implement the CBM Plan will provide extensive technical assistance on tasks (a)-(e) above.*
>
> *A Team consisting of both USGS and DoD personnel will identify installations considering or already carrying out bird monitoring programs and will work with natural resources managers to implement the CBM Plan, especially steps (a)-(e) above. We expect to work with approximately 15-20 installations per year and that assistance will average about one person-week per installation, though the time needed will likely vary considerably depending on the scope and complexity of the project(s) on which our assistance is needed. DoD personnel (especially Rich Fischer and Chris Eberly with whom we have been working closely on the CBM Plan) have agreed to provide the initial contacts and will explain the procedures in the CBM Plan to installation biologists. USGS staff to be hired for this project, along with the PI, Jonathan Bart (whose salary is covered as a contribution from USGS), will provide advice as needed especially about design, choice of field methods, and analysis. The USGS personnel will take the lead in helping installation biologists prepare metadata and format the data they collect for entry into the Coordinated Bird Monitoring Database at the USGS offices in Boise, Idaho. Annual reports will be submitted each year summarizing the assistance provided and discussing how DoD biologists are assuming responsibility for the planning of future monitoring efforts. Based on this work revisions will be made to the CBM Plan as needed. For example, our intention is to add the most comprehensive and relevant monitoring program descriptions to the Plan as examples for other natural resources managers to follow. American Bird Conservancy will also be engaged in assisting with the completion of a comprehensive implementation plan document.*

In addition, carrying out the implementation strategy described above will ensure that the DoD CBM Plan is reviewed and revised where necessary and that it is implemented throughout DoD.

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Appendix A. List of Avian Studies at DoD Installations

Bird monitoring and assessment that we were able to learn about are listed on the following pages. We know, as several reviewers pointed out, that many other programs exist, but we could only include the ones that the official contacts at each installation identified for us.

State	Service	Installation Name	Study
AK	AF	Fort Yukon LRRS (611 CES)	None
AK	AF	Murphy Dome LRRS (611 CES)	None
AK	AF	Indian Mountain LRRS (611 CES)	None
AK	AF	Tatalina LRRS (611 CES)	BBS
AK	AF	Sparrevohn LRRS (611 CES)	None
AK	AF	Tin City LRRS (611 CES)	Kittlitz's Murrelet study Sandhill Crane migration/windpower
AK	AF	Cape Lisburne LRRS (611 CES)	Eider study Kittlitz's Murrelet study
AK	AF	Kotzebue LRRS (611 CES)	Eider study
AK	AF	Point Barrow LRRS (611 CES)	Eider study Eider migration Raven nest chronology Breeding biology of Steller's eiders nesting near Barrow, AK
AK	AF	Oliktok LRRS (611 CES)	Eider study Brant study
AK	AF	Barter Island LRRS (Kaktovik) (611 CES)	Eider study
AK	AF	Cape Romanzof LRRS (611 CES)	Kittlitz's Murrelet study BASH survey Nesting biology and population ecology of yellow wagtails Avifaunal inventory
AK	AF	Cape Newenham LRRS (611 CES)	Kittlitz's Murrelet study Periodic Wildlife Surveys
AK	AF	Cold Bay LRRS (611 CES)	Included in USFWS BBS route
AK	AF	Bullen Point SRRS (611 CES)	Eider study
AK	AF	Wainwright SRRS (611 CES)	Eider study
AK	AF	Point Lay former LRRS (611 CES)	Eider study
AK	AF	Point Lonely former SRRS (611 CES)	Eider study
AK	AF	Clear Air Force Station	
AK	AF	Eareckson Air Station	Winter wildlife surveys Harlequin Duck diet contamination study Point count monitoring BASH surveys Spring & Fall Wildlife Surveys CBC Goose Forage Study
AK	AF	Eielson Air Force Base	Waterfowl brood and geese surveys BASH monitoring

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
AK	AF	Elmendorf Air Force Base	Monitoring Bird Migrations and Movements with Radar and Landsat Imagery-II Bohemian waxwing monitoring Alaska Loon Watch Owl monitoring Point count monitoring Raptor nesting habitat
AK	Army	Black Rapids Training Area	None
AK	Army	Donnelly Training Area	Alaska Landbird Monitoring Survey Cavity nesting ducks box project Sharp-tailed grouse lek surveys Whimbrel nest site survey Ruffed grouse survey
AK	Army	Fort Greely	None
AK	Army	Fort Richardson	INRMP Avian Projects BBS CBC
AK	Army	Fort Wainwright	Boreal owl nest box project
AK	Army	Gerstle River Training Area	None
AK	Army	Tanana Flats Training Area	Owl monitoring Swan nesting and brood survey
AK	Army	Yukon Training Area	Alaska Landbird Monitoring Survey Cavity nesting duck box project Ruffed grouse survey Owl monitoring
AK	Army/NG	Stewart River Training Area - National Guard	Breeding bird survey (different from national program)
AL	AF	Maxwell Air Force Base	
AL	Army	Anniston Army Depot	Survey of Breeding Birds
AL	Army	Fort Rucker	None
AL	Army	Redstone Arsenal	None (breeding bird study planned for 2007)
AL	Army/NG	Fort McClellan - National Guard	Point count survey
AL	Navy	OLFs - Whiting Field	
AR	AF	Little Rock Air Force Base	4-season point count landbird surveys
AR	Army	Pine Bluff Arsenal	
AR	Army/NG	Camp J.T. Robinson - National Guard	Nearctic-Neotropical Migrants pt cts (years) Bachman's Sparrow survey Loggerhead Shrike Survey Brown-headed Cowbird Survey Northern Bobwhite Survey Cerulean Warbler Survey
AR	Army/NG	Fort Chaffee - National Guard	Annual Bird Count MAPS / MAWS Greater Prairie Chicken search
AZ	AF	Davis-Monthan Air Force Base	Migratory linkages of Burrowing Owls Dispersal Patterns of Burrowing Owls on Davis-Monthan AFB
AZ	AF	Luke Air Force Base	

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
AZ	AF/MC	Barry M. Goldwater Range	Migratory linkages of Burrowing Owls
AZ	Army	Fort Huachuca	Grassland Bird Transect Monitoring Hummingbird Monitoring Mexican Spotted Owl Monitoring Southwestern Willow Flycatcher and Yellow-billed Cuckoo Surveys Wintering Ecology of Shrubland Birds
AZ	Army	Yuma Proving Ground	Migratory linkages of Burrowing Owls Wintering Ecology of Shrubland Birds Use of wildlife water developments by birds during migration
AZ	Army/NG	Camp Navajo - National Guard	Songbird monitoring
AZ	Army/NG	Florence Military Reservation - National Guard	
AZ	MC	MCAS Yuma	Migratory linkages of Burrowing Owls Wintering Ecology of Shrubland Birds
AZ	Navy	Flagstaff, NAVOBSY	None
CA	AF	Beale Air Force Base	Waterfowl Use of Wetland and Upland Nesting Habitats Surveys for Special-Status Aquatic Invertebrate, Botanical, and Wildlife Resources Hunting and Nesting Success of the Northern Harrier in Yellow Star-thistle Utility Pole Use and Electrocutions of Raptors Breeding bird point count survey (2005)
CA	AF	Edwards Air Force Base	Migratory linkages of Burrowing Owls Bird study at Edwards AFB Wintering Ecology of Shrubland Birds
CA	AF	March Joint Air Reserve Base	Migratory linkages of Burrowing Owls Burrowing Owl Monitoring at March Reserve Base
CA	AF	McClellan Air Force Base	
CA	AF	Travis Air Force Base	None
CA	AF	Vandenberg Air Force Base	SW Willow Flycatcher Study
CA	Army	Camp Parks (Reserve Forces Training Area)	
CA	Army	Fort Hunter Liggett	
CA	Army	Fort Irwin	Migratory linkages of Burrowing Owls Wintering Ecology of Shrubland Birds
CA	Army	Presidio of Monterey	None
CA	Army	Sierra Army Depot	None (several in past)
CA	Army/NG	Camp Roberts - National Guard	Bald eagle monitoring on the Nacimiento River MAPS
CA	Army/NG	Camp San Luis Obispo - National Guard	CBC
CA	Army/NG	Van Vleck Training Area - National Guard	

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
CA	MC	Marine Corps MWTC Bridgeport	Riparian Bird Monitoring and Habitat Assessment in the Upper East and West Walker River Watersheds
CA	MC	MCAGCC Twentynine Palms	Burrowing Owls
CA	MC	MCAS Miramar	California Gnatcatcher Surveys Southwestern willow flycatcher and least Bell's vireo surveys MAPS
CA	MC	MCB Camp Pendleton	Migratory linkages of Burrowing Owls
CA	MC	MCLB Barstow	Riparian Bird Survey on the Mojave River
CA	MC	MCRD San Diego	
CA	Navy	China Lake, NAWS	Migratory linkages of Burrowing Owls Wintering Ecology of Shrubland Birds BASH Bird use survey
CA	Navy	Chocolate Mountains Gunnery Range	
CA	Navy	Concord Detachment, NWS Seal Beach	
CA	Navy	Coronado, NAB	Migratory linkages of Burrowing Owls NAS North Island and Naval Outlying Field Imperial Beach BASH Project, Bird Survey and Data Collection CA Least Tern and Snowy Plover Monitoring Burrowing Owl Monitoring San Diego Bay Waterbird Surveys
CA	Navy	Dixon Navy Radio Transmitter Facility	
CA	Navy	El Centro, NAF and Ranges	Migratory linkages of Burrowing Owls
CA	Navy	Fallbrook Detachment, NWS Seal Beach	Migratory linkages of Burrowing Owls
CA	Navy	Imperial Beach, NOLF (inset)	
CA	Navy	Lemoore, NAS	Migratory linkages of Burrowing Owls An Adaptive Management Plan for the Burrowing Owls at NAS Lemoore
CA	Navy	Monterey, NPS	
CA	Navy	Mountain Warfare Training Ctr, La Posta	
CA	Navy	Naval Radio Receiving Facility Imperial Beach (inset)	
CA	Navy	North Island, NAS (inset)	CBC
CA	Navy	Point Loma, Naval Base (inset)	
CA	Navy	Point Mugu, NAS	T & E surveys Monthly surveys for shorebirds, waders, raptors and some passerines
CA	Navy	Port Hueneme, CBC	Brown pelican count
CA	Navy	San Clemente Island, NALF	San Clemente Island Loggerhead Shrike
CA	Navy	San Diego, NAVSTA (inset)	
CA	Navy	San Nicolas Island, NOLF	

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
CA	Navy	Seal Beach, NWS	Migratory linkages of Burrowing Owls
CA	Navy	Warner Springs, SERE Camp	
CO	AF	Buckley Air Force Base	Migratory linkages of Burrowing Owls Burrowing Owl surveys
CO	AF	Peterson Air Force Base	none
CO	AF	Schriever Air Force Base	Migratory linkages of Burrowing Owls
CO	AF	US Air Force Academy	Breeding Bird Census
CO	Army	Fort Carson	Migratory linkages of Burrowing Owls
CO	Army	Piñon Canyon Maneuver Site	Migratory linkages of Burrowing Owls
CO	Army	Pueblo Chemical Depot	Monitoring Colorado's Birds
CO	Army/FWS	Rocky Mountain Arsenal National Wildlife Refuge	Migratory linkages of Burrowing Owls
CO	Navy	Navy Oil Shale Reserve	
CT	Army/NG	Nehantic Training Site	
CT	Navy	New London, NSB	
CU	Navy	Naval Base Guantanamo Bay	
DE	AF	Dover Air Force Base	Migratory Bird Monitoring using Automated Acoustic and Internet Technologies
FL	AF	Avon Park AFR	Species at risk monitoring Bald eagle nest survey
FL	AF	Cape Canaveral Air Force Station	Seasonal bird surveys via installation-wide point counts Florida Scrub-Jay monitoring (yearly) Shorebird survey BASH point counts
FL	AF	Eglin Air Force Base	Red-cockaded woodpecker Shorebird surveys and nest monitoring Bald eagle monitoring Southeastern American Kestrel nesting Cavity nester community with RCW Longleaf pine restoration monitoring Habitat use by neotropical migrants Fall migration monitoring via radar/ground-based transects
FL	AF	Homestead Joint Air Reserve Base	
FL	AF	MacDill Air Force Base	None
FL	AF	Patrick Air Force Base	Seasonal bird surveys via installation-wide point counts Least Tern nesting surveys Shorebird survey BASH point counts
FL	AF	Tyndall Air Force Base	International Piping Plover Census
FL	Army	Malabar Transmitter Annex	Seasonal bird surveys via installation-wide point counts
FL	Army/NG	Camp Blanding - National Guard	Red-cockaded woodpecker Wild turkey Bald eagle
FL	Navy	Jacksonville, NAS	Neotropical migratory bird study

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
FL	Navy	Key West, NAS	Least tem nest monitoring Bald eagle nest monitoring
FL	Navy	Mayport, NAVSTA	Neotropical Migrant checklist survey International Shorebird Survey
FL	Navy	Navy Coastal Systems Station (Panama City)	
FL	Navy	NOLF Whitehouse	Neotropical migratory bird study
FL	Navy	OLFs - Whiting Field	Neotropical migratory bird study
FL	Navy	Pensacola, NAS	
FL	Navy	Pinecastle Impact Range	
FL	Navy	Rodman Bomb Target	
FL	Navy	Stevens Lake Bombing Range	
FL	Navy	Whiting Field, NAS	
GA	AF	Dobbins Joint Air Reserve Base	
GA	AF	Moody AFB + Grand Bay Range	BASH point counts
GA	AF	Robins Air Force Base	
GA	Army	Fort Benning	RCW monitoring MAWS LCTA survey
GA	Army	Fort Gillem	
GA	Army	Fort Gordon	
GA	Army	Fort McPherson	
GA	Army	Fort Stewart	Wood duck nest box monitoring Bobwhite quail cock count Swallow-tailed kite monitoring Red-cockaded woodpecker conservation and recovery
GA	Army	Hunter Army Airfield	
GA	Army/NG	Catoosa Range Training Site	
GA	MC	MCLB Albany	
GA	MC	Townsend Range	
GA	Navy	Kings Bay, NSB	
HI	AF	Bellows Air Force Station	
HI	AF	Hickam Air Force Base	
HI	Army	Kahuku Training Area/ Army Training Range	
HI	Army	Pohakuloa Training Area	
HI	Army	Schofield Barracks Military Reservation	
HI	MC	Marine Corps Base Hawaii, Kaneohe Bay	
HI	Navy	Barking Sands, PMRF	Laysan Albatross Egg Relocation Project Wedge-tailed Shearwater Monitoring Shorebird surveys
HI	Navy	Kaula Rock	
HI	Navy	Lualualei, NAVMAG	Point counts for endangered species Point counts for all species Elepaio playback surveys Endangered waterbird survey at Niuli'I Ponds

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
HI	Navy	NCTAMS Pacific Wahiawa	Flora and fauna survey
HI	Navy	Pearl Harbor, NAVSTA	
IA	Army	Iowa Army Ammunition Plant	
IA	Army/NG	Camp Dodge - National Guard	Avian species catalogue Avian and predator habitat use profiles in an agricultural matrix Avian communities on two prairie pothole wetlands Borrow area wetland mitigation monitoring
ID	AF	Juniper Butte Range	Raptor nest searching
ID	AF	Mountain Home AFB	Area search all species Sage grouse lek surveys Hummingbird banding
ID	AF	Saylor Creek Air Force Range	
ID	Army/NG	Kimama Training Area - National Guard	
ID	Army/NG	Orchard Training Area - (Idaho) National Guard	
ID	Navy	Bayview Det., Carderock NSWC	
IL	AF	Scott Air Force Base	Breeding bird survey via pt cts Spring migration survey Winter birds survey (all done in 2001)
IL	Army	Joliet Training Area	Long-term ecological study
IL	Army	Rock Island Arsenal	None
IL	Army/FWS	Lost Mound NWR (Savanna Army Depot)	
IL	Army/FWS	Midewin National Tallgrass Prairie (Joliet Arsenal)	
IL	Army/NG	Marseilles Training Area - National Guard	
IL	Navy	Great Lakes, NTC	
IN	AF	Grissom Joint Air Reserve Base	
IN	Army	Indiana Army Ammunition Plant	
IN	Army	Kingsbury Training Area	
IN	Army	Newport Chemical Depot	
IN	Army/FWS	Big Oaks NWR (Jefferson Proving Ground)	
IN	Army/NG	Camp Atterbury - National Guard	Surveys of State listed species CBC
IN	Navy	Crane, NSA	Indiana Breeding Bird Atlas MAPS in past T& E survey 2005
KS	AF	Forbes Field	
KS	AF	McConnell Air Force Base	
KS	AF	Smoky Hill Air Force Range	BBS Effects of management regimes on breeding bird densities
KS	Army	Fort Leavenworth	CBC MAPS in past

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
KS	Army	Fort Riley	Auditory Quail Survey Bald Eagle Diurnal Habitat Utilization Henslow's Sparrow Line Transects and Point Counts Bald Eagle Nocturnal Roost Utilization Prairie-Chicken Lek Survey Ring-necked Pheasant Survey Kansas Shorebird Surveys Winter Raptor Survey
KS	Army	Kansas Army Ammunition Plant (Parsons)	BBS Riparian species nest success and diversity
KY	Army	Blue Grass Army Depot (North and South polygons)	
KY	Army	Fort Campbell	
KY	Army	Fort Knox	PIF Point Counts (summer and winter 2005- installation wide surveys)
KY	Army/NG	Artemus Training Site - National Guard	
KY	Army/NG	Wendell Ford Regional Training Center - Nat. Guard	
LA	AF	Barksdale Air Force Base	Observational Wild Turkey Survey
LA	Army	Fort Polk	MAPS Winter abundance of and habitat use by Henslow's Sparrows Spring and fall migration monitoring via radar/ground-based transects (2005-06) CBC Raptor migration study Eastern bluebird monitoring Point count monitoring of residents and neotropical migrants Kestrel nest box study
LA	Army/NG	Camp Beauregard -National Guard	
LA	Army/NG	Camp Minden - National Guard	
LA	Army/NG	Camp Villere - National Guard	
LA	Navy	New Orleans, NAS JRB	
MA	AF	Hanscom Air Force Base	
MA	AF	Westover Air Reserve Base	
MA	AF/Army/NG	Massachusetts Mil. Res. (Otis ANGB/Camp Edwards)	
MA	Army	Fort Devens (Reserve Forces Training Area)	
MD	AF	Andrews Air Force Base	None
MD	Army	Aberdeen Proving Ground	Maryland Breeding Bird Atlas Bald eagle investigations
MD	Army	Fort Detrick	
MD	Army	Fort George G. Meade	
MD	Army	Fort Ritchie	

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
MD	Army/NG	Baker Training Site (Lil Aaron Strauss) - Nat. Guard	
MD	Navy	Annapolis USNA	
MD	Navy	Bloodsworth Island	
MD	Navy	Carderock, NSWC	None
MD	Navy	Indian Head, NSWC	Bald eagle monitoring
MD	Navy	Patuxent River, NAS	MAPS Nest box monitoring Migratory Bird Monitoring using Automated Acoustic and Internet Technologies
ME	AF/FWS	Aroostook NWR (Loring AFB)	
ME	Army/NG	Bog Brook/Riley Training Site - National Guard	
ME	Army/NG	Caswell Training Site - National Guard	
ME	Army/NG	Deepwoods Training Site - National Guard	
ME	Navy	Brunswick, NAS	
ME	Navy	Navy SERE Facility (Rangeley, Redington)	
ME	Navy	NCTAMS Cutler	
MI	AF	Selfridge Air Guard Base	
MI	Army/NG	Camp Grayling - National Guard	
MI	Army/NG	Fort Custer Training Center - National Guard	Raptor inventory Edge effects on avian nest predator Reproductive success, brood parasitism, and nest predation of forest-nesting neotropical migrants
MN	Army/NG	Arden Hills Training Site	
MN	Army/NG	Camp Ripley - National Guard	Bald eagle monitoring Ruffed grouse and wild turkey survey Red-shouldered hawk survey Bluebird nest box monitoring CBC Owl survey Annual songbird surveys Yellow rail monitoring
MO	AF	Whiteman Air Force Base	Point counts
MO	Army	Fort Leonard Wood	Spring migrant survey Great Blue Heron colony survey MAPS
MO	Army	Lake City Army Ammunition Plant	
MO	Army/NG	Camp Clark - National Guard	
MO	Army/NG	Camp Crowder Training Site - National Guard	
MO	Army/NG	Macon Training Site - National Guard	

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
MO	Army/NG	Wappapello Training Site - National Guard	Bald eagle nest survey CBC Bluebird and wood duck nest box monitoring
MO	Army/NG	Weldon Spring Training Site - National Guard	
MS	AF	Columbus Air Force Base	Wildlife hazard assessment Endangered and threatened species survey
MS	AF	Keesler Air Force Base	
MS	Army	Mississippi Army Ammo Plant	
MS	Army/NG	Camp McCain - National Guard	
MS	Army/NG	Camp Shelby - National Guard	
MS	Navy	Gulfport, NCBC	
MS	Navy	Meridian, NAS	None
MS	Navy	Multi-Purpose Target Range	None
MS	Navy	NOLF Joe Williams	None
MS	Navy	Pascagoula, NAVSTA	
MS	Navy	Searay Target Range	None
MT	AF	Malmstrom Air Force Base	None
MT	Army/NG	Bearmouth Training Area - National Guard	
MT	Army/NG	Fort William H. Harrison - National Guard	
MT	Army/NG	Limestone Hills Training Center - National Guard	
NC	AF	Dare County Range	
NC	AF	Pope Air Force Base	
NC	AF	Seymour Johnson Air Force Base	BASH point counts
NC	Army	Camp Mackall	Red-cockaded woodpecker monitoring
NC	Army	Fort Bragg	Investigation of the American Kestrel MAPS, MAWS (MoSI) Red-cockaded woodpecker monitoring Grassland Bird Surveys (2000)
NC	Army	Military Ocean Terminal Sunny Point	Red-cockaded woodpecker monitoring CBC
NC	Army/NG	Camp Butner - National Guard	
NC	MC	Atlantic Outlying Field	
NC	MC	Bogue Field	
NC	MC	MCAS Cherry Point	Point count monitoring Effects of aircraft activities on waterfowl at Piney Island RCW baseline survey
NC	MC	MCAS New River	
NC	MC	MCB Camp Lejeune	Red-cockaded woodpecker (many studies) International Piping Plover Census State aerial waterfowl survey In past – Painted bunting study Other shorebird monitoring?

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
NC	MC	Piney Island (Point of Marsh Target)	
NC	Navy	Harvey Point, DTA	
NC	Navy	Oak Grove Holt Navy Airfield	
ND	AF	Grand Forks Air Force Base	Seasonal bird surveys via pt cts installation-wide (2001 and 2004) Migration monitoring via radar
ND	AF	Minot Air Force Base	
ND	Army/NG	Camp Grafton - National Guard	
ND	Army/NG	Camp Grafton South - National Guard	
ND	Army/NG	Garrison Training Area - National Guard	
NE	AF	Offutt Air Force Base	
NE	Army/NG	Camp Ashland - National Guard	
NE	Army/NG	Cushing Training Site - National Guard	
NE	Army/NG	Greenlief Training Site (Hastings) - National Guard	
NE	Army/NG	Mead Training Area - National Guard	
NE	Army/NG	Stanton Training Site - National Guard	
NH	AF	New Boston Air Force Station	Birds in forested landscapes Whippoorwill monitoring
NJ	AF	McGuire Air Force Base	None
NJ	AF	Warren Grove Gunnery Range	Point counts
NJ	Army	Fort Dix	Bald eagle nest and foraging survey NJ winter bald eagle surveys Grasshopper sparrow nesting Raptor surveys Spring bird counts
NJ	Army	Fort Monmouth	None
NJ	Army	Picatinny Arsenal	Hawk Watch Bluebird nest box monitoring Passerine anecdotal info recorded Migratory Bird Monitoring using Automated Acoustic and Internet Technologies
NJ	Navy	Earle, NWS	Wetland Mitigation Area Monitoring Report 2005
NJ	Navy	Lakehurst, NAES	Grassland Bird Survey Migratory Bird Monitoring using Automated Acoustic and Internet Technologies Forest Bird Survey Nest box and platform monitoring
NM	AF	Cannon Air Force Base	Migratory linkages of Burrowing Owls Endangered, Threatened, Candidate and Sensitive Bird Species

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
NM	AF	Holloman Air Force Base	Migratory linkages of Burrowing Owls Boles Wells Water System Annex Bird Surveys Wetland bird nesting and aquatic invertebrate occurrence
NM	AF	Kirtland Air Force Base	Migratory linkages of Burrowing Owls Population Status, Reproductive Success, Prey Availability, Site Fidelity and Migration of Western Burrowing Owls Grey vireo monitoring Loggerhead shrike monitoring MAPS starting 07 Long-term songbird monitoring 07
NM	AF	Melrose Air Force Range	Endangered, Threatened, Candidate and Sensitive Bird Species and Birds of Conservation Concern
NM	Army	Fort Bliss McGregor Range	Wintering Ecology of Shrubland Birds
NM	Army	Fort Wingate Depot Activity	
NM	Army	White Sands Missile Range	Wintering Ecology of Shrubland Birds Migratory linkages of Burrowing Owls Mexican Spotted Owl habitat evaluation Pinyon Jay monitoring Delineation of southwestern willow flycatcher and yellow-billed cuckoo habitat Seasonal landbird surveys in riparian/wetlands (1997-98)
NM	Army/NG	Black Mountain Training Site (Deming) - Nat. Guard	
NM	Army/NG	Camel Tracks Training Site - National Guard	
NM	Army/NG	Farmington Training Site - National Guard	
NM	Army/NG	Happy Valley Training Site (Carlsbad) - Nat. Guard	Threatened and Endangered Species Survey
NM	Army/NG	Roswell Training Site - National Guard	
NV	AF	Creech Air Force Base	
NV	AF	Nellis Air Force Base	Migratory linkages of Burrowing Owls
NV	AF	Nellis Air Force Range	
NV	Army	Hawthorne Army Depot	
NV	Army/NG	Henderson Training Site - National Guard	
NV	Army/NG	Stead Training Site - National Guard	
NV	Navy	Fallon Training Range Complex	None

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
NV	Navy	Fallon, NAS	Nevada Breeding Bird Atlas Aquatic Bird Survey Monthly point counts CBC BASH Spring Wings
NY	Army	Fort Drum	Migratory Bird Monitoring using Automated Acoustic and Internet Technologies
NY	Army	West Point Military Reservation	Migratory Bird Monitoring using Automated Acoustic and Internet Technologies Spatial Distribution and Habitat Associations of Cerulean Warblers
OH	AF	Wright-Patterson Air Force Base	
OH	Army/NG	Newton Falls Training Site (NG)	
OK	AF	Altus Air Force Base	None
OK	AF	Tinker Air Force Base	Bird Inventory and Migration Trends
OK	AF	Vance Air Force Base / Kegelman Auxiliary Airfield	
OK	Army	Fort Sill	MAPS Black-capped Vireo Study
OK	Army	Lexington Army Aviation Facility	
OK	Army	McAlester Army Ammunition Plant	None
OK	Army/NG	Camp Gruber - National Guard	
OR	AF	West Coast Over the Horizon Backscatter Radar Sys.	
OR	Army	Umatilla Chemical Depot	
OR	Army/NG	Biak Training Center - National Guard	
OR	Army/NG	Camp Adair - National Guard	
OR	Army/NG	Camp Rilea - National Guard	
OR	Army/NG	Camp Withycombe - National Guard	
OR	Navy	Boardman, NWSTF	Migratory linkages of Burrowing Owls
PA	Army	Carlisle Barracks	
PA	Army	Letterkenny Army Depot	
PA	Army	New Cumberland Army Depot	
PA	Army	Tobyhanna Army Depot	
PA	Army/NG	Beaver Dam Training Site - National Guard	
PA	Army/NG	Fort Indiantown Gap - National Guard	Raptor Population Index Project Nest Box Monitoring Abundance and Diversity of Breeding Birds 2nd PA Breeding Bird Atlas Summer / winter owls and northern goshawk surveys eBird, opportunistic bird surveys Waterbird monitoring

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
PA	Army/NG	Marshburg Training Area - National Guard	
PA	Navy	Willow Grove, NAS JRB	
SC	AF	Charleston Air Force Base	
SC	AF	Poinsett Range (Shaw AFB)	RCW monitoring MAPS Raptor survey Northern bobwhite survey
SC	AF	Shaw Air Force Base	Least Tern monitoring BASH
SC	Army	Fort Jackson	MAPS Red-cockaded woodpecker monitoring Southeastern American Kestrel and Wood Duck nest box monitoring
SC	Army/NG	Leesburg Training Site (McCrady TC) -National Guard	
SC	MC	MCAS Beaufort	Migratory bird monitoring
SC	MC	MCRD Parris Island	
SC	Navy	Charleston, NWS	Point counts
SD	AF	Ellsworth Air Force Base	Burrowing owl use of prairie dog towns
TN	AF	Arnold Air Force Base	Bald Eagle Status and Distribution Heron Monitoring MAPS Henslow's Sparrow Monitoring Nightjar Monitoring
TN	Army	Holston Army Ammunition Plant	Bird checklist
TN	Army	Milan Army Ammunition Plant	BBS
TN	Army/NG	Volunteer Training Site-Milan - National Guard	
TN	Army/NG	Volunteer Training Site-Smyrna - National Guard	
TN	Army/NG	Volunteer Training Site-Tullahoma - National Guard	
TN	Navy	Mid-South, Naval Support Activity (Memphis)	
TX	AF	Brooks City-Base	None
TX	AF	Dyess Air Force Base	Spring point counts Bluebird nest box monitoring CBC Riparian restoration area- long-term monitoring of avian response
TX	AF	Goodfellow Air Force Base	
TX	AF	Kelly Annex (Lackland AFB)	
TX	AF	Lackland Air Force Base	
TX	AF	Laughlin Air Force Base	
TX	AF	Randolf Air Force Base	Golden-cheeked warbler habitat
TX	AF	Sheppard Air Force Base	Migratory bird surveys
TX	Army	Camp Bullis	Endangered species survey (long-term monitoring of GCWA and BCVI) All bird checklist
TX	Army	Fort Bliss	Migratory linkages of Burrowing Owls

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
TX	Army	Fort Hood	Endangered species monitoring Genetic Differentiation in the Endangered Black-Capped Vireo MAPS
TX	Army	Fort Sam Houston	
TX	Army	Lonestar Army Ammo Plant	
TX	Army	Longhorn Army Ammo Plant	
TX	Army	Red River Army Depot	
TX	Army/NG	Camp Bowie - National Guard	MAPS Black-capped vireo habitat survey Annual black-capped vireo survey
TX	Army/NG	Camp Maxey- National Guard	Baseline survey of birds
TX	Army/NG	Camp Mabry – National Guard	Bird species diversity & abundance Plant species on bird transects
TX	Army/NG	Camp Swift - National Guard	MAPS Avian richness and abundance Vegetation survey at bird sample points
TX	Army/NG	Fort Wolters - National Guard	Inventory of birds
TX	Navy	Corpus Christi, NAS	BASH International Piping Plover Grassland Bird Survey USGS
TX	Navy	Escondido Ranch (McMullen Range, Dixie Target)	Grassland Bird Survey USGS
TX	Navy	Ft Worth, NAS JRB	
TX	Navy	Ingleside, NAVSTA	
TX	Navy	Kingsville, NAS	BASH Grassland Bird Survey USGS
TX	Navy	NALF Orange Grove	BASH Grassland Bird Survey USGS
UT	AF	Hill Air Force Base	Bird Risk Assessment Population, Distribution and Habitat Study for Threatened, Endangered and Sensitive Species
UT	AF	Hill Air Force Range (Utah Test & Training Range)	Population Monitoring of Neotropical Migratory Birds BBS
UT	AF	Wendover Air Force Auxillary Field	
UT	AF	Wendover Range	
UT	Army	Deseret Test Center	BASH Nest boxes
UT	Army	Dugway Proving Ground	Raptor banding Eagle monitoring MAPS Nest boxes Hawkwatch
UT	Army	Tooele Army Depot (2 polygons)	None
UT	Army/NG	Camp Williams - National Guard	
VA	AF	Langley Air Force Base (inset)	
VA	Army	Craney Island Disposal Area (inset)	

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
VA	Army	Fort AP Hill	MAPS Nest box monitoring
VA	Army	Fort Belvoir	Multi-season avian surveys via installation-wide point counts BASH point counts CBC BBS Bluebird nest box Shorebird survey Chimney swift roost survey Waterfowl survey Bald Eagle nest surveys Wild Turkey roost and winter track counts
VA	Army	Fort Eustis (inset)	Breeding Bird Survey (1999) Spring Migration Survey (2000)
VA	Army	Fort Lee	Breeding Bird point counts Biological Surveys and Inventories Nest box program CBC Wading bird surveys
VA	Army	Fort Monroe (inset)	
VA	Army	Fort Story (inset)	Breeding Bird Survey (1999) Spring Migration Survey (2000)
VA	Army	Radford Army Ammunition Plant	CBC Sporadic surveys
VA	Army/NG	Camp Pendleton State Mil. Res. - Nat. Guard (inset)	
VA	Army/NG	Fort Pickett - National Guard	
VA	MC	Marine Corps Base Quantico	MAPS
VA	Navy	Camp Peary	
VA	Navy	Craney Island Fuel Depot (inset)	
VA	Navy	Dahlgren, NSF	Bluebird Nest Boxes Eagle nest surveys In past – MAPS and point counts
VA	Navy	Dam Neck Annex (inset)	
VA	Navy	Fentress, NALF	MAPS (in past) BASH
VA	Navy	Little Creek, NAB (inset)	MAPS (in past)
VA	Navy	Norfolk, Naval Base (inset)	MAPS (in past) BASH
VA	Navy	Norfolk, Naval Shipyard (inset)	
VA	Navy	Norfolk-Northwest Annex, NSA	MAPS (in past)
VA	Navy	Oceana, NAS (inset)	MAPS (in past) BASH
VA	Navy	St. Julian Creek Annex (inset)	
VA	Navy	Yorktown, NWS	Northern bobwhite count Mute swan and Canada goose counts
VT	Army/NG	Camp Johnson - National Guard	
VT	Army/NG	Ethan Allen Firing Range - National Guard	

Appendix A. List of Avian Studies at DoD Installations.—Continued

State	Service	Installation Name	Study
WA	AF	Fairchild Air Force Base	Survey of birds and mammals RTHA survey planned
WA	AF	McChord Air Force Base	Range-wide Streaked Horned Lark Assessment MAPS, Nest box monitoring
WA	AF	McChord Training Annex	
WA	AF/USFS	Cusick Survival Training Site	
WA	Army	Fort Lewis	Range-wide Streaked Horned Lark Assessment MAPS Nest box and cavity monitoring RTLA bird surveys
WA	Army	Yakima Training Center	Sage grouse lek surveys
WA	Army/NG	Camp Bonneville	
WA	Army/NG	Camp Murray	None
WA	Army/USFS	Mount Baker Helicopter Training Area (3 polygons)	
WA	Army/USFS	Nap of the Earth Helicopter Training Area	
WA	Navy	Everett, NAVSTA	
WA	Navy	Indian Island, NAVMAG	
WA	Navy	Jim Creek, NAVRADSTA (T)	
WA	Navy	Kitsap, Naval Base	CBC
WA	Navy	Puget Sound, Naval Shipyard	
WA	Navy	Whidbey Island, NAS	NOHA and BAEG surveys
WA	Navy	NSB Bangor	CBC
WI	AF	Hardwood Range (Volk Field)	
WI	AF	Volk Field (ANGB)	
WI	Army	Badger Army Ammunition Plant	
WI	Army	Fort McCoy	Eagle and osprey monitoring Distribution, abundance and productivity of grassland birds Winter finch banding Ruffed grouse drumming survey
WI	Army/NG	Camp Wismer - National Guard	
WV	Army/NG	Camp Dawson - National Guard	
WV	Navy	Sugar Grove, NIOC	MAPS
WY	AF	F.E. Warren Air Force Base	Survey for breeding birds on Crow Creek (pt cts) Mountain Plover surveys Mountain Plover habitat
WY	Army/NG	Camp Guernsey - National Guard	
WY	Army/NG	Lander Training Area - National Guard	
WY	Army/NG	Lovell Training Area - National Guard	
WY	Army/NG	Sheridan Training Area - National Guard	
WY	Navy	Navy Petroleum Reserve	

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APPENDIX G: SEA TURTLE MANAGEMENT

Documents included:

1. USFWS Biological Opinion RE: Sea Turtle Management, Naval Air Station Oceana – Dam Neck Annex and Virginia Army National Guard – Camp Pendleton*, Virginia Beach, VA, Project # 2016 – F-2328
2. 2016 Sea Turtle Nesting Communication Plan
3. Virginia Sea Turtle Nesting Handbook, VDGIF 2015
4. Lighting Inspections with Survey Form

*SMR

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

October 21, 2016

Mr. Michael H. Jones
Director, Environmental Planning and Conservation
Navy Region Mid-Atlantic
1510 Gilbert Street
Norfolk, VA 23511- 2737

Re: Sea Turtle Management, Naval Air Station Oceana – Dam Neck Annex and Virginia Army National Guard – Camp Pendleton, Virginia Beach, VA, Project # 2016 – F-2328

Dear Mr. Jones:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Department of the Navy's (Navy) proposed and ongoing sea turtle management at the Naval Air Station Oceana – Dam Neck Annex (NASO-DNA) and the Virginia Army National Guard's operations at Camp Pendleton (VAARNG-CP) in Virginia Beach, VA, and effects on the federally listed endangered Kemp's ridley sea turtle (*Lepidochelys kempii*) and federally listed threatened green sea turtle (*Chelonia mydas*) North Atlantic distinct population segment (DPS) and loggerhead sea turtle (*Caretta caretta*) Northwest Atlantic Ocean DPS in accordance with section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). Your February 29, 2016 request for formal consultation was received on March 3, 2016.

This biological opinion is based on information provided in the March 3, 2016 biological assessment, the project proposal, telephone conversations, field investigations, and other sources of information. A complete administrative record of this consultation is on file in this office.

The Navy determined in its biological assessment (Navy 2016) that the proposed and ongoing actions may affect, but are not likely to adversely affect the federally listed endangered leatherback (*Dermochelys coriacea*) and hawksbill (*Eretmochelys imbricata*) sea turtles. The Service concurs with the Navy's determination because although leatherback and hawksbill sea turtles have been documented in offshore environments, no nests of either species have been

documented in the area and these species are not expected to occur there in the future. These species are not considered further in this biological opinion.

This biological opinion is valid from the date of signature through August 15, 2031.

CONSULTATION HISTORY

10-08-03	The Service issued NASO-DNA a non-jeopardy biological opinion for a proposed beach replenishment project.
05-29-08	Agreement between NASO-DNA and the Service's Back Bay National Wildlife Refuge (BBNWR) that NASO-DNA would be responsible for conducting crawl and nest patrols on NASO-DNA beaches and BBNWR was responsible for biological data collection, nest confirmation, and nest relocation on NASO-DNA beaches.
05-25-12	The Service issued BBNWR and NASO-DNA a non-jeopardy biological opinion for the updated BBNWR Sea Turtle Management Program.
10-17-14	Meeting between the Service and Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Region (MIDLANT) to discuss sea turtle management.
01-06-15	Service review of the NASO-DNA Integrated Natural Resources Management Plan (INRMP) that includes standard operating procedures (SOP) for sea turtle management.
05-29-15	National Oceanic and Atmospheric Administration review of the NASO-DNA INRMP that includes SOPs for sea turtle management.
06-09-15	INRMP signed into official compliance by the Navy.
10-08-15	Coordination of INRMP updates at the INRMP Annual Partners meeting.
03-03-16	The Service received the Navy's February 29, 2016 request to initiate formal consultation on the sea turtle management program.
04-06-16	Meeting among the Service, NASO-DNA, Joint Expeditionary Base Little Creek-Fort Story, and Virginia Department of Game and Inland Fisheries (VDGIF) to discuss sea turtle management in Virginia.
05-03-16	The Service provided a letter to NAVFAC acknowledging receipt of the Navy's February 29, 2016 request to initiate formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Naval Air Station Oceana - Dam Neck Annex (NASO-DNA)

NASO-DNA is an approximately 1,900-acre installation in southern Virginia Beach, VA. NASO-DNA includes approximately 4.0 miles [mi] of intertidal beach and primary and secondary coastal dune habitat along the Atlantic Ocean (Navy 2015). The beaches and dunes on NASO-DNA encompass about 164 acres of dune protection area consisting of undeveloped primary and secondary dunes and natural communities.

The proposed sea turtle patrols and nest and stranding management are defined in the SOPs for sea turtles (Navy 2015, Appendix A) included in the NASO-DNA INRMP (Navy 2015). The SOPs for sea turtle patrols, stranding notifications and actions, and nest management include:

- conducting patrols within the beach and dune areas of NASO-DNA to locate stranded sea turtles, turtle crawls, and turtle nests;
- reporting and coordinating actions for stranded sea turtles with the Virginia Aquarium Stranding Team (VAST);
- protecting and monitoring *in situ* sea turtle nests until all hatchlings have emerged;
- relocating nests to established low activity (green) zones when operational uses of the beach (e.g., red or yellow activity zones) or nest location (e.g., below the high tide line) would result in disturbance or destruction of a nest; and
- reviewing projects proposed in the INRMP or by NASO-DNA or its tenant for their potential to affect sea turtles.

Sea Turtle Patrols – The procedure for sea turtle patrols was developed to identify stranded sea turtles, sea turtle crawls, and sea turtle nests within the beach and dune areas of NASO-DNA. Nesting surveys and egg relocations will only be conducted by persons with prior experience and training in these activities and who are duly authorized to conduct such activities through a valid permit issued by the VDGIF. The patrollers will have training on patrol procedures, crawl recognition, and all-terrain vehicle (ATV) use. From 15 May to 31 August, NASO-DNA's natural resources staff and other authorized individuals will patrol the beaches daily using ATVs starting 30 minutes before sunrise. If the morning is dark, ATV headlights will be covered in red filters before use on the beach. The water's edge will be patrolled first, and then the middle beach will be patrolled. Patrolling above the high-tide line is not advised because this habitat may contain shorebird nests.

If a stranded turtle, turtle crawl, or turtle nest is sighted, procedures outlined in the following sections will be followed. If unauthorized vehicles, artificial light, or any other activity that could negatively impact sea turtle activity on the beach is found, NASO-DNA's security, conservation

law enforcement officer, and Natural Resource Manager (NRM) will be contacted. Information from the patrol will be documented in a Sea Turtle Patrol Log.

Sea Turtle Stranding – During patrols, dead or live sea turtles may be found stranded. The NASO-DNA reporting procedures, which include contacting the NRM and the VAST, will be initiated for any stranded sea turtles. Appropriate contacts will be provided in the sea turtle communication protocol and updated yearly prior to the start of the sea turtle nesting season or as needed. If appropriate, the NRM will contact the NAVFAC MIDLANT Subject Matter Expert and the National Oceanic and Atmospheric Administration Point of Contact. After helping VAST remove either dead or live stranded turtles and completing patrols, the patrollers will complete patrol logs and stranding data sheets.

Dead Stranded Turtles – If the turtle is in the surf, patrollers will move it landward so it does not wash away before the VAST arrives. Patrollers will provide the day, time, and location information on whether the turtle was moved out of the surf and the patroller's name and contact information to the VAST and the NRM. The patrollers will help the VAST with base access, data collection, and removal of the turtle.

Live Stranded Adults – Patrollers will contact the VAST and the NRM, relay the location of the stranded adult turtle, and continue to search the beach. When they finish patrolling, they will return with supplies to protect the stranded turtle. Patrollers will keep the nose and eyes of the turtle moist and its body shaded and await further instruction from the VAST. Patrollers will aid the VAST with base access, data collection, and moving the turtle.

Live Stranded Hatchlings – Patrollers will contact the NRM and the VAST, relay the location of the stranded hatchling, and place the hatchling in a cooler with moist sand until they receive further instructions.

Crawl Procedures – When a patroller finds a nesting or crawling turtle, they will extinguish their ATV headlights. Patrollers will take care not to startle the turtle and keep a safe distance away until the turtle has returned to the sea. Any turtle crawls or nests will be reported to BBNWR, the NRM, range control if found on training beaches, security, VDGIF sea turtle program manager, Command Duty Officer, Public Affairs Officer, Installation Environmental Program Director, and Public Works Officer. The patrollers and NRM will coordinate with all agencies to document the occurrence and determine appropriate actions.

After the turtle crawl has been reported, the crawl will be marked with wire flags and the surrounding area will be identified with stakes and flagging to provide a buffer around the nest. The date, time, weather, crawl measurements, and any information that can be deduced about the time of emergence and return to the ocean will be recorded. The global positioning system location will be documented and pictures taken. Flashes should not be used for nighttime photography. A permitted biologist or other approved and permitted individual (i.e., Navy, VDGIF, Service, or Virginia Aquarium representative) will determine if a false crawl, false nest,

or nest is present. If a nest is present, nest procedures will be followed. Otherwise, the patroller will complete his/her patrol.

Nest Management – The procedures discussed below are general descriptions of nest management actions at NASO-DNA. Specific procedures are found in the *Standard Operating Procedures for Sea Turtles, Naval Air Station Oceana – Dam Neck Annex* (Navy 2016, Appendix A). Only individuals having the appropriate permits (e.g., Navy, VDGIF, Service, VAST) are legally authorized to perform nest management procedures on NASO-DNA.

To locate a nest, a permitted biologist will examine any disturbed areas. Nests will located by excavating the nest by hand. Nests will be left in place whenever possible. If a nest is relocated by a permitted biologist, it will be moved to the closest available designated location via strict protocols and prior to 9 am. Relocated nests will be not be placed in organized groupings. Relocated nests will be randomly staggered along the length and width of the beach in settings that are not expected to experience daily inundation by high tides or known to routinely experience severe erosion and egg loss, predation, or subject to artificial lighting. Nest relocations in association with construction activities will cease when construction activities no longer threaten nests. For all nests, data sheets and photographs documenting the actions taken will be completed and placed in a turtle nest binder.

If a nest is found below the high tide line, the responding permit holder and NRM determine whether the nest should be relocated above the high tide line. The responding permit holder and NRM determine whether the nest should be relocated to a different area of the installation considering whether the beach is in a military training area.

NASO-DNA has identified areas of the installation where sea turtle nests or hatchlings may be impacted as a result of training that cannot be relocated (Figure 1). The majority of this training is limited to between Labor Day and Memorial Day due to the installation's close proximity to Virginia Beach. Areas designated as red zones (Figure 1) are commonly used for training that is difficult to relocate and may put sea turtle nests at risk. In the red zone, routine exercises include: training, testing and evaluation in special warfare, ordinance, overland assault, beach assault, and tactical air operations radar. Amphibious landing exercises can occur up to 4 times per month and involve 1 to 4 amphibious vehicles maneuvering onto and across the beach, foot traffic across the beach and dunes, and support personnel digging foxholes to establish a beachhead. In the red zones (Figure 1), sea turtles may be impacted by ground disturbing training activities, amphibious landing exercises, explosive ordinance disposal, physical training, security patrols, maintenance of buried communication cables, and ATV training. Training and associated activities may disturb nesting attempts or reduce hatching success. To avoid potential adverse effects, nests laid in red zones will be relocated to the nearest adjacent green zone.

Areas designated as yellow zones (Figure 1) are used for training; however, training exercises are less frequent and more flexible than training exercises conducted in red zones and nests will be left *in situ* if they can be avoided. If nests are located in areas with a likelihood of negative effects on training, NASO-DNA will contact the Service and VDGIF to discuss potential for

relocation. Relocation of nests in yellow zones will be considered on a case-by-case basis. Nests above the high tide line can be left in place, with a self-release cage and posts on all sides. Nests that negatively inhibit established training routes may be relocated west, closer to the dune line. If the number of nests negatively inhibits training, and training exercises cannot be moved to a different location the nest will be relocated to the closest green zone. Nest sitting will not occur in yellow zones.

Areas designated as green zones (Figure 1) are generally used for activities where individuals are able to avoid a marked sea turtle nest, primarily recreational use areas. Recreational use of beaches on NASO-DNA occurs seasonally, with most activity concentrated in spring and summer months. Recreational use includes swimming, beachcombing, fishing, wildlife observation, sunbathing, and other typical beach recreation. Seasonal recreational use overlaps with sea turtle nesting season and may disturb nesting attempts or reduce hatching success. A nest laid in green zones will be left *in situ*, unless located below the high tide line, in which case it will be relocated due west above the high tide to avoid inundation. NASO-DNA staff routinely patrol the beach and recreational use areas. Nests will be marked conspicuously to reduce likelihood of disturbance prior to hatching. Nest sitting is authorized in green zones.

In Situ Nest Protection and Monitoring – In situ nests will be surrounded by a wire predator-proof exclosure, flagging, reflectors, and signage to inform the public about the protection program. Navy (2016, Appendix D) contains detailed procedures for construction and placement of predator exclosures. Navy (2016, Appendix A) contains detailed procedures for nest monitoring and nest sitting. Nest sitting will only be authorized in green zones (Figure 1).

Nest Relocation – Nest relocation procedures are outlined in Virginia Bureau of Wildlife Resources (2015) and Navy (2016, Appendix A). Nests will be moved to the nearest approved adjacent area (Figure 1). Relocated nests will be moved to an appropriate area on NASO-DNA or VAARNG-CP. In rare circumstances when no approved areas on NASO-DNA or VAARNG-CP are available, the nest will be moved to a beach location at BBNWR. A predator exclosure cage will be placed over the relocated nest using procedures described above and outlined in Navy (2016, Appendix D). The nests will be monitored following the same procedures as for nests left *in situ*.

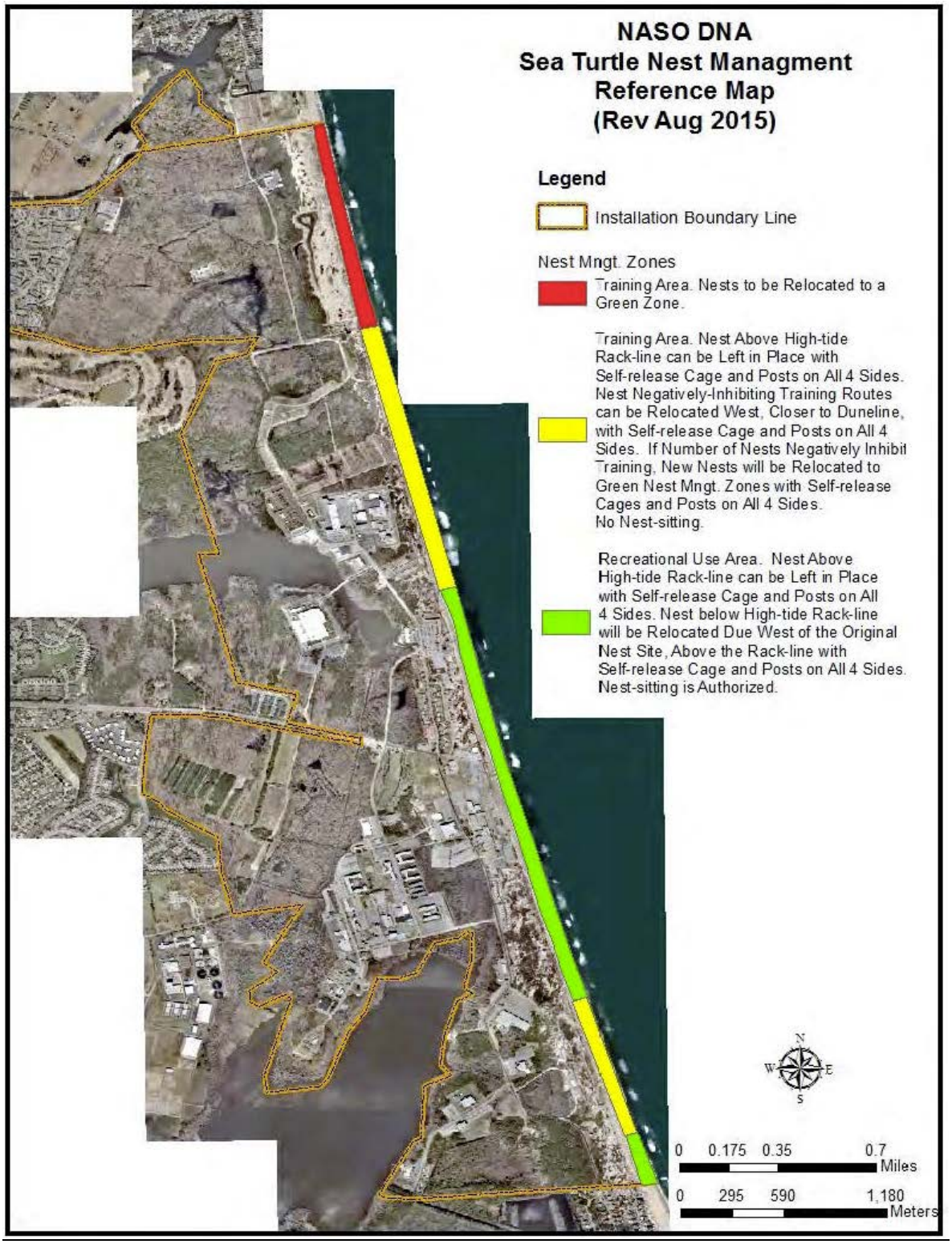

Figure 1. Naval Air Station Oceana – Dam Neck Annex sea turtle nest management map.

Virginia Army National Guard - Camp Pendleton (VAARNG-CP)

VAARNG-CP is adjacent to the northern boundary of NASO-DNA in southern Virginia Beach (Figure 2). The VAARNG-CP is situated along the Atlantic Ocean and has approximately 0.23 mi of intertidal beach and primary and secondary coastal dune habitat continuous with NASO-DNA beaches (VAARNG 2004). The VAARNG-CP beach is bounded to the north by the Croatan residential neighborhood and Croatan public beach and to the south by NASO-DNA. Through a cooperative venture with the City of Virginia Beach, approximately 1,000 ft of the northern portion of the VAARNG-CP beach is opened to the public as the Pendleton Surf Beach.

Sea Turtle Patrols – The VAARNG-CP INRMP recognizes the need for monitoring for sea turtle activity (VAARNG 2004). Currently, VAARNG-CP has a verbal agreement with NASO-DNA to conduct beach patrols. NASO-DNA beach patrols survey the VAARNG-CP beach to the property boundary for the portion of the beach leased to the City of Virginia Beach and use binoculars to survey the remaining beach. The area leased to the City of Virginia Beach is surveyed by Virginia Aquarium volunteers.

If a crawl, stranded sea turtle, or potential nest is located, the patrol will contact the NASO-DNA NRM, who in turn contacts the VAARNG-CP NRM. Notification is passed to the VAARNG-CP command staff. The VAARNG-CP NRM ensures that the Service, VDGIF, and VAST are notified as appropriate.

Nest Management – Limited training activities occur on VAARNG-CP beaches. Training includes driving vehicles such as Humvees and ATVs and can be suspended at any time to accommodate protection of sea turtles. Additional vehicular traffic can occur in an emergency situation for human safety or law enforcement activities. If a nest is located, the VAARNG-CP NRM will consult with the Service, VDGIF, and VAST to determine if the nest will be left *in situ* or relocated on VAARNG-CP, and who will be responsible for relocation. Nest management activities will be conducted in accordance with the 2015 Virginia Sea Turtle Nesting Handbook (Virginia Bureau of Wildlife Resources 2015).

In Situ Nest Protection and Monitoring – In areas with heavy foot or vehicular traffic the nest will typically be marked for avoidance. *In situ* nests will be marked with stakes, flagging, and signs that identify the site as a sea turtle nest. Stakes will be placed at each corner of the nest (36 – 40 inches from nest center) and encircled with flagging to preclude them from being run over or disturbed. A predator exclosure will be placed on the nest as described in Navy (2016, Appendix D). Nests will be monitored daily near the hatch window to determine success. A nest inventory may only be conducted 72 hours after the first sign of emergence or 70 days after the eggs were deposited (90 days for leatherbacks) whichever comes first. The nest will be excavated by permitted persons to quantify nest success.

Nest Relocation – When a nest is located below the mean high tide line, it may be moved immediately above the mean high tide line. A nest will only be moved for unusual activities, such as special military training operations by VAARNG-CP or the U.S. Navy, that pose a

serious threat to the nest. In these instances, VAARNG-CP NRM will consult with the VDGIF and Service to discuss potential mitigation measures that may include relocation. If the nest is relocated, permitted individuals will accomplish the relocation of the nest in accordance with the procedures outlined in the 2015 Virginia Sea Turtle Nesting Handbook (Virginia Bureau of Wildlife Resources 2015). Nests may be relocated to the closest adjacent suitable beach approved for relocation on VAARNG-CP or NASO-DNA. Prior to relocating any nest to the NASO-DNA green zone (Figure 1), coordination and approval must be obtained through the NASO-DNA NRM. Appendix K in the NASO-DNA Standard Operating Procedures for Sea Turtles (Navy 2016, Appendix A) lists areas approved for nest relocation. In rare circumstances when no approved areas on VAARNG-CP or NASO-DNA are available, the nest will be moved to a beach location at BBNWR. Relocated nests are marked as discussed above for *in situ* nest protection and monitoring.

Back Bay National Wildlife Refuge (BBNWR)

BBNWR has approximately 5 mi of intertidal beach and primary and secondary coastal dune habitat and is a potential relocation site for nests from NASO-DNA and VAARNG-CP. BBNWR is located south of Sandbridge, VA, and is about 8 mi south of NASO-DNA (Figure 2).

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project includes the beach and dune areas at NASO-DNA, VAARNGCP, and BBNWR. The action area at NASO-DNA is bounded by VAARNG-CP to the north and the community of Sandbridge, VA, to the south. The action area within NASO-DNA includes approximately 4 continuous mi of intertidal beach and primary and secondary coastal dune along the Atlantic Ocean, which total about 164 acres. The action area at VAARNG-CP is bounded to the north by the Croatan residential neighborhood and the Croatan public beach and to the south by NASO-DNA. The action area within VAARNG-CP has approximately 0.23 mi of intertidal beach and primary and secondary coastal dune habitat that is continuous with NASO-DNA beaches and includes the Pendleton Surf Beach. The action area at BBNWR is bounded to the north by Sandbridge beach and to the south by False Cape State Park. The action area within BBNWR has approximately 5 mi of intertidal beach and primary and secondary coastal dune habitat.

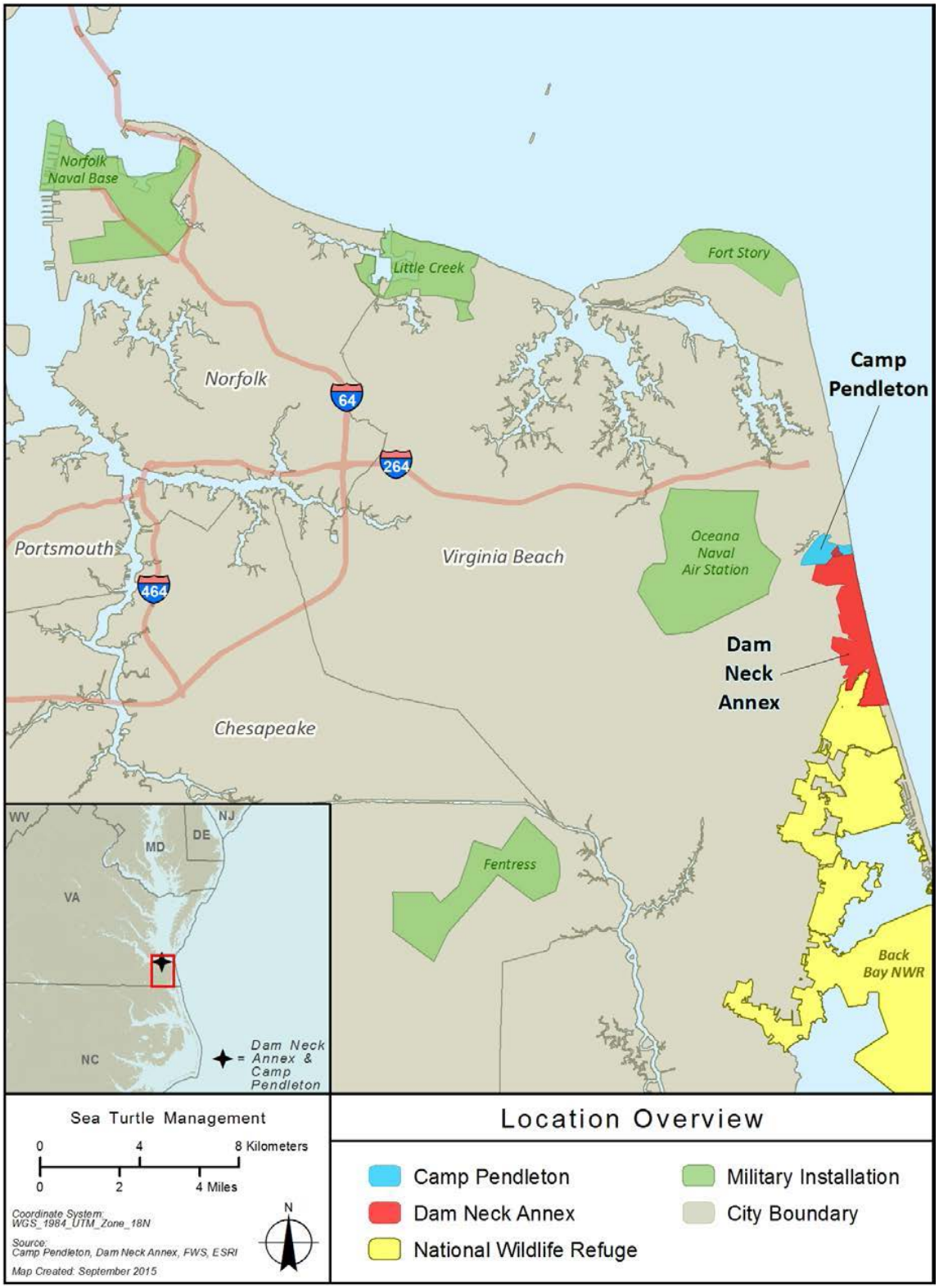

Figure 2. Location of Naval Air Station Oceana – Dam Neck Annex and Virginia Army National Guard – Camp Pendleton.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

Kemp's Ridley Sea Turtle – The species description, life history, population dynamics, status and distribution, and critical habitat description, if applicable are at: Lazell 1980; Morreale et al. 1982, 2007; Lutcavage and Musick 1985; Henwood and Ogren 1987; Ogren 1989; Collard 1990; Meylan et al. 1990; Manzella et al. 1991; Service and National Marine Fisheries Service (NMFS) 1992; Marquez-Millan 1994; Keinath et al. 1994; Renaud 1995; Weber 1995; Godfrey 1996; Musick and Limpus 1997; Landry and Costa 1999; Turtle Expert Working Group 2000; Coyne et al. 2000; Foote and Mueller 2002; Gulko and Eckert 2004; Morreale and Standora 2005; Renaud and Williams 2005; Seney and Musick 2005; Heppell et al. 2005; Schmid and Barichivich 2006; Frey et al. 2007; NMFS and Service 2011; NMFS et al. 2011; Witherington et al. 2012; Galloway et al. 2013; and Barco and Swingle 2014. No critical habitat has been designated for this species.

Green Sea Turtle North Atlantic Distinct Population Segment – The species description, life history, population dynamics, status and distribution, and critical habitat description, if applicable are at: Dolan et al. 1973; Parmenter 1980; Hosier et al. 1981; Morreale et al. 1982; Peterson et al. 1985; Carr 1987; Anders and Leatherman 1987; Hirth and Samson 1987; Nelson et al. 1987; Nelson and Dickerson 1987, 1988; Schwartz 1989; National Research Council 1990; NMFS and Service 1991, 2007, 2008, 2015; Cox et al. 1994; Epperly et al. 1995a, b; Meylan et al. 1995; Witherington and Martin 1996, 2003; Hirth 1997; Musick and Limpus 1997; Lutcavage et al. 1997; Bouchard et al. 1998; Mortimer 1999; Bjorndal et al. 2000; Broderick et al. 2001; Holloway-Adkins and Provancha 2005; Witherington et al. 2006, 2012; Hirama and Ehrhart 2007; McClellan and Read 2009; and Pintus et al. 2009. No critical habitat has been designated for this species in this area (81 FR 20057-20090).

Loggerhead Sea Turtle Northwest Atlantic Ocean Distinct Population Segment – The species description, life history, population dynamics, status and distribution, and critical habitat description, if applicable are at: Graham 1973; Dolan et al. 1973; Schwartz 1978; Limpus et al. 1979, 1985; Mrosovsky 1980, 1988; Hosier et al. 1981; Carr 1982; Bradner 1983; Mrosovsky et al. 1984; Lutcavage and Musick 1985; Anders and Leatherman 1987; Nelson and Dickerson 1987, 1988; Nelson et al. 1987; Dodd 1988; Musick 1988; Christens 1990; McGehee 1990; National Research Council 1990; NMFS and Service 1991, 2007, 2008; Witherington 1991; Burke et al. 1991; Shoop and Kenney 1992; Cox et al. 1994; Georges et al. 1994; Epperly et al. 1995c; Addison 1996; Witherington and Martin 1996, 2003; Bouchard et al. 1998; Hanson et al. 1998; Steinetz et al. 1998; Bollmer et al. 1999; Turtle Expert Working Group 2000, 2009; Prescott 2000; Wood and Bjorndal 2000; Webster and Cook 2001; Godley et al. 2001; Comer 2002; Snover 2002; Witzell 2002; Mitchell et al. 2002; Avens et al. 2003; Bolten 2003; Lohmann and Lohmann 2003; Carthy et al. 2003; Ehrhart et al. 2003; Hopkins-Murphy et al. 2003; Miller et al. 2003, Schroeder et al. 2003; Bowen et al. 2005; Roberts et al. 2005; Abella et al. 2007; Hawkes et al. 2007, 2011; McClellan and Read 2007; Bimbi 2009; McElroy 2009; Tuttle and Rostal 2010; Service 2011b, 2014; LeBlanc et al. 2012; Griffin et al. 2013; NMFS 2014; Barco and Swingle 2014; Fisher et al. 2014; and Mansfield et al. 2014. Critical habitat has

been designated for this species but not in the terrestrial environment in Virginia (79 FR 39756-39854).

ENVIRONMENTAL BASELINE

Status of the Kemp's Ridley Sea Turtle Within the Action Area – Kemp's ridleys have been recorded off the coast of southeastern Virginia throughout the year. In Virginia, the average strandings per year for Kemp's ridley is 39, with a peak in June and fall (Barco and Swingle 2014). Strandings have been recorded in or near NASO-DNA and VAARNG-CP during spring, summer, and fall. Two Kemp's ridley nests have been recorded in Virginia. One nest was recorded at NASO-DNA in June 2012, which was the first documented nest in Virginia. The nest was left *in situ* and a total of 71 hatchlings emerged in mid-August (VDGIF 2015). The second nest was located and left *in situ* at False Cape State Park near the North Carolina/Virginia border in July 2014 (VDGIF 2015). No Kemp's ridley nests or false crawls have been documented at VAARNG-CP or BBNWR. We anticipate Kemp's ridley turtles may nest on NASO-DNA, VAARNG-CP, or BBNWR in the future.

Status of the Green Sea Turtle Within the Action Area – Green turtles are present in waters off Virginia's coast throughout the year. Strandings have been recorded in the action area during summer and fall and just south of the region during winter. The first green sea turtle nest in Virginia was documented in 2005 at BBNWR (Service 2005). No nests or false crawls have been recorded on NASO-DNA or VAARNG-CP beaches; however, 1 green turtle nest was recorded on Sandbridge Beach, just south of the action area, in August 2005 and was subsequently moved to BBNWR (VDGIF 2015). Based on this previous nesting record in southeastern Virginia, scattered green turtle nesting in nearby North Carolina, and the nesting of other turtle species in the action area, green turtles may nest on NASO-DNA in the future. Habitat for nesting sea turtles at VAARNG-CP is effected by the high concentrations of people using the beach during the nesting season, the relatively short beach (0.23 mi), and proximity to the heavily populated Virginia Beach.

Status of the Loggerhead Sea Turtle Within the Action Area – Loggerheads have been recorded in and near NASO-DNA and VAARNG-CP throughout the year. A total of 128 and 8 strandings have been recorded at NASO-DNA and VAARNG-CP, respectively, particularly during spring, summer, and fall. Three loggerhead false crawls have been documented on NASO-DNA, 2 in 2012 and 1 in 2014. Two loggerhead nests have been documented on NASO-DNA in July 1992 and July 2002. Both nests were relocated to BBNWR (Navy 2016). A loggerhead nest was located on Pendleton Surf Beach in the VAARNG-CP action area in August 2015 (VDGIF 2015). This nest was relocated above the high tide line to prevent tidal inundation; however, the nest was washed out during Hurricane Joaquin in October 2015 (Navy 2016). Previous to 2015, no nests or false crawls had been documented at VAARNG-CP. There have been 78 loggerhead nests at BBNWR between 1970 and 2015; 4 nests in 2010; 6 nests in 2012; 2 nests in 2013; 1 nest in 2014; and 4 nests in 2015.

Factors Affecting the Species Environment Within the Action Area – Sea turtles at NASO-DNA and VAARNG-CP are affected by a suite of existing actions associated with the mission of the installations to provide education and training to sailors in specified combat systems operation and maintenance, to provide specialized skills training, to provide training systems support to operational and systems commands, as well as other functions and tasks. Training, testing, and evaluation facilities operated at NASO-DNA include a helicopter pad, weapons compound, and Beach and Dune Training Areas. The Marine Air Control Squadron operates a compound and radar tower in the northeastern portion of the installation. An explosives test facility is located adjacent to the northern beach. Other training activities on the northern beach include: training, testing and evaluation in special warfare, ordinance, overland assault, beach assault, and tactical air operations radar. Amphibious landing exercises can occur up to 4 times per month and involve 1 to 4 amphibious vehicles maneuvering onto and across the beach, foot traffic across the beach and dunes, and support personnel digging foxholes to establish a beachhead. Training and associated activities may disturb nesting attempts or reduce hatching success. Beach driving during training results in ruts, compaction of sand, and disturbance of beach flora and fauna, and may degrade the condition of upper beach habitat. Vehicle operation on the beach may also reduce beach stability and result in increased levels of sand transport both on and off of the beaches of NASO-DNA.

The facilities and land of VAARNG-CP are used to support training for various military and government agencies. The majority of training is limited to between Labor Day and Memorial Day due to the installation's close proximity to Virginia Beach. Training includes weapons firing certification, classroom training, field artillery drivers training, and construction equipment drivers training. Weapons firing certification is limited to small caliber weapons and is located immediately behind the dunes. No training activities occur on VAARNG-CP beaches. Sea turtles are potentially impacted by ground disturbing training activities, explosive ordinance disposal, physical training, security patrols, maintenance of buried communication cables, and ATV training. Training and associated activities may disturb nesting attempts or reduce hatching success.

Recreational use of beaches on NASO-DNA and VAARNG-CP occurs seasonally, with most activity concentrated in spring and summer months. Recreational use includes swimming, beachcombing, fishing, wildlife observation, sunbathing, and other typical beach recreation. NASO-DNA staff post signage and implement closures to aid in protecting sensitive resources and routinely patrol the beach and recreational use areas. Seasonal recreational use overlaps with sea turtle nesting season and may disturb nesting attempts or reduce hatching success. As a result of the refinement of methods and implementation of a detailed protocol to excavate, transport, and re-bury nests relocated by NASO-DNA and VAARNG-CP personnel, hatch success rates are generally comparable to those that may occur naturally and are likely to vary from approximately 70% to 90% of total eggs (Limpus 1979, Jones and Musick 1988).

The artificial dunes on BBNWR result in narrow beaches that lack upper beach zones and at high tides water is generally at or near the base of the dunes. Recreational use of beaches occurs seasonally, with most activity concentrated in spring and summer months. Recreational use

includes beach driving, beachcombing, fishing, and wildlife observation. BBNWR routinely patrol the beach and recreational use areas for sea turtle crawls and nests and post signage and implement closures to protect nests. Seasonal recreational use overlaps with loggerhead nesting season and may disturb nesting attempts or reduce hatching success. Beach driving results in ruts, compaction of sand, and disturbance of beach flora and fauna, and further contributes to the degraded condition of upper beach habitat. Vehicle operation on the beach may also reduce beach stability and result in increased levels of sand transport both on and off of the beaches of BBNWR.

Climate change effects on the Kemp's ridley sea turtle are summarized from the species recovery plan (NMFS et al. 2011). "In the case of sea turtles, where many other habitat modifications are documented (e.g., beach development, loss of foraging habitat), the prospects for accentuated synergistic impacts on survival of the species may be even more important in the long-term. Such potential problems have been discussed for some time (Myers 1992). In these species, where temperature determines the sex of the developing embryo, even a few degrees change in beach temperatures over the next decade will cause a strong shift toward more female hatchlings being produced. Data suggest that a female bias may be present in the Kemp's ridley population and would be advantageous to the short-term recovery of this endangered sea turtle, but manipulation of natural sex ratios may have long-term, unknown positive or negative consequences. Another serious impact from global climate change is sea level rise. In areas of development, nesting beaches have no possibility for natural barrier island migration landward as sea levels rise. In the case of the Kemp's ridley where most of the critical nesting beaches are undeveloped, beaches may shift landward and still be available for nesting. Impacts from climate change, especially due to global warming, are likely to become more apparent in future years (IPCC 2007)."

Climate change effects on the green sea turtle are summarized from Service's final rule to list 11 DPSs of the green sea turtle as endangered or threatened (81 FR 20058-20090). "Species with high fecundity and low juvenile survival, such as sea turtles, are the most vulnerable to climate change and elevated levels of environmental variability (Cavallo et al., 2015; Halley et al., in review). Temperature changes and sea level rise are likely to change ocean currents and the movements of hatchlings, surface-pelagic juveniles, and adults (Hamann et al., 2007; Hawkes et al., 2009; Poloczanska et al., 2009; Cavallo et al., 2015). Nesting beaches are likely to be impacted by climate change. Sea level rise is likely to reduce the availability and increase the erosion rates of nesting beaches, particularly on low-lying, narrow coastal and island beaches (Fish et al., 2005; Baker et al., 2006; Jones et al., 2007; Fuentes et al., 2009; Hawkes et al., 2009; Anasta´cio et al., 2014; Pike et al., 2015). On undeveloped and unarmored beaches with no landward infrastructure, a typical beach profile may maintain its configuration but will be translated landward and upward (Bruun, 1962); however, along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, sea level rise is likely to cause severe effects on nesting females and their eggs (Hawkes et al., 2009; Poloczanska et al., 2009). Increased storm frequency and intensity are likely to result in altered nesting beaches and decreased egg and hatchling success (Pike and Stiner, 2007; Van Houtan and Bass, 2007; Hawkes et al., 2009; Fuentes et al., 2011a; Dewald

and Pike, 2014; Brost et al., 2015). Increasing air and sea surface temperatures are strongly correlated to sand temperatures (Fuentes et al., 2009; Santos et al., 2015a), which could lead to embryonic mortality at 35 °C (Ackerman, 1997) and the loss of male hatchlings at 30.3 °C (Godfrey and Mrosovsky, 2006; Fuentes et al., 2010b; 2011b)."

"Adaptation by natural selection occurs when individuals with one heritable trait survive and reproduce (passing that trait onto their offspring) at a higher rate than individuals with other heritable traits. It occurs over many generations, and one green turtle generation is approximately 30 years (Seminoff et al., 2015). As climate change progresses (i.e., temperatures increase, ocean acidification increases, sea level rises, and storms increase in frequency and intensity), sea turtles that nest on lowlying beaches with inhospitable sand temperatures will produce less viable offspring than previously and as compared to those nesting at higher elevations and on beaches with sand temperatures conducive to embryonic development. This adaptation scenario will have a net effect of reducing the overall abundance of sea turtle populations in the future (e.g., reduced production at the low-lying beaches and constant production at the higher elevation beaches). The capacity for green turtles to quickly adapt is questionable because they are long-lived and late maturing, and the species has previously evolved in a climate that changed at a much slower rate than projections suggest for the next 100 years (Hamann et al., 2007; Hawkes et al., 2009; Poloczanska et al., 2009). Slow evolutionary rates (Avise et al., 1992) and smaller population sizes (as a result of previous declines and relative to preexploitation populations; McClenachan et al., 2006) may further limit the species' ability to adapt (Hawkes et al., 2009). Therefore, adaptation by natural selection for green turtles is likely to be limited and may not match the rate of climate change impacts within the foreseeable future. We agree that in response to climate change, green turtles may alter their behavior; for example, nesting females may use beaches with higher elevation or cooler sands (Santos et al., 2015). However, the likelihood of altered behavior is difficult to estimate because green turtles exhibit high nesting site fidelity at some locations (Carr and Carr, 1972; Dizon and Balazs, 1982; Mortimer and Portier, 1989; Marquez, 1990; Bowen et al., 1992) and low nesting site fidelity at others (Basintal 2002; Abe et al., 2003). Dizon and Balazs (1982) state, ''It is imperative for the well-being of the population that no alterations in the habitat be made since once imprinted the green turtle is unlikely to switch its breeding habitat.'' Santos et al. (2015a) conclude that no environmental condition may be important enough to deter a faithful nester. In addition, alternative nesting sites may not be available. Furthermore, coastal squeeze, where coastal development prevents the landward migration of beaches, may prevent the use of higher elevation areas (Fish et al., 2008; Mazaris et al., 2009), even on continental beaches. Alternative beaches may not provide the optimal substrate for nesting (Fuentes et al., 2010a)."

Climate change effects on the loggerhead sea turtle are summarized from Service's final critical habitat designation for the loggerhead sea turtle Northwest Atlantic Ocean DPS (79 FR 39756-39854). "Climate change has the potential to impact loggerhead sea turtles in the Northwest Atlantic, affecting nesting habitat availability, temperature dependent sex ratios, timing of the nesting season, and increased erosion from frequent intense storm events (Bender et al. 2010, p. 458; Weishampel et al. 2004, p. 1426; Hawkes et al. 2009, pp. 139–141; Reese et al. 2013, pp. 269– 271). The decline in loggerhead nesting in Florida from 1998 to 2007, as well as the recent

increase, appears to be tied to climatic conditions (Van Houtan and Halley 2011, p. 3). Although rapid changes in sea level are predicted, estimated timeframes and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (Bindoff et al. 2007, pp. 409, 421; Witt et al. 2009, p. 901). Potential impacts of climate change to the Northwest Atlantic Ocean loggerhead DPS include beach erosion from rising sea levels, repeated inundation of nests, skewed hatchling sex ratios from rising incubation temperatures, and abrupt disruption of ocean currents used for natural dispersal during the complex life cycle (Fish et al. 2005, pp. 489–490; Fish et al. 2008, p. 336; Hawkes et al. 2009, pp. 139–141; Poloczanska et al. 2009, pp. 164–175). Thus, climate change impacts could have profound long-term impacts on loggerhead nesting populations in the Northwest Atlantic Ocean, but it is not possible to project the impacts at this point in time."

EFFECTS OF THE ACTION

Direct and Indirect Effects – Direct effects are the direct or immediate effects of the project on the species, its habitat, or designated critical habitat. Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02).

Sea Turtle Patrols – Patrols are unlikely to disturb nesting sea turtles as they are conducted during morning hours, after a majority of sea turtles have initiated nesting. Protocols for patrols further reduce the likelihood of adverse effects to nesting or stranded sea turtles by limiting the speed of ATVs, training drivers to recognize the presence of stranded sea turtles or nest crawls, covering ATV lights, and implementing general best practices (e.g., communication protocols, avoiding distress to the animal, implementing area closures when needed). ATV use on the beaches may compact beach sand; however, ATVs are lighter than most vehicles and patrollers are trained to limit the likelihood of sand compaction due to ATV use. Therefore, sea turtles are not expected to be adversely affected by patrols.

Sea Turtle Stranding – Stranded sea turtles may suffer from illness, cold stunning, injury, or death. These effects are not a result of assistance (medical attention and transportation) provided to stranded turtles. While stranded turtles are being held or transported, standard protocols will limit the likelihood of further injury or death as a result of the stranding program. Sea turtles are not expected to be adversely affected as a result of the stranding program.

Crawl Procedures – When a patroller finds a nesting or crawling turtle, they will extinguish their ATV headlights, take care not to startle the turtle, and keep a safe distance away until the turtle has returned to the sea. If a nest is present, nest procedures will be followed. Sea turtles are not expected to be adversely affected as a result of crawl procedures.

Nest Management – Only individuals having the appropriate permits will perform nest management procedures. Because Service permits issued to these individuals/entities have already undergone section 7 consultation, effects to turtles from nest locating, nest relocation, and nest monitoring conducted by permitees will not be analyzed in this biological opinion.

In the red zone on NASO-DNA (Figure 1) training and associated activities may disturb nesting attempts or reduce hatching success and all nests will be relocated to the nearest adjacent green zone. Noise from training exercises conducted at night during nesting season may disturb nesting females. Noise can discourage nesting females from using particular sections of beach; however, training exercises are limited in scope and undisturbed beaches are available within other areas of NASO-DNA for nesting. Disturbance is likely to result in sea turtle nests being laid nearby in more protected areas, rather than an overall decrease in the number of nest attempts per year. If nests are not identified during patrols, training exercises may crush eggs within the nest; or crush, entrap, or disturb hatchlings attempting to leave the nest. Due to routine patrols and identification of stranded sea turtles, crawls, and nests within the beach and dune areas of NASO-DNA, the likelihood of unidentified nests being located within red zone training areas is low.

Relocation of sea turtle nests can be an effective conservation method for sea turtle populations where clutches would otherwise be lost and where populations require intervention (Pintus et al. 2009). However, nest relocation should only be conducted as a last resort because relocation may cause negative impacts to eggs and hatchlings through reduced hatch and emergence success (Wyneken et al. 1988, Mortimer 1999, NMFS and Service 2008, Sieg et al. 2011). Handling sea turtle eggs can injure or kill embryos as a result of disrupting membrane attachment (Limpus et al. 1979, Parmenter 1980, Eckert and Eckert 1990, Pintus et al. 2009, Sieg et al. 2011, Revuelta et al. 2014).

Relocated nests may have different moisture levels, gas exchange, thermal conditions, sand grain size, density, compaction, organic content, or color, which can lead to adverse effects on embryonic development and hatchling success, particularly sex ratios and survival of hatchlings (Ackerman 1980, Parmenter 1980, Miller and Limpus 1983, Spotila et al. 1983, McGehee 1990, Mortimer 1990, Georges et al. 1994, Crain et al. 1995, Ackerman 1997, Carthy et al. 2003, Fisher et al. 2014, Revuelta et al. 2014). Relocating nests into sands deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard et al. 1984), mobilization of calcium (Packard and Packard 1986), mobilization of yolk nutrients (Packard et al. 1985), hatchling size (Packard et al. 1981, McGehee 1990), energy reserves in the yolk at hatching (Packard et al. 1988), and locomotory ability of hatchlings (Miller et al. 1987). In a 1994 Florida study comparing loggerhead hatching and emerging success of relocated nests with nests left in their original location, Moody (1998) found that hatching success was lower in relocated nests at 9 of 12 beaches evaluated. In addition, emerging success was lower in relocated nests at 10 of 12 beaches surveyed in 1993 and 1994. If established protocols are followed successfully, nest relocation should result in a loss of no more than 10% of an average clutch (128 eggs).

It is uncertain whether the effects of intensive nest management discussed above will occur and to what degree they affect hatchling survival. The types of effects may vary depending on the environmental conditions within the specific nesting season, and the specific conditions that each

nest is subjected to during management activities and relocation. While hatch success has been used as a proxy to assess reproductive success, the factors discussed above may reduce recruitment, affect population demography, and affect future turtle use of nesting beaches in the action area. For the purposes of this analysis and in the absence of specific information that would allow us to consider the expected magnitude and severity of effects that may result, we make the conservative assumption that all of these factors affect hatchling sea turtles to a degree that cumulatively results in reduced survival and recruitment probability.

In the yellow zones on NASO-DNA (Figure 1) relocation of nests will be considered on a case-by-case basis. If a nest inhibits training, the nest will be relocated west, closer to the dune line. If there are multiple nests inhibiting training, they will be relocated to the closest green zone. Effects to nests in yellow zones will be similar to effects discussed above for nests in the red zone; however, the frequency, intensity, and duration of effects are likely to be less as training is less frequent and nests may be left *in situ*. If nests are not identified during patrols, training exercises may crush eggs within the nest; or crush, entrap, or disturb hatchlings attempting to leave the nest. Due to routine patrols and identification of stranded sea turtles, crawls, and nests within the beach and dune areas of NASO-DNA, the likelihood of unidentified nests being located within yellow zone training areas is low.

In the green zone on NASO-DNA and on VAARNG-CP nests will be left *in situ*, unless located below the high tide line, in which case the nest will be relocated west above the high tide to avoid inundation. Recreational use of these areas may result in trash on the ground, which could attract predators and increase the carrying capacity of the predators due to increased food availability. The increased numbers of predators may increase losses of turtle eggs and nests. However, use of these sites for recreation is generally light and not continuous and routine, and use of predator proof sea turtle exclosures will limit the ability of predators to disturb nests. Additionally, patrols to identify stranded sea turtles, crawls, and nests within the beach and dune areas of both locations and marking of nests will minimize the likelihood of these effects.

BBNWR is a potential relocation site for nests from NASO-DNA and VAARNG-CP. Impacts to sea turtles nests from relocation will be consistent with those discussed above. Nests will be preferentially relocated to green areas within NASO-DNA; however, in rare circumstances when suitable relocation sites are not available at NASO-DNA or VAARNG-CP, nests may be relocated to BBNWR. If established protocols are followed successfully, nest relocation should result in a loss of no more than 10% of an average clutch (128 eggs).

Interrelated and Interdependent Actions – An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The Service is not aware of activities interrelated to or interdependent with the proposed action at this time.

Beneficial Actions – Monitoring and *in situ* nest protection provide information on the sea turtle nesting within the action area. Routine patrols to identify stranded sea turtles, crawls, and nests

minimize impacts to nesting turtles and nests from training and recreational activities. Nest marking and predator protection reduce the potential for anthropogenic impacts including disruption of nests and predation.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. The Service is not aware of any future State, tribal, local, or private actions within the action area at this time.

CONCLUSION

The proposed and ongoing sea turtle management is anticipated to benefit stranded and nesting sea turtles and sea turtle nests vs. conducting training and recreational activities at NASO-DNA and VAARNG-CP without such a program in place. Effects to Kemp's ridley, green, and loggerhead sea turtle nests and nestlings/hatchlings as a result of operational and recreational activities are expected to be avoided and minimized as a result of monitoring for turtle crawls and marking of nests. The proposed and ongoing sea turtle management is expected to result in a reduction in either sea turtle reproductive output or success. However, these reductions are less than what would be expected if this program was not implemented.

After reviewing the status of the Kemp's ridley sea turtle, green sea turtle North Atlantic DPS, and loggerhead sea turtle Northwest Atlantic Ocean DPS; the environmental baseline for the action area; the effects of the proposed action; and the cumulative effects, it is the Service's biological opinion that proposed and ongoing sea turtle management at NASO-DNA and VAARNG-CP, as proposed, are not likely to jeopardize the continued existence of the Kemp's ridley sea turtle, green sea turtle North Atlantic DPS, and loggerhead sea turtle Northwest Atlantic Ocean DPS. No critical habitat has been designated for the Kemp's ridley sea turtle; therefore, none will be affected. No critical habitat has been designated for the green sea turtle North Atlantic DPS in this area; therefore, none will be affected. Critical habitat for the loggerhead sea turtle Northwest Atlantic Ocean DPS has been designated but not in the terrestrial environment in Virginia; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed

species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Navy so that they become binding conditions of any grant or permit issued to any applicant/contractor, as appropriate, for the exemption in section 7(o)(2) to apply. The Navy has a continuing duty to regulate the activity covered by this incidental take statement. If the Navy (1) fails to assume and implement the terms and conditions or (2) fails to require any applicant/contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Navy must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

AMOUNT AND EXTENT OF TAKE

During military operations, direct mortality of the developing embryos in nests within the red zone may occur for nests that are not found and relocated. The exact number of these missed nests is not known. However, in 2 separate monitoring programs, where hand digging was performed to confirm the presence of nests and thus reduce the chance of missing nests through misinterpretation, trained observers missed about 6 to 8% of the nests because of natural elements (Martin 1992, Ernest and Martin 1993). In another study, Schroeder (1994) found that under the best conditions, about 7% of nests can be misidentified as false crawls by highly experienced sea turtle nest surveyors.

The Service anticipates incidental take of sea turtles will be difficult to detect for the following reasons: (1) sea turtles nest primarily at night and all nests are not found because [a] natural factors, such as rainfall, wind, and tides may obscure crawls and [b] human-caused factors, such as pedestrian and vehicular traffic, may obscure crawls, and result in nests being destroyed because they were missed during a nesting survey and egg relocation program; (2) total number of hatchlings per missed nest is unknown; (3) reduction in percent hatching and emerging success per relocated nest vs a natural nest is unknown; (4) an unknown number of females may avoid the red zone beach and nest in a less than optimal area; and (5) lights may misdirect an unknown number of hatchlings and result in death.

However, the following level of take of these species can be anticipated by the disturbance of suitable sea turtle nesting beach habitat because turtles nest within the military operation area (red zone) and military operations will likely occur in the red zone during a portion of the nesting season. Incidental take is anticipated for 1 mile of sea turtle nesting beach habitat (0.75 miles in the red zone at NASO-DNA and 0.25 miles at VAARNG-CP) as a result of the proposed military

operations. The take is expected to be in the form of: (1) destruction of all nests that may be constructed and eggs that may be deposited and missed by a nest survey and egg relocation program within the red zone; (2) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (3) harassment in the form of disturbing or interfering with female turtles attempting to nest during military operations; (4) misdirection of nesting and hatchling turtles during military operations.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes that all reasonable and prudent measures necessary and appropriate to minimize take of Kemp's ridley, green, and loggerhead sea turtles have been incorporated into the proposed action.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Navy must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. Provide an annual report summarizing sea turtle survey and monitoring efforts, location and status of all sea turtle occurrences recorded, and any additional relevant information (nesting success, hatching success, emergence success, disorientations, and lighting surveys). Reports should be provided to the Service in digital format, at the email address provided below, by December 31 of each year.

2. Care must be taken handling any dead specimens of proposed or listed species that are found to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead specimen, notify the Service's Virginia Law Enforcement Office at 804-771-2883, 7721 South Laburnum Avenue, Richmond, Virginia 23231, and the Service's Virginia Field Office at 804-693-6694 at the address provided on the letterhead above.

The Service believes that no more than 1 mile of nesting beach habitat will be incidentally taken as a result of the proposed action over the 15-year term of the biological opinion. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- Collect data on characteristics of beaches where sea turtles nest and provide this information to the Service and VDGIF. Coordinate with other interested parties to develop protocols for data collection and analysis throughout Virginia to improve understanding of sea turtle habitat characteristics.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions, please contact Sarah Nystrom of this office at 804-824-2413, or Sarah_Nystrom@fws.gov.

Sincerely,

Digitally signed by CYNTHIA SCHULZ
Date: 2016.10.21 10:37:04 -04'00'

Cindy Schulz
Field Supervisor
Virginia Ecological Services

cc: NMFS, Gloucester, VA (Attn: David O'Brian)
Service, Virginia Beach, VA (Attn: Doug Brewer)
VDCR, False Cape State Park, Virginia Beach, VA (Attn: Kyle Barbour)
VDCR, DNH, Richmond, VA (Attn: René Hypes)
VDGIF, Machipongo, VA (Attn: Ruth Boettcher)
VDGIF, Richmond, VA (Attn: Ernie Aschenbach)

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2016 Sea Turtle Nesting Communication Plan

June 14, 2016

The purpose of this communication plan is to ensure that all the proper authorities and individuals are contacted regarding sea turtle nesting/hatching activity on Virginia's beaches extending from the NC/VA border to Ft. Story –Little Creek Joint Expeditionary Base. Agencies with their own internal USFWS-approved communication protocols are not included in this plan. The sea turtle nest monitoring patrol will initiate the call order listed under each scenario unless noted otherwise.

1. A sea turtle is confirmed by the sea turtle patrol on a City-owned beach outside of the Resort Strip or Camp Pendleton Beach that will ***likely not require relocation*** because of excessive lighting, disturbance or other factors.
    a. Call in this order immediately ***and before 0900***
        i. VAQS 24-hr Hotline
        ii. VAQS Sea Turtle Nesting Coordinator who, in turn, will immediately call:
            -VDGIF
            -VAQS Stranding Coordinator or VAQS Research Coordinator
            -Camp Pendleton POC *(only for nests laid on Camp Pendleton Beach)*
    b. The VAQS Sea Turtle Nesting Coordinator will call or send follow-up emails to the following agencies and City Departments notifying them of the location of each sea turtle nest (and relocation site, if applicable) laid on a City-owned beach **within 12 hours** of when the nest was confirmed and marked.
        i. USFWS
        ii. Virginia Beach Public Works - Beach Operations, Maintenance Division
        iii. Virginia Beach Public Works – Beach Operations, Engineering Division
        iv. Virginia Beach Lifeguards assigned to the beach where the nest is located
        v. Virginia Beach Animal Control
        vi. Virginia Beach Police Department
        vii. Virginia Aquarium Public Relations

2. A sea turtle nest is confirmed by the sea turtle patrol within the boundaries of the Virginia Beach resort Strip (i.e., 1st Street to 42nd Street) that ***will likely need to be relocated to an area north of 42nd Street because of excessive lighting and/or disturbance issues; thus, requiring real-time consultation among agencies.***
    a. Call in this order immediately ***and before 0900***
        i. VAQS 24-hr Hotline
        ii. VAQS Sea Turtle Nesting Coordinator who, in turn, will immediately call:
            -VDGIF
            -USFWS
            -VAQS Stranding Response Coordinator or VAQS Research Coordinator
    b. The VAQS Sea Turtle Nesting Coordinator will call or send follow-up emails to the following City of Virginia Beach Departments notifying them of the location of each sea turtle nest (and relocation site, if applicable) laid on a City-owned beach within **12 hours** of when the nest was confirmed and marked.
        i. Virginia Beach Public Works - Beach Operations, Maintenance Division
        ii. Virginia Beach Public Works – Beach Operations, Engineering Division
        iii. Virginia Beach Lifeguards assigned to the beach where the nest is located
        iv. Virginia Beach Animal Control

v. Virginia Beach Police Department
vi. Virginia Beach Resort Management
vii. Virginia Aquarium Public Relations

3. A sea turtle is confirmed by the sea turtle patrol on a City-owned beach or Camp Pendleton Beach that will ***likely require relocation*** because it was laid below the high tide line.
    a. Call in this order immediately ***and before 0900***
        i. VAQS 24-hr Hotline
        ii. VAQS Sea Turtle Nesting Coordinator who, in turn, will call:
            -VDGIF
            -USFWS
            -Camp Pendleton POC *(only for nests laid on Camp Pendleton Beach)*
            -VAQS Stranding Coordinator or VAQS Research Coordinator
    b. The VAQS Sea Turtle Nesting Coordinator will send follow-up emails to the following City Departments notifying them of the location of each sea turtle nest (and relocation site, if applicable) laid on a City-owned beach **within 12 hours** of when the nest was confirmed and marked.
        i. Virginia Beach Public Works - Beach Operations, Maintenance Division
        ii. Virginia Beach Public Works – Beach Operations, Engineering Division
        iii. Virginia Beach Lifeguards assigned to the beach where the nest is located
        iv. Virginia Beach Animal Control
        v. Virginia Beach Police Department
        vi. Virginia Aquarium Public Relations

4. A sea turtle false crawl is confirmed by the sea turtle patrol on any City-owned beach (except for Sandbridge) or Camp Pendleton.
    a. Call in this order immediately
        i. VAQS 24-hr Hotline
        ii. VAQS Sea Turtle Nesting Coordinator
        iii. Camp Pendleton POC *(only for false crawls observed on Camp Pendleton Beach)*
    b. The VAQS Sea Turtle Nesting Coordinator will notify the following agencies and individuals via email within 24 hours
        i. USFWS
        ii. VDGIF
        iii. VAQS Director of Research and Conservation, VAQS Research Coordinator and VAQS Stranding Coordinator

5. A sea turtle nest is confirmed by the sea turtle patrol at Ft. Story–Little Creek Joint Expeditionary Base (Ft. Story).
    a. Call in this order immediately ***and before 0900***
        i. The appropriate Ft. Story POC
        ii. Back Bay NWR
        iii. The Ft. Story POC will call VDGIF and USFWS if the nest ***may need to be relocated to another area of the installation because of planned military activities; thus, requiring real-time consultation among agencies***
        iv. If nest does not need to be relocated, or is only relocated to a higher location on the beach in order to avoid inundation, Military POC will email VDGIF and

USFWS and carbon copy VAQS Director of Research and Conservation, VAQS Research Coordinator and VAQS Stranding Response Coordinator

6. A member of the public calls the Virginia Aquarium, City of Virginia Beach, VDGIF or another agency and reports a turtle nesting on a City-owned beach (except for Sandbridge) or Camp Pendleton, the recipient of the call will contact the VAQS 24-hr Hotline immediately ***and before 0900*** to initiate the contact procedures listed under #1 or #2, depending on location of the activity.

7. A member of the public calls the Virginia Aquarium, City of Virginia Beach, VDGIF or another agency to report a turtle nesting ***or an unattended nest hatching*** at Sandbridge, Back Bay NWR or False Cape SP, the recipient of the call will notify Back Bay NWR by phone immediately ***and before 0900.***

8. A member of the public calls the Virginia Aquarium, City of Virginia Beach, VDGIF or another agency to report a turtle nesting at Ft. Story or the Naval Air Station Oceana Dam Neck Annex. The recipient of the call will notify the appropriate military POC and Back NWR by phone immediately ***and before 0900.*** The Ft. Story POC will initiate the procedures listed under # 4.

9. A known sea turtle nest on a City-owned beach or Camp Pendleton begins to hatch.
    a. The nest sitters will call the VAQS 24-hr Hotline immediately who, in turn, will call:
        i. VAQS Sea Turtle Nesting Coordinator
        ii. VAQS Stranding Coordinator or VAQS Research Coordinator
        iii. Camp Pendleton POC *(only for nests on Camp Pendleton)*
    b. The VAQS Sea Turtle Nesting Coordinator will notify the following via email within 24 hours of first emergence
        i. USFWS
        ii. VDGIF
        iii. Virginia Beach Public Works - Beach Operations, Maintenance Division
        iv. Virginia Beach lifeguards assigned to the beach where the nest is located
        v. Virginia Beach Animal Control
        vi. Virginia Beach Police Department
        vii. Virginia Beach Resort Management (only for nests deposited 1st Street and 42nd St)
        viii. VAQS Director of Research and Conservation, VAQS Stranding Response Coordinator and VAQS Research Coordinator
    c. Notify Virginia Aquarium Public Relations after the nest has finished hatching.

10. A member of the public calls the Virginia Aquarium, City of Virginia Beach, VDGIF or another agency to report an ***unknown*** sea turtle nest hatching on a City-owned beach or Camp Pendleton.
    a. The recipient of the call will contact the VAQS 24-hr Hotline.
    b. The 24-hr Hotline will call VAQS Sea Turtle Nesting Coordinator who, in turn, will call:
        i. VDGIF
        ii. USFWS
        iii. Back Bay NWR *(only for nests on Sandbridge)*
        iv. Camp Pendleton POC *(only for nests on Camp Pendleton)*
        v. Virginia Beach Police Department *(only for nests on City-owned beaches)*

vi. VAQS Nesting Volunteer Team Response Leader
vii. Virginia Beach Public Works - Beach Operations, Maintenance Division
viii. VAQS Stranding Coordinator or VAQS Research Coordinator

c. Notify the following via email ***within 12 hours*** of first emergence *(only for nests on a City-owned beach)*
   i. Virginia Beach Public Works - Beach Operations, Maintenance Division
   ii. Virginia Beach Public Works - Beach Operations, Engineering Division
   iii. Virginia Beach lifeguards assigned to the beach where the nest is located
   iv. Virginia Beach Animal Control
   v. Virginia Beach Resort Management (only for nests deposited 1st Street and 42nd St)
   vi. VAQS Director of Research and Conservation, VAQS Stranding Response Coordinator and VAQS Research Coordinator
d. Notify Virginia Aquarium Public Relations after the nest has finished hatching.

List of Abbreviations

NWR – National Wildlife Refuge
USFWS – US Fish and Wildlife Service – VA Field Office
VAQS - VA Aquarium Stranding Response Program
VDGIF – VA Dept. of Game and Inland Fisheries

Point of Contacts: Phone Numbers and Email Addresses

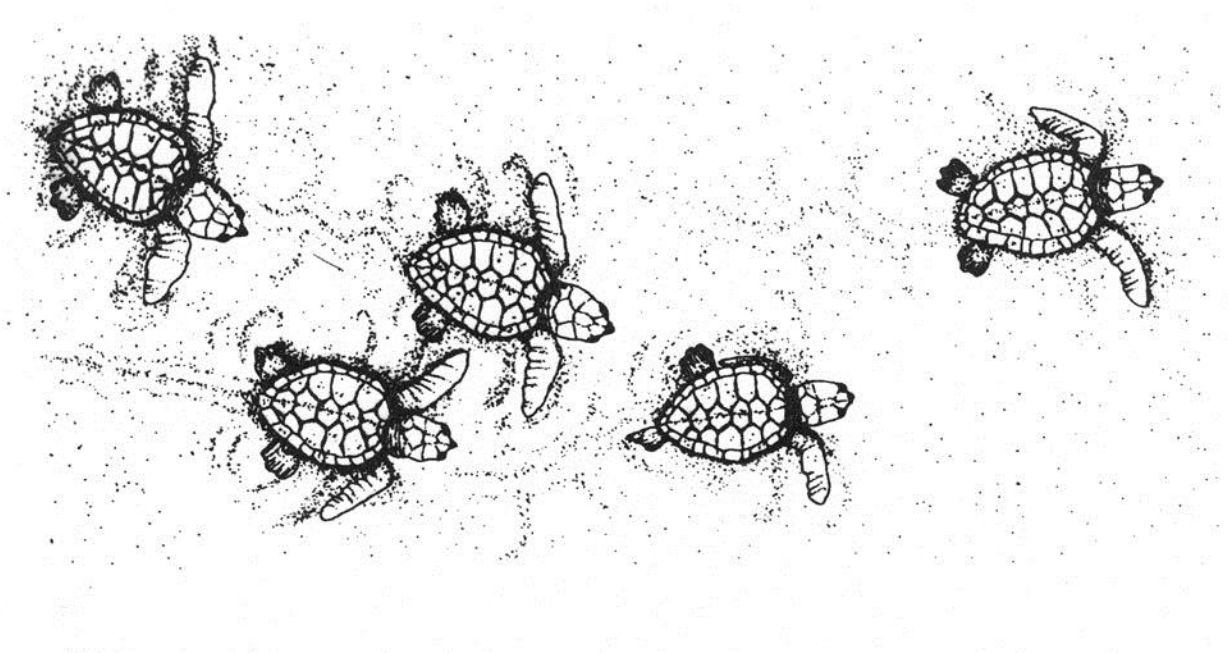
Affiliation	First POC or Alternate POC	Name	Title Dept. or Div.	Office Phone	Cell Phone	Email
Back Bay NWR	First POC	Geralyn Mireles	Biologist	757-301-7329 x. 3109	757-778-5828	geralyn_mireles@fws.gov
Back Bay NWR	Alternate POC	Lauren Mowbray	Supervisory Biologist	757-301-7329 x. 3108	703-919-1728	lauren_mowbray@fws.gov
Camp Pendleton	First POC	Ken Oristaglio	Natural Resources Program Manager	434-298-6416	434-264-4929	Kenneth.l.oristaglio.nfg@mail.mil
Camp Pendleton	1st Alternate POC	MSG Christopher B. Robbins	Post Operations NCOIC	757-493-3121	757-803-3299	christopher.b.robbins3.mil@mail.mil
Camp Pendleton	2nd Alternate POC	LTC Timothy Pillion (effective July 1, 2016)	Base Commander	757-493-3128	423-782-7159	timothy.d.pillion.mil@mail.mil
Dam Neck Naval Base	N/A	Michael Wright	Natural Resources Manager	757-433-3461	757-373-8531	michael.f.wright@navy.mil
Ft. Story - Little Creek JEB	First POC (M – F, 0700 -0900)	Sharon Waligora	Environmental Division Director	757-462-5350		sharon.waligora@navy.mil
Ft. Story - Little Creek JEB	Alternate POC (weekdays before 0700 and weekends)	On-call staff that rotates every 2 wks.			See Table below for on-call staff contact info.	
USFWS	First & only POC	Troy Andersen	Endangered Species	804-824-2428	804-654-9235	troy_andersen@fws.gov
VDGIF	First & only POC	Ruth Boettcher	Coastal Biologist	757-709-0766	757-709-0766	ruth.boettcher@dgif.virginia.gov
VAQS	First & only POC	Sarah Rose	Sea Turtle Nesting Coordinator	757-385-7575	845-699-7479	SARose@virginiaaquarium.com
VAQS	N/A	On-call staff	24-hr Hotline	757-385-7576	--	vaqstranding@gmail.com
VAQS	N/A	Susan Barco	Research Coordinator	757-385-6476	757-615-2740	SGBarco@virginiaaquarium.com
VAQS	N/A	Alexander Costidis	Stranding Response Coordinator	757-385-6482	727-543-6263	acostidi@virginiaaquarium.com
VAQS	N/A	Mark Swingle	Director of Research & Conservation	757-385-0326	757-615-6337	mswingle@virginiaaquarium.com
City of VA Beach	First & only POC	Meghan Conti	Animal Control	757-385-6581		mconti@vbgov.com
City of VA Beach	First & only POC	VB Life Saving	Lifeguard Central Off.	757-428-1546		
City of VA Beach	First & only POC	Sargent Walters	Police Dept.	757-385-2752		bwalters@vbgov.com
City of VA Beach	First & only POC	Mike Eason	Resort Management	757-385-6639		meason@vbgov.com
			Public Works–Bch			

City of VA Beach	First & only POC	Jim Huntington	Ops, Maintenance	757-385-1464	757-647-2121	jhuntington@vbgov.com
City of VA Beach	First & only POC	Phil Roehrs	Public Works–Bch Ops, Engineering	757-385-8985		PRoehrs@vbgov.com
VA Aquarium	First & only POC	Caryl Thompson	Public Relations	757-385-0250	757-274-2986	cthompso@virginiaaquarium.com

2016 Ft. Story - Little Creek JEB On-call Staff Schedule and Telephone Numbers

Name	Date	Cell #
Rick Little	16 - 29 May 2016	757-636-6809
Roger White	30 May - 12 Jun 2016	757-373-9753
Homer Grayson	13 - 26 Jun 2016	757-630-5437
Roger White	27 Jun - 10 Jul 2016	757-373-9753
Homer Grayson	11 - 24 Jul 2016	757-630-5437
Cenen Camerino	25 Jul - 7 Aug 2016	757-636-6421
Rick Little	8 - 21 Aug 2016	757-636-6809
Cenen Camerino	22 Aug - 4 Sep 2016	757-636-6421

VIRGINIA SEA TURTLE NESTING HANDBOOK



Bureau of Wildlife Resources
Virginia Department of Game and Inland Fisheries
3801 John Tyler Memorial Highway
Charles City, VA 23030

2015

ABOUT THIS HANDBOOK

This Handbook was developed to aid staff and volunteers responsible for monitoring sea turtle nesting beaches in Virginia by describing proper procedures and protocols for conducting surveys, identifying crawls, marking nests, monitoring hatching events and carrying out post-hatch excavations. This will ensure nest monitoring and management efforts are in compliance with laws pertaining to rare and endangered species at all levels of government. Occasionally, you will be faced with exceptional or extraordinary circumstances that are not covered in these pages. In all cases of uncertainty, please make every attempt to contact Ruth Boettcher, coastal biologist for the Virginia Dept. of Game and inland Fisheries BEFORE doing anything. We are also open to suggestions and discussions concerning any topic related to sea turtle management in Virginia or elsewhere. Please don't hesitate to call or email!!

Ruth Boettcher, Coastal Biologist
VA Dept. of Game and Inland Fisheries
Bureau of Wildlife Resources
757-709-0766
ruth.boettcher@dgif.virginia.gov

The Virginia Sea Turtle Nesting Handbook includes the following appendices:

Appendix I: On-line references and books that serve as additional information sources on sea turtle biology and conservation.

Appendix II: FAQ (Frequently Asked Questions) with recommended answers.

Appendix III: Individual Crawl Record. Use this datasheet in the field to record all the required information on each nesting and false (non-nesting) crawls encountered, including post-hatching or post-incubation nest excavations.

Appendix IV: Loggerhead, green, leatherback and Kemp's ridley crawl identification.

Appendix V: Construction and placement of predator-proof nest cages

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VIRGINIA SEA TURTLE NEST MONITORING MANGEMENT GUIDELINES

Virginia Dept. of Game and inland Fisheries
Bureau of Wildlife Resources

INTRODUCTION

The loggerhead sea turtle *(Caretta caretta)* nests most frequently on our beaches. To date, two kemp's ridley *(Lepidochelys kempii)* nests and one Green turtle *(Chelonia mydas)* nest has been documented in Virginia; thus it is highly likely that both species may be observed nesting in the state in the future. Leatherback sea turtles *(Dermochelys coriacea)* are seen passing through state waters as they migrate north along the Atlantic coast. Although there have been no leatherback nests documented in Virginia, they have been observed nesting in North Carolina nearly every year since 1998. In addition, a leatherback nest was reported in Maryland in 1996; thus it is possible we may observe leatherback nesting activity in Virginia in the future. All species of marine turtles that occur in Virginia are protected under the Endangered Species Act of 1973. Loggerhead and green sea turtles are listed as "threatened" and the Kemp's ridley and leatherback are listed as "endangered" under both federal and state law. All four species are listed as endangered or critically endangered by the World Conservation Union (www.iucnredlist.org).

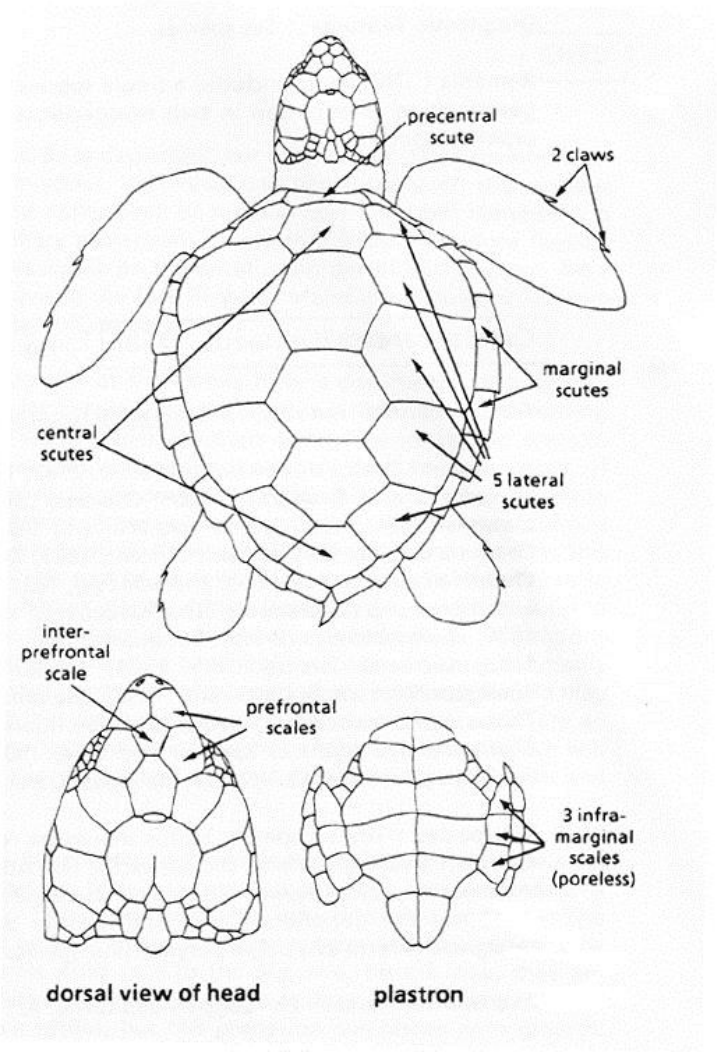
Everyone involved in management and protection of sea turtle nests should be aware of the life history of marine turtles and what actions are acceptable and consistent with the Endangered Species Act. As a rule, ***management and protection should be undertaken in a manner that will minimize impacts on the natural order of reproduction***. We hope this handbook provides the information necessary to meet these serious responsibilities.

IDENTIFICATION

SPECIES DESCRIPTIONS

LOGGERHEAD SEA TURTLE (*Caretta caretta*)

Distributed throughout the world. Primary nesting populations: Oman, Southeastern USA, Brazil, Australia, and Cabo Verde. The loggerhead is reddish brown in color, has 5 pairs of lateral plates with the first touching the precentral scale (scute), and 3 inframarginal scutes without any pores. The head is large relative to the body, the upper jaw is pointed and ***not*** hooked, and there are usually more than two prefrontal scutes between the eyes. Adult loggerheads in the southeastern United States have an average curved carapace length (CCL) of 98.6 cm (38.6 in.) and an average weight of 113 kg (250 lb.). Hatchlings are dark brown above and light brown or tan beneath. They typically have 3 dorsal keels and 2 plastral keels. The CCL at hatching is approximately 4.1 - 4.8 cm (1.6 - 1.9 in.).



LOGGERHEAD TRACK AND CRAWL CHARACTERISTICS:

Track Width: 65-100 cm (26-40 in.).

Type of Track: Moderately deeply cut with alternating (asymmetrical) diagonal marks made by front flippers.

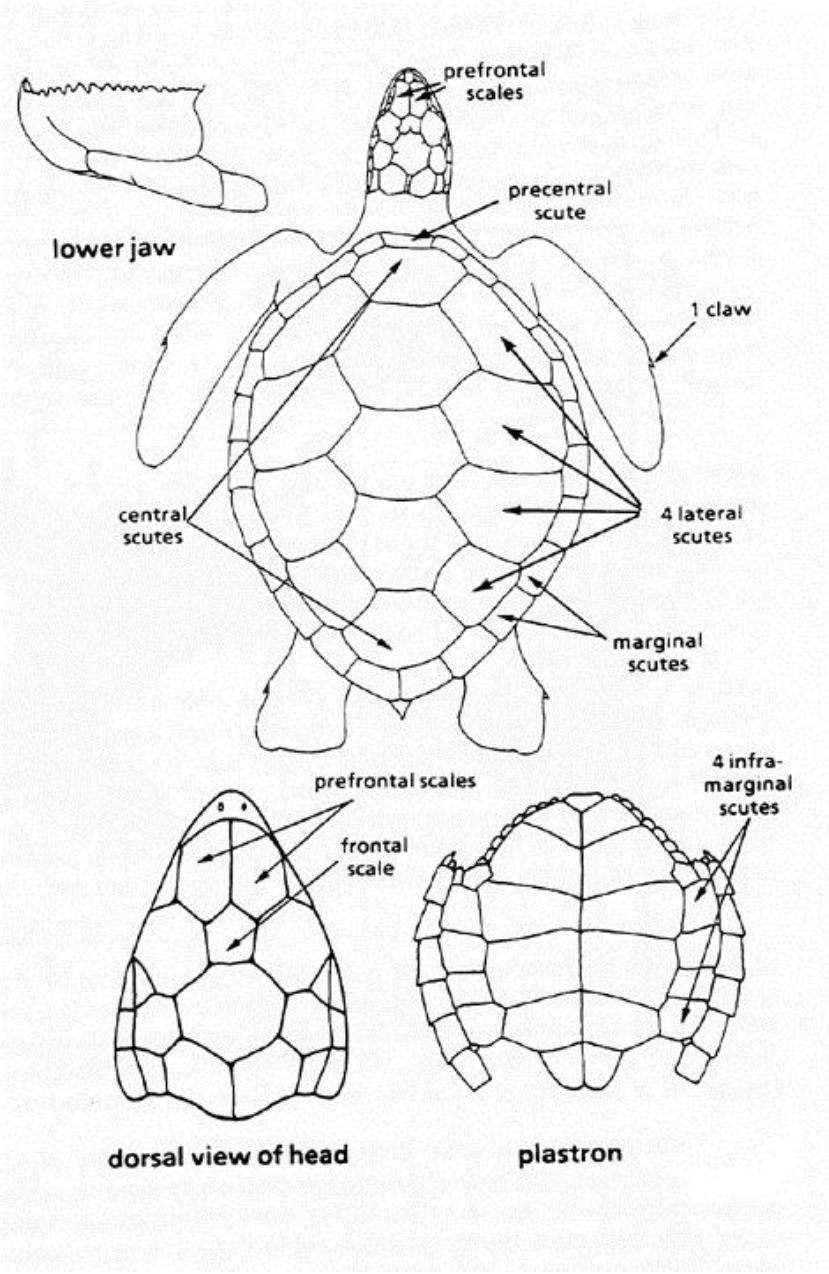
Preferred Beach Type: Extensive mainland beaches and barrier islands; moderately steep beach profile preferred.

Average clutch size: 120 eggs

Egg diameter: 4 cm (1.5 in.).

GREEN SEA TURTLE
(*Chelonia mydas*)

Distributed throughout the world. The green turtle is brown in coloration and derives its name from the color of its fat. The carapace varies from light to dark brown and is often mottled in appearance with radiating streaks or dark brown blotches present. The underside is light colored (creamy white in juveniles). There are 4 pairs of lateral plates that do not overlap and the first plate does not touch the precentral scute. The head appears small relative to the body, has a rounded beak, and usually ***only 1 pair of elongated prefrontal scutes between the eyes.*** Adult green turtles in the southeastern United States have an average CCL of 108 cm (42 in.) and an average weight of 135 kg (300 lb.). Hatchlings are dark brown to black above and creamy white to yellow beneath. Hatchling flippers are often black and edged in white. Hatchling carapaces are flat in profile, lack a pronounced dorsal keel and have a CCL of approximately 5 cm (2 in.).



GREEN TURTLE TRACK AND CRAWL CHARACTERISTICS:

Track Width: Typically 1 m (39 in.).

Type of Track: Deeply cut with ***symmetrical diagonal marks*** made by simultaneous movement of the front flippers with a center drag mark from the tail. Green turtles form much larger and deeper body pits than loggerheads and often dig multiple pits in a single crawl.

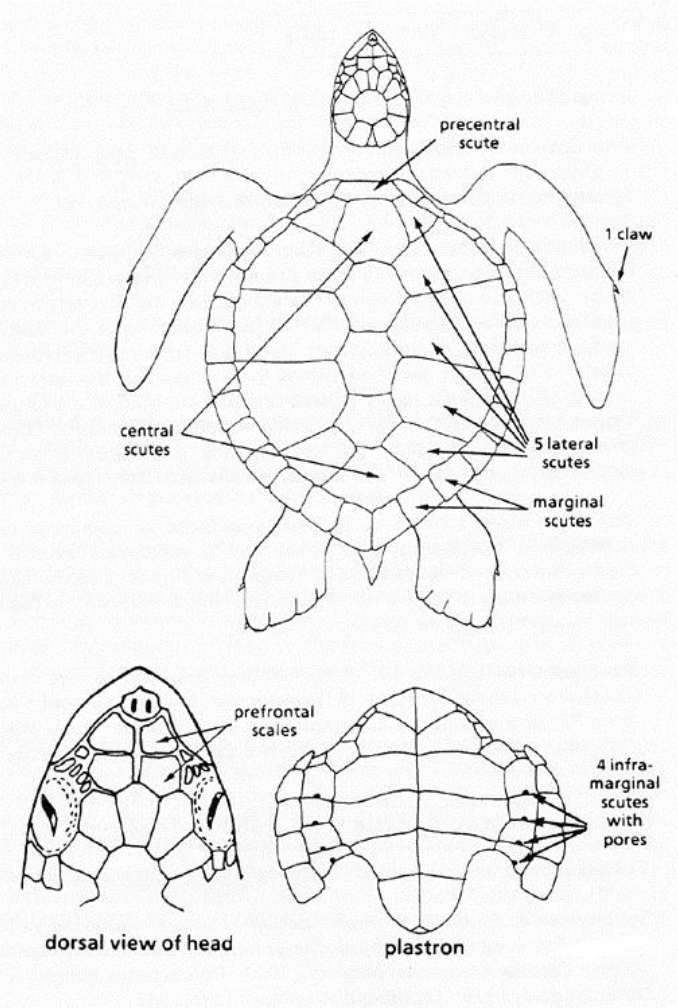
Preferred Beach Type: Generally large, open beaches.

Average clutch size: Variable, average = 111 in Tortuguero, Costa Rica and sometimes more than 200 in the Atlantic.

Egg diameter: 5 cm (2 in.).

KEMP'S RIDLEY SEA TURTLE
(*Lepidochelys kempii)*

Distributed in the Gulf of Mexico and North Atlantic. Primary nesting population: Tamaulipas state, Mexico, with small numbers regularly nesting along the Gulf coast of Texas. Kemp's ridleys are the smallest of all living sea turtles and also the least numerous. The ridley has a dull grayish-brown (or greenish-gray), almost circular carapace ***(shell width is often equal to or greater than the length)*** with 5 or more pairs of lateral plates; the first plate usually touches the nuchal scute. Kemp's ridleys have 4 inframarginal scutes ***with small pores.*** The head is more slender than that of the loggerhead, ***the upper jaw has an obvious hook***, and there are usually more than two pairs of prefrontal scutes between the eyes. Adult ridleys have an average CCL of 69 cm (27 in.) and weigh between 36 - 45 kg (80 - 100 lb.). Hatchlings are completely dark gray in coloration, except for a short streak of light gray along the trailing edges of the front flippers. The CCL at hatching is approximately 3.8 - 4.4 cm (1.5 - 1.75 in.).

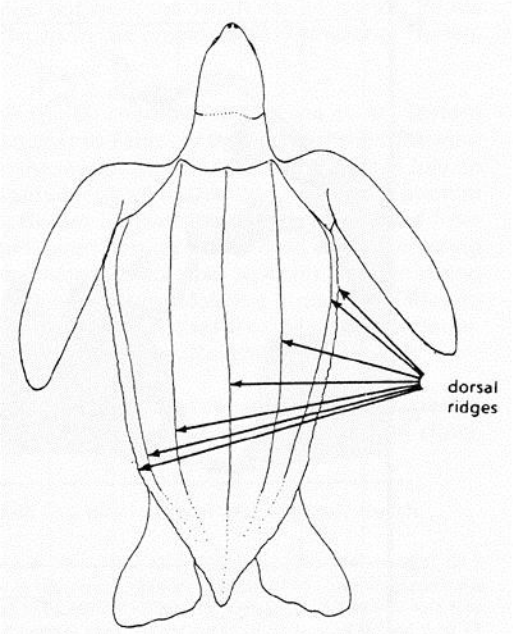


KEMPS RIDLEY TRACK AND CRAWL CHARACTERISTICS:

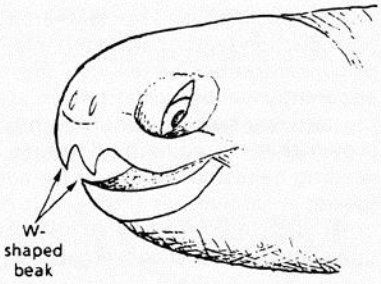
Track Width: Typically 31 in. (80 cm).
Type of Track: Very shallow with alternating (asymmetrical) diagonal marks made by front flippers. ***Nests most often in the daytime***.
Preferred Beach Type: Western Gulf of Mexico, Rancho Nuevo.
Average clutch size: 105 eggs
Egg diameter: 1.5 in. (4 cm).

LEATHERBACK SEA TURTLE
(*Dermochelys coriacea*)

Distributed throughout the world. Primary nesting populations: Suriname, French Guiana, Gabon, Trinidad, Costa Rica, Panama, Indonesia, India. This species is the most distinctive and the largest of all living turtles. It is generally an open sea or pelagic species but the migration of different species of jellyfish (its primary prey) brings it into nearshore areas. Seven prominent ridges are located on the carapace and 5 less prominent ridges are found on the plastron. ***No scutes are present***, instead a smooth, slate-black to bluish-black leathery skin covers the carapace and plastron. Irregular patches of white are predominant on the plastron and pink patches can be found on the throat, shoulder, and head regions. ***No scutes are found on the head*** and 2 notches are found in the upper jaw. The CCL of leatherbacks typically found in North Carolina ranges between 124 - 165 cm (49 - 65 in.) with weights exceeding 270 kg (600 lb.). Hatchlings are predominantly black with white along the outer edges of the flippers and the dorsal and ventral ridges. The body is covered with numerous small beady scales and the tail is keeled above. The CCL at hatching is approximately 6.4 - 7.6 cm (2.5 - 3 in.).



dorsal view



head

LEATHERBACK TRACK/CRAWL CHARACTERISTICS:

Track Width: 50 or more inches. (125+ cm).

Type of Track: Deeply cut with ***symmetrical diagonal marks*** made by simultaneous movement of the front flippers, with a central drag mark from the tail. The nest site is usually a large disturbed area, and re-entry track is wavy, curved, and sometimes with circular loops.

Preferred Beach Type: Dynamic beaches with deep entries.

Average clutch size: 100 eggs (***including many small misshapen yolkless eggs***)

Egg diameter: 2.5 in. (6 cm).

NEST MANAGEMENT

NESTING BEHAVIOR

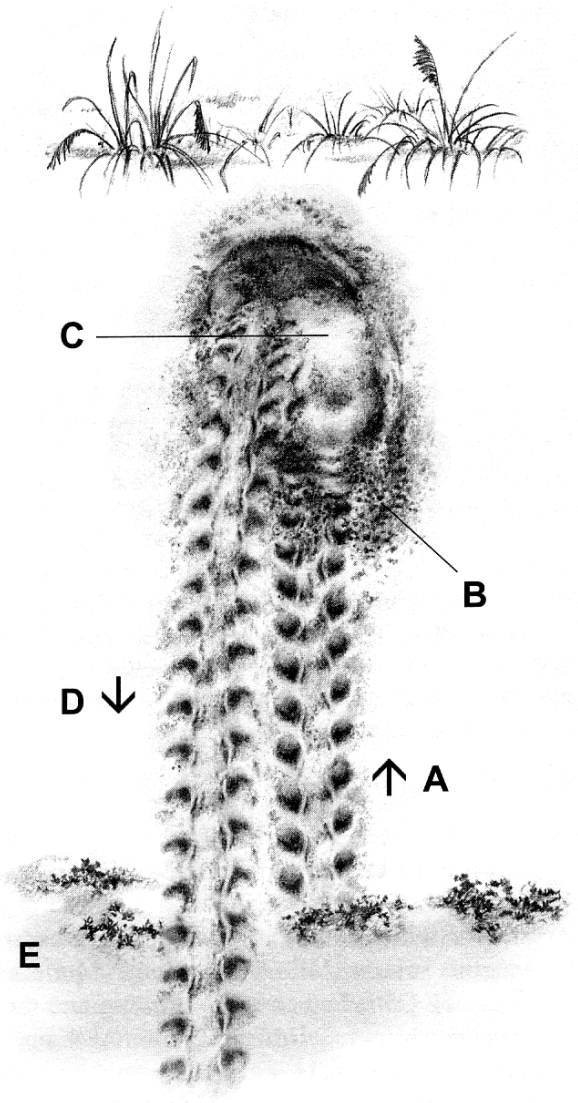
Female loggerheads, green turtles and leatherbacks usually come ashore to nest at night. Although nearsighted when they are out of the water, adult female sea turtles nevertheless can distinguish movement and light, and can be easily frightened and discouraged from laying eggs. The best way to avoid disturbing a nesting female is to not use a flashlight or camera/video flash when on the beach at night. If you must absolutely use a light, place a red filter over the flashlights or ATV lights. This is because the eyes of sea turtles are least sensitive to longer visible wavelengths of light (greater than 600 nm, which is red). If you see a female coming out of the surf, immediately turn off all lights and do not move. Wait until she has moved up the beach beyond you and has started digging before you move again.

If you wish to get a closer look at a nesting female, wait patiently for her to finish digging the nest cavity and slowly approach her from the rear when she has begun to lay eggs. On approach, do not shine lights directly on her eyes and stay away from her head. Turtles have very strong jaws and can break a bone or sever a finger if threatened. Do not touch her while she is nesting, unless you have been permitted to apply tags or if the turtle is carrying flipper tags. Flipper tags are typically located on the trailing edge of either one or both front or rear flippers and it may be necessary to reposition the flipper(s) to read the tag number. If you this Once she begins covering her nest, you should move away and extinguish all lights. The presence of artificial lights can cause her to become disoriented (move randomly) or even misoriented (move in a directed but incorrect direction). If you encounter a disoriented turtle, there are some things that will help you get her headed in the right direction. For example, by gently applying pressure on the right rear flipper you can get her to turn to the left. By gently applying pressure on the left rear flipper you can get her to turn to the right. Sometimes just by walking on one side of her you can get her to turn the other way. If a flashlight is available, you can remove the red cover, position yourself between the turtle and the water, and lure her into the water with the flashlight pointed downward but not at her eyes. Usually, all one needs to do is get her moving towards the ocean and she will continue in the correct direction on her own. If none of these methods work, a large canvas, along with the help of several people, can be used to drag or carry her to the water.

NEST SITE IDENTIFICATION

When conducting daily monitoring of a nesting beach, try to patrol the beach as soon as possible after sunrise. When a crawl is found on the beach, determine whether or not the crawl resulted in a nest (non-nesting crawls are also known as false crawls, half-moons and dry-runs). In most cases, non-nesting crawls are easily distinguished from nesting emergences because there will be little to no disturbed or excavated sand associated with the crawl. However, females will sometimes begin digging a nest chamber, give up and return to the water without laying any eggs. She may even make several separate nesting attempts, leaving a series of abandoned nest cavities before returning to the water. Under these circumstances, it is difficult to visually identify these crawls as non-nesting events. Here are some tips on finding the location in the crawl where eggs are most likely to have been laid:

You can distinguish between the arrival and departure crawl by looking for the direction that the sand is pushed in while the turtle was crawling (A and D in the figure). Also, examining the tracks and their relationship to the high tide line (E) can help determine the arrival crawl. Once determined, follow the arrival crawl up to the area where the sand is disturbed.



In the disturbed sand area (B and C in the figure), there may be two “body pits” or differentiated areas of digging. The primary body pit is the larger of the two (C) and usually the turtle makes this just before digging the nest chamber. The smaller chamber (B) is made after nesting, when the turtle covers and camouflages the site. False crawls with disturbed sand usually will not have a well-defined secondary body pit nor will the crawl have freshly thrown sand on it.

Still facing in the direction of the turtle’s approach, begin your search for the egg chamber approximately two feet at the midline into the disturbed area that forms the primary body pit (i.e., start digging about half-way between B and C in the figure). Expand your search outward from this point until you find the eggs or decide that the crawl was a non-nesting emergence.

To find the eggs, gently and systematically dig by hand; the sand covering the nest will “give way” as you probe with your fingers. ***Stop digging as soon as you see or feel the first layer of eggs***. Do not use a probe (a thin sturdy rod with a pointed end) to find a nest – it greatly increases the likelihood of accidentally puncturing several eggs. After verifying the presence of eggs, quickly cover up eggs with moist sand (do not allow dry sand to fall in the nest cavity) and replace the layer of dry sand over the nest. ***Do not remove any eggs from the chamber, unless it has been determined that the nest must be relocated (see Relocation section below).*** When you strongly suspect that a sea turtle has successfully nested, but are unable to locate the eggs, you should mark off the entire area for protection during incubation. Once the nest hatches, you should be able to follow the tracks of the hatchlings back to the precise nest location for eventual excavation (see below).

NEST PROTECTION PROCEDURES

Nests may need to be protected if raccoon or fox predation is high or the area is subject to heavy foot, vehicular traffic or severe erosion. Listed below are steps to take to help protect nests on the beach.

1. Nests should be marked in a manner that will allow you to find them later and also monitor the level of the sand. Curious beach walkers often try to read what is on a marker so signs should be placed where it can be read without stepping on the nest. Seaward of the nest is usually best. Some suggestions for marking nests are:

   - Place two stakes an equal known distance (~36 – 40 inches) from the center of the nest at two diagonal corners of the protective square buffer. Record the distance of each stake from the nest and number each stake with a permanent marker (#1 and #2). When you want to locate the nest later, attach a length of string equal to the known distance to each stake and make an arc in the sand. Where the arcs cross should be the center of the nest chamber.
   - Place two more stakes so that a square is formed around the nest site. Completely encircle the poles with construction tape, twine or other suitable line material with pieces of brightly colored flagging attached to it so that the line is visible.
   - Mark the original level of sand on all stakes with a permanent marker.

2. The use of protective screening laid flat on the sand and centered over the egg chamber has been effective with keeping most mammalian predators from digging into the nest. The advantage is that there is little disturbance to the nest and incubation and hatchling emergence is not permanently affected if the proper materials and methods are used. Use a one-yard square piece of 2 in. x 2 in. mesh plastic fencing (preferred) or 2 in. by 4 in. mesh welded wire fencing and center and anchor the piece with notched stakes over the nest. When using welded wire fencing, the 4-inch side of the wire opening should be parallel with the water line. Cover the wire with a thin layer of sand to hide it from passers-by and predators. If predators have learned to dig into the nest from the side, five-sided cages may be used. Refer to Appendix V for information on how to construct and place cages over nests.

3. Excess sand may blow over a nest making it very difficult for hatchlings to emerge. Monitor nest markers to determine if this is a problem (the original sand height should have been marked in permanent ink on the stakes when the nest was first laid). Reduce the depth of sand over the nest to its original level if it has increased appreciably (more than 12 in.).

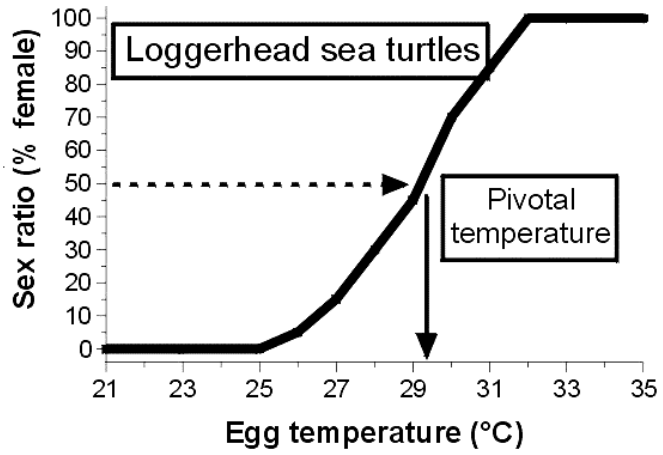
4. In situations where nests are incubating on beaches that also have any motor vehicle traffic, the nests must be marked with adequate buffer zones to avoid incidental crushing. Each nest should be marked such that a 10-25 foot buffer zone is allowed on all sides of the nest during incubation, depending on the amount of vehicular beach traffic. Additionally, when hatchlings are expected to emerge, a 50 foot wide corridor from nest to the ocean must be created and kept vehicle free starting at least a half hour before sunset to dawn, until emergence has completed and the nest has been excavated. During expected emergence,

all tire ruts between the nest and ocean must be smoothed to facilitate hatchlings reaching the water.

INCUBATION AND HATCHING

Eggs incubate in the sand for approximately 2 months. The incubation period varies throughout the nesting season and is largely dependent on local weather conditions. Cool ambient temperatures prolong incubation periods whereas hot temperatures shorten the development time. Other factors such as humidity and oxygen levels can also affect the incubation period of a nest. There is no set time or date when a nest should hatch. ***Do not dig into a nest prior to emergence.*** Not only can this cause harm to the hatchlings and possibly attract nest predators, it directly impacts the natural order of reproduction.

The incubation period is a critical time for marine turtles. Approximately 6-12 hours after deposition, the embryo becomes attached to the top of the eggshell. After this point, the embryo is highly sensitive to movement, and can be dislodged if the egg is rotated. This will result in the death of the embryo. Temperature within the nest is an important factor during development. Most notably, the temperature of the eggs during the middle third of incubation influences the direction of sexual differentiation in all sea turtles. At the northern extent of the loggerhead nesting range, warmer temperatures (>84.6 °F or >29.2 °C) produce more females, while cooler temperatures (<84.6 °F or <29.2 °C) produce more males. Constant temperatures of 84.6 °F or 29.2 °C will produce equal numbers of both sexes; this is called the **pivotal temperature**. Nest temperature is influenced by sand color and grain size, physical structure of the beach, local climate and how much metabolic heat is generated by the development of the embryos. The mechanism for sex determination is not known precisely, but it appears to be linked to the regulation of aromatase, an enzyme that converts testosterone (a male hormone) or its precursors to estrogen (a female hormone).



In the egg, the embryo develops in a folded position, as do most vertebrates. The yolk sac remains external to the embryo throughout incubation. At the end of incubation, each hatchling will slit the eggshell with a temporary “egg tooth” (or caruncle) on the tip of the beak. When the baby turtle hatches from its egg, it is still folded and the egg sac is still external to the body. Over the course of the next few days, the hatchling will straighten out and the yolk sac will be absorbed into the body cavity via a hole in the plastron (an “umbilical” hole). Most of the eggs in a single nest hatch at the same time, and the hatchlings work together to ascend the sand column above the nest cavity. The residual yolk provides important energy for this activity. Hatchlings become inactive in response to high temperatures, so when they reach the surface of the sand, they will wait until the temperatures have cooled before emerging onto the beach. Cooler surface sand temperatures usually correspond to nightfall, although on cloudy rainy days,

emergences can occur during the daytime because rain will cool the surface of the sand. Nighttime emergences are thought to a) provide protection from high lethal temperatures on the beach during the day, and b) help to avoid diurnal predators such as most birds. Once emerged, the hatchlings orient towards the sea using visual cues, specifically light gradients, and they scramble quickly towards the ocean. Once in the water, they swim without pause for 24-48 hours, as a way to get beyond the predators inhabiting Virginia's coastal waters.

The remaining yolk in the hatchlings powers this post emergence "frenzy". Loggerhead hatchlings have shown an affinity for floating mats of *Sargassum* seaweed once they enter a major oceanic current such as the Gulf Stream, presumably because they can hide among the vegetation and also find food there. The period of time they spend drifting passively in open ocean currents amid floating seaweed has been estimated to last anywhere from 2 to 10 years. Genetic studies have shown that loggerheads produced on US Atlantic coast beaches will use coastal areas around the Macaronesian Islands (the Azores, Madeira, the Canary Islands, and Cabo Verde) as feeding grounds as mid-sized juveniles, after which they return to the northwest Atlantic feeding grounds (such as Pamlico Sound and the Chesapeake Bay). Using bone-ageing techniques, researchers now estimate that it takes 32-35 years for loggerheads to reach maturity.

NEST RELOCATION

WHEN TO MOVE A NEST

Nests will remain *in situ* unless a nest is located below the estimated mean high tide line (as established by wrack lines and referenced to tidal conditions). If a nest is below the mean high tide line, it will be relocated above the mean high tide line, in close proximity to the original nest location. Relocation must be considered as a last resort in terms of nest management. In most cases, nests that are naturally laid in areas with heavy foot or vehicular traffic can be marked so that they are avoided by beach goers. If a nest is laid near a bright light that may misorient hatchlings, ask the appropriate party if the light can either be turned off or shaded, at least around the time of expected emergence. If you need assistance with lighting problems, please call the VDGIF coastal biologist. Nests should be moved ***only*** when one or more of the following situations exist:

In rare cases, a permit may be issued for unusual, but lawfully conducted, human activities that pose a serious threat to nests. When these situations arise, the USFWS and VDGIF will consult with the action agency to discuss mitigation measures that may include the relocation of nests. When these situations arise and only after a permit (or permits) has (or have) been issued, the local sea turtle volunteers/participants will be notified by the VDGIF and given instructions on nest relocation protocol that are unique to the situation at hand.

HOW TO MOVE A NEST

Relocated nests may have a lower hatching rate than natural nests, but careful and timely handling and transport of eggs will reduce this risk. The shorter amount of time between laying and relocation, the better the chances that successful emergence will occur. Beach patrols should be conducted as early in the morning as possible. If relocation is absolutely necessary, use the following guidelines:

1. Find the egg chamber by using the methods described in the section entitled NEST SITE IDENTIFICATION.

2. Try to move nests within 6 hours after they are laid or ***before 9:00 AM the following morning at the very latest.*** The potential for movement-induced mortality increases rapidly approximately 12 hours after deposition (turtles may nest as early as 9:00 pm the preceding night).

3. Take extreme care not to rotate eggs in any way during handling. Maintain the original orientation throughout the relocation process. It is sometimes helpful to place a small light pencil mark on the top to help maintain the original orientation. ***Do not use ink*** since it may contain solvents harmful to the embryo if it permeates the eggshell.

4. Excavate the eggs by hand, not with a shovel. Place them in a rigid container (for example, a bucket) with a 2 - 3 inch layer of moist sand on the bottom. When all the eggs are in the container, cover them with a layer of moist sand. Keep excavated eggs shaded on hot, sunny days.

5. In the event a nest is laid below the estimated mean high tide line, relocate the nests as close to the original nest site as possible and avoid forming clusters of nests. ***Moving nests into hatcheries will not be permitted under any circumstances.*** Concentrating nests in a small area may attract predators and/or alter natural sex ratios. Additionally, nests should be relocated to areas above the high tide line that are relatively free of vegetation to avoid nests being invaded by root systems. Roots may puncture and kill individual eggs and/or inhibit or prevent hatchlings from emerging from the nest.

6. Dig the new egg chamber by hand or with a trowel to the same depth and dimensions of the original nest. Round out the bottom with so that the shape of the nest is similar to a round-bottomed flask or inverted light bulb.

7. Relocate the eggs into the new egg chamber by transferring them one at a time while continuing to maintain each egg's original orientation. Try to wipe off any excess sand, because airspace between the eggs in the chamber is important for respiration. After all the eggs have been transferred, cover them with moist sand excavated from the new nest chamber. Dry sand should not be allowed to fall into the egg chamber. Once the eggs are reburied to the upper level of the surrounding moist sand, gently pat the sand surface above the eggs with your hand. Replace the dry sand over this area to the depth present before you began.

8. Mark the nest's new location following the steps listed in the preceding section entitled NEST PROTECTION PROCEDURES.

HATCHLING PROTECTION PROCEDURES

Although it is a relatively short interval, the timing and circumstances of hatchling emergence and dispersal is critical to survival. For this reason, the emergence of hatchlings should mimic the natural situation as closely as possible.

- Allow nests with possible hatchlings in it to complete the incubation process undisturbed. ***Do not dig into a nest to see if hatchlings are ready to emerge.*** The premature opening of a nest could attract predators or alter the physical environment of the nest resulting in the death of hatchlings.
- ***Nest excavations will be conducted a minimum of 72 hours after a mass emergence of hatchlings (boil) or 80 days after laying, whichever comes first*** (see below for an important exception). If the nest exhibits a trickle hatch (a few hatchlings emerge each night over 3 day period) then wait ***a minimum of 120 hrs. (5 days)*** after first hatchling emergence or until the majority of all hatchlings have emerged.
- Because cooler sand temperatures delay hatching and emergence, ***a nest that has been subjected to tidal inundation, excessive rainfall, or cold fronts should not be excavated until 90 days after egg deposition or at least 120 hours (5 days) after first emergence. This includes nests laid late in the season (August 1 or later).***
- If predators have entered a nest, determine if there are any eggs left intact and allow any live hatchlings to make their way to the ocean (see section entitled HATCHLING RESCUE AND RELEASE). If viable eggs are present, immediately remove spilled egg contents from the nest chamber. To quantify egg loss, count and record the number of damage eggs, only counting eggs that are 50% or more intact. To reduce further depredation, either dispose of egg shells and contents offsite, or bury a considerable distance from the nest. Remove all sand containing spilled egg contents from the surface of the nest. Carefully clean "dirty" eggs by gently rubbing them with dry sand ***(do not wash eggs in water!)***. Take extreme care to avoid rotating the eggs during this procedure. Rebury all intact eggs and screen the nest.
- Hatchlings that are disoriented by lights should be taken to a darker portion of the beach for release. Allow them to crawl a moderate distance to the water. A flashlight shining on the ground at the water's edge can sometimes overcome the effects of other lighting and attract hatchlings in the proper direction. Do not shine the light directly on the hatchlings.
- Hatchlings that emerge from the nest when nearshore water temperatures are below 50 °F or 11 °C stand a poor chance of survival. When faced with this situation, collect the hatchlings as they emerge and place them in a rigid container lined with several inches of moist sand. Bring the hatchlings inside a warm (60 – 65 °F or 16-18 °C), quiet, dark room and partially cover their container with a moist towel ***(do not cover the container completely to avoid suffocation).*** Call the VDGIF coastal biologist immediately for instructions on what to do with the turtles.

POST-HATCHING NEST EXCAVATION AND ANALYSIS

Excavate a nest only after a minimum of 72 hours have passed since the first emergence or 80 days after deposition whichever comes first (longer in cool and/or wet

weather; see section entitled HATCHLING PROTECTION PROCEDURES). You should use latex or vinyl gloves when cleaning a nest: it protects hatchlings from your bacteria, and protects you from any bacteria in the nest.

The point of excavation is to determine the success of the eggs in the nest. There are two basic measures: hatching success and emergence success. The main difference between the two is how the live hatchlings found remaining in the nest are classified. For consistency with other projects in the USA and elsewhere, the Virginia Sea Turtle Nesting Program will report emergence success, although it may be necessary in some cases to calculate hatching success.

Nest excavation protocols:

1. While wearing nitrile gloves, gently begin digging into the depression left by the hatched nest. When you feel the sand "give way" you have broken into the nest chamber. You may immediately find hatchlings that are entangled in roots or perhaps constrained by compacted sand. Do not pull on the hatchlings, but try to work them free by breaking the roots or loosening the sand. If the young turtles appear unharmed, follow release procedures listed in the next section entitled HATCHLING RESCUE AND RELEASE. ***Be sure to verify species when you find hatchlings in the nest.***

2. Carefully scoop out all contents of the nest. Be sure to verify that no extra eggshells or eggs remain on the sides of the “bowl” of the nest cavity. If you encounter many (>15) live hatchlings before reaching any eggs or eggshells, or find a mix of many (> 15) live, vigorous hatchlings, unhatched eggs and a few eggshells, quickly cover the egg chamber with moist sand and return the site to its original condition. Wait at least 48 hours before excavating again. If fewer than 15 hatchlings are encountered during the initial excavation, follow hatchling release procedures listed in the following section entitled HATCHLING RESCUE AND RELEASE.

3. Once you have collected all the material from the excavated nest, separate nest contents into the following groups:
   - **A. Live hatchlings (LH)**
   - **B. Dead hatchlings (DH)**
   - **C. Pipped eggs with dead hatchlings (PE)**
   - **D. Whole unhatched eggs (UE)**
   - **E. Whole eggshells (HE)** (>50% of the whole shell)
   - **F. Small eggshell pieces** (< 50% of the whole shell). *Note that this group of shells is not used in the overall calculations later on*.

Pipped eggs are those in which some part of the hatchling has broken through the egg but is not completely free of its eggshell. Pipped eggs range from those with just a small hole to those with large tears. ***Pipped eggs are not hatched eggs.*** See the note at the end of this section for instructions on what to do with live pipped eggs and live hatchlings whose yolk sacs are not completely absorbed. For reporting purposes, all pipped live hatchlings that survive to be released are counted as LH. Any that subsequently die are counted as PE. Don’t forget to add the shell of live pipped hatchlings to the ES category.

4. You can calculate **total clutch size (TCS)** by summing the numbers of groups C-E (above), that is

TCS = (PE+UE+HE)

Please calculate total clutch size based on nest excavation, even if you know original clutch size from nest relocation.

5. Calculate emergence success by the following formula:

$$\frac{HE-(LH+DH+PE+UE)}{TCS} \text{ X } 100$$

6. After you are finished, place unhatched eggs, dead hatchlings, and eggshells back in the nest and cover them up. The debris left in an emerged sea turtle nest is thought be an important source of energy for the resource-poor dune system.

PIPPED EGGS WITH LIVE HATCHLINGS: If the nest contained live pipped eggs, or live hatchlings with prominent yolk sacs perform these steps. Rebury the contents of the nest at the bottom of the egg chamber. Add a 3 - 4 inch layer of clean moist sand. Place the viable pipped eggs and live hatchlings with visible yolk sacs on this layer of sand and add more clean, moist sand over them. Cover the area with dry sand and keep the nest location marked. Wait one week before excavating again to complete the nest analysis. If you encounter this scenario when ambient temperatures and/or nearshore water temperatures are below 50° F, place the viable specimens in a rigid container lined with moist sand and bring them inside a warm (70° - 75° F), dark, quiet room. Partially cover the container with a damp towel and call the VDGIF coastal biologist immediately for further instructions on what to do with the turtles.

IN ADDITION TO CALCULATING THE EMERGENCE SUCCESS FOR EACH NEST, PLEASE RECORD ALL ACTIONS TAKEN WITH LIVE HATCHLINGS INSIDE PIPPED EGGS IN COMMENTS SECTION OF INDIVIDUAL CRAWL RECORD (APPENDIX III).

See Appendix III for the data sheet to record information on and the final outcome of each nest or crawl encountered.

HATCHLING RESCUE AND RELEASE

This activity includes salvaging live hatchlings (primarily disoriented hatchlings encountered on the beach or those found at the bottom of excavated nests) and ensuring they reach the water safely. Due to the short duration of the swimming frenzy period, hatchlings should be released as soon as possible following rescue. All hatchlings found during darkness are to be released immediately. All hatchlings found disoriented or at the bottom of nests during daylight excavations are to be released the same evening or night. ***Do not hold hatchlings in water***. If you must wait until nightfall to release the hatchlings, place them in a cooler or bucket lined with damp sand and partially cover with a moist towel in a near-dark environment. Once they are in a holding container, the hatchlings should not be handled or disturbed until they are ready for release. Disturbance can increase unnecessary expenditure of limited energy stores. It is best to keep the hatchlings in a dark, quiet, temperature-controlled area.

Release all hatchlings after dusk. Allow them to crawl to the water on their own. ***Do not toss hatchlings beyond the waves breaking on the beach.*** Occasionally, individual hatchlings may need assistance in reaching the water. In such cases, they may be moved closer to the water's edge or placed in the shallows and allowed to swim off on their own.

In some cases, weak hatchlings may need to be held for slightly longer periods to allow them to recover. This should not be a routine event. If hatchlings require further holding, please contact the VDGIF coastal biologist immediately for instructions on what to do with the turtles.

ACTIONS NOT ALLOWED UNDER VDGIF PERMIT

Engaging in any of the following activities is unlawful and could result in revocation of the permit and/or law enforcement action.

» Incubating eggs in artificial containers of any kind.

» Relocating nests for reasons other than outlined in the Nest Relocation section above.

» Keeping eggs or hatchlings in any kind of structure (sheds, garages, homes, etc.) or for any period of time except by special permission or per instructions given by the VDGIF.

» Moving nests landward of any obstacle that would prevent an unencumbered route to the sea for the hatchlings.

» Premature opening of the nest.

» Detaining hatchlings once they have emerged from the nest.

CROWD CONTROL

Historically, problems have occurred on the beach when there have been excessively large crowds during a nesting or hatching event. Although the presence of large crowds can make excavations more challenging, they also are a great opportunity for raising public awareness of sea turtle conservation. The following guidelines are provided for managing large crowds that may be encountered on the beach during a nesting event or nest excavation.

The VDGIF will furnish you with an official badge that will inform the public that you are duly authorized to perform sea turtle management activities. Please wear it at all times during your turtle activities!

1. Nesting event: Keep people at least 20 ft. from the female and make sure they remain behind the turtle at all times. Do not try to approach her when there is a large crowd of people. Inform them as to what is happening and ask them not to take pictures since the flash can cause the turtle to become disoriented. If necessary, you may remind them that all species of sea turtle are protected by

federal law and thus it is a crime to disturb them during their nesting process. You can always ask your local police department for help in crowd control – chances are good that the officers will be interested in the nesting event too!

2. Hatching event: Have one person act as an interpreter and have them circulate through the crowd informing people on what is happening and recruiting people out of the crowd to inform late arrivals. Use some sort of barrier such as string or construction tape to restrain the crowd from a fan-shaped alleyway for the hatchlings to use to get to the water. Short lawn fencing might also be used in the same manner, but do not leave it on the beach when no one is present. A low (4 in. or less) ridge of sand can be raked up to form a fan shaped alley which will keep the hatchlings moving toward the water. You can also drag your foot to make two parallel lines leading from the nest to the water – ask people to remain outside the two lines while the hatchlings make their way to the ocean while inside the lines.

3. When possible, periodically run articles in the local newspapers informing people about the life history of the turtles and what will happen if they are caught molesting or inhibiting nesting females or emerging hatchlings.

4. Organized public education presentations or lectures are a good way to keep crowds to a minimum or at least manageable. Slide shows to various groups such as Realtors, community service organizations, city administrators, etc. can help facilitate crowd control. Contact the Sea Turtle Project Biologist for more information about obtaining education materials.

REPORTING

All permit holders must submit an annual report of all activities involving sea turtles or their nests. In the case of sea turtle nest beach management projects, annual reports are made on forms developed by the VDGIF. Reports should be neat and legible and should include all information collected from each nest as indicated on the form. ***The annual report should be submitted by December 1 of each year as required in the permit***. Information collected is important to managing sea turtles in a biologically sound manner. In addition, all permit holders are strongly urged to submit their data in electronic format to the Sea Turtle Project Biologist, who may be contacted for more details.

IMPORTANT TELEPHONE NUMBERS

VDGIF Personnel:

Ruth Boettcher, Coastal Biologist.....757-709-0766

Jeremy Tarwater, Assistant Coastal Biologist 757-607-7343

VA Aquarium and Marine Science Center Stranding Response Program:

Main number during business hours (every day 8:00 am – 5 pm).....757-385-7575

Number to call outside of regular business hours……757-385-7576

Law Enforcement Hotlines:

VA Marine Resources Commission Hotline.....1-800-682-2632

VA Dept. of Game and Inland Fisheries Wildlife Crime Hotline.....1-800-237-5712

VA Beach non-emergency dispatch……1-757-385-5000

Naval Facility Numbers:

Dam Neck/Oceana Natural Resources Office (Michael Wright)……1-757-433-3461

Dam Neck/Oceana after hours Command Duty Officer (CDO)……..1-757-438-3159

JEB Little Creek Fort Story 24-hr. Emergency Communication Center…1-757-462-4444

APPENDIX I

INFORMATION SOURCES FOR SEA TURTLE BIOLOGY AND CONSERVATION

INTERNET:

http://www.seaturtle.org
This site contains a wealth of information concerning sea turtles, including the Marine Turtle Newsletter, a directory of sea turtle workers, an image library, book reviews, and links galore. This is a good place to start on a general search on sea turtles.

http://www.euroturtle.org
This site gives a good overview of the biology and conservation of sea turtles, with a focus on the Mediterranean. There is a section devoted to education and public awareness.

http://www.turtles.org
This is another site devoted to sea turtles, although with a focus on green turtles from Hawaii. It has great underwater photos of turtles, and lots of information on fibropapillomatosis.

http://webluis.fcla.edu/cgi-bin/cgiwrap/fclwlv3/wlv3/DGref/DBST/CM2/P1basic
This is the online search tool for the Sea Turtle Bibliography from the Archie Carr Centre for Sea Turtle Research of the University of Florida. You can use it to find publications about sea turtles.

http://www.sefsc.noaa.gov/seaturtlepublications.jsp
This is where the NMFS has available all NOAA publications related to sea turtles in the Atlantic Basin.

http://emys.geo.orst.edu/main_pages/database.html
This is an online database for information on ALL species of turtles (nearly 300!).

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BOOKS

There are many books on sea turtles, from kids books to coffee table book to more serious scientific books. The following is a partial list of some of the more recent books on sea turtles – you will find more if you go to www.amazon.com and search under "sea turtle"

P. L. Lutz and J. A. Musick (editors).1996. The Biology of Sea Turtles. CRC Press, Boca Raton, Florida.

P. L. Lutz, J. A. Musick, and J. Wyneken (editors). 2002. The Biology of Sea Turtles Vol. II. CRC Press, Boca Raton, Florida. ISBN: 0849311233

K. A. Bjorndal (editor). 1982. Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington. (Note: reprinted in 1995) ISBN: 1560986190

K. L. Eckert, K. A. Bjorndal, F. A. Abreu-Grobois, and M. Donnelly (editors). 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4, 1999 (online version of all chapters available here: http://www.iucn-mtsg.org/publications/ - click on the blue cover halfway down the page).

Bolten, A.B. and B.E. Witherington. 2003. Loggerhead Sea Turtles. Smithsonian Books, Washington DC ISBN: 1588341364

J.R. Spotila. 2004. Sea Turtles: A Complete Guide to Their Biology, Behavior, and Conservation. Johns Hopkins University Press, Baltimore ISBN: 0801880076

Gulko, D. and K.L. Eckert. 2004. Sea Turtles: An Ecological Guide. Mutual Publishing ISBN: 1566476518.

Rathmell, D. and B.J. Bergwerf. 2005. Carolina's Story: Sea Turtles Get Sick Too! Sylvan Dale Publishing ISBN: 0976494302

Davidson, O.G. 2001. Fire in the Turtle House: The Green Sea Turtle and the Fate of the Ocean. PublicAffairs ISBN: 1586480006

Sweet, M. and M. Sweet. 2005. Hawaiian Sea Turtles. Pacifica Island Art ISBN: 0975872125.

APPENDIX II

FAQ (Frequently Asked Questions)
experienced on the beach by volunteers, with recommended answers:

Concerning nest excavation:

Q. Why do some eggs not hatch from the nest?

A. Most eggs are fertilized and viable when laid. However, during the approximately 60 days of incubation, there are many environmental factors that can arrest development of the eggs. These include: temperature extremes (especially for those eggs closest to the surface of the sand), bacterial or fungal attack, predation by crabs or insects, tidal inundation, accidental trampling of the nest, plant roots.

Q. What is the average clutch size?

A. The average number of eggs per nest for loggerheads is about 110 eggs, although as many as 198 eggs in one nest were seen in North Carolina. For green turtles, it is about 120 eggs. For leatherbacks, the average number of eggs is about 80, not including the 20 or so small, yolkless eggs common to this species.

Q. How long does it take for the eggs to hatch?

A. It takes around two months, but the exact time depends on the temperature of the sand: warmer sand means faster incubation.

Q. How many of the hatchlings will survive?

A. This is one of the mysteries of sea turtles, although most people assume it is somewhere around 1 out of every 1000 hatchlings will make it to adulthood.

Q. How can you tell what the sex is?

A. You can't just by looking at them. In fact, sea turtles do no have sexually dimorphic sex chromosomes, so you can't even tell by looking at their genes. The sex of sea turtles is determined by incubation temperature of the eggs: warmer temperatures produce more females, cooler temperatures produce more males. In NC, the "pivotal temperature" (the temperature that produces 50% of each sex) is about 29.25 °C (or 84.65 °F).

Q. Where do the hatchlings go once in the ocean?

A. It isn't entirely known, because there are very few observations of sea turtles between the stages of hatchling and "dinner-plate" size. Once they reach this size, they are seen in the waters around Macaronesia (Cape Verde, Canaries, Azores, and Madeira islands). It is assumed that before arriving there, the small turtles float passively along major North Atlantic currents, near the Sargasso Sea.

Concerning nesting females:

Q. How old is the nesting turtle?

A. Nobody knows for sure, since they are not marked when they leave the beach as hatchlings. Some researchers think that it takes about 30 years minimum for loggerheads to reach the age of maturity, although any nesting female may be older than that. For green turtles, minimum age of maturity in the wild is around 30 years. For leatherbacks, it seems to be much shorter: ~10 years.

Q. Why is she crying?
A. Their “tears” are part of their means of exuding excess salt that accumulates from drinking seawater. They “cry” all the time, including in the water, but it is just more difficult to see the tears underwater.

Q. Does she come back to guard the eggs?
A. No. Once the female is finished covering, she will leave the eggs to their fate on the beach. Under normal conditions, the eggs should successfully produce hatchlings, although some predators or weather conditions can reduce hatching success.

Q. How often do the females lay eggs?
A. Usually, loggerheads and green turtles can lay several nests in one season, but they do not usually reproduce in consecutive years. Leatherbacks can lay up to 12 nests in one season, but they also do not nest in consecutive years. Kemp’s ridleys usually nest a few times, often in consecutive years.

Q. Where do they go between this nest and the next one they lay?
A. They will make nests every two weeks or so during the nesting season, and between nesting events they usually pick a spot offshore and remain there, mostly inactive, until it is time to nest again. Between nesting seasons, they can migrate long distances to feeding grounds. Several loggerhead females from NC have been tracked after their last nest of the season, and most went to the Chesapeake Bay for several weeks before moving south during the winter. Most adult female loggerheads appear to remain close to the Atlantic seaboard of the US.

APPENDIX III

ACTIVITY NO._____ **NEST ID_____**

INDIVIDUAL SEA TURTLE CRAWL RECORD

CRAWL DATE:_____(for all crawls discovered *after* midnight, enter the date the crawl was found. For all crawls found/reported *before* midnight, enter the next day's date.

CRAWL TYPE: ☐ Nest above HTL ☐ Nest below HTL ☐ False crawl above HTL ☐ False crawl below HTL

SPECIES: ☐ Loggerhead ☐ Green turtle ☐ Leatherback ☐ Kemp's ridley

TREATMENT: ☐ No treatment ☐ Relocated ☐ Screened or caged in place ☐ Relocated and screened or caged

CRAWL LOCATION (ISLAND, BEACH AND/OR BEACH DIVISION)**:**_____

DESCRIPTION OF CRAWL LOCATION (e.g., nearest street, hotel or business; north end of island)**:**_____

_____

FALSE CRAWL/NEST LATITUDE:_____FALSE CRAWL/NEST LONGITUDE:_____

DESCRIPTION OF RELOCATED NEST (RN) LOCATION**:**_____

_____

RN LATITUDE:_____RN LONGITUDE:_____ REASON FOR MOVING NEST:

_____

NO. EGGS RELOCATED:_____ NEST DEPTH:_____in./cm. TIME RELOCATION WAS COMPLETED_____

DISTANCE OF STAKE #1 FROM NEST:_____ in./cm. DISTANCE OF STAKE #2 FROM NEST:_____ in./cm.

EGG COLLECTED FOR GENETICS? YES NO (circle one)

TIDAL INNUNDATION

Enter "Y" if nest was washed by the tide, enter "N" if nest was not washed by the tide for each day during incubation.

Day 1_____	**Day 21**_____	**Day 41**_____	**Day 61**_____	**Day 81**_____
Day 2_____	**Day 22**_____	**Day 42**_____	**Day 62**_____	**Day 82**_____
Day 3_____	**Day 23**_____	**Day 43**_____	**Day 63**_____	**Day 83**_____
Day 4_____	**Day 24**_____	**Day 44**_____	**Day 64**_____	**Day 84**_____
Day 5_____	**Day 25**_____	**Day 45**_____	**Day 65**_____	**Day 85**_____
Day 6_____	**Day 26**_____	**Day 46**_____	**Day 66**_____	**Day 86**_____
Day 7_____	**Day 27**_____	**Day 47**_____	**Day 67**_____	**Day 87**_____
Day 8_____	**Day 28**_____	**Day 48**_____	**Day 68**_____	**Day 88**_____
Day 9_____	**Day 29**_____	**Day 49**_____	**Day 69**_____	**Day 89**_____
Day 10_____	**Day 30**_____	**Day 50**_____	**Day 70**_____	**Day 90**_____
Day 11_____	**Day 31**_____	**Day 51**_____	**Day 71**_____	**Day 91**_____
Day 12_____	**Day 32**_____	**Day 52**_____	**Day 72**_____	**Day 92**_____
Day 13_____	**Day 33**_____	**Day 53**_____	**Day 73**_____	**Day 93**_____
Day 14_____	**Day 34**_____	**Day 54**_____	**Day 74**_____	**Day 94**_____
Day 15_____	**Day 35**_____	**Day 55**_____	**Day 75**_____	**Day 95**_____
Day 16_____	**Day 36**_____	**Day 56**_____	**Day 76**_____	
Day 17_____	**Day 37**_____	**Day 57**_____	**Day 77**_____	
Day 18_____	**Day 38**_____	**Day 58**_____	**Day 78**_____	
Day 19_____	**Day 39**_____	**Day 59**_____	**Day 79**_____	
Day 20_____	**Day 40**_____	**Day 60**_____	**Day 80**_____	

Total number of days nest was washed over:

_____

Transcribe nest disturbance events recorded in the daily nest monitoring log. Record of nest disturbances that resulted in partial or total loss of eggs or hatchlings, loss of nest, nest markers or other damage incurred during the incubation period.

Date	Type of disturbance	Comments (include estimated # of lost eggs/hatchlings)

HATCHING/NEST INVENTORY DATA *SEE VOLUNTEER HANDBOOK FOR MORE DETAILED INSTRUCTIONS ON PERFORMING NEST EXCAVATIONS.*

Date of first hatchling emergence (if first emergence was seen *after* midnight, record that day's date; if first emergence was seen *before* midnight, record the next day's date)_____

Date of last hatchling emergence (if last emergence was seen *after* midnight, record that day's date; if last emergence was seen *before* midnight, record the next day's date)_____.

Nest inventory date:_____ Excavated by:_____
Perform the following steps to assist with the determination of the nest's hatch success rate.

1. Count the number of whole eggshells (>50%) [do not count pieces <50%] **HE** = _____
2. Count the number of whole unhatched eggs: **UE** = _____
3. Count the # of pipped eggs with dead hatchlings: **PE** =_____
4. Count the # of dead hatchlings that emerged from eggs but did not leave the nest: **DH** =_____
5. Count the # of live hatchlings free of eggshells remaining in the nest, regardless of condition **LH** =_____

TOTAL CLUTCH SIZE (TCS) = (PE+UE+HE):_____

EMERGENCE SUCCESS = $\frac{HE-(LH+DH+PE+UE)}{TCS}$ X 100:_____

***If the nest contains live hatchlings that emerged from the egg shell, but did not leave the nest cavity or pipped eggs with live hatchlings, see the volunteer handbook for further instructions.*

VERIFY SPECIES, BASED ON HATCHLINGS: ☐ **Loggerhead** ☐ G**reen turtle** ☐ **Leatherback** ☐ K**emp's ridley**

Additional comments (e.g., status of embryos in unhatched eggs, final disposition of live hatchlings, etc.):

_____

_____

APPENDIX IV

Loggerhead, Green, Kemp's Ridley and Leatherback Crawl Identification

GLOSSARY OF TERMS:

Crawl -- Tracks and other sign left on a beach by a sea turtle.
False crawl -- A crawl resulting from an abandoned nesting attempt (a non-nesting crawl).
Nest -- A crawl resulting from a nesting attempt in which eggs were deposited.
Egg chamber -- The cavity excavated by the rear flippers of a nesting turtle into which the turtle deposits a clutch of eggs.
Primary body pit -- The excavation made by a turtle on the beach just prior to digging the egg chamber.
Backstop -- An approximately 45° incline made in the sand as sand is pushed back with the rear flippers during the excavation of the primary body pit. Such a steeply inclined backstop is not present in the secondary body pit.
Secondary body pit -- An excavation made by a nesting turtle using the front flippers following the deposition of eggs. The spoil from the secondary body pit covers the primary body pit and the egg chamber with sand.
Escarpment -- The perimeter of the secondary body pit where the front flippers have cut away a small cliff into the surrounding sand.

CRAWL IDENTIFICATION:

I. **What species made the crawl?**

A. Track appearance as in Figure 1, tracks from a sea turtle with alternating limb movement, no tail drag mark, and track width approximately 25 inches: **loggerhead turtle**.

B. Track appearance as in Figure 2, tracks from a sea turtle with simultaneous limb movement, a center drag mark from the tail, and track width approximately 35 inches: **green turtle**.

C. Track appearance as in Figure 3, tracks from a sea turtle with simultaneous limb movement, a center drag mark from the tail, and track width approximately 45 inches or more; track path often circling or sinusoidal (Sshaped): **leatherback turtle**.

D. Track appearance as in Figure 4, tracks from a sea turtle typically with no conspicuous tail-drag mark, track width between 27.6 to 31.5 inches and alternating gait, similar to loggerheads. Kemp's ridleys are predominantly daytime nesters; thus if a nesting turtle is encountered during the daytime, be sure to look at it closely and take pictures to confirm the species. Kemp's ridleys also pack the sand down by rocking their bodies from side to side during nest covering unlike the other species that use their rear flippers to "knead" sand to compact it.

Note: Flipper injuries to turtles may influence track sign. Characteristics of the nest (given below) should be used in conjunction with track characteristics to identify species.

Figure 1. Loggerhead track

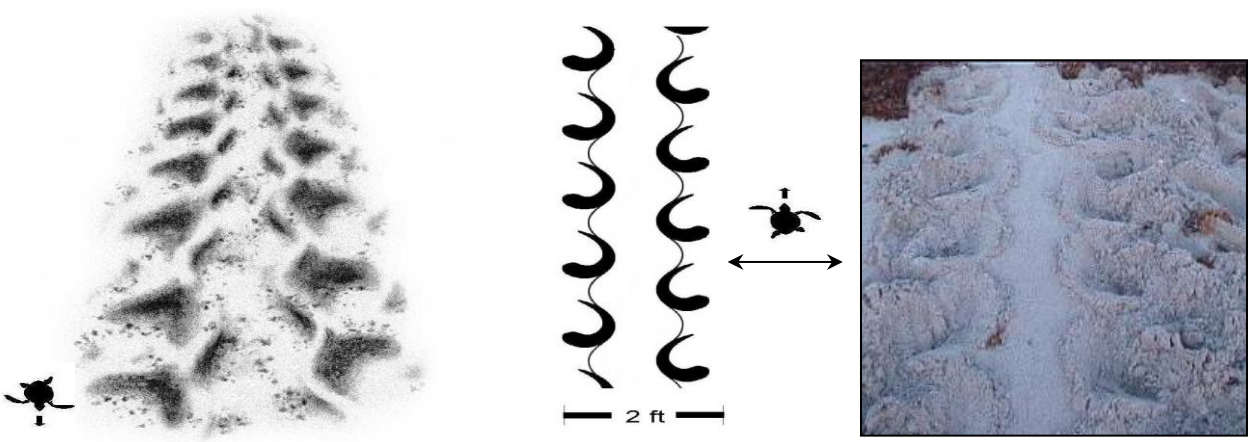


Figure 2. Green turtle track

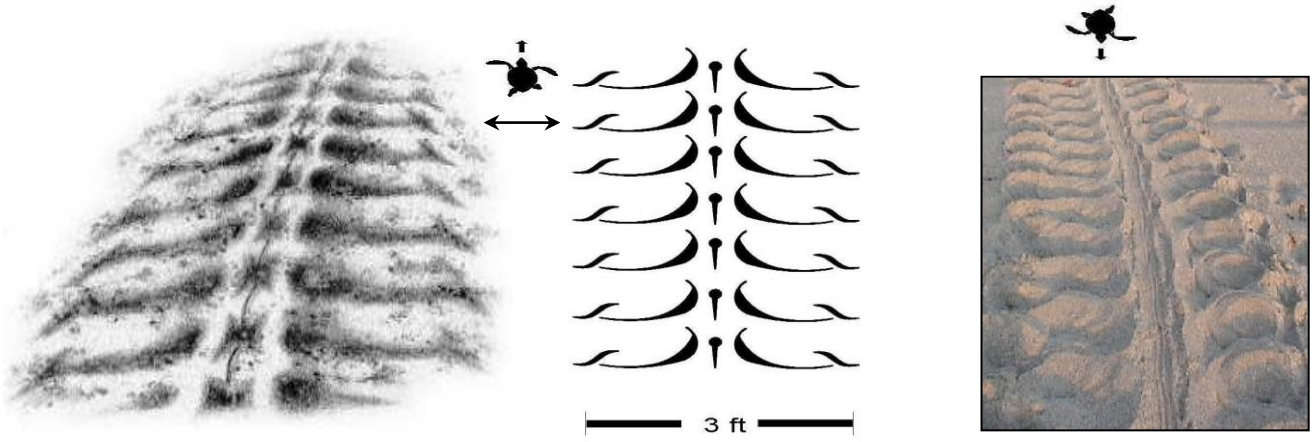


Figure 3. Leatherback track

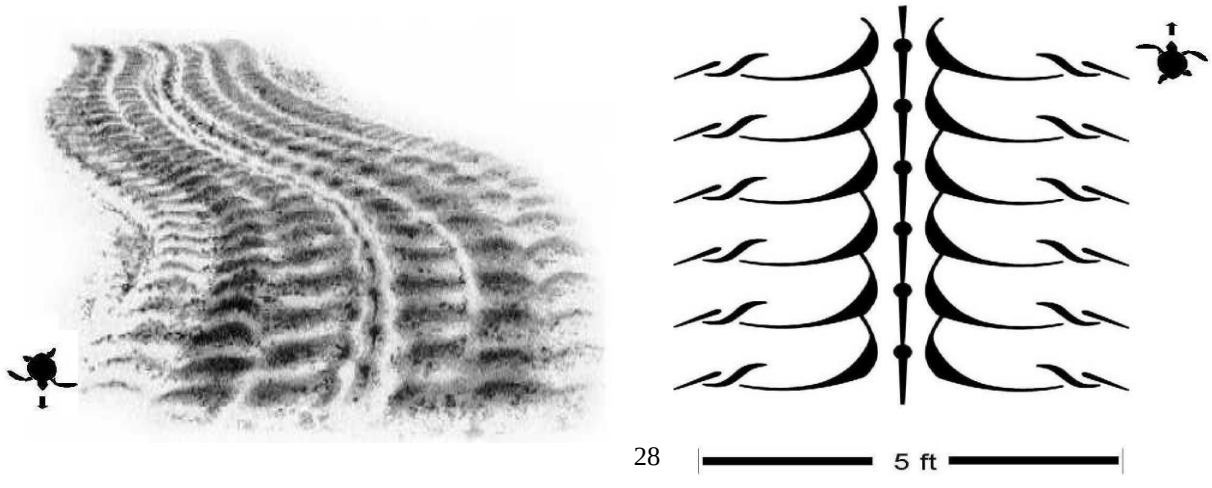
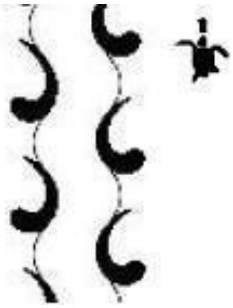


Figure 4. Kemp's ridley crawl



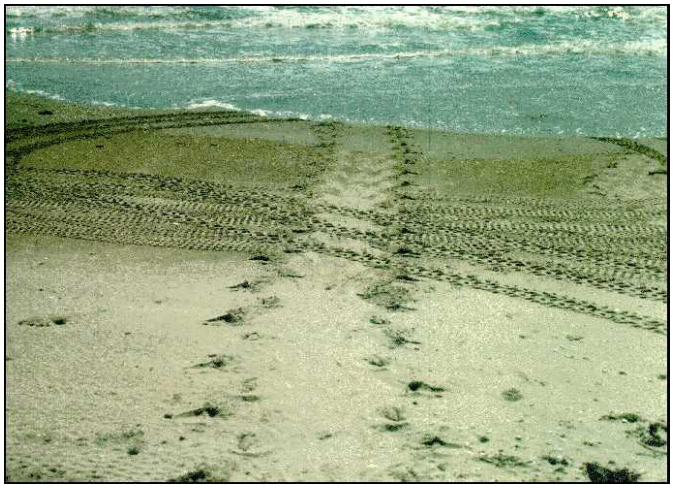


Photo courtesy of Donna Shaver

II. **If the crawl is from a loggerhead, is it a nest or a false crawl?**

A. Identify emerging and returning tracks by their direction (Figure 5). As a loggerhead crawls, it will push sand backward with each flipper stroke.

B. Follow the path taken by the turtle and look for the following attributes.

1. Evidence of front flipper covering (Figure 6-9). If present, the crawl is a **NEST**.
    a. Secondary body pit and/or escarpment.
    b. Sand "misted" or "thrown" over the emerging track.
2. Evidence of an abandoned nesting attempt. If present, the crawl is a **FALSE CRAWL**.
    a. Very little or no sand disturbed other than tracks.
    b. Back stop with sand pushed back (not thrown) over emerging crawl, typically between two ridges of sand piled by the front flippers during construction of the primary body pit.
    c. Considerable sand disturbed from a digging effort, but with the crawl exiting the disturbed area and continuing toward the dune before turning toward the ocean.
    d. Considerable sand disturbed from a digging effort, but with a smooth-walled or collapsing egg chamber (8-10 inches in diameter) in the center of a pit within the disturbed area.

Figure 5. A **loggerhead nest** site showing a secondary body pit (A), a mound of thrown sand that is wider than the track and the larger primary body pit (B).

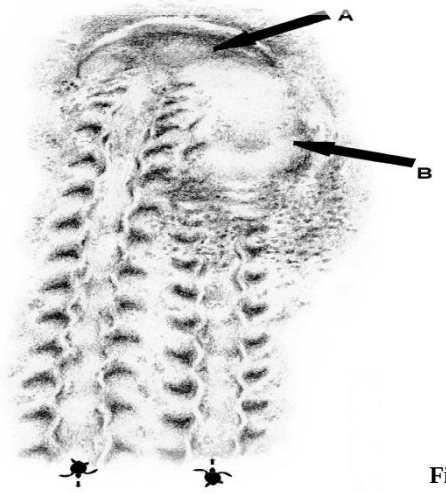


Figure 6. A **loggerhead false crawl** showing no evidence of disturbed sand other than the track.

Figure 7. A **loggerhead false crawl** showing a small abandoned primary body pit (C) and a mound of pushed sand (D) no wider than the track and lying between two conspicuous ridges.

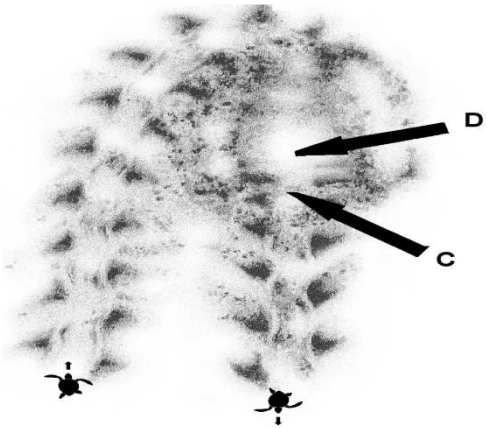


Figure 8. A **loggerhead false crawl** showing an abandoned primary body pit (C) and a mound of pushed sand (D) no wider than the track and lying between two conspicuous ridges. As is rarely found in nests, a track continues up the beach from the site where the turtle's last digging occurred.

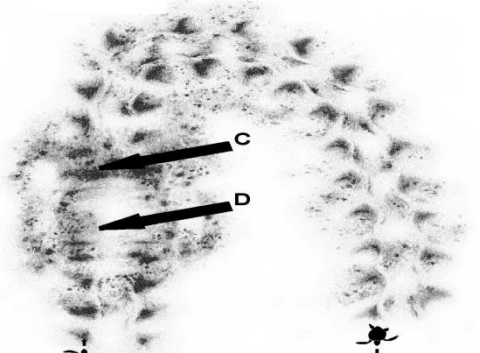
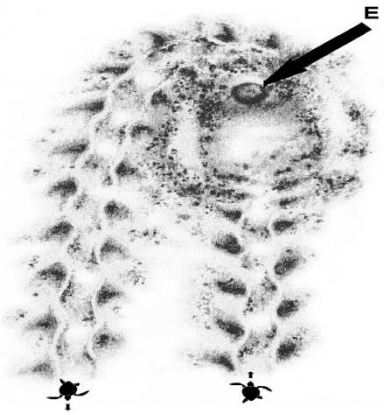


Figure 9. A **loggerhead false crawl** showing a primary body pit with an abandoned egg cavity (E).



III. **If the crawl is from a green turtle, is it a nest or a false crawl?**

A. Identify emerging and returning tracks by their direction (Figure 10). As a green turtle crawls, it will push sand backward with each flipper stroke.

B. Follow the path taken by the turtle and look for the following attributes.

1. Evidence of front flipper covering. If present, the crawl is a **NEST**.
   a. Sand thrown into a mound that is more than twice as long as the visible body pit or a deep (1-2 foot) secondary body pit with an escarpment (Figure 10).
2. Evidence of an abandoned nesting attempt. If present, the crawl is a **FALSE CRAWL**.
   a. Very little or no sand disturbed other than tracks.
   b. Less sand thrown over the emerging track and a shallower body pit than in 1a above (Figure 11).

Figure 10. A **green turtle nest** site on an open beach showing a secondary body pit (A) and a mound of thrown sand (B) that is greater than twice as long as the visible secondary body pit. Note that smaller nest mounds are expected when obstacles or vegetation impede digging.

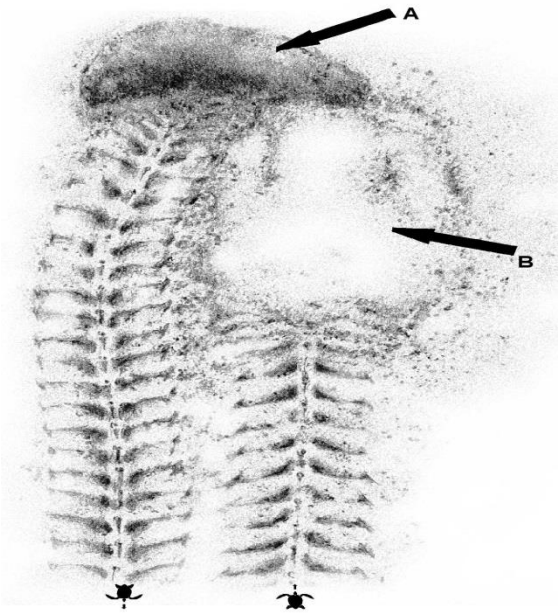
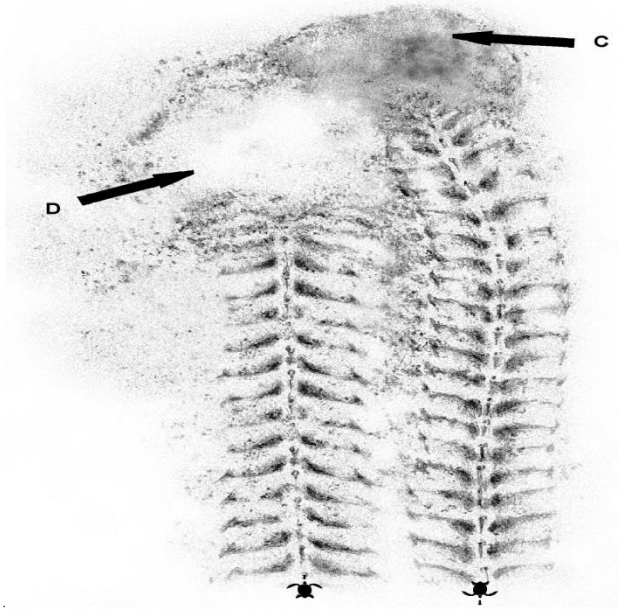


Figure 11. A green turtle false crawl on an open beach showing an abandoned primary body pit (C) and a mound of thrown sand (D) that is smaller than twice as long as the visible primary body pit. Note that many green turtle nests may have body pits and nest mounds that look similar to this.



IV. **If the crawl is from a leatherback turtle, is it a nest or a false crawl?**

A. If the crawl consists of a large expanse of beach (10x15 feet to 15x25 feet, sometimes greater) having extensive sand thrown and often in multiple directions, the crawl is a **NEST**.

B. If the crawl is less extensive than in A and has little evidence of thrown sand, the crawl is a **FALSE CRAWL**.

Note: The extent of the excavations described for all species above will be influenced by sand type, vegetation, and other objects encountered by turtles while digging. There is some variation in the behavior of turtles, and the above guidelines will not lead to a correct determination in every case. They are offered solely to help you with the task of determining whether a nest has been made.

APPENDIX V

Construction and Placement of Predator-proof Nest Cages

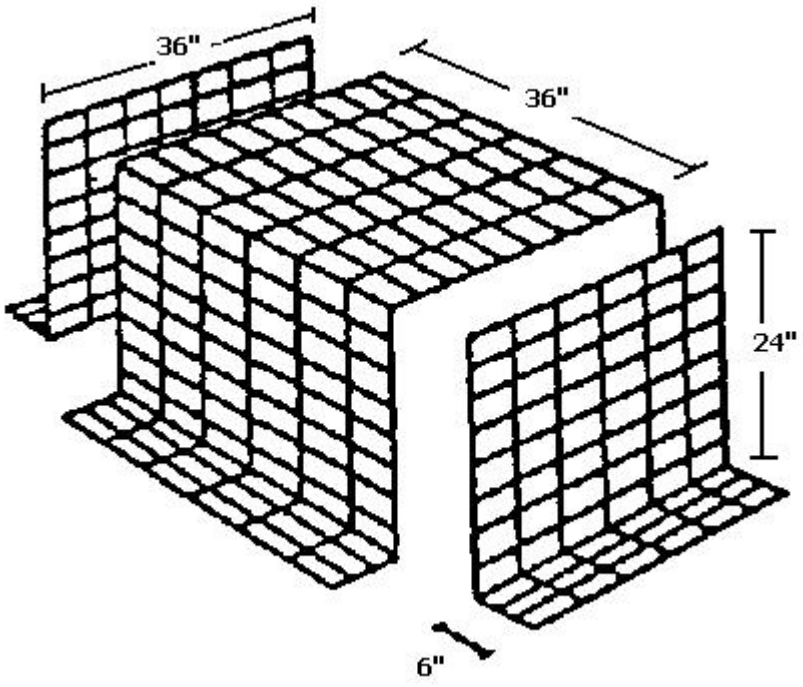
When a nest is at high risk of predation and flat a piece of screening is not enough of a deterrent to keep predators such as foxes, pigs and coyotes from digging into the nest, the eggs and pre-emergent hatchlings may be protected by placing a self-releasing cage over the nest (Figure 1). The cages should provide enough room for all hatchlings to completely emerge from the sand and be made of 2 in. x 4 in. mesh fencing (welded wire or some other strong bendable material). The 4" width of the mesh must be parallel to the surface of the sand.

Methods and Placement

Cut one piece of 36 in. x 96 in. and two pieces of 30 in. x 36 in. welded wire fencing. Shape the fencing pieces to create the cage and flanges as shown in Figure 1. Use plastic zip ties to attach the two short side pieces to the long piece that forms the top and two sides.

Cages are to be centered exactly over the egg chamber to make it less likely that mammalian predators will burrow to the eggs from the side of the cage, and to make sure that any anchoring stakes placed along the edges of the cage will not enter the egg chamber. Most cages are anchored by burying the outward pointing flanges (Figure 1) about one foot under the sand's surface. Center the cage over the egg chamber and trace the edges of the cage in the sand. The cage should be oriented so that the opposing sides of the cage are either parallel or perpendicular to the shoreline. Remove the cage and the temporary egg chamber marker, and carefully dig a one foot deep trench along the tracing of the edges of the cage. Place the cage into the trench and fill the trench with sand. When completed, the sand around the cage and over the egg chamber should be at the original level. Because cages may become partially or completely dislodged, they must be checked regularly.

Figure 1. Example of a self-releasing cage. The cage is constructed of 2" x 4" welded wire fencing. Hatchlings are able to escape through the mesh of the wire. Cage design courtesy of The Conservancy of Southwest Florida.



SEA TURTLE NEST PROTECTION PROCEDURES

Sea turtle nests may need to be protected if raccoon or fox predation is likely. Below are two methods for protecting nests from mammalian predators.

WIRE SCREENS

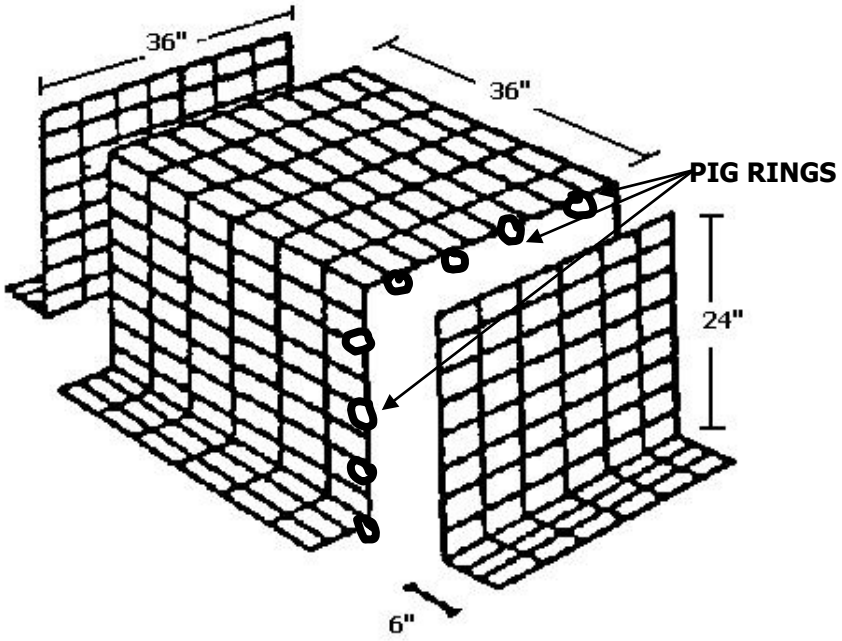
The use of wire screening has been effective with raccoons or other non-tunneling predators. The advantage is that there is little disturbance to the nest and incubation and hatchling emergence is not affected if the proper wire and methods are used. Use a one-yard square piece of welded, 2 in. by 4 in. mesh and anchor it with notched stakes over the nest. The 4-inch side of the wire opening should be parallel with the water line. Covering the wire with sand will hide it from passers-by and predators.

SELF-RELEASING SEA TURTLE NEST CAGES

When a nest is at high risk of predation by foxes, or other predators capable of tunneling into nests from the side, the eggs and pre-emergent hatchlings may be protected by placing a self-releasing cage over the nest. In all self-releasing cages, the 2" X 4" mesh of the cage must be oriented so that the 4" opening is parallel to the surface of the sand. Cages are to be centered exactly over the egg chamber to make it less likely that mammalian predators will burrow to the eggs from the side of the cage, and to make sure that any anchoring stakes placed along the edges of the cage will not enter the egg chamber.

Self-releasing cages are anchored by burying the outward pointing flanges about one foot under the sand's surface. Center the cage over the egg chamber and trace the edges of the cage in the sand. The cage should be oriented so that the opposing sides of the cage are either parallel or perpendicular to the shoreline. Remove the cage and the temporary egg chamber marker, and carefully dig a one-foot deep trench along the tracing of the edges of the cage. Place the cage into the trench and fill the trench with sand. When completed, the sand around the cage and over the egg chamber should be at the original level. If stakes are used to secure a cage, drive the stakes at an angle away from the egg chamber. Because cages may become partially or completely dislodged, they must be checked regularly. Self-releasing cages should be checked each morning during the period of anticipated hatching, just in case some hatchlings have become trapped. Please remove all cages from the beach after hatchling emergence is completed.

Figure 1. Example of a self-releasing cage. The cage is constructed of 2" x 4" welded utility wire. Hatchlings are able to escape through the mesh of the wire. Cage design courtesy of The Conservancy of Southwest Florida.



WHAT ARE LIGHTING INSPECTIONS?

During a lighting inspection, a complete census is made of the number, types, locations, and custodians of artificial light sources that emit light visible from the beach. The goal of lighting inspections is to locate lighting problems and to identify the property owner, manager, caretaker, or tenant who can modify the lighting or turn it off.

WHICH LIGHTS CAUSE PROBLEMS?

Although the attributes that can make a light source harmful to sea turtles are complex, a simple rule has proven to be useful in identifying problem lighting under a variety of conditions:

An artificial light source is likely to cause problems for sea turtles if light from the source can be seen by an observer standing anywhere on the nesting beach.

If light can be seen by an observer on the beach, then the light is reaching the beach and can affect sea turtles. If any glowing portion of a luminaire (including the lamp, globe, or reflector) is directly visible from the beach, then this source is likely to be a problem for sea turtles. But light may also reach the beach indirectly by reflecting off buildings or trees that are visible from the beach. Bright or numerous sources, especially those directed upward, will illuminate sea mist and low clouds, creating a distinct glow visible from the beach. This "urban skyglow" is common over brightly lighted areas. Although some indirect lighting may be perceived as nonpoint-source light pollution, contributing light sources can be readily identified and include sources that are poorly directed or are directed upward. Indirect lighting can originate far from the beach.

Although most of the light that sea turtles can detect can also be seen by humans, observers should realize that some sources, particularly those emitting near-ultraviolet and violet light (e.g., bug-zapper lights, white electric-discharge lighting) will appear brighter to sea turtles than to humans. A human is also considerably taller than a hatchling; however, an observer on the dry beach who crouches to the level of a hatchling may miss some lighting that will affect turtles. Because of the way that some lights are partially hidden by the dune, a standing observer is more likely to see light that is visible to hatchlings and nesting turtles in the swash zone.

HOW SHOULD LIGHTING INSPECTIONS BE CONDUCTED?

Lighting inspections to identify problem light sources may be conducted either under the purview of a lighting ordinance or independently. In either case, goals and methods should be similar.

GATHER BACKGROUND INFORMATION

Before walking the beach in search of lighting, it is important to identify the boundaries of the area to be inspected. For inspections that are part of lighting ordinance enforcement efforts, the jurisdictional boundaries of the sponsoring local government should be determined. It will help to have a list that includes the name, owner, and address of each property within inspection area

so that custodians of problem lighting can be identified. Plat maps or aerial photographs will help surveyors orient themselves on heavily developed beaches.

PRELIMINARY DAYTIME INSPECTIONS

An advantage to conducting lighting inspections during the day is that surveyors will be better able to judge their exact location than they would be able to at night. Preliminary daytime inspections are especially important on beaches that have restricted access at night. Property owners are also more likely to be available during the day than at night to discuss strategies for dealing with problem lighting at their sites.

A disadvantage to daytime inspections is that fixtures that are not directly visible from the beach will be difficult to identify as problems. Moreover, some light sources that can be seen from the beach in daylight may be kept off at night and thus present no problems. For these reasons, daytime inspections are not a substitute for nighttime inspections. Descriptions of light sources identified during daytime inspections should be detailed enough so that anyone can locate the lighting. In addition to a general description of each luminaire (e.g., HPS floodlight directed seaward at top northeast corner of the building at 123 Ocean Street), photographs or sketches of the lighting may be necessary. Descriptions should also include an assessment of how the specific lighting problem can be resolved (e.g., needs turning off; should be redirected 90° to the east). These detailed descriptions will show property owners exactly which luminaries need what remedy.

NIGHTTIME INSPECTIONS

Surveyors orienting themselves on the beach at night will benefit from notes made during daytime surveys. During nighttime lighting inspections, a surveyor walks the length of the nesting beach looking for light from artificial sources. There are two general categories of artificial lighting that observers are likely to detect:

1. **Direct lighting**. A luminaire is considered to be direct lighting if some glowing element of the luminaire (e.g., the globe, lamp [bulb], reflector) is visible to an observer on the beach. A source not visible from one location may be visible from another farther down the beach. When direct lighting is observed, notes should be made of the number, lamp type (discernable by color), style of fixture, mounting (pole, porch, *etc.*), and location (street address, apartment number, or pole identification number) of the luminaire(s). If exact locations of problem sources were not determined during preliminary daytime surveys, this should be done during daylight soon after the nighttime survey. Photographing light sources (using long exposure times) is often helpful.

2. **Indirect lighting**. A luminaire is considered to be indirect lighting if it is not visible from the beach but illuminates an object (e.g., building, wall, tree) that is visible from the beach. Any object on the dune that appears to glow is probably being lighted by an indirect source. When possible, notes should be made of the number, lamp type, fixture style, and mounting of an indirect-lighting source. Minimally, notes should be taken that would allow a surveyor to find the lighting during a follow-up daytime inspection (for instance, which building wall is illuminated

and from what angle?).

WHEN SHOULD LIGHTING INSPECTIONS BE CONDUCTED?

Because problem lighting will be most visible on the darkest nights, lighting inspections are ideally conducted when there is no moon visible. Except for a few nights near the time of the full moon, each night of the month has periods when there is no moon visible. Early-evening lighting inspections (probably the time of night most convenient for inspectors) are best conducted during the period of two to 14 days following the full moon. Although most lighting problems will be visible on moonlit nights, some problems, especially those involving indirect lighting, will be difficult to detect on bright nights.

A set of daytime and nighttime lighting inspections before the nesting season and a minimum of three additional nighttime inspections during the nesting-hatching season are recommended. The first set of day and night inspections should take place just before nesting begins. The hope is that managers, tenants, and owners made aware of lighting problems will alter or replace lights before they can affect sea turtles. A follow-up nighttime lighting inspection should be made approximately two weeks after the first inspection so that remaining problems can be identified. During the nesting-hatching season, lighting problems that seemed to have been remedied may reappear because owners have been forgetful or because ownership has changed. For this reason, two midseason lighting inspections are recommended. The first of these should take place approximately two months after the beginning of the nesting season, which is about when hatchlings begin to emerge from nests. To verify that lighting problems have been resolved, another follow-up inspection should be conducted approximately one week after the first midseason inspection.

WHO SHOULD CONDUCT LIGHTING INSPECTIONS?

Although no specific authority is required to conduct lighting inspections, property managers, tenants, and owners are more likely to be receptive if the individual making recommendations represent a recognized conservation group, research consultant, or government agency. When local ordinances regulate beach lighting, local government code-enforcement agents should conduct lighting inspections and contact the public about resolving problems.

WHAT SHOULD BE DONE WITH INFORMATION FROM LIGHTING INSPECTIONS?

Although lighting surveys serve as a way for conservationists to assess the extent of lighting problems on a particular nesting beach, the principal goal of those conducting lighting inspections should be to ensure that lighting problems are resolved. To resolve lighting problems, property managers, tenants, and owners should be give the information they need to make proper alterations to light sources. This information should include details on the location and description of problem lights, as well as on how the lighting problem can be solved. One should also be prepared to discuss the details of how lighting affects sea turtles. Understanding the nature of the problem will motivate people more than simply being told what to do.

Lighting Survey Form

The lighting survey must be conducted to include a landward view from the seaward most extent of the beach profile. The survey must occur after 9 p.m. The survey must follow standard techniques for such a survey and include the number and type of visible lights, location of lights and photo documentation.

Date: _____

Location (name of beach): _____

Contact information of person conducting the lighting survey: _____

_____

Lighting ordinance or Light Management Plan: _____

Compliance Officer name and contact information: _____

Survey start time: _____

Survey end time: _____

Survey start location (include address or GPS location):_____

_____

_____

Survey end location (include address or GPS location): _____

_____

Date summarizing report sent to mike_drummond@fws.gov:_____

Contact information for follow up meeting with the FWS:

_____

For each light visible from the nesting beach provide the following information:

Location of light (include cross street and nearest beach access)	**GPS location of light**	**Description of light (type and location)**	**Photo take (YES/ NO)**	**Notification letter with recommendations sent? (YES/NO)**

Location of light (include cross street and nearest beach access)	GPS location of light	Description of light (type and location)	Photo take (YES/ NO)	Notification letter with recommendations sent? (YES/NO)

APPENDIX H: INTEGRATED PEST MANAGEMENT PLAN

THE VIRGINIA ARMY NATIONAL GUARD

INTEGRATED PEST MANAGEMENT PLAN

FIELD MANUAL

JANUARY 2018

Table of Contents

1 Purpose

This IPMP is a framework that defines how pest management is accomplished by the VAARNG. This version is abridged from the October 2017 version approved by National Guard Bureau. A full version is available from the Integrated Pest Management Coordinator upon request. The plan identifies elements of the program to include health and environmental safety, pest identification, and pest management, as well as pesticide storage, transportation, use and disposal. This plan is used as a tool to reduce reliance on pesticides, to enhance environmental protection, and to maximize the use of IPM techniques.

2 Responsibilities

2.1 Integrated Pest Management Coordinator (IPMC)

2.1.1 Prepare and maintain the IPMP with 5-year revisions.

2.1.2 Annually review and update the IPMP as needed.

2.1.3 Ensure all pesticides are approved by the ARNG PMC prior to their use at VAARNG Federally-owned (Appendix A) sites and all pesticide used at VAARNG sites are listed on the VAARNG State Pesticide Use List (SPUL) (Appendix C).

2.1.4 Coordinate with personnel conducting pest surveillance and/or control to ensure all applicable information is recorded and reported as required by National Guard Bureau.

2.1.5 Function as a point of contact between those individuals who store and apply pesticides (e.g., facility management, pest control contractors) and activities or individuals who document or are impacted by pesticide usage at VAARNG sites (e.g., Environmental Office, Safety Office, Fire Department, and Industrial Hygienist).

2.1.6 Coordinate with the VAARNG Natural Resources Manager (NRM) about pest control actions in semi-improved or unimproved grounds where there may be endangered, threatened or sensitive animals (including insects) or plants.

2.1.7 Coordinate with the VAARNG Cultural Resources Manager (CRM) when pest control actions might impact native plants, potentially of interest to Indian tribes with which VAARNG consults, or might impact landscape areas or materials, or other resources with cultural significance, or might affect a building greater than 50 years old that may be eligible for listing in the National Register of Historic Places.

2.1.8 Coordinate with the VAARNG Directorate of Plans, Training, Mobilization and Security (DPTMS) for all pest management performed on training or maneuver land.

2.1.9 Coordinate with local health officials to determine the prevalence of disease vectors and other public health pests in the area surrounding VAARNG sites. Oversee surveillance at

VAARNG sites for known vectors for diseases such as West Nile, Dengue, Chikungunya and Zika viruses.

2.1.10 Coordinate with the State Surgeon for any necessary measures for control of disease vectors and other public health pests at VAARNG sites.

2.1.11 Oversee the technical aspects of the Self-Help Program (Appendix E) with respect to pest control products and training of program participants.

2.1.12 Monitor certification and continuing pest management training for pesticide applicators at VAARNG sites. Maintain copies of current certifications in Appendix K of this plan.

2.1.13 Coordinate with the CFMO to ensure that contracts including pest management activities at VAARNG Federally-owned (Appendix A) sites are forwarded to the ARNG PMC for technical sufficiency review prior to solicitation of the contract. For contracted pre-construction treatment of soil to control termites at Federally-owned VAARNG sites, ARNG PMC review and approval of the termite management section of contracts is not required if the contract language is in accordance with the current Unified Facilities Guide Specification for chemical termite control.

2.1.14 Ensure that pest management contracts at VAARNG Federally-owned (Appendix A) sites with efforts that exceed 0.25 work-years are monitored by a certified PMQAE.

2.1.15 Coordinate with local, state and federal agencies, as necessary, to conduct the VAARNG IPM program in accordance with federal, state, and local laws and regulations that apply to pest management, pesticide use, applicator certification, record-keeping, and reporting.

2.1.16 Provide answers to questions concerning pest management from Commanders, ARNG Directorate, Headquarter Department of Army (HQDA), and interested state agencies.

2.1.17 Perform design review of new construction and landscaping projects to ensure that pest entry points and potential harborage sites have been eliminated and that proper preconstruction termite treatment is included in project specifications.

2.1.18 Prepare, with assistance from a PMC certified in DOD Category 11: Aerial Application Pest Control, an Aerial Spray Statement of Need (ASSON) for any potential aerial application of pesticides to Federally-owned (Appendix A) VAARNG sites.

2.1.19 Obtain IPMC certification within two years of being appointed to the position and maintain certification with refresher training every three years.

2.2 Pest Management Quality Assurance Evaluator (PMQAE)

2.2.1 Monitor pest management contracts at VAARNG Federally-owned (Appendix A) sites when total efforts exceed 0.25 work-years for a single location.

2.2.2 Obtain PMQAE certification and maintain certification with refresher training every three years.

2.2.3 If a single location's pest management contract efforts are less than 0.25 work-years, the presence of a trained PMQAE at the installation is not mandatory.

2.3 Pest Management Provider (PMP)

2.3.1 Use IPM techniques to the maximum extent possible.

2.3.2 Maintain current DOD or Virginia Department of Agriculture & Consumer Services, Office of Pesticide Services certification to apply pesticides in the category of pest control for work being initiated at Federally-owned VAARNG (Appendix A) sites and comply with all state and federal regulations. Non-restricted use pesticides may be applied by Registered Technicians at State properties (those not in Appendix A) without use of the Self-Help program. All others must use the Self-Help program (Appendix E). Send a copy of all certifications to the IPMC annually.

2.3.3 Control pests according to the provisions of this plan, in accordance with state and local laws and regulations, and DOD, Army and ARNG instructions, regulations and policies (DODI 4150.07, AR 200-1, ARNG Integrated Pest Management Program Policy Memorandum).

2.3.4 Conduct surveillance for mosquitoes, ticks, bed bugs, cockroaches, or other pests that could adversely affect the health and welfare of installation personnel.

2.3.5 Operate in a manner that minimizes risk to personnel and the environment.

2.3.6 When using pesticides, always read and follow the label. The label is the law.

2.3.7 Keep records of all pest surveillance and control efforts using the Pesticide Management Treatment Record and provide reports to the IPMC by the end of each month.

2.3.8 Maintain effective liaison with county, state, and federal health and environmental officials, as necessary.

2.4 Pest Management Contractors

2.4.1 Use IPM and conduct pest management in accordance with this plan, including ARNG PMC contract pre-approval of pesticides applied at VAARNG Federally-owned (Appendix A) sites.

2.4.2 Comply with all federal, state, and local laws and regulations.

2.4.3 When using pesticides, always read and follow the label. The label is the law.

2.4.4 Submit written records of all pest management activities to the Contract POC using the Pesticide Management Treatment Record (Appendix D) within one week of application.

2.5 Fort Pickett Department of Public Works (DPW) and CFMO Operations and Maintenance (O&M)

2.5.1 Determine the pest management requirements for the VAARNG sites and request appropriate funding to support contracted pest control operations.

2.5.2 Ensure that VAARNG personnel performing pest control as a part of their assigned duties receive adequate training in accordance with this plan, and achieve pest management certification, as required.

2.5.3 Ensure all pest management activities, including those that are part of the Self-Help Program, are recorded in accordance with this plan and reports are provided to the IPMC at intervals as specified in this plan. Maintain records of pest management operations as required.

2.5.4 Request and monitor contracted pest control operations.

2.5.5 Coordinate with the IPMC to ensure that contracts including pest management activities at VAARNG Federally-owned (Appendix A) sites are forwarded to the ARNG PMC for review for technical sufficiency prior to solicitation of the contract. For contracted pre-construction treatment of soil to control termites at VAARNG Federally-owned (Appendix A) sites, ARNG PMC review and approval of the termite management section of contracts is not required if the contract language is in accordance with the current Unified Facilities Guide Specification for chemical termite control.

2.5.6 Provide a copy of each finalized pest control contract to the IPMC.

2.5.7 Initiate requests for aerial application of pesticides, when necessary.

2.5.8 Stray animal control is coordinated and performed by the Fort Pickett Entomologist for requests within the installation using in-house personnel and through an agreement with local municipal animal control authorities. For animal control outside of Fort Pickett, contact local municipal animal control services.

2.6 Directorate of Plans, Training, Mobilization and Security (DPTMS)

2.6.1 Determine the pest management requirements for the VAARNG training and maneuver lands and request appropriate ITAM funding when pests are impeding training/maneuvers.

2.6.2 For management of pests that are not impeding training/maneuvers (e.g., hornet nests in bivouac areas, noxious/invasive weeds in maneuver areas, etc.), use all non-chemical pest control techniques as recommended in the IPM outlines (Appendix B) before requesting further assistance from DPW for in-house or contracted pest control.

2.6.3 Coordinate with the IPMC for any pest management activities occurring on VAARNG training and maneuver lands.

2.6.4 Ensure all pest management activities on training and maneuver lands, including those that are part of the Self-Help Program, are performed in accordance with this plan, including the records and reporting of pesticide usage.

2.6.5 Request and assist with the monitoring of contracted pest control operations.

2.6.6 Coordinate with the IPMC to ensure that contracts including pest management activities at Fort Pickett training and maneuver lands are forwarded to the ARNG PMC for review for technical sufficiency prior to solicitation of the contract.

2.6.7 Initiate requests for aerial application of pesticides to the IPMC no later than 12 months from the desired application date. Do not plan aerial spraying of defoliants or other pesticides within the northern long-eared bat active season.

2.7 Facility Managers and Maintenance Personnel

2.7.1 Apply good sanitary practices, landscape maintenance, and materials management to prevent pest infestations.

2.7.2 Use all non-chemical pest control techniques as recommended in the IPM outlines (Appendix B) before requesting further assistance from the O&M Office for in-house or contracted pest control.

2.7.3 Ensure all pest management activities, including those that are part of the Self-Help Program, are recorded in accordance with this plan and reports are provided to the IPMC at intervals specified in this plan.

2.7.4 Cooperate fully with pest management personnel in scheduling pest management operations, to include preparing the areas to be treated.

2.7.5 Have available on-site Safety Data Sheets (SDSs) for any pesticide stored or used on the premises.

2.8 Unit Commanders

2.8.1 Assure the proper use of the DOD Arthropod Repellent System and other personal protective measures while troops are exposed to potential disease vectors such as mosquitoes and ticks.

2.8.2 Brief troops on potential biological threats (such as poison ivy) before training exercises.

2.8.3 Appoint a field sanitation team for each company, troop, or battery-size unit. Assure that field sanitation teams are trained at resident courses, supplied, and mission capable prior to deployment to training areas.

2.9 Building Occupants

2.9.1 Apply good sanitary practices to prevent pest infestations. Areas need to be free of open food containers. Don't accumulate pest harborage materials such as empty boxes or dunnage.

2.9.2 Cooperate fully with contractors and billeting personnel in scheduling pest management operations, to include preparing the areas to be treated.

2.9.3 Report all pest management issues to the Maneuver Training Center (MTC) Fort Pickett Entomologist while on the installation and the appropriate Regional Armory Maintenance Manager for other facilities.

2.10 Self-Help Program Participants (generally maintenance workers, but Self-Help is available to all VAARNG members and employees)

2.10.1 Keep all areas clean, dry, and sanitary. Areas need to be free of open food containers. Don't accumulate pest harborage materials such as empty boxes or dunnage.

2.10.2 Determine if Self-Help is allowed for the pest problem using the IPM outlines in Appendix B.

2.10.3 If Self-Help is appropriate, follow the requirements found in Appendix E covering the Self-Help Program. Only pesticides that are pre-approved for Self-Help Program use and listed as such on the VAARNG SPUL (Appendix C) are allowed. All training, recording, reporting, handling and storage of pesticides must be done as specified under the Self-Help Program and in accordance with the pesticide label.

2.10.4 If Self-Help is not appropriate for the pest or level of the pest problem, fill out a work-order requesting assistance with your pest problem and submit it to the Facility Manager.

2.10.5 When using pesticides as part of the Self-Help Program, always read and follow the label. The label is the law.

3 Integrated Pest Management Operations

3.1 The four basic principles of IPM work together to provide long term control of pest populations at acceptable levels with the least detrimental impact on the environment. Although the use of the least-toxic pesticide is an integral part of IPM, non-chemical control is emphasized. Use of pesticides is almost always a temporary measure and often more expensive if used regularly. Non-chemical control may initially be more expensive, but will usually be more cost effective long-term with ongoing pest management. Non-chemical controls have the added advantage of being less toxic which reduces the potential risk to human health and the

environment. Surveillance and monitoring of pests are stressed in an IPM program since it is important to determine the cause of the pest infestation and the most effective management of the problem. Insect and vertebrate pests require food, water, and harborage (a place to rest or breed). Long term control is dependent upon eliminating or restricting pests' access to these requirements.

3.2 Mechanical and Physical Control: This type of control alters the environment where pests live, excludes pests, or traps and removes pests where they are not wanted. Examples of mechanical and physical control include: harborage elimination in structures through caulking or filling voids, screening, mechanical traps or glue boards, and nets and other barriers to prevent entry into buildings.

3.3 Cultural Control: Strategies in this method involve manipulating environmental conditions to suppress or eliminate pests. For example, judicious sanitation at dining facilities reduces the attractiveness of the area to flocks of birds that may cause increased air strike hazard. Replacing ornamental trees and shrubbery with native plants that are less attractive to defoliating pests is another cultural measure.

3.4 Biological Control: In this control strategy, predators, parasites or disease organisms are used to control pest populations. For example, the introduction of ragwort flea beetle, and the cinnabar moth have dramatically reduced the prevalence of tansy ragwort. Release of these biological controls in infested areas can eliminate tansy ragwort at that location. Introduction of new biological controls is the responsibility of the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine, Biological Control Program.

3.5 Chemical Control: Pesticides kill living organisms, whether they are plants, insects or other animals. At one time, pesticides were considered to be the most effective control available, but pesticide resistance has rendered many ineffective. In recent years, the trend has been to use pesticides that have limited residual action. While reducing human exposure and lessening environmental impact, the cost has risen due to requirements for more frequent application. Since personal protection and special handling and storage requirements are necessary with the use of pesticides, the overall cost of control can be quite high when compared with non-chemical control methods. However, the use of chemicals may be warranted to control some pests and invasive species when other control methods are not sufficiently effective.

4 Health and Safety

4.1 Medical Surveillance of Pest Management Personnel

Pesticide applicators must read and follow all health and safety information on the label. If applying pesticides requires formal medical surveillance or respirators, VAARNG personnel must work with the VAARNG Safety Office to initiate medical surveillance physical exams, as appropriate. Contractors performing pest management services are responsible for their own medical surveillance program.

4.2 Hazard Communication

Safety Data Sheets (SDSs) for pesticides used are made available to all individuals who have contact with these chemicals. Hazard Communication (HAZCOM) training is mandatory for individuals working with hazardous materials, including pesticides.

4.3 Personal Protective Equipment

4.3.1 Personal Protective Equipment (PPE) as specified on the pesticide's label is provided to pest management personnel by the Safety Office. Submit purchase order requests when supplies of PPE become low.

4.3.2 Appropriate respiratory protection (High-Efficiency Particulate Air (HEPA) filter cartridges) should be used when working in enclosed areas infested with rodents and rodent waste, as well as additional measures like disposable gloves and the use of disinfectants. Rodent waste is associated with Hantavirus and Hantavirus pulmonary syndrome.

4.4 Fire Protection

The usual hazards presented by a fire are compounded in the case of a pesticide fire by the danger of pesticide poisoning and contamination. Fire protection of pesticides will be governed by the label and the VAARNG Hazardous Material, Waste and/or Spill Management Plans.

4.5 Pest Management Vehicle(s)

Whenever possible, designate a single vehicle to transport and apply pesticides. Large quantities of pesticides that meet thresholds for placarding must be transported in approved vehicles by appropriately licensed drivers. Pesticides are never transported in the cabs of vehicles, in personally-owned vehicles, or in vehicles generally used for non-pesticide related activities unless the pesticides are being used in the Self-Help program and constitute a small quantity with no human health risks for transportation. Whenever possible, pesticides are transported in a lockable storage compartment of an assigned vehicle. In addition, care is taken to secure pesticides to prevent damage to the containers and spillage of the chemicals. At no time are pesticides to be left unsecured in an unattended vehicle at an unsecure location.

4.6 Protection of the Public

Take precautions during pesticide application to protect the public, on and off VAARNG sites. Follow all precautions listed on the label. Pesticides are not applied outdoors when the wind speed exceeds label-specified levels. Whenever pesticides are applied outdoors, ensure that any drift is kept away from individuals, including the applicator. At no time are personnel permitted in a treatment area during pesticide application unless they are appropriately trained, have met the medical monitoring standards, and are protected in accordance with the pesticide label requirements.

4.7 Pesticide Shop Health, Safety, and Hazards

4.7.1 Personnel will follow all label precautions that deal with the storage of pesticides. Pesticides should be kept secure at all times. Pesticides should be under the applier's direct control or located in a secure locked facility or cabinet that is marked "Pesticide Storage" and posted with applicable "Danger", "Poison" and/or "Flammable" signs. Pesticides are a hazardous material and should be stored according to the SDS.

More information on pesticide storage can be found in the Armed Forces Pest Management Board (AFPMB) Technical Guide No. 17, "Design of Pest Management Facilities". This technical guide can be found on the AFPMB website (go to: http://www.acq.osd.mil/eie/afpmb/ search for "AFPMB") or obtained from the ARNG PMC.

4.7.2 Used pesticide aerosol cans must be turned-in to the Hazardous Waste Program Manager as hazardous waste. Other pesticide containers must be disposed of according to the label directions or turned-in as hazardous waste.

5 Environmental Considerations

5.1 Sensitive Areas

5.1.1 Special consideration is given prior to conducting pest control operations in sensitive areas that are identified on pesticide labels. No pesticides are applied directly to wetlands or water areas (lakes, rivers, etc.) unless their use is specifically approved on the label and in compliance with National Pollutant Discharge Elimination System (NPDES) regulations for application over or into waters of the United States. Separate NPDES permitting may be required in some instances and will require coordination with the VAARNG Environmental Office personnel.

5.1.2 In addition to aquatic and marine habitats, sensitive areas also include critical habitat of endangered, threatened, or rare flora or fauna species, and unique geological and other natural features.

5.1.3 All aerial application of pesticides to Federally-owned (Appendix A) VAARNG sites requires an Aerial Spray Statement of Need (ASSON) that has been approved by the ARNG PMC. The ASSON is prepared by VAARNG personnel with assistance from a PMC certified in DOD Category 11: Aerial Application Pest Control. Aerial application of pesticides to Federally-owned (Appendix A) VAARNG sites also requires additional environmental documentation.

5.2 Endangered or Protected Species and Critical Habitats

5.2.1 Protected migratory birds that occur on VAARNG property cannot be controlled without a permit. Migratory birds and their nests are protected. Neither migratory birds nor their eggs may be harmed. Birds may be scared or herded to encourage them to move (unless the birds are otherwise protected under separate authority such as the ESA). Nuisance nests may be destroyed

(not collected) before eggs are laid or after chicks have fledged unless protected under the ESA or the Bald and Golden Eagle Protection Act (BGEPA).

5.2.2 The IPMC periodically reviews, with assistance from the VAARNG Natural Resources Manager (NRM), ongoing pest control operations and also evaluates all new pest management operations to ensure compliance with the ESA, Migratory Bird Treaty Act, the BGEPA and state wildlife regulations. No pest management operations are conducted that are likely to have a negative impact on endangered or protected species or their habitats without prior approval from the ARNG PMC. Special consideration must be given when using pest management tactics in areas where endangered species and/or nesting/roosting eagles are found. Refer to the Fort Pickett and Camp Pendleton-specific Integrated Natural Resources Management Plans (INRMP) for special environmental concerns pertaining to endangered species and coordinate with the VAARNG NRM before performing any pest management operations that might affect endangered or protected species or their habitats.

5.2.3 Coordinate with the VAARNG NRM regarding pest control operations that could affect pollinators (such as insecticides or herbicides that kill flowering plants). All efforts should be made to reduce the use of pesticides that may affect pollinators. If pesticides must be used, apply the lowest toxicity pesticide available and apply pesticides at times of day and/or season when pesticide use will have the least impact on pollinators, but achieve pest contract objectives.

5.3 Cultural and Historical Sites

All IPM activities must be in accordance with the VAARNG Integrated Cultural Resources Management Plan (ICRMP). In case of an inadvertent discovery of cultural materials, follow the procedures and notifications specified in the ICRMP immediately upon discovering cultural materials, as set forth in the ICRMP Standard Operating Procedure No. 5 for Inadvertent Discovery of Cultural Materials. Prior to beginning pest control operations, the VAARNG Cultural Resources Manager will review any necessary ground disturbance or work requiring alteration of a building eligible for the National Register of Historic Places, or actions that might impact culturally significant landscape areas and materials. Sufficient time must be allowed to coordinate with the Cultural Resources Program in advance of implementing pest controls, as consultation outside VAARNG might be required.

5.5 Pesticide Spills and Remediation

An adequate pesticide spill cleanup kit is maintained wherever bulk pesticides are stored or used. All pesticide spills are reported to the VAARNG Hazardous Waste Program Manager. Spills are governed by the label and the VAARNG Hazardous Material, Waste and/or Spill Management Plans.

6 Program Administration

6.1 Pest Management Operations

6.1.1 Pest management operations are conducted in accordance with Appendix B, “Integrated Pest Management (IPM) Outlines”.

6.1.2 If the pest problem cannot be solved using the Self-Help Program (see Appendix E), then a request for pest control is sent to the Facility Manager or Department of Public Works.

6.1.3 All pesticides used at VAARNG sites will be approved prior to use by the ARNG PMC and listed on the VAARNG SPUL (Appendix C).

6.2 Pest Management Contracts and Contract Quality Assurance

6.2.1 VAARNG site personnel may use contracts when essential pest management services are not provided in-house. Contracts are administered in accordance with DODI 4150.07 for VAARNG Federally-owned (Appendix A) sites. The requesting office will contact the IPMC for guidance for any contracts that include pest management.

6.2.2 Pest management contracts for VAARNG Federally-owned (Appendix A) sites are forwarded to the ARNG PMC for technical sufficiency review prior to advertisement of the contract. For contracted pre-construction treatment of soil to control termites, PMC review and approval of the termite management section of contracts is not required for VAARNG Federally-owned sites if the contract language is in accordance with the current Unified Facilities Guide Specification for chemical termite control.

6.2.3 State contracting procedures and regulations are utilized to contract pest control on VAARNG State-owned sites.

6.2.4 Pest management contracts are initiated on an "as needed" basis. Regularly scheduled, monthly or periodic treatments will be eliminated unless deemed necessary after surveying and monitoring pest population levels. Regularly scheduled monthly or periodic treatments at VAARNG Federally-owned (Appendix A) sites must be approved by the ARNG PMC. Use of IPM techniques is encouraged in all contracts to decrease DOD’s use of toxic chemicals and pollutants. Pest problems threatening the health, safety, or welfare of installation personnel receive priority.

6.2.5 Contractors will conduct pest management in accordance with this plan and may only apply pesticides listed on the VAARNG SPUL at VAARNG sites. Contractors may request addition of pesticides to the VAARNG SPUL via the IPMC.

6.2.6 Once a contract is awarded, it is the responsibility of the originating office to establish a date and time for work to commence.

6.2.7 The IPMC is responsible for ensuring the requirements of this plan are implemented for contracted pest management and for assuring the quality of all pest management activities via the Facility Managers. Work performed by contracted pest management personnel is evaluated based on the adherence to the contract statement of work negotiated through the originating office, the requirements outlined in this plan, and the Facility Manager’s review of contracted

pest control work to determine the effectiveness of control efforts. Failure of a contractor to adequately control pests is reported to the IPMC. Ongoing contracts are evaluated annually or as necessary. An evaluation to confirm the satisfactory completion of all work is performed prior to payment being made.

6.3 Reports and Records

6.3.1 The VAARNG IPMC is responsible for the maintenance of pesticide use records for all in-house and contracted pest management operations.

6.3.2 Records of pesticide applicator certification must be retained by the applicator and available for review. Current in-house pesticide applicator records are provided to the IPMC.

6.3.3 All pest surveillance and control operations are recorded by the pesticide applicator or pest management provider (PMP). This includes pest management actions done in-house, by contractors, Self-Help Program participants, and as part of land management and forestry programs. These records must contain at a minimum:

a. Date and time of pesticide application
b. Target pest(s)
c. Specific pesticide application location(s)
d. Name of the person (and company, if contractor) applying the pesticide and their certification number (if applicable)
e. Name and manufacturer of pesticide
f. EPA registration number of the pesticide
g. Sufficient information to determine the amount (in pounds) of pesticide active ingredient applied (such as amount of undiluted pesticide used, total amount of concentrate used, or amount of diluted pesticide applied, and the dilution rate)

6.3.4 Pest surveillance and control operations are recorded using the Pest Management Maintenance Record (DD Form 1532-1), the VAARNG Pesticide Management Treatment Record (Appendix D) or an equivalent hard-copy or electronic form. These records are maintained indefinitely at the Natural Resources Entomology Office on Fort Pickett or by Regional Operations and Maintenance Manager Offices at Readiness Centers and are a permanent record of pest management activities.

6.3.5 Reports of pesticides used at VAARNG sites are compiled at the end of each fiscal year by the IPMC to compute total pounds of active ingredients used. PMPs provide reports to their respective Facility Manager to assemble the state-wide data for future reports. Facility Managers will forward all application reports from Contractors or PMPs for their properties to the IPMC at the end of each calendar month.

6.3.6 The IPMC calculates and provides the data required for the annual Plan Update Form (PUF). All pesticide usage will be reported in pounds of active ingredient (PAI) yearly via the PUF, or when requested by the ARNG PMC. The PUF is sent to the ARNG PMC. Only pest-management activities performed at VAARNG Federally-owned sites (Appendix A) are reported on the PUF.

6.3.7 For pest management activities at VAARNG State-owned sites (those not listed in Appendix A), the IPMC collects the data for annual recording as required by the Virginia Department of Environmental Quality.

6.3.8 The IPMC (or designee) provides the data required for the quarterly IPM Installation Status Report (ISR). This data is reported in square footage (indoor pest management) or acreage (outdoor pest management) treated and is reported to the State ISR Program Manager. Only Federally-funded pest management activities are reported in the ISR.

6.3.9 The IPMC (or designee) is responsible for answering all IPM-related data calls and submittal of information via the Army Environmental Database Environmental Quality/Headquarters Army Environmental System (AEDB-EQ/HQAES) or another electronic reporting system as specified by ARNG-IEZ.

6.4 Training and Certification

6.4.1 All individuals who apply pesticides at VAARNG Federal sites (Appendix A) are to hold current pesticide applicator certification in the appropriate categories for the pests being treated, unless the pesticide application is done under the Self-Help Program. In-house pesticide applicators are to be certified by the DOD or the Virginia Department of Agriculture & Consumer Services, Office of Pesticide Services. Individuals who apply non-restricted use pesticides at State properties must be Registered Technicians unless they are using pesticides that are covered in the Self-Help section. All contractors who apply pesticides must be certified by the Commonwealth of Virginia in order to apply pesticides at VAARNG sites. Initial training, apprenticeship periods and refresher training will be completed as required by the certifying agency to maintain current pesticide applicator certification.

6.4.2 The VAARNG IPMC must complete an initial DOD-taught PMQAE/IPMC training course within two years of being appointed IPMC and take refresher training every three years. HAZCOM training is also appropriate since exposure to pesticides may occur in the course of the job. The IPMC is not required to be a certified pesticide applicator if the IPMC will not apply pesticides as part of their duties.

6.4.3 Self-Help Program participants training will consist of reading the Self-Help Handouts for the applicable pest, signing the Training Use Agreement (page E-5), and following the directions of the label for each pesticide used. HAZCOM training is mandatory for personnel exposed to pesticides. When pest management actions are performed in accordance with the requirements of the Self-Help Program (Appendix E), participants are not required to be certified pesticide applicators.

6.4.4 PMQAEs must complete an initial DOD-taught PMQAE/IPMC training course and take refresher training every three years. PMQAEs are not required to be a certified pesticide applicator if the PMQAE will not apply pesticides as part of their duties.

6.5 Pesticide Security

Pesticides and pesticide equipment must be properly stored in facilities and safeguarded. Facilities must be well lighted with a secure perimeter. Video cameras, alarm systems, and self-locking doors are appropriate measures of security. Access to pesticides should be restricted with appropriate warning signs posted. Refer to the AFPMB Technical Guide No. 7, "Installation Pesticide Security" for more information on proper storage and security of pesticides. This technical guide can be found on the AFPMB website (go to: http://www.acq.osd.mil/eie/afpmb/ search for "AFPMB") or obtained from the ARNG PMC.

Appendix A – Federally-owned VAARNG Sites

1. Sandston Readiness Center
2. Sandston Army Aviation Support Facility (AASF)
3. Hampton Readiness Center
4. Fort Pickett MTC
5. Fort Belvoir (29th Infantry Division, 91st Cyber Command, and Field Maintenance Shop)
6. Fort AP Hill (Bowling Green Readiness Center)
7. Defense Supply Center Richmond (VA ARNG Joint Forces Headquarters, CSMS, and CIF)

Appendix B – Integrated Pest Management (IPM) Outlines

IPM Outline 1
American Cockroaches

Target Pest or Group	American cockroaches.
Target Area(s)	Office buildings, warehouses, residences; storm sewers
Impact on Mission	▪ May cause food damage through contamination. ▪ Affect human health through allergic reactions or "entomophobia". ▪ An aesthetic or morale nuisance. ▪ Large size often frightens people.
Scope	Base-wide in buildings and in sewers.
Responsibility	▪ All personnel: Ensure proper sanitation in all living and working spaces. ▪ Self-Help Program Participants: Conduct integrated pest management to control infestations indoors and in outdoor living areas and around the perimeter of buildings using approved Self-Help control methods. ▪ Food Service personnel (FSP): Ensure compliance with food handling regulations that prevent pest infestations. ▪ Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management to control infestations. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude and minimize pest infestations as requested.
Reporting	Record all pest management operations using the Pesticide Management Treatment Record and report usage to the IPMC every month

Survey

Survey Method(s)	▪ Visual inspections:
	  ▪ Visual surveys of low to moderate infestations may require visiting the facility at night.
	  ▪ Observation of pests in harborages.
	  ▪ Look around areas with heat and moisture.
	  ▪ Inspect floor drains.
	▪ Application of a flushing agent (or canned air) to suspected harborages.
	▪ Sticky trap surveys.

	▪ Vacuum surveys of harborages. ▪ Personnel complaints: including information on when pests were observed, where, and how many. ▪ Conduct pre and post-treatment surveys to determine whether control operation was effective.
Survey Frequency / Schedule	▪ Daily observation by building occupants ▪ Monthly observation and/or sticky trap monitoring by pest management personnel.
Action Threshold(s)	▪ Visual sighting of 1 or more cockroaches (all life stages) per room per survey. Flushing agents or sticky traps may be used. ▪ Sighting of 1 egg capsule per survey.

Non-Chemical Control

Type	Method	Responsibility
Sanitation	▪ Thorough cleaning of potential food sources in buildings, especially coffee and food preparation areas. ▪ Clean up spills immediately. ▪ Clean out floor drains by rinsing with hot water or using cleaners specifically designed to remove sludge from pipes. ▪ Store food in pest-proof containers ▪ Empty trash cans daily, or avoid putting food items in trash. ▪ Do not eat at desk; eat in a designated coffee break or dining area.	All personnel; Self-Help Program Participants; FSP
Mechanical Removal	▪ Vacuum cockroaches from their harborages. ▪ Used canned air to flush cockroaches from their harborages. ▪ Then use a wet/dry vacuum cleaner filled with water or empty and dispose of vacuum bag immediately.	Self-Help Program Participants; FSP; PMP
Pest Proofing	▪ Seal holes in walls, ceilings and other areas that may serve as cockroach harborage, as required. ▪ Request support from facilities maintenance provider if necessary.	Self-Help Program Participants; FSP; FMP
Prevention	▪ Inspect food boxes before bringing them into a building	All personnel; Self-Help Program Participants; FSP
Eliminate harborage	▪ Seal cracks and crevices with caulk ▪ Remove corrugated cardboard and other materials that can serve as harborage	Self-Help Program Participants; FSP; FMP

Eliminate Standing Water	▪ Fix plumbing leaks, especially around sinks, faucets and dishwashers. ▪ Remove standing water from floors after daily cleaning.	FSP; FMP
Education	▪ Proper storage of food and sanitation to prevent infestations and increase effectiveness of pesticide applications. ▪ Understanding the delayed effect of baits.	In-House PMP; IPMC

Chemical Control

Application Site	Apply pesticides as required based on survey information to areas where cockroaches are known to live or travel.
Site Preparation	Pre-treatment procedures: ▪ Visual inspections (canned air may be used, but no flushing agents) or placement of sticky traps may be accomplished while the space is occupied. ▪ All pesticide applications shall be done only when the space is unoccupied. ▪ Pesticide applicators shall notify building occupants prior to pesticide use. ▪ If insecticidal baits are used, thorough cleaning is required to remove competing food sources. ▪ Remove all food from exposed areas, cover or store processing equipment and utensils, and turn off ventilation system. ▪ Remove and dispose all food debris to increase the effectiveness of bait stations. ▪ Clean grease off surfaces. Oil can interact with some insecticides and reduce their effectiveness. Post-treatment procedures: ▪ Thoroughly clean all food preparation surfaces. ▪ Do not remove bait stations or bait gel placements.
Sensitive Areas	▪ Exposed food products, food containers, counter tops, any surface where food may be stored or prepared, or any food storage area. ▪ Minimize application of pesticides directly into drains. ▪ Use care in selecting pesticides for use in storm sewers as this can lead to stormwater pollution. Applications should be made when storm sewers are dry and rain is not anticipated within a week.
Restrictions	▪ Preventive baseboard spraying in the absence of a pest is prohibited. ▪ Do not apply liquid or dust formulations to occupied spaces or near exposed food. ▪ In food service areas, use only insecticides specifically labeled for those areas.
Prohibited Items	▪ Use of ultrasonic pest repelling devices is prohibited.
Common Active Ingredients	▪ Abamectin ▪ Borate-based products ▪ Fipronil ▪ Hydramethylnon

	▪ Imidacloprid ▪ Indoxacarb ▪ Insect Growth Regulators (IGRs) ▪ Pyrethroids (i.e. bifenthrin, cyfulthrin, cyhalothrin, esfenvalerate, permethrin, tetramethrin)	
Types of Pesticides		**Authorized Applicators**
Baits	▪ Use Cockroach baits (stations containing solid bait or injectable style gel baits) as much as possible. ▪ Gel bait can be applied to a sheet of hardware cloth and hung in manholes. ▪ Proper bait placement is critical to the success of treatment. ▪ Do not apply other insecticides around bait treatment areas.	Self-Help Program Participants; In-House PMP; Contracted PMP
Flushing Agents	▪ Use aerosol contact pesticides directed into potential harborage areas to flush out and kill pests as needed.	In-House PMP; Contracted PMP
Crack and Crevice Residuals	▪ A residual pesticide may be applied (by crack and crevice technique) to all known or suspected harborages, feeding sites, or passageways.	In-House PMP; Contracted PMP
Spot Treatment Residuals	▪ A residual pesticide may be applied as a "spot treatment" to indicated areas (such as under dishwashers and refrigerators or behind stoves).	In-House PMP; Contracted PMP
Dusts	▪ Boric acid dust is an effective low toxicity insecticide that can be applied to wall voids and into manholes of storm sewers. The treatment area should remain dry after the application to avoid washing the dust away.	In-House PMP; Contracted PMP
Growth Regulators	▪ Insect growth regulators will always be mixed with "knock-down" pesticides.	In-House PMP; Contracted PMP
Fogging	▪ For rapid knockdown of large infestation; follow up with crack and crevice treatments and/or bait placement if needed.	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	▪ Dependent on impact on mission. ▪ In food service areas, where impact is on health, and office spaces, where impact is on aesthetics and morale, response time should be within 24 hours. ▪ Warehouses and unoccupied or rarely occupied spaces may warrant a longer response time.

Time Period to Obtain Control	▪ Baits are designed to have a delayed toxic effect which allows cockroaches to take the bait to other cockroaches in their harborage. Generally, baits should result in fatalities within 3 days. ▪ Other insecticide treatments should result in immediate kill of the pest. ▪ Many insecticides are ineffective on egg cases (ootheca) and nymphal cockroaches may emerge within days after treatment, causing another infestation.
Level of Control	Post-treatment survey of the target area should result in a pest population lower than the action threshold number.
PMQAE Assessment	▪ Sticky traps are the best way to quantify and compare pre- and post-treatment surveys. ▪ Visual surveys of low to moderate infestations may require visiting the facility at night. ▪ Follow up surveys should be done one week later to see if eggs have hatched and resulted in another infestation.
Reasons for Treatment Failure	▪ Improper application of the insecticide ▪ Harborages not identified and treated ▪ Eggs hatched after treatment ▪ Insecticide resistance ▪ Improper placement of bait stations or gel baits.
Safety Considerations	▪ Do apply liquid and dust Insecticides to occupied spaces or when food is exposed; baits may be applied when spaces are occupied ▪ Allow for ventilation of spaces after liquid insecticides have been applied. ▪ Clean food preparation surfaces after treatment. ▪ Applicators must wear personal protective equipment as required by the product label. ▪ Most insecticides used for indoor pest control are low in toxicity (signal word "Caution"), but care should be taken to prevent exposure to humans and domestic animals
Environmental Considerations	▪ Outdoor treatments with pyrethroids are susceptible to runoff and contamination of stormwater. ▪ Disposing of pesticides in a drain or stormdrain is strictly prohibited.
Special Applicator Qualifications	▪ Cockroach control using canned air and approved bait stations may be accomplished by non-certified personnel as part of the Self-Help Program. ▪ All PMP applying pesticides must be DOD or State-certified as pesticide applicators.

Resources

http://www.extension.umn.edu/garden/insects/find/cockroaches/

http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7467.html (helpful for identifying types of cockroaches)

http://pestsense.cahnrs.wsu.edu/Search/MainMenuWithFactSheet.aspx?CategoryId=2&ProblemId=799

IPM Outline 2

Filth Flies

Target Pest or Group	House flies (*Musca domestica*), face flies (*Musca autumnalis*), stable flies (*Stomoxys calcitrans*), little house flies (*Fannia* spp.), and other fly species that breed in garbage, compost, manure, or other organic debris.
Target Area(s)	▪ Dumpsters ▪ Garbage dumps and recycle centers ▪ Any places where organic debris may accumulate
Impact on Mission	▪ Nuisance that interferes with mission ▪ Mechanical transmission of pathogens leading to illnesses
Scope	Management of biting and non-biting flies associated with organic debris. Excludes flies of public health importance such as mosquitoes, biting gnats, black flies, and bot flies.
Responsibility	• All personnel: Ensure proper sanitation in all living and working spaces. • Self-Help Program Participants: Conduct integrated pest management to control infestations indoors and in outdoor living areas and around the perimeter of buildings using approved non-Chemical control methods. • Food Service personnel (FSP): Ensure compliance with food handling regulations that prevent pest infestations • Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management to control infestations. • Janitorial Service Provider (JSP): Ensure that refuse containers are frequently emptied and sanitized. • Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude and minimize pest infestations as requested.
Reporting	Record all pest management operations using the Pesticide Management Treatment Record and report usage to the IPMC every month.

Survey

Survey Method(s)	Visual sighting: ▪ Flies are active during the daytime in warm weather ▪ Flies may be seen flying around and landing on dumpsters and trash cans ▪ Fly larvae (maggots) may be seen at the bottom of trash cans ▪ Flies that enter buildings will congregate around windows ▪ Flies may be seen crawling on or flying around organic debris ▪ Visual surveys of adult flies should also identify where flies are entering a building and where they are breeding. Bites: ▪ Adult stable flies will inflict a painful bite on humans, dogs, and livestock. ▪ Most filth flies do not bite. Trapping: ▪ Light traps: Flies are attracted to ultraviolet light and trapped on a sticky pest strip. These traps can also be used to control adult flies as well as monitor populations. ▪ Sticky traps: Place around areas where filth flies are known to be a problem. Many types contain visual lures. ▪ Pheromone traps: Fly pheromones (such as muscamone) attract flies to a container. Speck counts: ▪ 3X5 index cards may be placed around areas to be monitored. Flies that land on the cards will leave vomit or fecal specks that can be counted. Though inexpensive and simple, this technique gives no indication of fly species, and may overestimate fly numbers since a single fly may leave multiple specks. Note: Identification of adult flies is helpful in determining where flies are breeding, in order to target control at the source of the infestation. If the breeding location of the flies cannot be found, collect some flies and identify or send to an
Survey Frequency/ Schedule	▪ Visual observations should be made around likely breeding sites (i.e. dumpsters). ▪ Traps should be inspected weekly. More frequent inspection may be necessary if sticky traps are placed in areas where they will quickly become covered with dust, insects, or other debris.
Action Threshold(s)	▪ The presence of biting flies in numbers constituting a nuisance for people or animals indicates a need for control within 24 hours if it is interfering with the mission or activities. ▪ In sensitive areas (i.e. kitchens, medical facilities) the threshold should be low: 2 flies/room. ▪ For counts on sticky traps, 100 flies per week indicates a need for control.

Non-Chemical Control

Type	Method	Responsibility
Sanitation	▪ Eliminating breeding sites is critical for effective filth fly control. ▪ Filth flies often breed in neglected refuse containers. ▪ Cover outdoor trash containers with tight-fitting lids. ▪ Empty trash containers frequently. ▪ Sanitize trash containers that have accumulated organic material. ▪ Steam clean dumpsters regularly.	All personnel, including: Self-Help Program Participants; JSP
Exclusion	▪ Seal cracks and other openings around doors and windows. ▪ Use tight-fitting screens. ▪ Air-curtains may be installed in commercial facilities.	Self-Help Program Participants; FMP
Trapping	▪ Ultraviolet light traps may be used to reduce adult fly populations in buildings invaded by flies. Light traps shall not be used outdoors. ▪ Exercise caution when placing traps; if the trap is visible from outside the structure, it may attract flies into the building. ▪ Traps by themselves are unlikely to control heavy fly infestations. ▪ Do not use bug zappers that electrocute flies in food-preparation areas or eating facilities. Use attractant light traps that collect flies on sticky traps.	All personnel, including: Self-Help Program Participants
Biological	▪ Several species of parasitic wasps can be purchased for use against filth flies. ▪ Biological control agents do not kill adult flies. Wasps lay their eggs in fly pupae, where the wasp larvae consume the developing fly, preventing it from emerging. ▪ Biological control agents will not sting or otherwise harm humans or animals. ▪ Biological control agents are not compatible with chemical insecticides. ▪ Release timing, climatic conditions, release frequency, and number of agents released are all critical for biological control success. ▪ Contact pest management consultants for additional information before instituting a biological control program.	In-House PMP; Contracted PMP
Education	▪ Educate building occupants on sanitation, excluding flies by closing doors and maintaining screens, and proper food storage	In-House PMP; IPMC

Chemical Control

Application Site	▪ Fly resting areas	
Site Preparation	Do not apply residual insecticides during high temperatures, high winds, or if precipitation is expected.	
Sensitive Areas	▪ Food service areas. Ensure that the insecticide is labeled for use in food preparation areas, and that foods are not contaminated during application. ▪ Emphasize non-chemical control in these areas. ▪ Ensure that insecticides do not enter drains, streams, lakes and other surface water.	
Restrictions / Regulations / Permits	▪ Do not apply liquid or dust formulations in occupied spaces. ▪ Dichlorvos is a carcinogen and cannot be placed in occupied spaces.	
Common Active Ingredients	▪ Neonicotinoids ▪ Pyrethroids ▪ Methomyl ▪ Cyromazine ▪ Other insecticides	
Methods of Application		**Authorized Applicators**
Non-residual space spray or aerosol	▪ Will temporarily control adult fly populations in buildings and outdoors. ▪ Will not provide long-term control unless breeding sites are eliminated.	In-House PMP; Contracted PMP
Residual insecticides	▪ May be applied to outside areas where adult flies rest. ▪ Will not provide long-term control unless breeding sites are eliminated.	In-House PMP; Contracted PMP
Baits	▪ May be used around refuse containers and other places to which flies are attracted. ▪ Pheromone baits are commonly used so that competing food sources are not a problem. ▪ Do not use baits indoors or in other areas where flies are not already present. ▪ Baits may attract flies to an otherwise fly-free area.	In-House PMP; Contracted PMP
Impregnated strips	▪ Plastic strips impregnated with dichlorvos will kill adult flies. ▪ Use only inside trash cans or other unoccupied spaces.	In-House PMP; Contracted PMP
Insect repellents	▪ May be used on humans for temporary prevention of fly bites. ▪ Will not provide long-term control of fly populations, and must be frequently re-applied.	All personnel

Larvicides	▪ Control fly larvae in breeding sites. ▪ Can be used simultaneously with adulticides. ▪ Some larvicides are insect growth regulators with lower toxicity for non-target organisms.	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	Indoor infestations should have shorter response time than outdoor infestations.
Time Period to Obtain Control	Most control methods result in rapid kill and so control should be obtained in a short period of time
Level of Control	100% control indoors. Outdoors the level can be lower depending on the level of tolerance by people around the buildings. If the source of flies is treated then you should expect 100% control in that area.
Safety Considerations	▪ Take precautions when using pesticides around food service areas ▪ Applicator should use personal protective equipment as required by the product label
Environmental Considerations	▪ Avoid contaminating water with pesticides. ▪ Space spraying outdoors can result in drift and impact on non-target organisms.
Special Applicator Qualifications	▪ Fly control using non-chemical/biological methods may be used by non-certified personnel as part of the Self-Help Program. ▪ All PMP or GMP applying pesticides (including herbicides) must be DOD or State-certified as pesticide applicators.

Additional Information

The numbers of products available for filth fly monitoring and control is overwhelmingly large. The efficacy of a given product often depends on local climatic characteristics, the severity of the infestation, the species comprising the infestation, and other localized conditions. Also, many products are available that do not work, or whose efficacy is unproven. Pest management consultants or county or state extension personnel can assist with choosing fly control methods that are most appropriate for a given area.

Resources

http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7457.html
http://www.acq.osd.mil/eie/afpmb/docs/techguides/tg30.pdf
http://www.acq.osd.mil/eie/afpmb/docs/techguides/tg29.pdf

IPM Outline 3
Ticks

Target Pest or Group	Ticks
Target Area(s)	Outdoors, especially near or in wooded areas.
npact on Mission	To prevent the spread of tick-borne diseases.
Scope	Near training or encampment areas.
Responsibility	▪ All personnel: Wear proper clothing and use repellents when working or training in areas where there are ticks. ▪ Pest Management Provider (PMP), In-House or Contract: Apply pesticides, as needed. ▪ Grounds Maintenance Provider (GMP): Mowing and removal of vegetation. ▪ IPMC/Environmental Office: Surveillance. Recommendations and approval for land modifications near improved areas to eliminate tick harborage.
Reporting	Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month

Survey

Survey Method(s)	▪ Personnel complaints. ▪ Cloth drag surveys. ▪ CO_2 ground traps.
Survey Frequency / Schedule	▪ As needed. ▪ Areas identified by personnel complaints, or with a history of infestation.
Action Threshold(s)	▪ 5 or more adult vector species captured in a 5 minute drag near training or encampment areas.

	▪ During declared disease emergencies, one or more adults or nymphs that have been identified as carrying the disease within 5 miles. NOTE: Action thresholds can be changed on advice of an APHC entomologist

Non-Chemical Control

Type	Method	Responsibility
Cultural	▪ Personnel should wear proper clothing such as long pants with the legs tucked into their socks and boots. ▪ Tick infested areas should be avoided for use when an alternative site is feasible.	All personnel
Habitat Modification	▪ Eliminate brush and high grass from training, encampment, improved and high traffic areas. ▪ Mow and otherwise clear overgrown areas next to wood margins with substantial under story. ▪ Rake up leaf litter in smaller, contained areas that receive high human use. ▪ Controlled burning, where environmentally acceptable, has been shown to reduce tick populations for six months to a year.	GMP
Prohibited Items	Use of ultrasonic pest repelling devices is prohibited.	

Chemical Control

Application Site	Apply pesticides as required based on survey information.
Site Preparation	Pre-treatment procedures: ▪ Visual inspections. Post-treatment procedures: ▪ Populations of ticks can be expected to fully recover within 18 months of the last treatment.
Sensitive Areas	▪ Waterways. Avoid stormwater runoff of insecticides and do not apply directly to water. Many insecticides are highly toxic to aquatic organisms. ▪ Areas with high density of pollinators. Many acaricides are highly toxic to bees, butterflies and other beneficial pollinators.
Restrictions	▪ Making large area applications when personnel are present is prohibited

Common Active Ingredients	Repellents for Personal Use: ▪ DEET ▪ Permethrin Residual Pesticides: ▪ Bifenthrin ▪ Cyfluthrin ▪ Cyhalothrin ▪ Cypermethrin ▪ Deltamethrin ▪ Esfenvalerate ▪ Resmethrin ▪ Other synthetic pyrethroids ▪ Pyrethrins or natural Pyrethrum	
Types of Pesticides		**Authorized Applicators**
Repellents	▪ Tick repellent should be applied to exposed skin and around the edge of openings in clothing such as cuffs and waistbands and around boot tops. ▪ Effectiveness of skin-applied repellents decreases over time, especially if the user sweats. They should be periodically re-applied. ▪ Treating clothing with an approved tick repellent pesticide containing DEET or Permethrin to provide additional protection. ▪ Never apply Permethrin directly to the skin.	All personnel
Barrier sprays or granules	▪ Vegetation surrounding training areas and encampments may be treated with a pesticide that leaves a residual barrier to ticks. ▪ Dispersal is done with a back-pack or truck-mounted power sprayer ▪ Reapply if needed in 4 to 6 weeks (or as directed on the pesticide label).	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	Ticks are generally not an emergency and do not require immediate response. If high densities of ticks are found in bivouac areas during training exercises, immediate response may be necessary.
Time Period to Obtain Control	Immediately after treatment.
Level of Control	It is not possible to totally eliminate tick pest populations; control is achieved when the human health concern has been reduced to a nuisance level.
Safety Considerations	▪ Applicators must wear personal protective equipment as required by the product label. ▪ Permethrin repellent should never be applied directly to the skin.
Special Applicator Qualifications	▪ All PMP or applying pesticides (including herbicides) must be DOD or State-certified as pesticide applicators. ▪ Repellents used for personal protection are exempt from applicator certification requirements. However, they must always be applied in accordance with the label directions.

Additional Information

All personnel should check for ticks after working or training in areas where ticks are known to occur.

Removing ticks within 24 hours of their attachment significantly decreases the chances of contracting tick-borne diseases.

Care must be taken when removing an attached tick. Not every tick is infested with a human disease pathogen, but all ticks should be treated as a risk to human health.

Do not apply heat (lighted match) to the tick in hopes it will release. This action may cause the tick to expel its contents (including disease pathogens, if present) into the bite victim.

Do not apply grease or coat the tick in Vaseline. This will kill the tick and likely cause it to expel its contents into the bite victim.

To remove a tick:

- Firmly grasp the head of the tick as close to the skin as possible with tweezers. If you grasp the tick by the abdomen and pinch with the tweezers, you may inject the contents of the tick (including any disease pathogens) into the bite victim. Pinch with only enough pressure to firmly hold onto the tick.
- With gentle but steady pressure, pull on the tick. Usually, the tick will release its hold. Ticks have hooks on their mouthparts and forceful removal may leave the mouthparts imbedded in the skin where they could cause a secondary infection requiring medical attention.

Resources

AFPMB TG 26, Tick-Borne Diseases: Vector Surveillance and control, http://www.acq.osd.mil/eie/afpmb/docs/techguides/tg26.pdf

AFPMB TG 36, Personal Protective Measures Against Insects and Other Arthropods of Military Significance http://www.acq.osd.mil/eie/afpmb/docs/techguides/tg36.pdf

IPM Outline 4
Nuisance Ants

Target Pest or Group	Black ants, Pavement ants, Odorous house ants, Pharaoh ants, Argentine ants, Crazy ants and other nuisance species.
Target Area(s)	Offices, food preparation areas, food storage, patios, barracks, medical treatment facilities.
Impact on Mission	Eat and contaminate food; make spaces uninhabitable or unusable.
Scope	Base-wide, in and around buildings.
Responsibility	▪ All personnel: Ensure proper sanitation in all living and working spaces. ▪ Self-Help Program Participants: Conduct integrated pest management to control infestations indoors and in outdoor living areas and around the perimeter of buildings using approved Self-Help control methods. ▪ Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management to control infestations indoors and in outdoor living areas and around the perimeter of buildings. ▪ Grounds Maintenance Provider (GMP): Control aphids and similar insects on ornamental plants. Aphids may attract and feed ants. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude and minimize pest infestations as requested.
Reporting	Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month.

Survey

Survey Method(s)	▪ Visual inspections
	  ▪ Observation of foraging scout ants or ant trails.
	  ▪ Follow ant trails to entryways into building and to food sources.
	  ▪ Follow ant trails to nests.
	▪ Personnel complaints: including information on when pests were observed, where, and how many.
	▪ Conduct pre and post-treatment surveys to determine whether control operations were effective.

Survey Frequency / Schedule	▪ Daily observation by building occupants. ▪ Monthly inspections by PMP, In-House or Contract, outdoors around buildings to identify ant nests.
Action Threshold(s)	▪ Food service areas: 3 per room ▪ Living areas: 5 per room ▪ Medical treatment facilities: 1 per room ▪ Grounds: 2 mounds per yard

Non-Chemical Control

Type	Method	Responsibility
Sanitation	▪ Thorough cleaning of potential food sources in buildings, especially coffee and food preparation areas. ▪ Thoroughly clean food preparation surfaces, countertops, and stoves. ▪ Remove and discard food scraps that may be attractive to ants. ▪ Clean up food and drink spills as soon as possible. ▪ Do not leave dirty dishes on countertops or in sinks	All personnel, including: Self-Help Program Participants
Mechanical Removal	▪ Use a wet sponge or cloth to wipe up ants. ▪ Spray ant trails with household cleaner or soapy water, then wipe up. ▪ This is **not** an effective control method for Pharaoh ants.	All personnel, including: Self-Help Program Participants
Pest-Proofing	▪ Put food in tightly sealed containers. ▪ Seal holes in walls with caulk or temporarily with petroleum jelly.	All personnel, including: Self-Help Program Participants
Control of Plant Insects	▪ Ants live in cooperation with some plant-infesting insects such as aphids. These insects produce sugars that are food for the ants, while the ants provide protection for the plant juice-sucking insects. Control aphids and other plant juice-feeding insects on plants	GMP

Education	▪ Proper food storage and sanitation to prevent infestations. ▪ Use of soapy water to control ants indoors.	In-House PMP, IPMC
Prohibited Items	▪ Use of ultrasonic pest repelling devices is prohibited.	

Chemical Control

Application Site	When non-chemical methods do not control pests to an acceptable level, apply pesticides to areas where ants nest or travel as based on surveillance information.	
Site Preparation	Pre-treatment procedures: ▪ Visual inspections. ▪ Pesticide applicator shall contact building occupants prior to pesticide applications. ▪ All food should be removed from exposed areas and processing equipment and utensils covered or stored. Post treatment procedures: ▪ Thoroughly clean all food preparation surfaces. ▪ Do not remove bait stations or other bait placements.	
Sensitive Areas	▪ Exposed food products, food containers, counter tops, or any surface where food may be stored or prepared, or any food storage area. ▪ Outdoors where children or pets may be exposed to pesticides. ▪ Medical treatment facilities. ▪ Waterways. Avoid stormwater runoff of insecticides and do not apply directly to water. Many insecticides are highly toxic to aquatic organisms.	
Restrictions	▪ Use baits and spot treatments indoors; do not apply to baseboards as a preventive residual spray. ▪ Do not apply liquid or dust formulations of insecticides in occupied spaces.	
Common Active Ingredients	▪ Abamectin ▪ Borate-based products ▪ Fipronil ▪ Hydramethylnon ▪ Indoxacarb ▪ Insect Growth Regulators (IGRs) ▪ Pyrethroids (i.e. bifenthrin, cyfulthrin, cyhalothrin, esfenvalerate, permethrin, tetramethrin) ▪ Sulfluramid	
Types of Pesticides		**Authorized Applicators**
Baits	▪ Bait stations can be used indoors or outdoors. ▪ Granular baits can be applied outdoors near nests. ▪ Baits are specific to the species of ant. ▪ Most effective since it kills the egg-producing queen of the colony. ▪ May require 2 to 7 days for complete control.	Self-Help Program Participants; In-House PMP; Contracted PMP

Barrier Spraying	▪ Application of a residual outdoors around a building may be necessary if there are many nests and entryways into the building. ▪ May also be necessary if nests are difficult to find. ▪ Usually requires periodic reapplication if ant nests are not destroyed. ▪ Application is not allowed in occupied interior spaces.	In-House PMP; Contracted PMP
Dusts	▪ Boric acid dust is an effective low toxicity insecticide that can be applied into wall voids where ants may be nesting. ▪ The treatment area should remain dry after the application to avoid washing the dust away. ▪ Application not allowed in occupied interior spaces.	In-House PMP; Contracted PMP
Granular Insecticides	▪ Acute toxicant in granular form. ▪ Only effective if applied directly to the nest.	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	Ant infestations are generally not an emergency and do not require immediate response. At sensitive sites, such as medical treatment facilities, immediate response may be necessary
Time Period to Obtain Control	For indoor infestations control should be within 2 hours when liquid formulations are used. Baiting indoors or outdoors may take up to a week or more for complete control.
Level of Control	100% control indoors is required.
PMQAE Assessment	Usually customer complaints and follow-up are sufficient to assess efficacy of work.
Safety Considerations	▪ Liquid and dust insecticides should not be applied to occupied spaces or when food is exposed. ▪ Baits may be applied when spaces are occupied. ▪ Allow for ventilation of spaces after liquid insecticides have been applied. ▪ Clean food preparation surfaces after treatment. ▪ Applicators must wear personal protective equipment as required by the product label.
Environmental Considerations	▪ Pyrethroid insecticides can be highly toxic to aquatic organisms.
Special Applicator Qualifications	▪ Ant control using approved bait stations may be used by non-certified personnel as part of the Self-Help Program. ▪ All PMP or GMP applying pesticides (including herbicides) must be DOD or State-certified as pesticide applicators.

Additional Information

For most people, ants become a problem and require action only when they enter a building. Sometimes ants may nest in walls, especially if there is moisture in those areas. This is a common problem in bathrooms and kitchens. Surveys may be used to determine if the source of the infestation is indoors or

outdoors. Control of ant nests outdoors during the spring and early summer may reduce ant problems later in the season. The most effective ant baits are slow acting which gives worker ants enough time to carry small amounts of bait back to the nest. Worker ants will feed the bait to the other ants and eventually kill the entire colony. For this reason, it may take several days to see results from baiting. Different species of ants prefer different forms of bait, and sometimes preferences even vary by season. Ants can be given a "taste test" of several baits to see which ones they prefer and to ensure bait is still effective for that species.

Resources

http://www.ipm.ucdavis.edu/PMG/menu.ants.html

http://www.extension.umn.edu/garden/insects/find/what-to-do-about-household-ants/

http://www.p2pays.org/ref/14/13177.pdf

IPM Outline 5

Mosquito Control

Target Pest or Group	Flying adult mosquito species.
Target Area(s)	All areas, base-wide.
Impact on Mission	▪ Transmission of mosquito-borne diseases to installation personnel ▪ Nuisance biting interfering with occupational and recreational activities
Responsibility	Installation Preventive Medicine Technicians (PMTs): Conduct adult mosquito trapping to identify problem areas and mosquito species. ▪ Map locations of trapping sites. ▪ Conduct disease risk assessments including pathogen testing if that laboratory capability is available. ▪ Provide information to personnel on how to prevent mosquito bites. Pest Management Provider (PMP), In-House or Contract, or Mosquito Control Provider: ▪ Conduct surveys to verify presence of adult mosquitoes at site to be treated. Treat only when and where adult mosquitoes are present. ▪ Use integrated pest management methods to control adult mosquitoes. ▪ Use pesticides in accordance with the label.

Responsibility (continued)	Natural Resources Manager (NRM): ▪ Review and approve mosquito control operations conducted in sensitive areas to ensure minimal impact on the environment. Integrated Pest Management Coordinator (IPMC): ▪ Coordinate with PMTs, control provider, PMPAR, and natural resource manager to identify mosquito-breeding sites that can be permanently eliminated by non-chemical methods. ▪ Maintain mosquito control operation records. Conduct pre- and post-treatment surveys to monitor efficacy of control measures. Facilities Maintenance Provider/Grounds Maintenance Provider (FMP/GMP): ▪ Keep building window and door screens in good repair. ▪ Remove tall and/or overgrown vegetation that provides resting areas for adult mosquitoes. Self-Help Program Participants: ▪ Conduct integrated pest management to control infestations in outdoor areas using approved Self-Help non-chemical control methods. Unit Commanders and Building Supervisors: ▪ Ensure maintenance of window and door screens. ▪ If screens are not available, keep doors and windows closed when mosquitoes are present. ▪ Ensure distribution of mosquito prevention and control information to personnel. All Personnel: ▪ Use personal protective measures to prevent mosquito bites.
Reporting	▪ PMTs report surveillance results to IPMC and Mosquito Control Provider. ▪ Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month.

Survey

Survey Method(s)	▪ Conduct surveys using visual assessments (i.e. landing counts) and/or traps at sites where personnel complain about mosquito bites to verify presence of mosquitoes. ▪ Record sites of verified complaints on a map. Use GPS device if available. ▪ Use traps weekly at same locations to reveal seasonal trends in mosquito abundance. Can be used in subsequent years to plan mosquito control program. ▪ Trap mosquitoes for virus testing.

Survey Frequency / Schedule	▪ Ongoing surveys by residents. ▪ Survey prior to application of adulticide. ▪ For visual surveys, post-treatment surveys may be conducted immediately after the treatment. ▪ For traps, within 24 hours after application.
Action Threshold	▪ Light traps: 25 biting females or 1 vector species in an un-baited light trap ▪ Landing counts: 4 per 15 minutes ▪ Disease emergencies declared: light traps: 1 female of a species which has been identified as carrying disease within 5 miles of base caught in a trap NOTE: Action thresholds can be changed on advice of a DOD entomologist or State Public Health Department personnel

Non-Chemical Control

Type	Method	Responsibility
Personal Protection	▪ Encourage use of repellents when outdoors in mosquito-infested areas. ▪ Products with the active ingredient diethyl toluamide (DEET) are most effective. ▪ Picaridin (KBR 3023) and IR3535 are also effective. ▪ Avoid outdoor activities at dusk and during the evening hours to lessen chances of being bitten. ▪ Wear long-sleeved shirts and pants when outdoors in mosquito infested areas.	FMP; GMP
Exclusion / Pest Proofing	▪ Window and door screens ▪ Remove tall weeds and overgrowth to remove possible resting areas for mosquitoes.	All personnel, including: Self-Help Program Participants; FMP; GMP
Traps	▪ Propane powered trapping devices that use heat and a chemical attractant have been shown to be effective for small to moderate area control of certain species of mosquitoes.	All personnel, including: Self-Help Program Participants

Chemical Control

Application Site	When the use of non-chemical methods and larvicide do not control adult mosquitoes to an acceptable level, apply adulticides based on surveillance information and risk of mosquito-borne disease.

Site Preparation	▪ Survey treatment site prior to application to ensure presence of flying mosquitoes. ▪ Ensure building occupants are given warning of spray operations if they will be in the area during treatment. They should be advised to stay indoors and keep doors and windows closed during spraying. ▪ Check for thermal inversion (the ground is cooler than the air) to ensure pesticide stays close to ground. ▪ Check for light wind (3-5 mph) perpendicular to path of vehicle travel to maximize swath width. ▪ Check direction of wind and ensure pesticides do not drift into environmentally-sensitive areas. The pesticide label will indicate what animal species are at risk for pesticide poisoning. ▪ Survey area surrounding treatment area to ensure that bee hives will not be in the path of pesticide drift.	
Sensitive Areas	▪ All ULV and aerial applied pesticides may affect aquatic organisms especially fish. Care should be taken to ensure proper insecticide droplet size, timing of application, environmental conditions and calibration of equipment.	
Restrictions / Regulations / Permits	▪ Pesticide applications to, over, or near waters of the US may require coverage under a NPDES Aquatic Pesticide Permit depending on size of treatment area.	
Common Active Ingredients	▪ Naled ▪ Malathion ▪ Permethrin ▪ Resmethrin ▪ d-Phenothrin (Sumithrin) ▪ Prallethrin ▪ Etofenprox ▪ Various Herbicides (for habitat reduction)	
Type	**Method**	**Responsibility**
Mosquito Adulticides	▪ Apply with ULV or fog generating ground equipment. ▪ Some chemicals may be corrosive and areas where cars are parked should be avoided or owners notified prior to application.	In-House PMP; Contracted PMP; Mosquito Control Provider
Aerial Application of Adulticides:	▪ Emergency control operations as the result of a disease outbreak may require large area application of an adulticide. ▪ Aerial spraying with an appropriately labeled pesticide and application equipment may be used. ▪ An Aerial Application Statement of Need must be prepared by the IPMC and approved by the ARNG PMC prior to aerial application of pesticides. ▪ Additional NEPA documentation and permitting may be required	Contracted PMP; Mosquito Control Provider

Herbicides	▪ Herbicides may be used to remove vegetation where removal by mechanical means is impractical.	In-House PMP; Contracted PMP
Special Applicator Qualifications	▪ All PMP and Mosquito Control Providers applying pesticides (including herbicides) must be DOD or State-certified as pesticide applicators.	

Additional Information

See AFPMB Technical Guide No. 13 for information on ULV application of pesticides: http://www.acq.osd.mil/eie/afpmb/docs/techguides/tg13.pdf

IPM Outline 6

Stinging Insects

Target Pest or Group	Wasps, hornets yellow-jackets and bees.
Target Area(s)	Outdoors.
Impact on Mission	▪ Stinging insects can cause painful stings, massive envenomization, or serious allergic reactions in personnel. ▪ Hives and nests can cause property damage and attract other unwanted pests.
Scope	▪ Outdoors where stinging insects are a threat to personnel. ▪ In occupied buildings and outbuildings where stinging insects nest.
Responsibility	▪ Self-Help Program Participants: Conduct integrated pest management to control infestations indoors, in outdoor living areas and around the perimeter of buildings using approved Self-Help control methods. ▪ Pest Management Provider (PMP), In-House or Contract: Conduct inspections and integrated pest management to control infestations through killing or removal. Remove wasp/hornet/yellowjacket nests and beehives in buildings. Relocate European honey bee swarms and beehives. ▪ Facilities Maintenance Provider (FMP) and Grounds Maintenance Provider (GMP): Report any stinging insect nest sightings.
Reporting	▪ Record all pest management operations using the Pest Management Treatment Record and report usage to the IPMC every month. ▪ Unusually aggressive bee colonies should be immediately reported to the IPMC.

Non-Chemical Control

Type	Method	Responsibility
Discourage and Eliminate Nests	▪ Nests should be removed or relocated by trained personnel.	In-House PMP; Contracted PMP
Avoidance	▪ Stay away from stinging insects if possible.	All personnel
Eliminate Food Sources	▪ Feed pets indoors. ▪ Cover trash cans.	All personnel
Eliminate Standing Water	▪ Some stinging insects are attracted to water. ▪ Repair leaking outdoor faucets and other mechanical water sources. ▪ Eliminate standing water.	FMP; GMP
Traps (Wasps and Yellowjackets)	<u>Wasps, hornets and yellowjackets:</u> ▪ Trapping should start in the spring and be continued through the summer. Early elimination of the queen will reduce the size of populations later in the year. ▪ Lure traps – baited with a chemical attractant or with meat. ▪ Water traps – Meat hung on a string 1-2 inches over a bucket of soapy water. Cover bucket with mesh to exclude other animals. <u>Bees:</u> ▪ Swarming bees can be lured into a trap that mimics a nesting site. ▪ Trapped bees can be relocated to less populated areas.	In-House PMP; Contracted PMP
Mechanical Removal	▪ Wet/dry vacuums may be used to remove bees, but this should only be done by trained personnel.	In-House PMP; Contracted PMP
Pest Proofing	▪ Seal holes in exterior walls of buildings. Request support from facilities maintenance provider if necessary. ▪ Remove debris that can serve as nesting areas. ▪ Cover tree holes or fill with expanding spray foam.	FMP; GMP

Chemical Control

Application Site	▪ Apply pesticides, as required based on survey information, to areas where stinging insects are known to harbor or rest.

Site Preparation	Pre-treatment procedures: ▪ Determine the extent of nesting in buildings to determine whether hive removal will be necessary after removing bees. ▪ Ensure the safety of people in the immediate area of the treatment. Do not allow unprotected bystanders to watch control procedures ▪ Pest management personnel should don protective bee suits. Post-treatment procedures: ▪ Remove dead bees and hive material from buildings. The melting of hive materials can cause extensive damage to building structures as well as attract other pests.	
Sensitive Areas	▪ Places where personnel may be harmed by bees or pesticide application. ▪ Buildings that may be damaged by hives.	
Restrictions	▪ Do not apply water-based aerosol pesticides in vicinity of electrical equipment. ▪ Do not apply liquid, aerosol or dust formulations of insecticides in occupied spaces.	
Common Active Ingredients	▪ d-trans Allethrin ▪ Cypermethrin ▪ Deltamethrin ▪ Ethofenprox ▪ Esfenvalerate ▪ lambda-Cyhalothrin ▪ n-Octyl bicycloheptene dicarboximide ▪ Permethrin ▪ d-Phenothrin ▪ Piperonyl butoxide ▪ Prallethrin ▪ Pyrethrins ▪ Prallethrin	
Types of Pesticides		
Aerosol Knockdown Agents	▪ High pressure aerosols that can be applied from a long distance can be used. ▪ Application of these insecticides results in a rapid knockdown of the insects.	Self-Help Program Participants, In-House PMP; Contracted PMP
Dusts	▪ Dusts can be applied to nesting areas.	In-House PMP; Contracted PMP
Baits	▪ Baits mixed with a toxicant can be used for wasps, hornets and yellowjackets.	In-House PMP; Contracted PMP

Environmental Considerations	▪ Ensure that insecticides do not enter drains, streams, lakes and other surface water. ▪ Some pollinators (including bees) are protected under the Endangered Species Act. Check with your Environmental Natural Resources office to determine if you have any protected species of bees in your area.
Special Applicator Qualifications	▪ Stinging insect control using approved aerosol insecticides may be used by non-certified personnel as part of the Self-Help Program. ▪ All PMP applying pesticides must be DOD or State-certified as pesticide applicators.

Additional Information

Rusty patched bumble bees are a protected species and should never be harmed. For more information and to learn how to identify these endangered bees from other common bumble bees, go to: https://www.fws.gov/midwest/endangered/insects/rpbb/pdf/RPBBFactSheet10Jan2017.pdf

Resources

http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7450.html

IPM Outline 7
Subterranean Termites

Target Pest or Group	Several species of termites in the family Rhinotermitidae, particularly: ▪ Arid Land Subterranean Termite – *Reticulitermes tibialis* ▪ Dark Southeastern Subterranean Termite – *Reticulitermes virginicus* ▪ Desert Subterranean Termite – *Heterotermes aureus* ▪ Eastern Subterranean Termites – *Reticulitermes flavipes* ▪ Western Subterranean Termite – *Reticulitermes hesperus*
Target Area(s)	Structures containing wood.
Impact on Mission	Damage to wood structures.
Scope	Base-wide, in and around buildings
Responsibility	▪ All personnel: Report termite sightings and damage to the IPMC, FMP or PMP. ▪ Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management to control infestations. ▪ Grounds Maintenance Provider (GMP): Perform grounds maintenance that minimizes pest infestations, as requested. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude and minimize pest infestations, as requested. ▪ Construction and Facility Management Office (CFMO): Ensure design, construction and pre-treatment techniques that can help prevent subterranean termite infestations are used in all new construction and structure renovations.
Reporting	Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month.

Survey

Survey Method(s)	Visual Inspections: ▪ Inspect wood that is touching or near the soil surface. ▪ Pay particular attention to wood that is damp. ▪ Look for shelter tubes in crawl spaces and in walls. ▪ Termite galleries will be filled with excrement and other debris ▪ Infested wood may be discolored (darkened) and can often be easily punctured by a knife or screwdriver. ▪ The surface of a severely damaged piece of wood may appear blistered or peeled. ▪ Conduct pre and post-treatment surveys to determine whether control operation was effective.
Survey Frequency / Schedule	▪ Annually in most regions. ▪ Biannually in arid regions. ▪ Ongoing observation by building occupants. ▪ During inspections done by PMP for other wood destroying pests, such as carpenter ants, as they occur.
Action Threshold(s)	▪ Presence of termites infesting wood indicates a need for control.

Non-Chemical Control

Type	Method	Responsibility
Building Design	Several design and construction techniques can help prevent subterranean termite infestations: ▪ Use wood species that are resistant to termite attack. ▪ Keep all wooden components at least 12-inches above the surface of the soil. ▪ Replace soil around the foundation of the building with sand (particle size ranging from 10 to 16 mesh). Before pouring slab, install termite-resistant mesh and eliminate openings around plumbing and other utilities protruding from slab. ▪ Provide adequate ventilation in crawl spaces to keep wood dry.	CFMO, FMP
Cultural	▪ Do not place firewood or other wood against the outside of the building. Doing so can: ▪ Bring wood infested with termites into proximity to the building. ▪ Provide habitat for termites. ▪ Hold moisture next to the building. ▪ Prevent inspection of that section of the building. ▪ Do not allow lawn sprinklers to constantly hit wooden portions of the building or allow water to puddle next to building foundations.	All personnel, FMP, GMP
Physical/ Mechanical	▪ Reduce sources of moisture, such as condensation and leaks.	FMP, GMP

	▪ Trim vegetation against siding and roofs. ▪ Use sealants, such as caulking, to minimize access into buildings. ▪ Clean gutters and ensure they are pitched for proper drainage. ▪ Check to ensure soffits are seated and roofing materials are in good repair. ▪ Replace severely damaged wood. ▪ Remove scrap wood from around structures. ▪ Replace soil around foundation and in crawl spaces with sand. Sand particles should be 10 to 16 mesh. Termites are unable to tunnel through sand.	
Prohibited Items	Use of ultrasonic pest repelling devices is prohibited.	

Chemical Control

Application Sites	▪ Structures containing wood that are infested with termites. ▪ Construction sites determined to be good candidates for pre-treatment.
Site Preparation	Pre-treatment procedures: ▪ Visual inspection of crawl spaces and review of structural plans to determine the best locations for insecticide injections. ▪ Pesticide applicator shall contact building occupants prior to pesticide applications. ▪ All food should be removed from exposed areas and processing equipment and utensils covered or stored. ▪ Cover furnishings and surfaces to protect from dust generated during drilling. Post treatment procedures: ▪ Do not remove bait stations or other bait placements. ▪ Thoroughly clean surfaces and furnishings that may have been covered with dust during drilling ▪ Plug drill holes with cement, caulking, or other appropriate material and repair any other damages associated with drilling and termite survey. ▪ Thoroughly clean all food preparation surfaces in treated buildings.
Sensitive Areas	▪ If properly applied, insecticide pre-treatments and injections should pose little risk of unwanted insecticide exposure. ▪ Bait stations should be placed to minimize the chances that children or facilities maintenance personnel will disturb them. ▪ Ensure that insecticides do not enter drains, streams, lakes and other surface water.
Common Active Ingredients	▪ Diflubenzuron ▪ Fipronil ▪ Hydramethylnon ▪ Sulfluramid ▪ Plus other termiticides

Types of Pesticides		Authorized Applicators
Chemically Treated Lumber	▪ Use lumber near the soil surface that has been impregnated (pressure treated) with a variety of repellent/fungicidal/insecticidal chemicals prior to construction. ▪ Some of these products are also available for topical application to wood after construction. ▪ These products are not effective for controlling pre-existing termite infestations.	FMP; Construction Contractors; In-House PMP; Contracted PMP
Pre-Construction Soil Treatment	▪ The soil under and around the perimeter of a slab is treated with an insecticide prior to construction. ▪ The insecticide acts as a barrier, either by killing termites that contact the treated soil. ▪ Only non-repellent termiticides should be used.	In-House PMP; Contracted PMP
Baits	▪ Bait stations containing a slow acting insecticide are placed around the building. ▪ Termites feed on the bait, then return to the colony where they share the bait with other members of the colony. ▪ Although some baits are available to the general public, proper and thorough bait placement is critical to the success of the procedure and must be performed by pest management personnel with experience in termite baiting.	In-House PMP; Contracted PMP
Soil Insecticide Injection	▪ Most common method for controlling termites if a pre-construction chemical barrier fails or was never applied. ▪ Holes are drilled through the foundation of the building, and insecticides are injected into the soil. ▪ Insecticides will kill termites already infesting the building and prevent future infestations for several years. ▪ A licensed professional is need for this work. Applying pesticide to the wrong place can cause contamination in the plumbing or heating ducts.	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	Subterranean termite infestations progress very slowly. Take time to select the proper control measures and find a PMP with termite-control experience.
Time Period to Obtain Control	Termiticides are slow acting. Treatments target not only foragers but the colony and queen as well, and require time before there is a noticeable effect.
Level of Control	Once the colony is destroyed control level should be 100%
PMQAE Assessment	▪ Observe mixing and application during pre-construction treatments to ensure that the PMP uses the proper concentration and amount of termiticide, and that the ground is thoroughly treated to prevent gaps in coverage. ▪ Conduct pre and post-treatment surveys with PMP for post construction treatments to determine efficacy.

Safety Considerations	▪ Applicators must wear personal protective equipment as required by the product label.
Environmental Considerations	▪ Termiticides have a long residual in soil. Care must be taken when applying to prevent contamination of non-target areas.
Special Applicator Qualifications	▪ All PMP must be DOD or State-certified as pesticide applicators. ▪ Subterranean termite control is NOT part of the Self-Help Program.

Resources

http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7415.html
http://www.acq.osd.mil/eie/afpmb/docs/techguides/tg29.pdf

Subterranean termite shelter tubes.

IPM Outline 8
Mice and Rats

Target Pest or Group	Norway rats, roof rats, house mice, and deer mice
Target Area(s)	Buildings, utility vaults, and other structures
Impact on Mission	▪ May transmit disease ▪ Contaminate food ▪ Damage equipment ▪ Nuisance / morale
Scope	Only commensal rodents and those that are frequent pests of structures. Does not include landscape rodents such as gophers and squirrels.
Responsibility	▪ All personnel: Ensure sanitation and other measures to prevent introduction and propagation of pests. ▪ Self-Help Program Participants: Conduct integrated pest management to control infestations indoors and around the perimeter of buildings using non-chemical control methods. ▪ Pest Management Provider (PMP): Conduct integrated pest management to control infestations. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude and minimize pest infestations as requested. ▪ Grounds Maintenance Provider (GMP): Remove potential food sources (i.e. fruit on trees) and create barriers (i.e. by vegetation removal) around buildings to deter rodent invasion. ▪ Natural Resources Manager (NRM): Provide guidance when rodent control operations may impact endangered or threatened species or species of concern.
Reporting	▪ Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to IPMC every month.

Survey

Survey Methods	▪ Visual inspections: observations of rodents or signs of rodents, such as nests, rubmarks, gnawing, earth mounds, burrows, etc. ▪ Use of tracking powder ▪ Personnel complaints: including information on when pests were observed, where, and how many. ▪ Conduct pre and post treatment surveys to determine whether control operations were effective ▪ Use of ultraviolet inspection lights (rodent urine and hair will fluoresce under UV light)
Survey Frequency / Schedule	▪ Daily observation by building occupants. ▪ Routine facilities inspections by PMP or pest control service provider.
Action Threshold(s)	Sighting of any rodent or sign of rodent in or immediately surrounding the building.

Non-Chemical Control

Type	Method	Responsibility
Sanitation	▪ Remove or prevent access to all potential food and harborage sources inside and outside of buildings.	All personnel, including: Self-Help Program Participants
Eliminate Standing Water	▪ Fix plumbing leaks around buildings	FMP
Rodent Proofing	▪ Trim ornamental plants and trees to remove harborage. ▪ Seal holes that may serve as entryways through exterior walls. ▪ Trim tree limbs so that they are at least 6 feet from buildings. ▪ Trim vegetation around buildings. ▪ Clean up debris from inside and around buildings. ▪ Request support from facilities maintenance and/or grounds maintenance provider if necessary.	FMP, GMP
Habitat Modification	▪ For field mice: removing vegetation and disking soil in a barrier 50 ft. around buildings will prevent rodent invasion. This is usually done after area wide rodenticide application. ▪ Use of native landscaping will tend to reduce peridomestic and landscape rodent infestations. Avoid heavy ground covers that provide harborage and cover. This type of planting allows rodents to move into buildings from unimproved grounds.	GMP

Trapping	▪ Glue boards, snap traps, or other mechanical trapping devices. (see health precautions below)	Self-Help Program Participants, In-House PMP; Contracted PMP
Education	▪ Awareness of the importance of sanitation on preventing rodents ▪ Understanding and preventing diseases associated with rodents.	In-House PMP; IPMC
Prohibited Items	▪ Use of ultrasonic pest repelling devices is prohibited. ▪ Myth: Allowing cats to live around buildings controls rodent population. Reality: Cats are inefficient at rodent control especially when they are already being fed. In many situations, cats pose greater hazards than rodents.	

Chemical Control

Application Site	Apply pesticides as required based on survey information to areas where rodents are known to harbor, feed or travel.
Site Preparation	Pre-treatment procedures: ▪ Pesticide applicators shall contact building occupants prior to pesticide applications. ▪ All bait locations must be mapped. ▪ Bait stations should be secured to prevent removal. ▪ Bait stations must be properly labeled and marked with the date on which they were placed. Post treatment procedures: ▪ Bait stations should be checked to ensure that stations are refilled, intact, and no bait has fallen from them. ▪ Remove bait stations once post treatment surveys indicate that rodents have been eliminated.
Sensitive Areas	▪ Areas where people and non-target animals may come into contact with the rodenticide. ▪ Areas where endangered or threatened rodent species occur and may consume bait. ▪ Areas where rodents may be the primary food source for an endangered or threatened animal. ▪ Habitat destruction to reduce rodent food sources or harborage may also be destructive to critical habitats of endangered or threatened species. ▪ The IPMC must consult the NRM before any pest management operations are conducted outdoors on unimproved grounds or wildlands.

Common Active Ingredients	Second generation anti-coagulants: ▪ Brodifacoum ▪ Bromadiolone ▪ Difenacoum ▪ Difethialone First generation anti-coagulants: ▪ Diphacinone ▪ Chlorophacinone ▪ Warfarin Others: ▪ Zinc phosphide ▪ Cholecalciferol ▪ Bromethalin Fumigants: ▪ Aluminum phosphide	
Types of Pesticides		**Authorized Applicators**
Bait	▪ Anticoagulant bait: Multi or single dose blocks or pellets; toxicant effect is delayed. ▪ Single dose acute toxicant bait: Acute toxicant effect. ▪ Liquid bait: Used in areas where water sources are scarce. ▪ All rodenticide baits must be applied in tamper-proof bait stations. ▪ Baits may also be applied directly into burrows in some circumstances and when explicitly allowed according to the product label.	In-House PMP; Contracted PMP
Fumigants	▪ Used for control of rodents in burrows. ▪ Fumigants are often restricted use pesticides and may require additional record-keeping and certification.	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	▪ Rodents indoors require an immediate response. ▪ High priority areas (i.e. food service establishments) with known rodent problems may require continuous surveillance and subsequent baiting as part of a recurring contract.
Time Period to Obtain Control	▪ Trapping may take several days to complete. ▪ Most rodenticides have a delayed effect and may take 24-48 hours to kill the rodent.
Level of Control	100% indoors.
Safety Considerations	▪ Active ingredients in rodenticides are highly toxic to humans and precautions must be taken to prevent human exposure. ▪ Applicators must wear proper protective equipment as required by the product label

Environmental Considerations	▪ Rodenticides can adversely impact non-target animals through direct poisoning or secondary poisoning. ▪ Traps, such as sticky traps, may catch non-target animals such as reptiles and birds. Sticky traps should only be used indoors.
Special Applicator Qualifications	▪ Rodent control using mechanical methods (traps) may be used by non-certified personnel as part of the Self-Help Program. ▪ All PMP applying pesticides must be DOD or State-certified as pesticide applicators.

Additional Information

Precautions on indoor rodent control:

- Most rodents are infested with ectoparasites (fleas, mites, lice) that may also infest or transmit disease to humans. Ectoparasite control should be conducted prior to eliminating (trapping or rodenticides) rodents.
- Rat control indoors using rodenticides should be avoided. The most commonly used rodenticide baits have a delayed toxic effect that does not kill the rodent until hours (or days for multi-dose) after they have consumed the bait. Rodents may die in walls and other voids where the carcass is difficult to retrieve leading to odor problems caused by the decaying carcass.

Disease Prevention:

Rodents can harbor a number of human disease agents; among them are hantavirus and plague. Precautions must be taken when working in rodent infested areas. Rodent feces and dried urine may contain hantavirus that is transmitted when these waste materials are inhaled. Precautions should also be taken when handling dead rodents in traps, and when carcasses are found after rodenticide use. The following precautions should be taken:

- Avoid disturbing feces and other rodent waste when entering enclosed spaces. Use a fitted respirator with high efficiency particulate air (HEPA) filter if necessary.
- Soak rodent waste and dead rodents with a household disinfectant or 10% bleach solution before removing.
- Wear gloves when cleaning or picking up rodent carcasses. Put material in a double plastic bag and dispose of in regular trash.

Resources

House mice: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7483.html

Rats: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74106.html

IPM Outline 9
Nuisance Birds



Target Pest or Group	Birds
	▪ Most birds are protected under the Migratory Bird Treaty Act (MBTA).
	▪ Without a permit issued by the U.S. Fish and Wildlife Service (USFWS), no actions that affect birds can be taken.
	▪ Actions that affect birds includes:
	  ▪ Harassment, using non-lethal means
	  ▪ Shooting
	  ▪ Live trapping for relocation
	  ▪ Removal of active nest (or inactive nest of eagles and threatened/endangered species of birds)
	  ▪ Or any action that is considered an impact by the USFWS.
	▪ Bald and Golden eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA) that has greater protections and requirements than the MBTA.
	▪ The following birds are some of the common non-native birds to the United States. These birds are not protected by the MBTA or BGEPA:
	  ▪ European Starlings – *Sturnus vulgaris*
	  ▪ House Sparrows – *Passer domesticus*
	  ▪ Pigeons (or Rock Doves) – *Columba livia domestica*
	  ▪ Mute Swans – *Cygnus olor*

Target Area(s)	Areas near buildings or populated areas.

Impact on Mission	▪ Most birds do not pose any serious medical hazard or create a significant threat to government property or mission accomplishment.
	▪ Birds may carry diseases and parasites that can infect humans.
	  ▪ Bird feces may contain several pathogenic disease-causing organisms such as Histoplasma and Cryptococcus.
	  ▪ Nests may also contain ectoparasites, such as mites or swallow bugs (similar to bed bugs), that may feed on humans if there are no longer birds using the nest. While this is usually a minor medical issue, it can cause significant morale issues.
	▪ Birds that build nests or deposit feces on the exterior of structures can adversely impact the aesthetics of the structure and surrounding area.

Scope	▪ Base-wide (For control of birds at airfields/heliports, please refer to the site-specific Bird/Wildlife Airstrike Hazard (BASH/WASH) Plan or contact the IPMC.)
Responsibility	▪ Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management of nuisance birds. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude nuisance birds from buildings. ▪ Base Operation Support: Ensure that dumpsters and trashcans are emptied on schedule, and that they are securely covered to prevent entry by nuisance birds. ▪ Natural Resources Manager (NRM): Provides information regarding any regulatory protections of nuisance birds. ▪ All Installation Personnel: Practice good sanitation and do not feed unwanted or nuisance birds to prevent attracting them.
Reporting	▪ Record all pest management operations to the IPMC using the Pest Management Treatment Record and report usage to IPMC every month.

Survey

Survey Method(s)	▪ Visual sighting of birds, nests or bird feces.
Survey Frequency / Schedule	▪ As needed.
Action Threshold	▪ Any verified sighting of a bird where it enters a building or poses a safety or health hazard.

Non-Chemical Control

Type	Method	Responsibility
Exclusion	▪ Primary methods for controlling nuisance birds. ▪ Use screening, hardware cloth and metal flashing to cover holes and cracks to prevent entry of birds into buildings. ▪ Use netting to prevent access to the area under building eaves. ▪ Use lids / covers that can be secured on dumpsters and trashcans.	FMP; PMP
Cultural	▪ Keep loading dock doors and unscreened windows closed when not in use. ▪ Deny access to trash and other sources of food. ▪ Prevent personnel from feeding birds other than at authorized bird feeding locations. ▪ Repair leaking plumbing to remove sources of water. ▪ Raising the mowing height of grass can discourage nuisance birds (especially Canada geese). ▪ Erect nesting platforms for birds such as osprey to offer nesting locations other than power poles.	All personnel

Mechanical/ Physical	▪ Nesting in and roosting on buildings can be reduced by architectural modifications of ridges and openings.
	▪ Silicone-based, anti-graffiti paint can be used to discourage nesting of swallows (the surface of the paint is too slick for the mud nests to stick to it).
	▪ Removal of inactive nests (unless it is an eagle or threatened/endangered species nest).
	▪ Power washing with water can remove inactive nests, but NRM must be consulted prior to any nest removal.
	▪ Shooting may be used to control small populations (i.e., geese, crows) in areas where:
	  ▪ Shooting is legal and completed by a professional.
	  ▪ Shooting can be safely conducted.
	  ▪ Appropriate permits have been obtained.
	▪ Must have NRM coordination and oversight.
		FMP; Qualified PMP; NRM coordination

Trapping	▪ Live cage-type traps may be used for birds, especially if inside buildings. ▪ Lethal trapping may be appropriate in instances when nuisance birds are non-native species. ▪ Extreme care must be taken to prevent killing non-target animals. ▪ All trapping of nuisance birds must be done with coordination and oversight of the NRM.	PMP In-House or Contract; NRM coordination
Harassment	▪ Use of specially-trained dogs can be very effective to discourage non-migratory Canada geese from foraging/roosting on turf in cantonment areas. ▪ Flashing lights and sounds typically have only temporary effects and are not recommended for most circumstances. ▪ All harassment of nuisance birds must be done with coordination and oversight of the NRM.	PMP In-House or Contract; NRM coordination
Prohibited Practices	▪ Use of electronic or ultrasonic pest repelling devices is prohibited. ▪ Predator (owls, coyotes, etc.) statues/decoys are ineffective and prohibited. ▪ Relocation of trapped animals farther than one mile from point of capture is prohibited. ▪ Killing, trapping, relocating or harassing any birds protected under the MTBA, BGEPA and/or Endangered Species Act (ESA) is prohibited, unless the proper permit/authorization is obtained.	
Sensitive Area/ Environmental Concerns	▪ Coordinate with the Cultural Resources Manager (Environmental Office) before undertaking any architectural modifications involving buildings or structures over 50 years old; allow sufficient time for coordination, as consultation outside VAARNG might be required. ▪ Most birds are protected and the identity of nuisance bird species should be certain before any control work takes place.	
Permitting	▪ The appropriate USFWS permit/authorization must be obtained if control actions have any potential to affect MBTA, BGEPA or ESA-protected birds (birds other than European Starlings, Pigeons, House Sparrows, and Mute Swans).	

Special PMP Qualifications	▪ All PMPs performing bird control should hold appropriate licenses and permits to legally capture, transport and release (or euthanize) nuisance birds. ▪ Nuisance birds should never be handled alive or dead with bare hands. PPE should be worn when removing inactive nests and/or bird feces.

Chemical Control

Chemical control (avicides) is rarely used for the control of birds at ARNG sites. Chemical control is only performed in extreme cases, such as when birds are nesting on aircraft or causing danger to human life. In most cases, control is achieved with non-chemical methods since using avicides may kill endangered or threatened birds, and/or non-target species. All chemical control of birds must be pre-approved by the ARNG PMC.

Additional Information

Woodpeckers often "drum" on buildings during the mating season to attract a mate. Drumming typically does not cause any damage to the building. If a woodpecker is causing damage to a building, there is usually an infestation of wood-boring insects. More information on woodpeckers can be found in the link listed in the Resources section below.

Swallows (especially Cliff and Barn Swallows) may carry Swallow Bugs. Swallow Bugs are very similar in appearance to Bed Bugs. If there is a reported outbreak of Bed Bugs in buildings where swallows nest, ensure the infestation is actually Bed Bugs. Swallow bugs are considerably less costly to control than Bed Bugs and require different control techniques.

Some populations of Canada Geese have become non-migratory and may live year-round in cantonment areas, often where there is turf surrounding an ornamental pond. Limiting access to the pond with taller vegetation or a low fence around the entire edge of the pond can help to discourage the geese from using the area since geese prefer to walk into the pond rather than fly up and over a boundary to get to the water.

Resources

Swallow management: http://ipm.ucanr.edu/PMG/PESTNOTES/pn7482.html
Woodpecker management: http://ipm.ucanr.edu/PMG/PESTNOTES/pn74124.html

IPM Outline 9

Vertebrate Wildlife Pests

Target Pest or Group	Vertebrate pests, such as: ▪ Raccoons ▪ Skunks ▪ Squirrels and chipmunks ▪ Voles ▪ Moles and shrews ▪ Groundhogs ▪ Beavers ▪ Opossums ▪ Deer ▪ Coyotes, bobcats and other carnivores ▪ Other nuisance wildlife
Target Area(s)	Areas near buildings or populated areas.
Impact on Mission	▪ Wild and feral animals are dangerous when they are cornered and can become aggressive. ▪ Many wild and feral animals may carry rabies and other diseases and parasites that can infect humans. ▪ Nuisance wildlife can cause severe damage to buildings, other structures and equipment.
Scope	▪ Base-wide

Responsibility	▪ Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management of vertebrate pests. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude vertebrate pests from buildings. ▪ Base Operation Support: Ensure that dumpsters and trashcans are emptied on schedule and that they are securely covered to prevent entry by vertebrate pests. ▪ Natural Resources Manager (NRM): Provides information regarding any regulatory protections of vertebrate pests. ▪ All Installation Personnel: Practice good sanitation and do not feed wild and feral animals to prevent attracting them.
Reporting	▪ Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month.

Survey

Survey Method(s)	▪ Visual sighting of vertebrate pests or signs of raccoons. ▪ A number of vertebrate pests are nocturnal, so visual surveys may need to be conducted at night. ▪ Verify personnel reports of vertebrate pest activity.
Survey Frequency / Schedule	▪ As needed.
Action Threshold	▪ Any verified sighting of a vertebrate pest when it enters a building or poses a safety or health hazard.

Non-Chemical Control

Type	Method	Responsibility
Exclusion	▪ Use lids / covers that can be secured on dumpsters and trashcans. ▪ Use hardware cloth and metal flashing to cover holes and cracks to prevent entry of vertebrate pests into buildings. ▪ Repair leaking plumbing to remove source of water for vertebrate pests.	FMP

Trapping	▪ Live cage-type traps may be used for most wildlife and for feral cats and dogs. ▪ Use cat food containing fish or canned tuna as a bait for most vertebrate pests. ▪ Ensure that the target pest cannot reach through the back or side of the trap to steal the bait. ▪ Secure trap to the ground to prevent the animal from tipping it over. ▪ Lethal trapping may be appropriate for instances of nuisance wildlife that is not easily relocated or is a non-native species. ▪ Extreme care must be taken to prevent killing non-target animals. ▪ **All trapping of nuisance wildlife must be done with coordination and oversight of the NRM.**	PMP In-House or Contract; NRM coordination
Food Removal	▪ Deny access to trash and other sources of food. ▪ Prevent personnel from feeding wildlife and feral animals.	All personnel

Shooting	▪ Shooting may be used to control small populations in areas where:
	  ▪ Shooting is legal.
	  ▪ Shooting can be safely conducted.
	  ▪ Appropriate permits have been obtained.
	▪ Qualified marksmen should perform the shooting.
	▪ Not generally practical for large populations
	▪ **All shooting of nuisance wildlife must be done with coordination and oversight of the NRM.**
		Qualified PMP

Prohibited Practices	▪ Use of ultrasonic pest repelling devices is prohibited. ▪ Relocation of trapped animals greater than one mile from point of capture is prohibited. ▪ Killing, trapping, relocating or harassing any wildlife protected under the Endangered Species Act is prohibited.	
Special PMP Qualifications	▪ All PMP performing vertebrate pest control should hold appropriate licenses and permits to legally capture, transport and release (or euthanize) nuisance wildlife and vertebrate pests. ▪ Vertebrate pests should never be handled alive or dead with bare hands. ▪ All PMP performing vertebrate pest control should have pre-exposure immunization against rabies.	

Chemical Control

Chemical control is rarely used for the control of most vertebrate pests.

If sufficient control of vertebrate pests cannot be achieved using the non-chemical controls, contact your IPMC or the ARNG PMC for further guidance. Chemical control of some vertebrate pests may be allowed under certain circumstances. However, all chemical control of

vertebrate pests must be in accordance with a site-specific IPM outline/SOP for chemical control of that pest.

Additional Information

Beaver management: http://agrilifecdn.tamu.edu/txwildlifeservices/files/2016/07/fs_beaver.pdf

Coyote management: http://icwdm.org/handbook/carnivor/coyotes.asp

Deer management: http://ipm.ucanr.edu/PMG/PESTNOTES/pn74117.html

Groundhog management: http://icwdm.org/handbook/rodents/woodchucks.asp

Mole management; http://ipm.ucanr.edu/PMG/PESTNOTES/pn74115.html

Opossum management: http://ipm.ucanr.edu/PMG/PESTNOTES/pn74123.html

Raccoon management: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74116.html

Skunk management: http://ipm.ucanr.edu/PMG/PESTNOTES/pn74118.html

Squirrel management: http://ipm.ucanr.edu/PMG/PESTNOTES/pn74122.html

IPM Outline 10
Weeds and Unwanted Vegetation

Target Pest or Group	Grasses, broadleaf weeds and woody weeds.
Target Area(s)	Fence lines, road shoulders, parking lots, around fuel storage tanks, utility easements, sidewalks, landscaped areas, lawns and turf, recreational fields and ranges.
Impact on Mission	▪ Fire hazard. ▪ Dense weeds encourage rodent and other pest infestations. ▪ Weeds along roadways hide wildlife increasing the risk for vehicle and animal collisions. ▪ Weeds impair sight-lines along security fences and on training ranges. ▪ Degrades installation appearance.
Scope	Improved and semi-improved grounds, rights-of-way, fence lines, paved areas and ranges.
Responsibility	▪ Self-Help Program Participants: Conduct integrated pest management to control weeds using approved Self-Help control methods. ▪ Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management to control weeds. ▪ Grounds Maintenance Provider (GMP) and/or Facilities Maintenance Provider (FMP): Mechanical control methods and/or mowing to reduce height of weeds.
Reporting	Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month.

Survey

Survey Method(s)	▪ Visual observation and identification during routine inspections. ▪ Annual surveys of roadways and fence lines. ▪ Personnel complaints of weeds impeding mission, contributing to pest infestations, fire hazard or degradation of aesthetics. ▪ Conduct pre and post-treatment surveys to determine whether control operations were effective.
Survey Frequency / Schedule	▪ Daily inspection of areas with extreme fire hazard. ▪ Weekly inspection of landscaped areas. Can be done in conjunction with regular landscape maintenance.
Action Threshold(s)	▪ There is a zero tolerance for weeds installation areas where ordinance or other flammable/explosive materials are stored, due to fire hazard. Consequently, visual sighting of any weed warrants control.

Non-Chemical Control

Type	Method	Responsibility
Mechanical Removal	Pulling or hoeing: ▪ Pull weeds either by hand or with tools that work well on large plants, such as a weed. ▪ Pull up as much root as possible since plants can re-sprout new shoots from the root. ▪ Digging or hoeing is sometimes used in conjunction with pulling to remove the entire root. ▪ Follow-up work will be necessary until desired plants become well established. Mowing: ▪ Mow unwanted plants before they have a chance to set seeds. Chaining: ▪ Drag heavy chains across the tops of target weeds, destroying the foliage and reducing weed density. Root plowing: ▪ Plow with horizontal blades beneath the surface of the ground to sever the root system of target weeds.	Self-Help Program Participants, In-House PMP, Contracted PMP, GMP (or FMP)
Steam	▪ Apply steam to foliage to kill plants. ▪ This technique is unlikely to be cost effective for most weed-control situations and is not recommended by the IPMC.	In-House PMP, Contracted PMP, GMP (or FMP)
Plant Competition	▪ Plant areas with desirable low-growing plants, such as native grasses, to shade-out and outcompete weeds.	GMP (or FMP)
Weed Control Mat	▪ Apply weed control matting. ▪ Matting is composed of synthetic polyester fibers spun tightly together to prevent weed growth by blocking sunlight while still allowing water percolation for drainage. ▪ The matting is unrolled to cover weed-infested areas.	GMP (or FMP)

Improve Vigor of Desirable Plants	▪ Healthy landscaping plants are better able to compete with weeds, thereby slowing the rate of weed invasion. ▪ Aerate and remove thatch in lawns. ▪ Maintain proper watering, fertilizing, and pruning schedules for desirable landscape plants. This is particularly important for managing crabgrass in turf.	GMP (or FMP)
Mulch	▪ Apply course-textured mulches up to 4 inches deep. ▪ Apply fine-textured mulches to a depth of about 2 inches. ▪ Organic mulches: wood chips, sawdust, yard waste, and bark chips. ▪ Inorganic mulches: sand, gravel and pebbles. Use a porous landscape fabric underneath to prevent mulch from sinking into soil. ▪ Synthetic mulches: include geotextiles and landscape fabric. Can be used in conjunction with organic and inorganic mulches.	GMP (or FMP)

Chemical Control

Application Site	When non-chemical methods do not control weeds to an acceptable level, apply herbicides as required based on survey information, to areas where target weeds are problematic.
Site Preparation	<u>Pre-treatment procedures:</u> ▪ Check the local weather forecast. Rain can reduce or negate the effectiveness of an herbicide by washing herbicide off the plant. If precipitation is expected in the next 24-hours, delay application. ▪ Modify irrigation schedule, if necessary. Ensure that sprinklers do not come on immediately following an herbicide application. ▪ Check the local wind conditions. Herbicides can drift and affect non-target plants if applied during windy conditions. ▪ Do not apply herbicides during high temperatures (>95ºF), as this can result in excess vaporization of the herbicide. <u>Post-treatment procedures:</u> ▪ Survey the area to establish the efficacy of control. The length of time between application and survey is dependent upon the species of weed being controlled. ▪ Multiple applications may be necessary, particularly if conditions during the first application were too warm, too dry, or too wet.

Sensitive Areas	▪ Use mechanical controls instead of chemical controls whenever possible around playgrounds and areas frequented by children. ▪ Natural areas containing endangered or threatened plant or animal species are normally off-limits for chemical weed control. Do not apply herbicides or allow herbicide drift onto these areas. ▪ Desirable landscape plants. Prevent herbicide drift onto these plants. ▪ Waterways. Avoid stormwater runoff of herbicides and do not apply directly to water unless allowed by the label. Many herbicides are highly toxic to aquatic organisms.	
Restrictions/ Permitting	▪ When applying herbicide to riparian areas or other sites near water, use only formulations labeled for aquatic sites. ▪ Herbicide applications to, over, or near waters of the US may require coverage under a NPDES Aquatic Pesticide Permit.	
Prohibited Items	▪ Application of salt to control weeds.	
Common Active Ingredients	▪ Glyphosate ▪ Imazapyr ▪ Dichlobenil ▪ Bromacil ▪ Diuron ▪ Pendimethalin ▪ Prometon ▪ Tebuthiuron ▪ Hexazinone ▪ Dicamba ▪ 2,4-D ▪ Diflufenzopyr ▪ Triclopyr ▪ Metsulfuron methyl ▪ Sulfometuron ▪ plus others	
Types of Pesticides		**Authorized Applicators**
Ready-to-Use Glyphosate Herbicides	▪ Spray herbicide directly onto the foliage of the weed. ▪ Apply after the weed emerges, but before seed set. ▪ Foliar application is most effective when weeds are young and the weather is clear. ▪ Spot treat weeds growing in paved areas.	Self-Help Program Participants; In-House PMP; Contracted PMP
Pre-Emergent Herbicides	▪ Apply herbicide to the soil before the first leaves emerge to prevent the weed from developing. ▪ Apply pre-emergent herbicides to the soil just before seed germination. ▪ Selective pre-emergent herbicides must be used so that desirable landscape plants are not harmed.	In-House PMP; Contracted PMP

Foliar-Sprayed Post-Emergent Herbicides	▪ Spray herbicide directly onto the foliage of the weed. ▪ Apply post-emergent herbicides after the weed emerges, but before flowering and seed set. ▪ Foliar application is most effective when weeds are young. ▪ Spot treat weeds growing in paved areas.	In-House PMP; Contracted PMP
Soil-Applied Post-Emergent Herbicides	▪ Apply herbicide to the soil around the weed. ▪ The herbicide is absorbed by the plant through its root system.	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	Dependent on service levels. Can be scheduled annually for pre-emergent applications if there is an established history of weed problems.
Time Period to Obtain Control	Dependent on service levels. May take several days before signs of herbicide effect appear.
Level of Control	Dependent on service levels. Complete removal of weeds from sidewalks and other paved surfaces. For fence lines, weed should be low enough to maintain sight lines. Control weeds around fuel tanks to reduce fire risk.
Safety Considerations	▪ Applicators must wear personal protective equipment as required by the product label. ▪ Restrict entry of personnel into treated areas as directed by the product label.
Environmental Considerations	▪ Prevent herbicide drift to non-target areas and prevent contact with desirable plants. Avoid contaminating water.
Special Applicator Qualifications	▪ Small-scale weed control using approved low-toxicity, ready-to-use herbicides may be performed by non-certified personnel as part of the Self-Help Program. ▪ All PMP or GMP applying pesticides (including herbicides) must be DOD or State-certified as pesticide applicators.

Additional Information

Correct timing of the herbicide application is often essential for effective weed control. Timing will depend on the species of weed, the mode of action and persistence of the herbicide, non-chemical practices in use, soil conditions, and climate.

Resources

Weed Management in Landscapes: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7441.html
Weed Management in Lawns: http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74113.html
Roadside Weed Management: http://edis.ifas.ufl.edu/topic_roadside_weeds
Integrated Roadside Vegetation Management: http://www.tallgrassprairiecenter.org/irvm
DOT Roadside Vegetation Management: https://www.environment.fhwa.dot.gov/ecosystems/vegmgmt.asp

IPM Outline 11
Non-Native, Invasive/Noxious Weeds
In Natural Areas, Ranges and Training Areas

Target Pest or Group	Non-native plants that are widespread and adversely affect the habitats they invade, economically, environmentally or ecologically.
Target Area(s)	Natural areas, ranges, riparian areas, training areas, encroachment buffers.
Impact on Mission	▪ Control required by law ▪ Impacts access to and use of training areas and ranges ▪ Interferes with mission operations ▪ Degrades natural habitats ▪ Impacts endangered and threatened species habitats ▪ May increase wildfire hazard
Scope	Installation unimproved grounds.
Responsibility	▪ Natural Resources Manager (NRM): Oversees weed program coordinating detection and control. ▪ Pest Management Provider (PMP), In-House or Contract: Conducts integrated pest management to control weeds. ▪ IPM Coordinator (IPMC): Ensures environmental compliance of the program.

Control Strategy	▪ Develop a plan to determine what resources need protection against invasive species and which plants pose an actual threat. ▪ Place highest priority on the weeds that have the highest mission impact. ▪ The plan should include solid knowledge of the target plant, such as growing habit, how often it sets seed, months of seed production, etc. and a solid knowledge of the native species whose populations need to be maintained. ▪ Use the following resource: http://plants.usda.gov/java/noxiousDriver - Federal and State Noxious Weed Lists to help prioritize. . ▪ Strategy options are generally to eradicate or to control and maintain invasive species at an acceptably low threshold. ▪ One strategy is to map the infestation then break the map into sections depending on the density of the invasive weed. Some areas will be dense and completely overrun, while other patches are relatively free of weeds. Removal efforts should begin in outlier areas that are only lightly infested. Efforts should move gradually from the easiest areas to the more densely infested areas. The densest patches should be eliminated last. Refer to the Bradley Method referenced below. At each step of the way the areas targeted for clean-up must be of a size and quality that goals are achievable within one growing season. ▪ Because of the bank of seeds stored in the soil, weeds will re-sprout for years after the plants have been removed. In the case of some weeds, the seeds can survive for decades. It is important to return and maintain cleared areas until the seed bank has been exhausted. ▪ After weeds have been removed, it is important to recover the area in native plants to crowd out and help stop the reinvasion of invasive species.
Reporting	▪ Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month. Report invasive weed control operations to Natural Resources Personnel in cases where weeds are being removed to protect or restore natural habitats. ▪ Reporting of herbicide use and application monitoring to local Water Regulatory Agency is required when the operation is covered under a NPDES Aquatic Pesticide Permit.

Survey

Survey Method(s)	Visual inspection and mapping
Survey Frequency / Schedule	Ongoing inspection, especially in the spring and summer when plants are easy to identify by their blooms.
Action Threshold(s)	▪ Priority of control of weeds is based upon the Federal and State Noxious Weeds list and impact on mission. ▪ Areas of installations where ordinance or other flammable/explosive materials are stored have zero tolerance for weeds due to fire hazard. Consequently, visual sighting of any weed warrants control.

Non-Chemical Control

Type	Method	Responsibility

Prevention	▪ Preventing just one new invasive weed is of greater conservation benefit in the long run and is far less costly than controlling a widespread rampant pest.
	▪ Block the transport of plant materials onto relatively clean sites or sites that are actively being cleaned.
	▪ Common means of spreading plant materials are:
	  ▪ Tire tread from bicycles and vehicles
	  ▪ Vehicle undercarriages
	  ▪ Boot treads
	  ▪ Top soil; seeds are often brought in with imported soils
	  ▪ Seed mixes; Invasive species are often included in planting mixes.
	  ▪ Potted plants; Seeds are sometimes transported in the potting soil
	  ▪ Fill for construction sites such as rock fill and soil
	▪ Check plants that are intentionally brought in to ensure none of them are invasive.
	▪ Keep vehicles, tire treads and boots free of dirt and seeds before entering a sensitive area.
	▪ Import fill dirt and gravel from areas that do not have invasive weeds or purchase from suppliers that are certified weed free.
		NRM oversees prevention program

Pulling	▪ Tools are available that help pull weeds. ▪ When pulling plants bring as much of the root as possible out of the ground since many plants can re-sprout from even a small amount of root. ▪ Digging can be used along with pulling to lift the entire plant from the soil.	In-House PMP; Contracted PMP
Cutting	▪ Cutting works well for woody plants that do not re-sprout. Especially if those plants are cut as close to the ground as possible. ▪ If the plant is likely to re-sprout, chemical herbicides can be painted on top of the cut stump. ▪ For invasive trees the herbicide needs to come in contact with the cambial ring between the wood and bark of the trunk. The cambial tissues will transport the herbicide to the roots.	In-House PMP; Contracted PMP

Flaming	▪ Flaming does not involve incinerating the plant, rather to heat it just long enough to produce visible wilting. Heat causes cell walls to burst, which interrupts the flow of water and nutrients. ▪ Flaming is most effective when plants are in very early stages of growth. Older plants with significant stored reserves will require repeat applications and/or concentrating enough heat on the root crown to produce mortality. ▪ Flaming is generally used as a way of coping with the huge flush of seedlings which is often triggered by the removal of parent plants. ▪ This technique is most effective and best done when the ground and vegetation are too wet to carry fire. Avoid conditions that may lead to injury or wildfire.	In-House PMP; Contracted PMP
Solarization	▪ Weeds and insect pests can be killed by covering the ground with layers of clear plastic allowing the sun to create enough heat to destroy all living things.	In-House PMP; Contracted PMP
Prescribed Fire	▪ Prescribed fire can be effective in removing fire-sensitive invasive species from communities that evolved with fire. ▪ Blowtorches and flamethrowers can also be used to burn individual plants or small areas.	NRM Coordinates; In-House PMP; Contracted PMP
Competition and Restoration	▪ Use native plants to out-compete invasive weeds. To do so natives must be planted and cared for until they are well established. ▪ When choosing seed mixes choose seeds that are from adjacent sites and well adapted to the climate. ▪ Choosing plants from far away sources is a common cause of failure. ▪ Be careful of seed mixes that include other invasive plants.	NRM coordinates
Grazing	▪ Grazing animals can selectively control or suppress weeds. ▪ Cattle, sheep, goats, geese, and chickens have been used to graze undesirable species. ▪ Grazing must be continued until the weed's seed bank is exhausted. ▪ It is important never to move the animals from an infested to an uninfested site since seeds can be spread in the animals' droppings.	NRM coordinates
Biological Control	▪ Beneficial organisms can reduce a few specific plants. For example two species of leaf beetle have been very effective in wiping out populations of purple loosestrife. ▪ To be effective, the insect or pathogen must be host-specific and not pose a threat to other plants.	NRM coordinates

Plant Disposal	▪ Avoid leaving plant remains onsite. Many plants can re-root themselves and continue to grow if left in piles. ▪ When invasive plants are removed they should be placed directly into plastic bags which are sealed at the end of the removal process. The sealed bags should be disposed of by being buried in a landfill or burned.	In-House PMP; Contracted PMP
Cleaning of Vehicles and Equipment	▪ In order to prevent the introduction and spread of invasive weeds, all vehicles and equipment used on a base (especially those used for weed control) must be cleaned of dirt, mud, and visible plant material prior to being brought on base (if coming from off-base) or prior to coming on site (if coming from another location on base). ▪ Vehicles and equipment must also be cleaned after being used on a construction site, prior to being used elsewhere on base. ▪ Vehicles/equipment moved from site to site during weed control should also be inspected and cleaned in order to prevent further spread. ▪ Equipment to be cleaned may include things like weed whackers, shoes, shovels, etc. Before leaving a site workers should brush off shoes in order to prevent tracking seeds on the way to other sites.	In-House PMP; Contracted PMP

Chemical Control

Application Site	Apply herbicides as required based on survey information to areas where target weeds are problematic.
Site Preparation	<u>Pre-treatment procedures:</u> ▪ Check the local weather forecast. Rain can reduce or negate the effectiveness of an herbicide by washing the herbicide off the plant. If precipitation is expected in the next 24-hours, delay application. ▪ Check the local wind conditions. Herbicides can drift and affect non- target plants if applied during windy conditions. ▪ Do not apply herbicides during high temperatures (>95□F), as this can result in excess vaporization of the herbicide. <u>Post-treatment procedures:</u> ▪ Survey the area to establish the efficacy of control. The length of time between application and survey is dependent upon the species of weed being controlled. Multiple applications may be necessary, particularly if conditions during the first application were too warm, too dry, or too wet.

Sensitive Areas	Areas frequented by children: ▪ Use mechanical controls instead of chemical controls whenever possible around playgrounds. Sensitive habitat: ▪ Use non-chemical methods in natural areas containing endangered or threatened plant or animal species, or use herbicides with care. ▪ Use drift reduction methods to prevent damage to non-target plants and other organisms and sensitive sites.	
Restrictions / Regulations / Permits	• When applying herbicide to riparian areas or other sites near water use only formulations labeled for aquatic sites. • Herbicide applications to, over, or near waters of the US may require coverage under a NPDES Aquatic Pesticide Permit.	
Common Active Ingredients	▪ Imazapyr ▪ Dichlobenil ▪ Bromacil ▪ Diuron ▪ Pendimethalin ▪ Prometon ▪ Tebuthiuron ▪ Hexazinone ▪ Dicamba ▪ 2,4-D ▪ Diflufenzopyr ▪ Glyphosate ▪ Triclopyr ▪ Metsulfuron methyl ▪ Sulfometuron ▪ plus others	
Methods of Application		**Authorized Applicators**
Selective Broadcast Herbicides	▪ These herbicides selectively kill one class of plants and are safe for other classes of plants. ▪ The herbicide is applied evenly over a large area of land, usually through a boom sprayer. ▪ Boom sprayers can be mounted on a tractor, ATV, truck, airplane or helicopters. ▪ Relatively small areas can be treated with a backpack sprayer or hand-compressed sprayer.	In-House PMP; Contracted PMP
Non-selective Spot Treatment Herbicides:	▪ This method directly targets individual plants. ▪ Non-selective herbicides are used and are applied directly to the target plant. ▪ Care must be taken to reduce drift that could harm non-target plants. ▪ Direct application sometimes is used in conjunction with	In-House PMP; Contracted PMP

	non-chemical treatments, especially when removing invasive trees and shrubs which require root kill to prevent re-sprouting. (See "Cutting" in the Mechanical Control section.)	
Foliar Spray	▪ Herbicide is sprayed directly onto the foliage of the weed. ▪ Post-emergent herbicides should be applied after the weed emerges, but before seed set. ▪ Foliar application is most effective when weeds are young.	In-House PMP; Contracted PMP
Cut Stump Treatment	▪ Herbicide is brushed or sprayed on freshly-cut stumps	In-House PMP; Contracted PMP
Aerial Application of Pesticides:	▪ An Aerial Application Statement of Need must be prepared by the IPMC and approved by the ARNG PMC prior to aerial application of pesticides (including herbicides). ▪ Additional NEPA documentation and permitting may be required	Contracted PMP

Contract or Work Considerations

Time Period to Respond	Control is often conducted during surveys. This may involve observing a plant and then hand pulling or applying an herbicide. Responding to a large area of weeds will depend on timing factors.
Time Period to Obtain Control	Most non-chemical methods and many herbicides result in immediate or rapid kill. However, signs of the effectiveness of some herbicides (i.e. browning of leaves) may not be visible for several days.
Level of Control	In high priority areas a high level of control must be maintained.
Safety Considerations	Applicators use personal protective equipment required by the product label.
Environmental Considerations	When operations are conducted in natural areas, care must be taken to prevent adverse impact to the environment by control measures, vehicles, and workers.
Special Applicator Qualifications	▪ All PMP (or GMP/FMP) applying pesticides (including herbicides) must be DOD or State-certified as pesticide applicators. ▪ PMP conducting invasive weed control must be knowledgeable about identifying and controlling the target plants. ▪ PMP conducting invasive weed control must also be knowledgeable about preventing the spread of invasive plants. ▪ PMP conducting invasive weed control should also be able to produce maps (preferably using GPS and GIS) and write detailed reports.

Additional Information

Correct timing of the herbicide application is essential for effective weed control. Timing will depend on the species of weed, the mode of action and persistence of the herbicide, non-chemical practices in use, soil conditions, and climate.

References

www.cal-ipc.org/ip/inventory/index.php - California Invasive Plant Council; lists of invasive species and control advice http://courses.washington.edu/ehuf462/462_mats/bradley_method.pdf - The Bradley Method for Control of Invasive Plants

http://www.cal-ipc.org/ip/management/wwh/ - California Invasive Plant Council; a guide to techniques for removing Bay Area invasive plants. Site has a downloadable handbook
http://plants.usda.gov/java/noxiousDriver - Federal and State Noxious Weed Lists

http://www.weedcenter.org/ - Center for Invasive Plant Management;
http://www.weedcenter.org/dodworkshop/2009/index.html - DoD Strategic Management of Invasive Species in the Southwestern U.S.

IPM Outline 12
Bed Bugs

Target Pest or Group	Bed Bugs (Cimex species).
Target Area(s)	Primarily billeting areas, especially transient billeting.
Impact on Mission	Bed bugs bite people, cause allergic reactions, and are generally a nuisance that negatively affect morale and quality of life.
Scope	Base-wide, but most likely in billeting.
Responsibility	▪ Billeting Managers: ▪ Establish rules and regulations to prevent establishment and propagation of pests. ▪ Prevent movement of furniture between rooms when bed bugs are identified. ▪ Contact the IPMC when bed bugs are discovered. ▪ Billeting Residents: ▪ Comply with billeting rules and regulations. ▪ Maintain sanitation and cleanliness of personal items such as bedding. ▪ Immediately report suspected infestations of bed bugs to Billeting Managers. ▪ Pest Management Provider (PMP), In-House or Contract: Conduct surveillance and integrated pest management to control infestations. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude and minimize pest infestations as requested.
Reporting	▪ Report all bed bug infestations to IPMC to assist in identifying and preventing further infestations. ▪ Record all pest management operations to the IPMC using the Pest Management Treatment Record and report usage to IPMC every month.

Survey

Survey Method(s)	▪ Personnel complaints: Complaints are commonly received when personnel go to medical with itching or dermatitis due to bites. ▪ Visual inspections: ▪ Look for pests in mattresses, box springs, bed frames and headboards.

	Less commonly bed bugs are found on baseboards and on walls behind furniture. ▪ Apply a flushing agent to cracks and crevices. ▪ Sticky trap surveys. ▪ Vacuum surveys of harborages. ▪ Dry ice / CO_2 attractant traps. ▪ Conduct pre and post treatment surveys to determine whether control operation was effective
Survey Frequency / Schedule	▪ In billeting, housekeeping should perform inspections during cleaning. ▪ Daily observation by residents in billeting. ▪ Observation during inspections of billeting by unit command leadership personnel. ▪ Monthly observation and/or sticky trap monitoring by PMP of spaces post-treatment
Action Threshold(s)	▪ Detection of 1 bedbug, cast skins, or fecal stains should initiate survey and control as needed.

Non-Chemical Control

Type	Method	Responsibility
Sanitation	▪ Thorough cleaning shall be performed in each room. ▪ Remove all clutter particularly from under and around beds to reduce harborage. Removal of clutter also enables easier inspection of furniture and mattress. ▪ **When removing materials from an infested room, either treat the material or place in bags. Seal bags before taking out of room to prevent spread of the bugs.**	Billeting Residents
Washing/ Cleaning	▪ Before washing, place all clothes and bedding in a dryer and dry on the highest setting for at least 20 minutes to kill bed bugs. ▪ Thoroughly wash bedding in hot water and dry on highest heat setting until dry. ▪ Clean mattresses, box springs, frames, headboards with soap and water.	Billeting Residents; Billeting Manager
Mechanical Removal	▪ Vacuum bedbugs from their harborages on mattresses, headboards and other surfaces where they are found. Use a wet/dry vacuum cleaner filled with water or empty and dispose of vacuum bag immediately.	Billeting Residents; Billeting Manager
Isolation and Exclusion	▪ Prevent removal of furniture from rooms found to be infested until each item is cleaned. ▪ Remove debris from around outside of buildings. ▪ Repair cracks in walls. ▪ Caulk cracks and crevices in bed frames and furniture. ▪ Specially designed mattress encasements will prevent bed bugs from getting on mattresses and leaving mattresses to infest other areas. They do not have seams that can harbor the bugs.	Billeting Manager; FMP

Heat	▪ Heat infested areas to at least 113º F (45º C) for at least 1 hour. ▪ A pesticide barrier around doorways may be necessary to prevent spread of fleeing bed bugs to adjacent spaces. ▪ Heat may damage sprinkler systems. Implement protective measures before treatment of rooms. ▪ Place all bedding and clothing into a dryer on the highest heat setting for a minimum of 20 minutes then laundered in hot water for at least 10 minutes. Dryer must not be loaded more than 50% capacity. ▪ Due to its prolonged contact with skin, clothing cannot be treated with pesticides. Laundering is crucial to ensure the treatment program does not fail with the re-introduction of bed bugs from infested clothing.	Contract PMP; Billeting Residents
Prohibited Items	Ultrasonic pest repelling devices are useless and prohibited.	

Chemical Control

Application Site	▪ Apply pesticides as required based on survey information to areas where bed bugs are known to harbor. Including: ▪ Bed frames ▪ Mattresses ▪ Baseboards ▪ Furniture ▪ For heavy infestations, barrier treatments may be required, especially around doors, to prevent bed bugs from fleeing to adjacent areas during treatment. ▪ Chemical control using insecticides alone will not control/prevent bed bug infestations.
Site Preparation	▪ <u>Pre-treatment procedures</u>: ▪ No pesticide applications shall be initiated until the space is unoccupied. ▪ Do not remove furniture or beds until PMP has conducted an inspection. ▪ Pesticide applicator shall contact the Billeting Manager prior to pesticide applications. ▪ All bedding and personal items should be removed from exposed areas, placed in bags, and washed or cleaned.
Sensitive Areas	▪ Some people may be sensitive to pesticides. The insecticide on treated mattresses should be allowed to dry and then covered with a mattress cover before being used. ▪ Ensure that insecticides do not enter drains, streams, lakes and other surface water.

Restrictions	▪ Insecticide resistance may cause treatment failure ▪ Aerosols, dusts and other insecticide formulations that can become airborne shall not be applied in occupied spaces. ▪ Spaces must be vacated before treatment, and then ventilated and the insecticide allowed to dry before personnel reoccupy the space. ▪ Foggers are mostly ineffective in controlling bed bugs because bed bugs hide in crevices and voids where aerosols do not penetrate and they are able to avoid contact with the insecticides. Use of foggers is not recommended.	
Common Active Ingredients	▪ Bifenthrin ▪ Cyhalothrin ▪ Deltamethrin ▪ Other Pyrethroids ▪ Pyrethrin For pyrethroid-resistant bed bugs: ▪ Hydroprene (IGR) ▪ Chlorfenapyr (▪ Silica gel ▪ Boric acid	
Types of Pesticides		**Authorized Applicators**
Flushing Agents	▪ Use aerosol contact pesticides directed into potential harborage areas to flush out and kill pests as needed.	In-House PMP; Contracted PMP
Crack and Crevice Residuals	▪ Apply (by crack and crevice technique) a residual pesticide spray to all known or suspected harborages.	In-House PMP; Contracted PMP
Spot Treament Residuals	▪ Apply as a "spot treatment" to indicated areas.	In-House PMP; Contracted PMP
Mattress Treatment	▪ Apply to infested mattresses.	In-House PMP; Contracted PMP
Insect Growth Regulators	▪ IGRs affect the development and reproduction of insects. ▪ When properly applied, IGRs have essentially no effect on vertebrate metabolism because of their mode of action and low application rates, but they can have a significant impact on bed bug molting, fertility and egg hatching success. ▪ Apply according to label directions.	In-House PMP; Contracted PMP

Contract or Work Considerations

Time Period to Respond	Discovery of bed bugs in any area requires a response within 24 hours.
Time Period to Obtain Control	One to two weeks.
Level of Control	100% control
Safety Considerations	▪ Do not treat occupied rooms with liquid or dust formulations.
Special	▪ All PMP or GMP applying pesticides (including herbicides) must be

Applicator Qualifications	DOD or State-certified as pesticide applicators.

Additional Information

Treatment failures are due to incomplete surveys for the pest, improper application, and insecticide resistance. Follow up inspections and control is crucial to eliminating the bugs.

Resources

http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7454.html
http://www.acq.osd.mil/eie/afpmb/docs/techguides/tg44.pdf
http://www.epa.gov/pesticides/bedbugs/

IPM Outline 12

Feral Dogs and Cats

Target Pest or Group	▪ Feral Dogs and Cats. (For control of birds and other vertebrate wildlife pests, please refer to their specific IPM outlines.)
Target Area(s)	Areas near buildings or populated areas.
Impact on Mission	▪ Feral animals may be dangerous when they are cornered and can become aggressive. ▪ Many feral animals may carry rabies and other diseases and parasites that can infect humans.
Scope	▪ Base-wide
Responsibility	▪ Pest Management Provider (PMP), In-House or Contract: Conduct integrated pest management for vertebrate pests. ▪ Facilities Maintenance Provider (FMP): Perform facilities repairs and improvements that exclude vertebrate pests from buildings. ▪ Base Operation Support: Ensure that dumpsters and trashcans are emptied on schedule and that they are securely covered to prevent entry by vertebrate pests. ▪ Natural Resources Manager (NRM): Provides information regarding any regulatory protections of vertebrate pests. ▪ All Installation Personnel: Practice good sanitation and do not feed feral animals to prevent attracting them.
Reporting	▪ Record all pest management operations using the Pesticide Management Treatment Record Form and report usage to the IPMC every month.

Survey

Survey Method(s)	▪ Visual sighting of feral animals or signs of their presence. ▪ Some feral animals may become mainly nocturnal, so visual surveys may need to be conducted at night. ▪ Verify personnel reports of feral dog or cat activity.
Survey Frequency / Schedule	▪ As needed.
Action Threshold	▪ Any verified sighting of a feral dog or cat.

Non-Chemical Control

Type	Method	Responsibility
Exclusion	▪ Use lids / covers that can be secured on dumpsters and trashcans. ▪ Use hardware cloth and metal flashing to cover holes and cracks to prevent entry of feral animals into buildings. ▪ Repair leaking plumbing to remove sources of water for feral animals.	FMP
Food Removal	▪ Deny access to trash and other sources of food. ▪ Prevent personnel from feeding feral animals.	All personnel
Education	▪ Teach site personnel the impact of feral dogs and cats on native wildlife, especially birds, reptiles and small mammals. ▪ Teach site personnel about the threat to human health posed by feral dogs and cats. ▪ Provide resources for pet fostering and adoption organizations.	In-House PMP; IPMC
Trapping	▪ Only live cage-type traps should be used for feral dogs and cats. ▪ Use cat food containing fish or canned tuna for bait. ▪ Ensure that the target pest cannot reach through the back or side of the trap to steal the bait. ▪ Secure trap to the ground to prevent the animal from tipping it over. ▪ Situate and regularly monitor traps to prevent unnecessary stress to trapped animals. ▪ Trap-Neuter-Release (TNR) programs are prohibited.	PMP In-House or Contract; NRM coordination

Shooting	▪ In instances where there is a known threat to human health, shooting may be used to control small populations in areas where: ▪ Shooting is legal. ▪ Shooting can be safely conducted. ▪ Appropriate permits have been obtained. ▪ Qualified marksmen should do the shooting. ▪ Not generally practical for large populations. ▪ Lethal control has considerable risk for generating negative public relations. ▪ Make completely sure that target animals are feral animals and not stray pets.	Qualified PMP
Prohibited Practices	▪ Use of ultrasonic pest repelling devices is ineffective and prohibited. ▪ Relocation of trapped animals is prohibited. ▪ Trap-Neuter-Release (TNR) programs are prohibited. ▪ Killing, trapping, relocating or harassing any wildlife protected under the Endangered Species Act is prohibited.	
Special PMP Qualifications	▪ All PMP performing vertebrate pest control should hold appropriate licenses and permits to legally capture, transport and/or euthanize feral animals. ▪ Feral animals should never be handled, alive or dead, with bare hands. ▪ All PMP performing feral animal control should have pre-exposure immunization against rabies.	

Chemical Control

Chemicals are never used for the control of feral cats and dogs.

Additional Information

Informational brochure about hazards associated with cats:
http://www.denix.osd.mil/nr/otherconservationtopics/invasivespecies/publications/don-t-let-your-cat-go-awol-indoor-cats-are-safe-cats/

Feral cat management:
http://extensionpublications.unl.edu/assets/pdf/ec1781.pdf

Rabies in domestic animals:

https://www.cdc.gov/rabies/exposure/animals/domestic.html

Appendix C – VAARNG State Pesticide Use List (SPUL)

EPA Reg No.	Label Name	ACTIVE Ingredient (Primary)
228-139-71368	2,4-D L.V. 4 (EC) Ester	2,4-dichlorophenoxy-, 2-ethylhexyl ester
62719-556	Accord XRT II (GF-1280/Durango DMA/Duramax)	Glyphosate, dimethylammonium salt
81927-23	Alliagare Imazapyr 2 SL	Imazapyr, isopropylamine salt
83851-3	Amtide MSM 60 DF	Metsulfuron-methyl
228-365	Aquaneat Aquatic Herbicide	Glyphosate-isopropylammonium
241-299	Arsenal AC (Applicators Concentrate) Herbicide	Imazapyr, isopropylamine salt
3862-176-13051	Assualt Wasp and Hornet Killer	Permethrin, mixed cis, trans
706-110-10320	Bed Bug, Lice and Dust Mite Spray	Permethrin, mixed cis, trans
53883-118	Bifen IT (TC) Termaticide/Insecticide	Bifenthrin
34704-955	Bisect L	Bifenthrin
83923-2	Bithor SC	Bifenthrin
67603-11-64695	Blast 'Em Wasp and Hornet Killer	Permethrin, mixed cis, trans
4-392	Bonide Wasp & Hornet Spray	Permethrin, mixed cis, trans
64405-1	Bora-Care	Boron sodium oxide (B8Na2O13), tetrahydrate
73079-4	Boractin Insecticide Powder	Boric Acid
9444-129	Borid	Boric Acid
50534-188-100	Bravo (720) Weather Stik	Chlorothalonil
55467-9	Buccaneer Plus Glyphosate Herbicide	Glyphosate-isopropylammonium
3862-174-11861	Buzz Off Wasp & Hornet Killer	Permethrin, mixed cis, trans
10088-115-68562	Buzz Saw Wasp and Hornet Killer	d-Phenothrin
62719-572	Capstone (Milestone VM Plus)	Aminopyralid, triisopropanolamine salt
432-1332	Centerfire (Premise 75) Insecticide	Imidacloprid
9688-190-8845	Chemisco (Spectricide/Hot Shot) Wasp & Hornet Killer (LE)	lambda-Cyhalothrin
241-430	Chopper Gen2 Herbicide	Imazapyr, isopropylamine salt
73079-12	CimeXa Dust (Silicide)	Silicon dioxide
64240-45	Combat Quick Kill Roach Killing Gel	Fipronil

12455-79	**Contrac All Weather Blox (Rat & Mouse Bait)**	**Bromadiolone**
55809-3	**CRC Wasp & Hornet Killer Plus**	**d-Phenothrin**
62719-260	**Crossbow**	**Butoxyethyl 2,4-dichlorophenoxyacetate**
1021-2776	**Crossfire Insecticide**	**Clothianidin**
8959-10	**Cutrine-Plus Algaecide/Herbicide**	**Copper ethanolamine complex**
499-304	**Cy-Kick CS Contolled Release Cyfluthrin**	**Cyfluthrin**
53883-261	**Cyzmic (Lamba CSI 9.7) CS**	**lambda-Cyhalothrin**
829-287	**Daconil SA-50 Liquid Ornatmental and Vegetable Fungicide**	**Chlorothalonil**
100-1066	**Demand (Patrol) CS Insecticide**	**lambda-Cyhalothrin**
352-853	**DuPont LeadOff Herbicide**	**Thifensulfuron methyl**
432-1549	**Escort XP Herbicide**	**Metsulfuron-methyl**
432-1528	**Esplanade EZ**	**Diquat dibromide**
EX-2	**Essentria (EcoEXEMPT) JET Wasp & Hornet Killer**	**Rosemary Oil**
34704-915	**Evade 4 FL**	**Prodiamine**
12455-97	**Fastrac Place Pacs**	**Bromethalin**
12455-91	**Final Rodenticide Place Pac**	**Brodifacoum**
100-1084	**Fusilade II Turf and Ornamental Herbicide**	**Fluazifop-p-butyl**
62719-37	**Garlon (Element) 3A**	**Triethylamine triclopyr**
62719-40	**Garlon (Element) 4**	**Butoxyethyl triclopyr**
2724-484	**Gentrol (RF 9707) Aerosol**	**(7s)-Hydroprene**
2724-351	**Gentrol IGR (Zoecon RF-259) Emulsifiable Concentrate**	**(7s)-Hydroprene**
42750-61	**Gly Star (Cornerstone/Glyphosate 41) Plus (Pro)**	**Glyphosate-isopropylammonium**
67760-47-9688	**Glyfos Ultra-Kill Ready-To-Use 1.92% Weed & Grass Killer**	**Glyphosate-isopropylammonium**
4787-23	**Glyfos X-tra**	**Glyphosate-isopropylammonium**
72159-14	**Glyphosel Pro Herbicide**	**Glyphosate-isopropylammonium**
241-426	**Habitat Herbicide**	**Imazapyr, isopropylamine salt**
1021-1780-3	**Harris Yellow Jacket Wasp and Hornet Spray**	**d-Phenothrin**
524-445	**Honcho (Plus) (Roundup) (MAX)**	**Glyphosate-isopropylammonium**
524-454	**Honcho (Plus) (Roundup) (Original II)**	**Glyphosate-isopropylammonium**
352-346	**Hyvar X-L Herbicide**	**Bromacil, lithium salt**
73079-6	**InTice Perimeter Bait**	**Boric Acid**
45385-101	**JT EATON Kills Bed Bugs Plus**	**Piperonyl butoxide**

7405-73-10320	**K-2 Spray (DO NOT REORDER)**	**Permethrin, mixed cis, trans**
40208-7	**Kibosh Wasp, Hornet, Bee & Yellow Jacket Killer**	**Piperonyl butoxide**
42750-66-7401	**Kilz all (Gly Star)**	**Glyphosate-isopropylammonium**
10404-43	**Lesco Three-Way Selective Herbicide**	**Dicamba, dimethylamine salt**
12455-61	**Liqua-Tox II**	**Diphacinone, sodium salt**
7173-188	**Maki (Boot Hill) Rat and Mouse Bait Packs (Pellets)**	**Bromadiolone**
11694-107	**Marksman (The End/Tough Guy 720) Wasp & Hornet Killer**	**Permethrin, mixed cis, trans**
432-1264	**Maxforce FC Professional Insect Control Ant Killer Bait Gel**	**Fipronil**
432-1455	**Maxforce Fly Spot Bait**	**cis-9-Tricosene**
6218-73	**Mosquito Bits**	**Bacillus thuringiensis subspecies israelensis Strain**
64405-2	**Niban (Redzone) Granular Bait**	**Boric Acid**
9688-325	**No-Pest Wasp & Hornet Killer5**	**Cypermethrin**
228-570	**Nufarm Polaris AC Complete Herbicide**	**Imazapyr, isopropylamine salt**
228-480	**Nufarm Polaris AC Herbicide**	**Imazapyr, isopropylamine salt**
228-534	**Nufarm Polaris Herbicide**	**Imazapyr, isopropylamine salt**
1021-1603	**Nyguard IGR Concentrate Insecticide (Nylar 10 EC)**	**Pyriproxyfen**
1021-1780-239	**Ortho Hornet & Wasp Killer**	**d-Phenothrin**
432-1557	**Oust Extra Herbicide**	**Metsulfuron-methyl**
241-392	**Phantom (SD) Termiticide-Insecticide**	**Chlorfenapyr**
66222-22	**Pramitol 25E**	**Prometon**
499-550	**PT Waso-Freeze II Wasp & Hornet Insecticide**	**Prallethrin**
66222-192	**Quali-Pro Bifenthrin (Golf & Nursery 7 9F)**	**Bifenthrin**
66222-176	**Quali-Pro Glyphosate (Glyphogan) Plus Herbicide**	**Glyphosate-isopropylammonium**
66222-230	**Quali-Pro Prodiamine 4L Herbicide**	**Prodiamine**
228-366	**Razor Pro Herbicide**	**Glyphosate-isopropylammonium**
305-55	**Repel Mosquito Stop (Permanone)**	**Permethrin, mixed cis, trans**
9688-190-305	**Repel Wasp, Hornet & Yellowjacket Killer**	**lambda-Cyhalothrin**
62719-324	**Rodeo (Glypro/Accord Concentrate) Herbicide**	**Glyphosate-isopropylammonium**

524-549	**Roundup PowerMax Herbicide**	**Glycine, n-(phosphonomethyl)-potassium salt**
524-475	**Roundup Pro (Ultra) Herbicide**	**Glyphosate-isopropylammonium**
524-529	**Roundup Pro Concentrate**	**Glyphosate-isopropylammonium**
524-535	**Roundup Quickpro Herbicide**	**Diquat dibromide**
71995-33	**Roundup Weed & Grass Killer Ready-to-Use Plus**	**Glyphosate-isopropylammonium**
61842-37	**Sevin Brand XLR Plus Carbaryl Insecticide**	**Carbaryl**
9688-141-8845	**Spectracide Pro Wasp & Hornet Killer**	**Permethrin, mixed cis, trans**
2217-833	**Speed Zone Broadleaf Herbicide For Turf**	**2,4-dichlorophenoxy-, 2-ethylhexyl ester**
498-156	**SprayPak Wasp , Bee & Hornet Killer**	**d-Phenothrin**
228-690	**Spyder Extra**	**Metsulfuron-methyl**
352-622-85588	**Sulfomet Extra Herbicide**	**Metsulfuron-methyl**
432-763	**Suspend SC Insecticide (K-Othrine® SC Insecticide)**	**Deltamethrin**
228-520	**Tahoe 3A (Triclopyr 3) Herbicide**	**Triethylamine triclopyr**
279-3206	**Talstar TC Flowable Termaticide/Instecticide**	**Bifenthrin**
432-1483	**Temprid SC Insecticide**	**beta-Cyfluthrin**
7969-329	**Termidor HE Highly Effective Termiticide**	**Fipronil**
7969-210	**Termidor SC Termiticide/Insecticide**	**Fipronil**
149-8	**Terro Ant Killer II**	**Borax (B4Na2O7.10H2O)**
11694-109	**The END Wasp & Hornet Killer**	**Piperonyl butoxide**
9688-190	**Ultra-Kill/Black Flag/Chemisco Wasp and Hornet Killer (LE)**	**Prallethrin**
706-109-9250	**United 173 Wasp Whacker**	**Tetramethrin**
7969-88-829	**Vantage (Poast Plus) Herbicide (DO NOT REORDER)**	**Sethoxydim**
71368-14-55467	**Weedone LV4 Solventless Herbicide**	**2,4-dichlorophenoxy-, 2-ethylhexyl ester**
499-290	**Whitmire PT (Prescription Treatment) 565 Plus XLO**	**n-Octyl bicycloheptene dicarboximide**
11694-111-1270	**Zep Stay Away (DO NOT REORDER)**	**n,n-Diethyl-meta-toluamide and other isomers**
2724-786	**Zoëcon (RF 2050) Wasp-X™ Wasp & Hornet Spray**	**Ethofenprox**

Appendix D – VAARNG Pesticide Management Treatment Record Form

Virginia Army National Guard
PESTICIDE MANAGEMENT TREATMENT RECORD

Instructions:
Submit to the VAARNG Integrated Pest Management Coordinator. Use a separate form for each pesticide when using multiple chemistries on single application.

1. Date	2. Time of Application	
3. Facility/Address/Room Number		
4. Applicator's Name and Certification No.	5. Company Name (If Contractor)	
6. Pesticide Used (Trade Name)	EPA REG No.	
7. Active Ingredient (From Label)	% Active Ingredient	
8. Total Quantity of Pesticide Used Before Mixing (i.e. gallons/fluid ounces or pounds/dry ounces)		
9. Total Quantity Applied After Mixing (i.e. gallons/fluid ounces or No. of bait stations, etc.)		_____ lbs of active ingredient applied
10. Site Description/Size of Treated Area/Wind Speed & Direction/Weather		
11. Purpose of Application (Target Organism and Nature of Problem)		
12. Application Status (Circle One)	Preventive	Recurring Problem One Time Treatment
13. Recommend Alternative Methods to Alleviate the Problem	(i.e. Physical, Mechanical, Cultural, Biological)	

_____	_____	_____	_____
Applicator	**Date**	**Facility Manager**	**Date**

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Appendix E – VAARNG Self-Help Program

The VAARNG Self-Help Program allows maintenance workers, facility managers, building occupants and unit personnel to use Integrated Pest Management (IPM) measures for control of minor pests. This program features ready-to-use, low toxicity pesticides pre-approved by the ARNG Pest Management Consultant (ARNG PMC).

VAARNG Self-Help Program participants may only perform pest management actions listed in the Self-Help sections of the IPM Outlines (Appendix B) for the pest(s) being controlled.

Only pesticides that are specifically listed on the VAARNG SPUL for use in the Self-Help Program (Appendix B) may be used and participants must review the educational materials for the pest and the control method prior to their use.

All application, safety, storage, disposal and recording requirements as outlined on the pesticide label, the Self-Help training materials, this IPMP and the Self-Help IPM Outlines are to be followed.

When pest management actions are performed in accordance with the requirements of the VAARNG Self-Help Program, participants are not required to be certified pesticide applicators.

Step 1. Determine if Self-Help is appropriate. Use the Self-Help IPM Outlines (pages E-5-84) to help identify the pest, assess the level of the pest problem and determine what IPM controls can be used to reduce pest presence to acceptable levels.

Step 2. If there is not a Self-Help IPM Outlines (pages E-5-84) for the pest, Self-Help control is NOT appropriate for the pest or, if the level of the pest problem is greater than can be controlled with Self-Help, put in a Work-Order with O&M or DPW.

Step 3. If Self-Help control is appropriate for the pest and the level of the pest problem, use the Self-Help control methods in the order they are given in the Self-Help IPM Outline (pages E-5-84) for the pest. Use all Self-Help cultural, mechanical and physical control methods before using Self-Help chemical control methods. Also, keep in mind that it is rarely possible to completely eradicate a pest and the goal is to control the pest to acceptable levels.

Step 4. If non-chemical Self-Help control methods do not control the pest(s) to acceptable levels, Self-Help-approved pesticides listed in the Self-Help IPM Outlines may be used. These are low-toxicity, ready-to-use pesticides and are the only pesticides allowed for use by Self-Help Program participants.

Pesticides that require dilution are not allowed for use in the Self-Help Program at VAARNG sites.

Step 5. Obtain pesticides/equipment listed on Self-Help SPUL from those distributed by Building 303 (Entomology) or DPW Warehouse 224.

All pesticides used for Self-Help MUST have the exact EPA Registration Number as the pesticide listed on the VAARNG SPUL as approved for Self-Help Use. Pesticide approval is based on the EPA Registration Number of the pesticide and, even if the active ingredient is the same and the pesticide contains the same concentration, a pesticide is not approved for use unless it is listed on the SPUL with that specific EPA Registration Number.

If a Self-Help pesticide for the pest(s) with the listed EPA Registration Number cannot be reasonably procured, contact the IPMC to determine if there is a substitute available. The IPMC can request the addition of pesticides to the Self-Help Program list by submitting the pesticide name, manufacturer, EPA registration number, target pest and target site to the ARNG IPMC for review and approval.

Step 6. Review the Self-Help IPM Outline for the pest (pages E-5-84) and the pesticide label(s) BEFORE applying any Self-Help pesticides.

Those who are applying pesticides on Federal properties (Appendix A) who are not licensed applicators must complete a VAARNG Self-Help Training Acknowledgement before applying the pesticide. After reviewing the training materials and label(s), sign and submit a VAARNG Self-Help Training Acknowledgement of Understanding (in Appendix E, page E-5) to the IPMC (MAJ Webb, brian.j.webb14.mil@mail.mil) and keep a copy locally. The pest/pesticide-specific educational materials must be reviewed at least annually and a VAARNG Self-Help Training Acknowledgement of Understanding is to be resubmitted to the IPMC at that time.

The pesticide label must be reviewed before EVERY application of the pesticide since label requirements can change.

Step 7. Apply the pesticides in accordance with the label and the pest-specific Self-Help IPM Outlines (pages E-5-84). Pesticide labels are legal documents and all directions and restrictions on the label MUST be followed.

Step 8. Report pesticide applications using the VAARNG Pesticide Management Treatment Record (Appendix D). This report is to be completed at time of application and a copy sent to the Facility Manager within one calendar week from application. Facility Managers will send all treatment records to the IPMC on the last business day of each month. Complete all fields in the section marked “Self-Help”.

Step 9. Store and dispose of pesticides as directed by the VAARNG IPMP and in accordance with label directions.

Step 10. If the Self-Help control methods in the Self-Help IPM Outline do not control the pest to acceptable levels, put in a Work Order with O&M or DPW.

Pesticides Approved for use by Self-Help Program Participants:

EPA Reg No.	Label Name	ACTIVE Ingredient (Primary)
3862-176-13051	Assualt Wasp and Hornet Killer	Permethrin, mixed cis, trans
67603-11-64695	Blast 'Em Wasp and Hornet Killer	Permethrin, mixed cis, trans
4-392	Bonide Wasp & Hornet Spray	Permethrin, mixed cis, trans
10088-115-68562	Buzz Saw Wasp and Hornet Killer	d-Phenothrin
9688-190-8845	Chemisco (Spectricide/Hot Shot) Wasp & Hornet Killer (LE)	lambda-Cyhalothrin
64240-45	Combat Quick Kill Roach Killing Gel	Fipronil
55809-3	CRC Wasp & Hornet Killer Plus	d-Phenothrin
EX-2	Essentria (EcoEXEMPT) JET Wasp & Hornet Killer	Rosemary Oil
67760-47-9688	Glyfos Ultra-Kill Ready-To-Use 1.92% Weed & Grass Killer	Glyphosate-isopropylammonium
1021-1780-3	Harris Yellow Jacket Wasp and Hornet Spray	d-Phenothrin
40208-7	Kibosh Wasp, Hornet, Bee & Yellow Jacket Killer	Piperonyl butoxide
42750-66-7401	Kilz all (Gly Star)	Glyphosate-isopropylammonium
432-1264	Maxforce FC Professional Insect Control Ant Killer Bait Gel	Fipronil
9688-325	No-Pest Wasp & Hornet Killer5	Cypermethrin
1021-1780-239	Ortho Hornet & Wasp Killer	d-Phenothrin
499-550	PT Waso-Freeze II Wasp & Hornet Insecticide	Prallethrin
9688-190-305	Repel Wasp, Hornet & Yellowjacket Killer	lambda-Cyhalothrin
71995-33	Roundup Weed & Grass Killer Ready-to-Use Plus	Glyphosate-isopropylammonium
9688-141-8845	Spectracide Pro Wasp & Hornet Killer	Permethrin, mixed cis, trans
498-156	SprayPak Wasp , Bee & Hornet Killer	d-Phenothrin
11694-109	The END Wasp & Hornet Killer	Piperonyl butoxide
9688-190	Ultra-Kill/Black Flag/Chemisco Wasp and Hornet Killer (LE)	Prallethrin
706-109-9250	United 173 Wasp Whacker	Tetramethrin

499-290	Whitmire PT (Prescription Treatment) 565 Plus XLO	n-Octyl bicycloheptene dicarboximide
2724-786	Zoëcon (RF 2050) Wasp-X™ Wasp & Hornet Spray	Ethofenprox

VAARNG SELF-HELP TRAINING
Acknowledgement of Understanding

Type of Pest:

Control Methods:

1. I have read and understand the instructions for performing Self-Help pest control for _____ and have read and understand the pesticide label(s). I will follow the label instructions and all other instructions given to me. If I do not understand the instructions, I will have a qualified person explain them to me before continuing. I understand that any pesticide application not in accordance with the label is a violation of the Federal Insecticide, Fungicide, and Rodenticide Act.

2. I will make sure pets, children, and individuals who may be sensitive or allergic to pesticides will not be present during any application nor will they be allowed back into the treated area(s) before thorough post-treatment ventilation.

3. I will perform the control procedures myself, at my facility area only.

4. Once I have received the Self-Help pest control items, I will not use any of the products in a manner inconsistent with the label. Unused items and empty containers will be disposed of as specified by the Integrated Pest Management Coordinator (IPMC) and the product label.

5. I will record and report Self-Help actions as directed by the IPMC.

Signature:_____ Date:_____

Name:_____ Facility:_____

VAARNG Self-Help IPM Outlines

SELF-HELP IPM Outline 1

Stinging Insects

A. PURPOSE

The Self-Help pest management program authorizes the use of approved Self-Help products (ready-to-use aerosol bee, wasp, and hornet control pesticides) by installation maintenance and VAARNG personnel who encounter stinging insects during the normal course of their assigned duties.

B. RESPONSIBILITIES

- Self-Help Program participants are responsible for proper use, recording, reporting, storage and disposal of Self-Help products.
- **All** label instructions must be read and followed – **The Label is the Law!**
- A Safety Data Sheet (SDS) should accompany the Self-Help product and be readily available to personnel using the product and working in the area where the product is used.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program. Contact the VAARNG IPMC (MAJ Brian Webb) for a current list of approved Self-Help products.
- Self-Help products can be obtained by submitting a Work Order to O&M. Pesticides will be shipped or picked up at the warehouse (Bldg 224) on Fort Pickett.
- Record and report usage of Self-Help products to the VAARNG IPMC at the end of each month using the Pest Management Treatment Record form.

C. ACTIONS

STEP 1. Surveillance.

- Identify the type of stinging insect using the information in this outline.
- Self-Help Program participants **MUST** identify the stinging insect(s) before control is attempted. Controlling some stinging insects and/or the nests may be too dangerous for Self-Help Program participants.
- Many types of stinging insects are "social" and can act together as a single unit. This can increase the risk during control operations since numerous insects can attack simultaneously to defend their nest.
- Additionally, several different species of bees, wasps, and hornets are capable of inflicting severe stings and can sting multiple times.
- Some people are allergic to venomous stings and can have a serious physical reaction if stung. More people die annually from allergic or severe allergic (anaphylactic) reaction caused by insect stings than from snake bites.

STEP 2. Decide if Self-Help is appropriate.

- If it is determined the type of stinging insect is not appropriate for Self-Help Program control, contact the O&M Branch or Entomology to arrange for control by a Pest Management Professional (PMP).
- The decision to use Self-Help for control of stinging insects is often based on personal judgement and common sense. If you have **any** doubts that the stinging insects cannot be controlled with Self-Help actions, do not proceed with Self-Help.
- Approved Self-Help products are tools to assist Self-Help Program participants with the control of small, non-threatening stinging insect nests so that designated tasks can be completed without loss of time waiting for a Pest Management Professional (PMP) to arrive. Trying to control too large a nest could result in multiple stings, loss of work time, and unacceptable risk to VAARNG personnel.

STEP 3. Perform Chemical Control (aerosol spray)

- Self-Help products for stinging insects can be obtained by request from the O&M or Entomology.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program.
- Read the entire product label. **The Label is the Law!**
- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do **NOT** eat, drink or smoke while using any pesticide.
- Use product as directed on the label for control of the stinging insect and/or nest.
- Always thoroughly wash hands with soap and water after using product and before eating, drinking or smoking.

STEP 4. Storage and Disposal of Self-Help Products.

- Store and/or dispose of any leftover Self-Help products as directed on the label and the VAARNG IPMP.
- If you have any questions on storage or disposal of the Self-Help products, contact the VAARNG IPMC (MAJ Brian Webb).

STEP 5. Recording and Reporting.

- Report Self-Help product use to the VAARNG IPMC (MAJ Brian Webb) using form the Pest Management Treatment Record form.
- The form(s) recording usage should be sent to the VAARNG IPMC at the end of the month.

STEP 6. Follow-up and Assessment.

- If the Self-Help control methods in this outline do not control the pest to acceptable levels, put in a Work Order with the CFMO or contact the Entomologist.

STEP 7. Perform Physical and Cultural Controls.

- Use of chemical controls (pesticides) will only provide temporary control. Habitat modification, building practices (exclusion), or nest removal are more permanent controls.
- Report repeated encounters with stinging insects to the O&M Office or Entomology so that more permanent controls can be implemented.

Honey Bees

- Honey bees are about ½" long, black and yellow, with fuzzy hair on most of their body.
- Honey bees are highly-organized social group insects with a queen, drones, and potentially hundreds to thousands of workers.
- Nests are found in building walls, hollow trees and hollow pillars.
- Honey bees are active during the day and tend to be quiet during the cooler evenings and night, staying close-by or in the nest.
- In most cases, honey bees are fairly docile and will not attack humans unless the nest is disturbed.

Do Not Kill Honey Bees Unless Necessary!

Honey bees are excellent pollinators of plants and are considered beneficial insects.

Honey Bee Nest Control:

- Nest removal by a bee keeper should always be the first control option.
- **Honey bee nest removal is NOT done by Self-Help Program participants!**
- Most honey bee nests will be large. Self-Help Program participants should **NOT** attempt control.
- Contact the VAARNG IPMC (MAJ Webb) for honey bee nest removal.

Mud Daubers

- Mud Daubers are "solitary" wasps (i.e. one adult maintains one nesting site) that build small pipe-shaped mud nests on the underside of roofs, soffits, porches, and other structural members.
- The adults are brown and about ¾" long.
- The mud tube nest is the key to identification of this species.
- Mud daubers can sting repeatedly, but seldom sting unless disturbed.

Mud Dauber Nest Control:

- Mud dauber nests are commonly encountered by maintenance personnel and can generally be controlled by using Self-Help products that have been approved for use on stinging insects.
- Exercise caution when multiple nests are in the same location or if the nests are in a confined location.
- Spray the attending adult with the Self-Help product and quickly move away from the area, then knock off the mud tubes using a screw driver or some other tool.
- It is best to control mud daubers at dawn, dusk, or at night, when the adult is present, and most docile.

Paper Wasps

- Paper wasps are ½" to 1" in length, typically a black, red or brownish color, and may have yellow or orange highlights.
- Many people call this group "umbrella wasps" because of the umbrella-shaped paper comb nest, and identifying the nest is the easiest way to identify this group of wasps.
- The nest is usually a single tier, open paper comb with the cells pointed downwards.
- The nests will be found beneath eaves, soffits, window enclosures, under porches, under wooden shelves, below or in electrical enclosures, in tightly enclosed ornamentals plantings, etc.
- Paper wasp colonies can contain from a few up to a few hundred adults.
- The size of the nest is a direct indicator of the number of adult wasps attending the nest.
- Paper wasps are generally docile and will not attack as a large group like some types of bees. However, paper wasps can sting repeatedly.

Congregations of Paper Wasps:

- Paper wasps over-winter as adults and, in the fall, hundreds to thousands of them may congregate (group together) on the highest structure in an area, such as a church bell tower, an airport control tower, or the peak of an administrative building.
- While this may seem threatening, control is not usually required because the wasps will move on after a while.
- After congregation, these insects will hunt for protected sites to overwinter and will enter buildings around windows, under soffits, past loose flashing, and into any location that may provide shelter.
- On warm winter days, paper wasps can become active and enter the interior of the buildings, causing a nuisance to occupants.

Paper Wasps (continued)

- Generally, these wasps are not aggressive in this situation and a fly swatter or rolled up magazine is the most effective control for small numbers that are found inside of buildings.

Paper Wasp Nest Control:

- Paper wasp colonies are commonly encountered by maintenance personnel and most of them can be controlled using Self-Help products that have been approved for use on stinging insects.
- The nests increase in size as the summer season progresses.
- Exercise common sense if the nest appears large or if there are multiple nests in the area.
- When a nest is sprayed, the adult wasps at the nest will get aggressive, so quickly move away from the area after spraying.
- After the adults die, knock the nest down (if possible).
- It is best to control paper wasps at dawn, dusk, or at night when the adults are at the nest site and the insects are most quiet.

Cicada Killers

- The cicada killer is a very large wasp (1” to 2” long) that is usually seen flying close to the ground.
- The body is shiny black with bright yellow highlights.
- These wasps nest in the ground.
- Because of the large size, many fear this insect.
- Cicada killers are semi-social wasps, but are typically not aggressive.
- There is little chance of being stung unless the insect is handled, agitated, or stepped on with bare feet.
- Control is usually **NOT** required.

Other Solitary Ground-Nesting Wasps & Bees

- Some species of wasps and bees are solitary ground or lawn nesters.
- The nests are typically single round holes in turf or ground with a small untidy mound of excavated soil around the entrance.
- **Control is NOT done by Self-Help Program participants!**
- Control of these ground or lawn-nesting wasp or bee species should **NOT** be performed unless there is a huge number of nests causing turf damage or their presence in a frequently occupied area threatens human health. In such cases, contact O&M or Entomology to arrange for control by a Pest Management Professional.

Yellowjackets

- Yellowjacket wasps are black and yellow insects about ½-inch in length.
- This group of wasps is social and builds large paper comb nests in the ground, in wall voids, or other well protected areas.
- A yellowjacket colony will grow throughout the summer and have thousands of workers by the fall of the year.
- Yellowjackets can sting repeatedly and will attack as a group if the nest is disturbed.
- Yellowjackets are sometimes described as an insect with a bad attitude and many feel that this is the most dangerous of the stinging wasps because of their unpredictable behavior.
- Yellowjacket wasps tend to scavenge at human food sources. Often, they will be found foraging around open trash cans, trash dumpsters, outdoor food serving areas, etc.
- Keeping areas clean, trash cans covered, soda cans properly disposed of etc. will lessen the attractiveness of an area and generally result in adequate control.

Yellowjackets (continued)

Yellowjacket Nest Control:

- **Extreme CAUTION is required.**
- Yellowjackets will fiercely defend their nest. Most incidents of people being repeatedly stung occur when a person unknowingly disturbs an underground nest.
- The nests can be hidden in an ornamental garden, in tall un-mowed grass, under foundations, under large rocks, or in some location that offers concealment for the yellowjacket entrance.
- Self-Help products are inadequate for controlling a nest full of yellowjackets.
- Self-Help Program participants should **NOT** attempt to control yellowjacket nests that are underground or in wall voids unless positive the nest is small.
- To gauge the size of a yellowjacket colony:
  1. Consider the time of year – nests start small in the spring and get larger as the season progresses.
  2 . Watch the entrance. If it is late summer and yellowjackets are observed coming and going every second or two, assume it is a large colony and do **NOT** attempt control.
- When controlling small yellowjacket nests, perform the work at dawn, dusk, or at night when most of the adults are in the nest, and the insects are least active.
- Usually the best choice for yellowjacket nest control is to contact O&M or Entomology to arrange for control by a Pest Management Professional

Hornets (Bald-faced and European)

- Bald-faced and European hornets are wasps that are about 3/4" in length, generally brown and black in color, with vivid yellow or white markings on the face.
- This group of social, stinging insects will build spectacular aerial nests in plain view. The nests are large, grayish-brown, teardrop-shaped, paper carton structures.
- Nests can be found hanging from a tree branch, in a tall ornamental bush, or attached to the eve of a dwelling.
- The nest encloses many tiers and may be tended by thousands of insects by the end of the summer.
- The Bald-faced and European hornets are two common varieties found throughout the United States. They are very aggressive when disturbed, can sting repeatedly, and will attack as a group.
- Generally, hornets should only be controlled by experienced Pest Management Professionals.

Hornets (Bald-faced and European) (continued)

Hornet Nest Control:

- Self-Help Program participants should **NOT** attempt control of aerial hornet nests unless the nest is very small (smaller than a softball).
- If the nests are bigger than a softball, or if there is any doubt about personal safety or risk, do **NOT** attempt Self-Help control and report nest location(s) to the O&M Office or Entomology to arrange for control by a Pest Management Professional (PMP).
- Spraying an aerial nest with an aerosol pesticide will generally split open the nest and agitate the hornets to a stinging frenzy, resulting in their attack of anything nearby. Self-Help products are a very poor defense against frenzied hornets.
- If control is attempted, perform it at dawn, dusk, or after dark when the hornets are in the nest, and most quiet.

Carpenter Bees

- Carpenter bees are semisocial bees that look very much like large bumble bees.
- The size of carpenter bees make them appear intimidating, but they are not aggressive unless handled or agitated.
- Carpenter bees can sting repeatedly.
- Carpenter bees are most likely seen flying close to flowers to collect pollen or hovering near wooden structures where they nest.
- These insects make a ½" to ¾"-round hole in wood such as eves, porch ceilings, window sills, telephone poles, fence posts, etc.
- Unpainted, soft woods are preferred.
- Carpenter bees lay their eggs in the holes.
- Maintenance personnel usually encounter the holes of the carpenter bee rather than the bee itself.
- Do not spray Self-Help products into the hole since it will likely splash back out of the hole.
- Since these holes are often used year after year by succeeding generations or carpenter bees, they should be sealed. Carpenter bee holes can be caulked and the surface repainted to reduce likelihood for reuse.

Approved Self-Help Products for Control of Stinging Insects:

EPA Reg No.	Label Name	ACTIVE Ingredient (Primary
3862-176-13051	Assualt Wasp and Hornet Killer	Permethrin, mixed cis, trans
67603-11-64695	Blast 'Em Wasp and Hornet Killer	Permethrin, mixed cis, trans
4-392	Bonide Wasp & Hornet Spray	Permethrin, mixed cis, trans
10088-115-68562	Buzz Saw Wasp and Hornet Killer	d-Phenothrin
9688-190-8845	Chemisco (Spectricide/Hot Shot) Wasp & Hornet Killer (LE)	lambda-Cyhalothrin
55809-3	CRC Wasp & Hornet Killer Plus	d-Phenothrin
EX-2	Essentria (EcoEXEMPT) JET Wasp & Hornet Killer	Rosemary Oil
1021-1780-3	Harris Yellow Jacket Wasp and Hornet Spray	d-Phenothrin
40208-7	Kibosh Wasp, Hornet, Bee & Yellow Jacket Killer	Piperonyl butoxide
9688-325	No-Pest Wasp & Hornet Killer5	Cypermethrin
1021-1780-239	Ortho Hornet & Wasp Killer	d-Phenothrin
499-550	PT Waso-Freeze II Wasp & Hornet Insecticide	Prallethrin
9688-190-305	Repel Wasp, Hornet & Yellowjacket Killer	lambda-Cyhalothrin
9688-141-8845	Spectracide Pro Wasp & Hornet Killer	Permethrin, mixed cis, trans
498-156	SprayPak Wasp , Bee & Hornet Killer	d-Phenothrin
11694-109	The END Wasp & Hornet Killer	Piperonyl butoxide
9688-190	Ultra-Kill/Black Flag/Chemisco Wasp and Hornet Killer (LE)	Prallethrin
706-109-9250	United 173 Wasp Whacker	Tetramethrin
2724-786	Zoëcon (RF 2050) Wasp-X™ Wasp & Hornet Spray	Ethofenprox

SELF-HELP IPM Outline 2

Cockroaches

A. PURPOSE

The Self-Help pest management program authorizes the use of approved Self-Help products (ready-to-use cockroach baits) by installation maintenance and VAARNG personnel who encounter cockroaches during the normal course of their assigned duties.

B. RESPONSIBILITIES

- Self-Help Program participants are responsible for proper use, recording, reporting, storage and disposal of Self-Help products.
- **All** label instructions must be read and followed – **The Label is the Law!**
- A Safety Data Sheet (SDS) should accompany the Self-Help product and be readily available to personnel using the product and working in the area where the product is used.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program. Contact the VAARNG IPMC (MAJ Brian Webb) for a current list of approved Self-Help products.
- Self-Help products can be obtained by request from the O&M Warehouse or Fort Pickett Entomology (Bldg 303).
- Record and report usage of Self-Help products to the VAARNG IPMC at the end of each month using the Pest Management Application Report form.
- Approved Self-Help products are tools to assist Self-Help Program participants with the control of small-scale cockroach infestations that have yet become extensive enough to warrant Pest Management Professional (PMP) control. Trying to control an excessively large infestation can result in loss of work time and higher costs resulting from cockroach contamination of facilities.
- Cockroach feces and saliva contain proteins and allergens that may trigger asthma attacks in some people. In densely populated areas, scientists have identified a correlation between roach presence and the incidence of asthma.
- Cockroaches can also spread various pathogens, including bacteria, viruses and parasitic worms.

C. ACTIONS

STEP 1. Surveillance.

- Identify the type of cockroach, the extent of the infestation and possible entry points into the building, food sources and water sources.
- It is important to identify the type of cockroach so the most effective baits are used. The size and type of bait depends on the type of the cockroach. Use the fact sheets attached to this outline to identify the type of cockroach.
- Determine the extent of the cockroach infestation to help decide if the control needed

is beyond that available to Self-Help Program participants.

- Locating where cockroaches are entering the building(s) and their sources of food and water is vital to long-term control of cockroaches. There is an endless source of cockroaches in the world and control will be a never-ending battle if cockroaches can easily get into the building and/or there is readily-available food and water.

STEP 2. Decide if Self-Help is appropriate.

- If it is determined the extent of the cockroach infestation is not appropriate for Self-Help Program control, contact the O&M Office or Fort Pickett Entomology to arrange for control by a Pest Management Professional (PMP).
- The decision to use Self-Help for control of cockroaches is often based on personal judgement and common sense. If you have **any** doubts that the cockroach infestation can be controlled with Self-Help actions, do not use Self-Help.

STEP 3. Perform Physical and Cultural Controls.

- Using cockroach baits as the only control method will rarely provide sufficient control of cockroach infestations.
- Habitat modification (cleaning up food sources and nesting locations) and building maintenance practices (repairing holes, cracks and other paths that cockroaches use to enter buildings) are vital in controlling cockroach infestations.
- If all the actions in STEP 3 and 4 have been done and there are still on-going or repeated cockroach infestations at the same facility, contact the VAARNG IPMC (MAJ Brian Webb). More extensive control methods may need to be done by contract or the Fort Pickett Entomologist.

STEP 4. Perform Chemical Control (baiting).

- Self-Help products for cockroaches can be obtained by submitting a Work Order request to O&M. Only use products that are pre-approved for use in the VAARNG Self-Help Program.
- Read the entire product label. **The Label is the Law!**
- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do **NOT** eat, drink or smoke while using any pesticide.
- Use product as directed on the label for control of cockroaches.
- See Section 3 Control, Chemical below for further guidance on using cockroach baits.
- Always thoroughly wash hands with soap and water after using product and before eating, drinking or smoking.
- Bait will not kill all the cockroaches immediately – the pesticide has a delayed effect so the cockroaches that have eaten the bait can expose other cockroaches. They do this by spreading small amounts of the bait around on their body/feet, when other cockroaches eat their pesticide-containing feces, or when other cockroaches eat the bodies of pesticide-killed cockroaches.
- Use of chemical controls (pesticides) only will rarely provide sufficient control of cockroaches. Habitat modification through cleaning and sanitation, and building

practices (exclusion) are more permanent controls.

STEP 5. Storage and Disposal of Self-Help Products.

- Store and/or dispose of any leftover Self-Help products as directed on the label and the VAARNG IPMP.
- If you have any questions on storage or disposal of the Self-Help products, contact the VAARNG IPMC (MAJ Brian Webb).

STEP 6. Recording and Reporting.

- Report Self-Help product use to the VAARNG IPMC using the Pest Management Treatment Record form.
- The form recording usage should be sent to the VAARNG IPMC at the end of the month with any other IPM reports.

STEP 7. Follow-up and Assessment.

- If the Self-Help control methods in this outline do not control the cockroaches to acceptable levels with 30 days, put in a Work Order with the O&M Office.

COCKROACH CONTROL

WHY IS CONTROL NEEDED?

Cockroaches are often the most abundant and troublesome pests in offices, dining halls and other buildings.

The cockroach's appearance, odor and habits make them objectionable to many people. A few cockroaches can become a large infestation very quickly because of their extraordinary ability to reproduce and how well they are able to co-exist with people.

Cockroaches' feces and saliva contain proteins and allergens that may trigger asthma attacks in some people. In densely populated areas, scientists have identified a correlation between roach presence and the incidence of asthma.

Cockroaches can also spread various pathogens, including bacteria, viruses and parasitic worms.

1. GENERAL BIOLOGY

There are several thousand species of cockroaches throughout the world. Four species are of primary economic importance: German, Brown-Banded, Oriental and American. However, seven species/groups are commonly found in buildings (depending on geographic area). The Asian cockroach (a recently introduced species) is being seen with increasing frequency.

See information sheets below for more information on each of the common cockroach species.

2. INSPECTION AND SURVEY

Cockroaches are seldom seen during daylight hours and, in colder climates, they will live year round in structures. In warmer climates, once cockroaches gain entry into buildings, they seek out safe areas (harborages) and make the regular trips, usually during dark periods, to food sources from their harborages. Inspection for cockroach infestations normally involves flushing of pests from harborages (using canned air), sticky traps and/or inspection for droppings.

Visual Sighting: A good flashlight is an essential tool for cockroach inspections. Cracks and crevices should be examined with specific attention near sources of food and water, or in damp areas. Canned air can be sprayed into cracks as a flushing agent to force the cockroaches out where they can be seen and identified.

An indicator of a heavy cockroach infestation is fecal spots near likely harborages (places where they hide).

Cockroach fecal droppings are sometimes confused with rodent droppings. The feces of small cockroaches are black and resemble ground coffee or black pepper. Larger cockroaches leave black or brown droppings which are cylindrical in shape and have ridges down the side.

Rodent fecal droppings are usually dark, moist, soft and shiny, if recent, or dry and hard, if a few days old. When examined under a magnifier or microscope, hairs can usually be seen in rodent droppings. Mouse droppings have pointed ends.

Trapping:
Sticky traps (aka glue boards or glue traps) are excellent tools for cockroach surveys. They are inexpensive, non-toxic and easy to use. Placement of sticky traps near suspected cockroach harborages (places where they hide) for 24 hours will provide quantitative results of current infestations. However, catching no roaches does not necessarily mean there are no roaches. Sticky trap catches are proportionate to roach population size and activity in the area where the trap is placed.

Sticky traps should never be placed outdoors or in areas where non-target wildlife (such as birds, bats or snakes) may be accidentally trapped. If non-target wildlife is found alive on a sticky trap, talcum powder, cornstarch or vegetable oil can be applied to the exposed glue around the trapped wildlife and the animal can then usually free itself. For birds and bats, it is best to immediately take the trap, without attempting to remove the animal, to a licensed wildlife rehabilitator for assistance.

3. CONTROL METHODS

Cultural:

Sanitation: Most cockroach infestations can usually be traced to poor sanitary conditions that provide a source of food for the cockroaches. A control program should include removal of the food supply by improving food and refuse storage and removal.

- Keep kitchen scraps in sealed containers.
- Clean up food and beverage spills immediately.
- Do not leave food out overnight.
- Vacuum or sweep frequently.
- Fix leaking faucets and plumbing.

Because of cockroach habits, good sanitation is important to achieving and maintaining successful control of cockroaches. In the absence of good sanitation, chemical control measures cannot be expected to be fully effective.

Physical:

Exclusion: Cockroaches can get inside of buildings by hiding themselves or their egg cases in packages (such as cartons of supplies, cases of soda, boxes of vending machine

foods, etc.) that are brought into the building. It is impossible to inspect all incoming boxes, but efforts should be made to inspect as much as possible.

Movement of cockroaches between buildings may be along steam and water lines, or in sanitary and storm drain sewers. In warmer climates where they can live outdoors most of the year, cockroaches may simply walk into a building looking for food or water. The use of exclusion practices such as caulking and sealing cracks and other possible entrances is very helpful in preventing and controlling cockroach infestations.

Since cockroaches often enter through small openings, seal the following areas:

- Cracks and crevices where cockroaches can hide, such as crevices where countertops and kickboards meet the walls.
- Holes in the walls that lead into the wall void, such as around pipes.
- Around doors and windows.
- Cracks, crevices and holes in walls and foundation; this will reduce entry of the larger cockroaches (such as American cockroaches) from the outdoors.
- Seal exterior cracks and crevices with silicone caulk, making sure all windows have tight fitting screens in good repair.
- Use door sweeps and screen doors.

Mechanical:

Sticky Traps: Sticky traps (aka glue traps or glue boards) alone will not control most cockroach infestations. Although sticky traps are simple to use and may be effective in stopping an infestation from occurring, chemical control is usually necessary once an infestation is established.

Ultrasonic and/or Electromagnetic Repellent Devices: These devices have been proven to be ineffective and may **NOT** be used.

Chemical:

As a general rule, 4-6 bait stations are needed for every 100 square feet (10' x 10' room) of infested area.

Use a higher number of bait stations where the infestations are heaviest.

Placement should be concentrated where there is a food source, in areas that have not been treated with other pesticides, or where there are access routes from untreated adjoining areas.

Do not spray insecticides in areas where bait stations are placed. Insecticide sprays kill cockroaches on contact and then they are not able to expose other cockroaches to the bait.

The bait must be placed where cockroaches live or travel so the insects have maximum access to it. Bait stations should usually be placed next to walls and/or in dark, enclosed areas.

For active infestations, the bait stations should be replaced every 90 days.

<u>German or Brown Banded Cockroaches (smaller infestations – less than 10 cockroaches found in one room only):</u>

- Use 6 small bait stations and 3 sticky traps.
- Place the sticky traps along baseboards, usually behind appliances and other objects that are not moved on a daily basis.
- Read the entire bait station label. **The Label is the Law!**
- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do NOT eat, drink or smoke while using any pesticide.
- Place the bait stations along floor/wall junctions in protected places, especially in those areas where cockroaches have been seen.
- Bait stations can also be placed under appliances, preferably next to the sides of the devices.

Always follow the label directions for the use, placement and disposal of bait stations.

<u>German or Brown Banded Cockroaches (for larger infestations – cockroaches found in more than one room):</u>

- Get 6-12 small bait stations and 6-8 sticky traps.
- Read the entire bait station label. **The Label is the Law!**
- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do NOT eat, drink or smoke while using any pesticide.
- Place the bait stations along floor/wall junctions in protected places, especially in those areas where cockroaches have been seen.
- Bait stations can also be placed under appliances, preferably next to the sides of the devices.

Always follow the label directions for the use, placement and disposal of bait stations.

<u>American, Smokybrown, Oriental or Australian Cockroaches:</u>

- Use 3-5 large bait stations and 3 sticky traps per each room where cockroaches are found (i.e., bathrooms, kitchens and utility rooms).
- Read the entire bait station label. **The Label is the Law!**

- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do NOT eat, drink or smoke while using any pesticide.
- Place the sticky traps along baseboards, usually behind appliances and other objects that are usually not moved on a daily basis.
- Place the bait stations along floor/wall junctions in protected places, especially in those areas where cockroaches have been seen.
- Bait stations can also be placed under appliances, preferably next to the sides of the devices.
- Adult American, Smokybrown and Oriental cockroaches are too large to enter the small bait stations.

Always follow the label directions for the use, placement and disposal of bait stations.

Asian Cockroaches:

- Control with cultural and physical controls:
  - Change white light bulbs to yellow bulbs around entrance doors.

  - Seal exterior cracks and crevices with silicone caulk, making sure all windows have tight fitting screens in good repair.
  - Use door sweeps and screen doors.
  - If cultural and physical controls are not enough, put in a Work Order with O&M for PMP control of outdoor populations.

Wood Cockroaches:

- Bait stations are not effective for wood cockroaches.
- Vacuum or sweep up individual wood roaches and dispose of them outside.

Wear appropriate Personal Protective Equipment (PPE) as directed on the label whenever handling cockroach bait stations.

Bait will not kill all the cockroaches immediately – the pesticide has a delayed effect so the cockroaches that have eaten the bait can expose other cockroaches to the bait. They do this by spreading small amounts of the bait around on their body/feet, when other cockroaches eat their pesticide-containing feces, or when other cockroaches eat the bodies of pesticide-killed cockroaches.

Dispose of used bait stations as directed on the label. If the label is missing, dispose of by wrapping the bait station and placing in a garbage can.

4. AFTER TREATMENT SURVEILLANCE

Clean up or remove egg cases, cast skins and droppings/stains in order to tell if there is new cockroach activity.

Continue to use sticky traps and check them regularly, noting what is captured. Look for cockroaches at night just after the lights in a room are switched on. Look for egg cases, cast skins, fecal droppings or staining.

If there is a reduction in the number of cockroaches, then Self-Help control efforts are working. Remove sticky traps after 30 days if additional roaches are not caught.

If sticky traps are full of cockroaches and/or there are still egg cases, cast skins and droppings/stains being seen after cleaning up those from the initial infestation, put in a Work Order with O&M for PMP control.

German Cockroach

- The German cockroach is the most common pest in homes, barracks, dining facilities, and warehouses.
- It is a small brownish insect about 5/8-inches long and easily identified by two longitudinal black bars on the pronotum (the disc-like plate behind head).
- German cockroaches live in warm, dark places and are most commonly found in places close to food and water such as dining facilities, bathrooms and pantries. They live in walls, cabinets and other hiding places in these rooms.
- They will also live anywhere that has adequate food, water and shelter present. They may be found near plants, pet food, in clutter such as clothing on the floor, books, magazines, newspapers, boxes and paper bags.
- They secrete a fluid that leaves a characteristic odor. This odor may even linger after the cockroaches are gone if there was a large infestation.
- German cockroaches can be found in almost all geographical areas of the United States.
- In addition to common human foods, German cockroaches will feed on almost anything with nutritional value such as saps, glue and toothpaste.
- German cockroaches breed year-round.
- The females produce from 4-5 egg capsules during their life span. Each egg capsule (called an "ootheca") produces about 30 nymphs.
- The adult female carries her egg case until 1-2 days before hatching. The egg case is then deposited in a sheltered place.
- Nymphs hatch from the egg case and are somewhat similar in appearance to adults except that they lack wings.
- Development from egg to adult ranges from about 50 to 200 days depending on temperature and relative humidity.

Asian Cockroach

- Asian cockroaches were introduced to Florida in 1980's and have quickly become established in the southeastern United States. Their range is expanding and Asian cockroaches have been found as far north as Michigan.
- Asian cockroaches are almost identical in appearance to the more common German cockroach. Adults of both species are approximately 5/8-inches long and 3/16-inches wide. Both are similar in color, with prominent dark stripes just behind the head. However, their behavioral patterns are quite different.
- Unlike German cockroaches that are repulsed by light and the presence of people, Asian cockroaches live outdoors in warm climates, are attracted to light and take little notice of human presence.
- Asian cockroaches usually live outside buildings in moist shady leaf litter and grassy areas and are generally not active during the day. If the leaf litter is disturbed, adult Asian cockroaches will fly to escape.
- If the temperature is 70 degrees F. or higher at dusk, Asian cockroaches fly towards any light source. They are very strong flyers and can fly as far as 120 feet. They are attracted to light and usually invade buildings by entering around doors and windows. Once inside, they fly to sources of light.
- Asian cockroaches are omnivorous and will eat pet food, seeds, flowers, and even pet feces.
- In the winter, Asian cockroaches survive by burrowing into leaf litter and soil. In the spring, they begin to emerge, and their numbers grow into large populations that can reach 30,000 to 240,000 cockroaches per acre.
- Asian cockroaches are often mistaken for German cockroaches, and control measures are applied the interiors of buildings but not outside where Asian cockroaches live.
- Because Asian cockroaches live outdoors, management practices need to target leaf litter and mulch. It is imperative that cockroaches be identified correctly so that control and management practices can be applied in the correct locations.

Female Asian and German cockroaches.
Asian cockroach on the left and German cockroach on the right.

- Asian and German cockroaches are best told apart by looking to see if the wings of the female cover the egg case (ootheca) when it is being carried. Males can only be told apart using magnification.
- In contrast, German cockroaches live strictly inside homes, flee from sources of light, and, although adult German cockroaches have fully developed wings, German cockroaches do not fly.
- Asian cockroaches are easily controlled with most pesticides; in contrast, German cockroaches often have resistance to many classes of insecticides.

Oriental Cockroach

- Oriental cockroaches are medium sized, black cockroaches that are often called "waterbugs".
- They are shiny, blackish-brown and are approximately ¾ to 1-inches long.
- The wings of adult male Oriental cockroaches cover two-thirds of the abdomen. Adult

female specimens are wingless, and their small wing pads extend only to the middle of the abdomen.

- Oriental cockroaches do not fly and prefer warm, damp places such as cellars and sewers.
- Oriental cockroaches are primarily an outdoor species. Most outdoor populations live beneath mulch in landscape beds, in leaf litter, beneath stones or debris outside.
- They frequently get into buildings beneath doors, through open doors or gaps beneath siding. If access is available, Oriental cockroaches can thrive in the voids or openings beneath porches, in wall voids and crawlspaces.
- In urban areas, Oriental cockroaches can be found in large numbers living in storm drains and sewers.
- Oriental cockroaches are known for their preference for feeding on garbage, filth or material that has begun to decay.
- Oriental cockroaches are very dependent on water. Studies have shown they can survive up to a month without food, but they cannot survive for more than two weeks without water.
- Although their natural habitat is outdoors, Oriental cockroaches may infest homes in summer. Inside, they tend to remain on lower floors.
- Oriental cockroaches tend to gather in large numbers near water sources.
- In areas where large populations of Oriental cockroaches are present, a musty odor can often be detected
- On average, an adult male oriental cockroach will live 110 to 160 days and the adult female can live anywhere from 35 to 180 days.
- A single female oriental roach can produce approximately eight egg cases with approximately 16 eggs per case.
- Approximately 30 hours after a female Oriental cockroach has produced an egg case, she will drop it in a protected area where it will stay until the young hatch.
- In the warmer months, the time it takes for an egg to develop into an adult may be as few as 200 days. However, when the weather becomes colder, or during the late fall and winter months, it can take as many as 800 days for Oriental cockroaches to go from egg to adult.
- Oriental cockroaches are found worldwide, although they are more common in the northern states than in the southern United States.

American Cockroach

- American cockroaches are one of the largest commonly-found roaches in the United States.
- They are about 1¼ to 1½-inches long and dark brown to mahogany color with somewhat obscure yellow margins on the pronotum (the disc-like plate behind the head). The adults have fully developed wings that completely cover the back end of their body.
- In northern states, American cockroaches almost always live indoors and are found in warm, damp places such as sewers, steam tunnels, around floor drains, near sump pumps, crawl spaces and damp basements. In basements, they may be found in corners areas high on the walls or in floor drains. They more commonly congregate in open spaces instead of small cracks and crevices.
- In southern states, American cockroaches live and reproduce outdoors and are capable of flight. They can be found in moist, shady areas like yards, hollow trees, woodpiles and mulch. At times they can be found under roof shingles or attics. Usually, they will live outside but will wander inside in search of food and water or during extremes in weather conditions.
- American cockroaches enter buildings to find water or food. They forage under appliances, in drains, in food storage cabinets and on the floor for crumbs, and scraps of food. They will also eat any food that is left out overnight and will even chew through thin plastic food packaging.
- Adult American cockroaches live from 200 to 400 days.
- The American cockroach will reproduce indoors (and outdoors in warmer climates).
- The female can produce as many as 90 egg capsules in its life time. Each egg capsule has approximately 15 eggs.
- The young or nymphs (1/4-inch long) emerge from the eggs in about 60 days. It takes about 30 days for the young to mature to adulthood, but this is temperature dependent and means the nymphs will mature faster in warmer temperatures and slower in colder temperatures.
- American cockroaches are the most common cockroach found in the sewers of the United States. Because of their longevity and reproductive capacity, American cockroaches can produce very large populations. As many as 5,000 American cockroaches have been collected from a single sewer manhole.

Smokeybrown Cockroach

- Smokybrown cockroaches are approximately 1¼-inches long. They are typically brownish black but their color can vary from dark mahogany to black, they.do not have markings and are shiny, Both sexes have wings that extend beyond their abdomen.
- They live primarily outdoors and are good fliers. Smokybrown cockroaches are attracted to lights and may enter buildings because they are drawn to interior lighting.
- Smokybrown cockroaches enter buildings through openings or gaps beneath siding, through attic or soffit vents, openings around utility and plumbing penetrations, and through open windows or doors.
- Smokybrown cockroaches are found outside in areas that are warm, very moist and protected from the elements. They can easily become dehydrated, so the availability of a moist environment is critical for survival. Around buildings and structures, smokybrown cockroaches can be found in tree holes and cavities, beneath mulch beds and ground cover, and around soffits and eaves, or areas where moisture problems may exist.
- Smokybrown cockroaches primarily feed during the late dusk or early dawn hours when they leave their hiding places in search of food. They will feed on any food that may be available, including human food scraps, dead insects, fecal matter and even plant materials. They may also be seen drinking available water.
- Female smokybrown cockroaches deposit their egg cases approximately one day after it is formed and firmly glue it to an object. Females produce from 4-32 egg cases in a lifetime with each case containing from 4-29 eggs.
- The time spent from egg to adult is about 400 days depending on humidity and temperature.
- An adult female smokybrown cockroach can live about 250 days.
- Smokybrown cockroaches are common pests of the southeastern United States. Although they are mainly found from central Texas eastward, and as far north as North Carolina, smokybrown cockroaches have also been found as far north as Indiana and Illinois.

Australian Cockroach

- The Australian cockroach is slightly smaller in size (about 1-inch long) and similar in appearance to the American roach.
- It can be recognized by the vivid pale area surrounding the edge of the pronotum (the disc-like plate behind head).
- Australian cockroaches can be found in wall voids, tree holes, leaf piles, mulch, wood piles, tree bark, in and around shrubs and greenhouses. Inside they are found in attics, kitchens, garbage cans and garages.
- Australian cockroaches feed on plant material and decaying material. They will also eat starchy materials like book bindings and glue in boxes.
- Australian cockroaches are good fliers and they will enter buildings where enough food, moisture, and heat are available.
- Females drop egg cases in hidden areas and cracks and crevices. Each case has about 24 eggs with a smaller percentage that hatch. The nymphs are marked with yellow patches and take about a year to develop.
- They are mostly found in the south and tropical areas like Hawaii. They have been found in houses in the northern states due to transportation and shipping. They can populate well when temperatures stay above 80 degrees.
- Australian cockroaches are more common in Florida and California than in more northern, colder states.

Brown Banded Cockroach

- Adult brown banded cockroaches are 1/2 to 5/8-inches long and are reddish brown to dark brown in color. They have two cross bands of lighter color, one is at the base of the wings and the other is about 1/3 of the way down the back. The female is broader than the male; her wings do not extend to the tip of her abdomen like the male's wings.
- Brown banded cockroaches are not as common as German cockroaches, but they are found nationwide.
- Brown-banded cockroaches like warm temperatures and are found in places where cockroaches are usually not expected, such as on closet shelves and inside/under large and small electrical appliances (electric clocks, computers, radios and television sets). They tend to hide in places up off the floor, including behind pictures and wall hangings.
- Brown-banded cockroaches are not normally as troublesome as German cockroaches, but they can reach large numbers if food and water are abundant.
- They produce an unpleasant odor and will feed on food product, glues and fabrics.
- The female produces about 13 egg capsules in her lifetime. Each egg capsule contains 10 to 18 eggs.
- Female brown banded cockroaches frequently glue their egg capsules beneath furniture and behind pictures.
- Adult brown-banded cockroaches live about 6 months. The developmental time from egg to adult is over 200 days.

Wood Cockroaches

- Wood cockroaches are light to dark brown, about ¾ to 1-inch long, and the sides of the thorax and front half of the wings have a yellow border. The females are wingless and are rarely seen.
- Wood cockroaches are found mostly in the eastern United States.
- Wood cockroaches live outside, but will occasionally enter homes by coming in with firewood or other items stored outside. They are often confused with German, American or Smoky Brown cockroaches.
- Behavior is the best way to tell the difference between wood cockroaches and other cockroaches. Wood cockroaches can be seen day or night, they aren't skittish and are less likely to scurry away when approached, and they wander around when inside a building without gathering in any particular area.
- Wood cockroaches normally live outdoors in moist woodland areas, including woodpiles, mulch, under the loose bark of trees, branches or decaying logs. Wood cockroaches eat decaying organic matter such as rotting trees and leaf litter.
- They are generally considered a minor pest since they prefer to be outside, need an environment that is consistently moist, and do not survive long nor breed indoors
- Wood cockroaches don't breed inside and pesticides that control other roaches are not as effective against them, so it is best to simply pick them up with a vacuum cleaner or broom and dustpan and discard them outside.

Approved Self-Help Products for Control of Cockroaches:

Combat Quick Kill Roach Killing Gel EPA Registration Number 64240-45

SELF-HELP IPM Outline 3

Nuisance Ants

A. PURPOSE

The Self-Help pest management program authorizes the use of approved Self-Help products (ready-to-use ant baits) by installation maintenance and VAARNG personnel who encounter ants during the normal course of their assigned duties.

B. RESPONSIBILITIES

- Self-Help Program participants are responsible for proper use, recording, reporting, storage and disposal of Self-Help products.
- **All** label instructions must be read and followed – **The Label is the Law!**
- A Safety Data Sheet (SDS) should accompany the Self-Help product and be readily available to personnel using the product and working in the area where the product is used.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program. Contact the VAARNG IPMC (MAJ Brian Webb) for a current list of approved Self-Help products.
- Record and report usage of Self-Help products to the VAARNG IPMC at the end of each month using the Pest Management Treatment Record form.
- Approved Self-Help products are tools to assist Self-Help Program participants with the control of small-scale ant infestations that have not become extensive enough to warrant Pest Management Professional (PMP) control. Trying to control an excessively large infestation can result in loss of work time, higher costs and unnecessary exposure of personnel to pesticides.

C. ACTIONS

STEP 1. Surveillance.

- Identify the type of ant, the extent of the infestation and possible entry points into the building, food sources and water sources.
- It is important to identify the type of ant so the most effective baits are used. The type of bait and methods used depend on the type of the ant. Use the fact sheets attached to this outline to help identify the type of ant or contact the VAARNG IPMC for assistance.
- Determine the extent of the ant infestation to decide if the control needed is beyond that available to Self-Help Program participants.
- Locating where ants are entering the building(s) and their sources of food and water is vital to long-term control. There is an endless source of ants outdoors, and ant control will be a never-ending battle if ants can easily get into the building and/or there is readily-available food and water.

STEP 2. Decide if Self-Help is appropriate.

- After identifying the type of ant using the information in this outline and determining the type of ant is **NOT** appropriate for Self-Help Program control, do not attempt Self-Help.
- Approved Self-Help products are tools to assist Self-Help Program participants with the control of small-scale ant infestations that have not yet become wide-spread enough to warrant Pest Management Professional (PMP) control. Trying to control an excessively large infestation will result in loss of work time, higher costs and unnecessary exposure of VAARNG personnel to pesticides.

STEP 3. Perform Physical and Cultural Controls.

- Using ant baits as the only control method will rarely provide sufficient control of nuisance ant infestations.
- Habitat modification (cleaning up food sources) and building maintenance practices (repairing holes, cracks and other paths that ants use to enter buildings) are vital in controlling nuisance ant infestations.
- If all the actions in STEP 3 and 4 have been done and there are still on-going or repeated ant problems at the same facility, contact the VAARNG IPMC. More extensive control methods may need to be done by contract or the O&M Office or Fort Pickett Entomology.

STEP 4. Perform Chemical Control (baiting).

- Self-Help products for ants can be obtained by submitting a Work Order request to O&M.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program.
- Read the entire product label. **The Label is the Law!**
- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do **NOT** eat, drink or smoke while using any pesticide.
- Use product as directed on the label for control of ants.
- See section 3 Control, Chemical, below for further guidance in effectively using ant baits.
- Always thoroughly wash hands with soap and water after using product and before eating, drinking or smoking.
- Baits will not kill all the ants immediately – the pesticide has a delayed effect so ants that have eaten the bait can carry it back to the nest to feed to other ants.
- Use of chemical controls (pesticides) will only rarely provide sufficient control of ants. Habitat modification through cleaning and sanitation, and building practices (exclusion) are more permanent controls.

STEP 5. Storage and Disposal of Self-Help Products.

- Store and/or dispose of any leftover Self-Help products as directed on the label and the VAARNG IPMP.
- If you have any questions on storage or disposal of the Self-Help products, contact the VAARNG IPMC.

STEP 6. Recording and Reporting.

- Report Self-Help product use to the VAARNG IPMC using the Pest Management Treatment Record form.
- The form recording usage should be sent to the VAARNG IPMC at the end of each month that the treatment is conducted.

STEP 7. Follow-up and Assessment.

- If the Self-Help control methods in this outline do not control the ants to acceptable levels with 30 days, put in a Work Order with O&M.

ANT CONTROL

1. WHY IS CONTROL NEEDED?

Ants are common pests across the United States.

With the exception of carpenter ants, most ant species do not cause damage to structures.

However, ants enter buildings in search of food/water and their presence is disruptive to most people. Also, some ants may bite or sting.

2. GENERAL BIOLOGY

Ants are small, usually wingless insects. However, winged ants may be seen swarming at certain times during the year.
Ants are 1/8 to 1/2-inch in length and may be yellow, red, brown, or black.

Ants (above left) should not be confused with termites (above right). Both ants and termites swarm at various times of the year. Ants have a thin waist (pedicel), elbowed antennae, and the forewings are distinctly larger than the hind set of wings. Termites have a fat waist (actually, no waist), the antennae are straight, and all four wings are of equal size.

Where ant nests occur may change with the seasons or where in the United States they occur. Ant species found nesting in structures in the north may be found nesting both in and out of structures in the south.

Ants enter structures through cracks and crevices as they search for food, water and shelter.

Ants generally live outdoors, but a few species may build nests inside buildings.

Ant nests are usually found behind loose baseboards, behind hollow walls, or in other protected voids.

Adult ants are the only life stage normally seen inside facilities.

A colony of ants consists of one or more queens, workers and males. As many as 500,000 ants may live in one colony.

Males and queens emerge in the late spring or early summer when it is time for mating. Mating usually occurs in flight and the queen loses her wings afterwards, then starts a new colony or joins an existing colony.

The queen is the only ant that lays eggs. Depending on the type of ant, she lays as few as 15-20 eggs per year or as many as 5-20 eggs per day.

See attached information sheets for each of the common ant species.

2. INSPECTION AND SURVEY

It is very important to determine which species (one or more may be involved) of ants are present and, if possible, the nest locations.

Visual Sighting: Follow ant trails to find the nests. Ants lay down a chemical pheromone trail along their established routes to and from a food source so other ants can easily find the food.

Inside a building, inspect along the carpet edges, doors, windows, and especially areas where food is stored or eaten. The easiest way to find a trail to the nest is to watch where ants go after reaching a food source.

Outside of a structure, inspect around foundation walls, areas of vegetation, and mulch. Any vegetation found near patios and walls may hide ant nests or their trails. Check under any item that is on the ground. Some ant nests are well hidden.

Use of non-toxic baits is also a very effective surveillance tool. Survey bait items may include, but are not limited to, peanut butter, jelly, hamburger, bacon grease, french fries, or honey. The combination of a sweet and a meat/grease is a very enticing combination. Map the premises and note the locations of the baits and where ants are seen each day.

3. CONTROL METHODS

Carpenter Ant control is NOT done by Self-Help Program participants.

Cultural:

Sanitation: Most ant infestations can usually be traced to a source of food for the ants. A control program should include removal of the food supply by improving food and refuse storage and removal.

- Keep food in sealed containers.
- Clean up food and beverage spills immediately.
- Vacuum or sweep regularly to remove spilled food particles.
- Do not leave food out overnight.

- Fix leaking faucets and plumbing.
- Store garbage cans in dry places, keep them clean and empty often.

Good sanitation is important to achieving and maintaining successful control of ants. In the absence of good sanitation, chemical control measures are not fully effective.

Physical:

Exclusion: The use of exclusion practices such as caulking and sealing cracks and other possible entrances can be very helpful in preventing and controlling ant infestations.

Since ants often enter through small openings, seal the following areas with caulking:
- Cracks, crevices or holes that provide entry into the facility, especially in the walls and foundation.
- Holes in the walls that lead into the wall void, such as around pipes.
- Around doors and windows, making sure all windows have tight fitting screens in good repair.

Ants may also be carried into buildings in or on objects. Inspect plants and other items before bringing them indoors.

Move firewood, dead trees and limbs away from facilities. Keep vegetation trimmed so it does not touch buildings.

Mechanical:

Sticky Traps: Sticky traps are not effective in controlling ants and are generally not used.

Ultrasonic and/or Electromagnetic Repellent Devices: These devices have been proven to be ineffective and may NOT be used.

Chemical:

While sanitation will help a great deal in controlling ants, it will not always completely solve the problem if large numbers of ants are entering or nesting in the structure.

Toxic Ant Baits: Toxic ant baits are an effective control for most species of ants, and an appropriate control method for Self-Help program participants.

Ants take the toxic bait back to the nest and feed it to the other ants in the colony. After a number of days (or weeks in some cases), all of the ants in the colony have eaten, or been fed, the bait and die.
Using a toxic bait that is attractive to the species of ant is important. The lure part of the bait may be solid or liquid and based on sugar, fat or protein. With some species of ants, different baits may be preferred at different seasons. If ants are not showing any interest in a bait, try another formulation that has a different type of lure.

Bait should be replaced regularly and an ample amount should be used.

As a general rule, one bait station is adequate for every 100 square feet (10' x 10' room) of infested area.

Toxic ant bait is best placed along an active trail. Otherwise, place it in areas where there is a food source, that have not been treated with other chemicals and/or where there are access routes from untreated adjoining areas.

Do not spray insecticides in areas where bait has been placed. Insecticide sprays kill ants on contact and they are not able take the bait back to other ants in the colony.

Do not clean up ant trails that lead between the bait and the ant nest. The ants must be able to access the bait **and** return to the nest with it.

Practice good sanitation in the areas where the bait is located so the bait is not competing with other sources of food.

For active infestations, the bait should be replaced every 30 days or when the ants have eaten it all.

Wear appropriate Personal Protective Equipment (PPE) as directed on the label whenever handling toxic ant bait.

Bait will not kill all the ants immediately – the pesticide has a delayed effect so ants can carry the bait back to the nest to feed to other ants.

Dispose of used bait stations as directed on the label. If the label is missing, dispose of by wrapping the bait station and placing in a garbage can.

Be sure to continue to do the cultural and mechanical controls (sanitation and exclusion). As long as the ants can enter the building and food/water are available, they may continue to be a problem even though bait stations are in place.

<u>Ants that are Nesting Inside Buildings:</u>

- Use approximately one bait station/100 square feet.
- Always wear appropriate Personal Protective Equipment (PPE) as directed on the label whenever handling ant bait.
- Place bait stations next to ant trails and/or where ants have been seen.
- Replace bait stations that are empty and relocate stations that have little or no ant activity.
- Bait stations should be used until ants disappear.

Always follow the label directions for the use, placement and disposal of bait stations.

Pharaoh Ants:
Pharaoh ants are a special problem because their colonies "bud" when stressed or threatened and create multiple new colonies. When dealing with pharaoh ants, use ant baits that have Hydramethylnon as an active ingredient. They have been the most effective to date against the pharaoh ant. Other type of insecticidal baits (such as those containing the active ingredient methoprene) have a delayed action and are generally not successful with pharaoh ants.

- Baits are usually the only effective method of control.
- Use approximately one bait station/100 square feet.
- Always wear appropriate Personal Protective Equipment (PPE) as directed on the label whenever handling ant bait.
- Place a bait station as close as possible to a line of foraging ants without disturbing them.
- Do not disturb the colonies or spray them with insecticides since it can cause them to "bud" and form new colonies in the building.

Always follow the label directions for the use, placement and disposal of bait stations.

Ants that are Nesting Outside and Foraging Inside (other than Fire Ants or Carpenter Ants):
Perform the Cultural and Physical controls listed in the previous sections, especially sealing the routes ants are using to get into the building.

If ants are **NOT** entering structures and are **NOT** Fire Ants, Carpenter Ants or a species of ant that poses a risk to the environment, human health or property, there is usually not a need to control them.

If Cultural and Physical controls have been performed to the greatest extent possible and ants continue to enter a building:

- Toxic ant baits are usually the secondary method of control.
- Get approximately one bait station/100 square feet.
- Always wear appropriate Personal Protective Equipment (PPE) as directed on the label whenever handling ant bait.
- Place a bait station as close as possible to a line of foraging ants without disturbing them.
- Replace bait stations that are empty and relocate stations that have little or no ant activity.
- Bait stations should be used until ants disappear.

Always follow the label directions for the use, placement and disposal of bait stations.

Put in a Work Order with the O&M Office or contact the Fort Pickett Entomologist to arrange for control of Carpenter ants by a Pest Management Professional (PMP).

4. AFTER TREATMENT SURVEILLANCE

The number of ants should diminish within days (or weeks in some cases) after using toxic ant baits.

Remove toxic bait after 30 days if ants are no longer being seen.

If ants are still being seen after 30 days, even after trying different formulations of bait, put in a Wok Order with the O&M Office or contact the Entomology Office for PMP control.

INTERIOR-NESTING ANTS

- Most ants that nest in buildings and structures range from 1/15 to1/4-inches long and range in color from a light yellow to a reddish yellow and jet black.
- These ants will nest in walls, woodwork, behind cabinets and beneath masonry.
- Indoor colonization by ants occurs year-round, especially in warmer climates.
- They will feed on all types of food material, such as sweets, fruits or nuts, and fatty, greasy, or oily materials.
- Once ants find a food source, they will leave a pheromone trail for other ants to follow.
- The thief ant and the odorous house ant (pictured above) are two of the more common species nest indoors.
- Other ants that may nest indoors are Argentine Ants, Crazy Ants, Fire Ants, Ghost Ants, Leafcutter Ants, Pavement Ants and Pharaoh Ants.

OUTDOOR-NESTING ANTS
(other than Fire Ants or Carpenter Ants)

- Many species of ants that nest outdoors and will forage indoors for food.
- Pavement ants prefer to nest under rocks, next to buildings and under cracks in pavement. Harvester ants (pictured above) are often confused with fire ants, but harvester ants are much larger than fire ants and make large bare areas around their nests with a single entrance hole to the colony.
- Leafcutter ants are also much larger than fire ants and have a distinctive built-up dense cluster of mounds at the colony's center called a "town", and have many entrance holes over a very large area.
- The large yellow ant (citronella ant) nests near structures and their winged reproductives are often confused with termites.
- Field ants occasionally invade structures. They nest in open areas in small mounds.
- If ants are **NOT** entering structures and are **NOT** Fire Ants, Carpenter Ants or a species of ant that poses a risk to the environment, human health or property, there is usually not a need to control them.

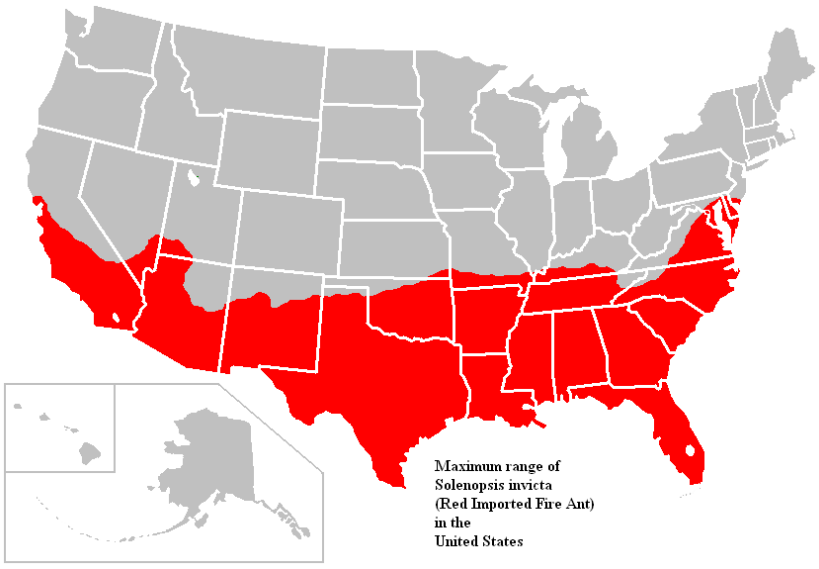
PHARAOH ANTS

- Workers are approximately 1/5 to 1/2-inches long. The body is often pale yellow or red with a darker abdomen.
- Pharaoh ants may bite.
- They will feed on all types of food material.
- Pharaoh ant workers search actively for food and often use pipes, electrical and telephone wires to enter buildings. They also get inside through poorly caulked windows or under flashing.
- Once pharaoh ants invade a building, they will infest other rooms and are usually found year-round.
- Pharaoh ants tend to nest in inaccessible areas such as behind baseboards, in wall voids, wall sockets, in furniture and appliances, in ceilings and under floors.
- Pharaoh ants can also nest outside, but cannot survive outdoors during winter in northern areas of the United States.
- Pharaoh ants are a special problem because their colonies "bud" when stressed or threatened and create multiple new colonies.
- Pharaoh ant queens can produce 400 eggs in a lifetime. New nests can be formed by the migration of as few as 10 immatures, 5 workers, and one queen. This process is called “budding”.
- Colonies consist of queens, males, workers and brood (eggs, larvae, and pupae). Flights of swarmers seldom ever take place even through winged reproductive ants are produced.
- Development time from egg to adult for workers averages 38 days at 80F.
- A queen can live from 4-14 months, a worker lives for about 10 weeks, and males live 3-5 weeks.
- Pharaoh ants have many queens. More than one nest may occur inside a home and individual ants from one nest do not fight with their counterparts from any other nests.
- Baits are usually the only effective method of control. Place bait station as close as possible to line of foraging ants without disturbing them. Do not disturb the colonies or

spray them with insecticides as this can cause them to "bud" and form new colonies in the building.

- When controlling pharaoh ants, use ant baits that have Hydramethylnon as an active ingredient. Other type of toxic ant baits (such as those containing the active ingredient methoprene) have a delayed action and are generally not successful with pharaoh ants.
- Never attempt control of pharaoh ants using a contact insecticide since it will only cause the colony to "bud" and spread to other areas.

FIRE ANTS



- Fire ants are medium-sized red and black colored ants that build mounds of soft soil.
- Worker fire ants vary in size from small (1/16-inch long) to large (almost 1/4-inch long). Many other ant species have worker ants that are uniform in size and may be a similar color.

- Other small to medium-sized ants that build small nests in soil often have central nest openings through which the ants enter and leave. Fire ant mounds have no central openings.
- Harvester ants are much larger than fire ants and make large bare areas with a single entrance hole to the colony.
- Leafcutter ants are also much larger than fire ants and have a distinctive built-up dense cluster of mounds at the colony's center called a "town", and have many entrance holes over a very large area.

- Red and black imported fire ants (Solenopsis invicta, and Solenopsis richteri) are native to South America. They were accidentally introduced into the United States around the 1930's through the port of Mobile, Alabama; probably in soil used for ship ballast, and have spread through the southern United States.
- There are several other species of fire ants that are native to the United States.
- Mounds are rarely larger than 18″ in diameter. In cold, dry areas, mounds are usually much smaller and harder to detect.
- When disturbed, fire ants emerge aggressively, crawling up vertical surfaces, biting and stinging. Their sting usually leaves a white pustule on the skin.
- Fire ants are sensitive to vibration or movement and tend to sting when the object they are on moves. Usually, whatever causes one ant to bite and stings triggers the other ants to sting as well.
- A very small portion of the human population (approximately 1%) are hypersensitive to ant venom and can experience potentially lethal allergic reactions. However, even healthy individuals may experience severe reactions such as anaphylactic shock if they suffer from a multiple stinging incident.

CARPENTER ANTS

- Carpenter ants are large, black or red, and 3/8 to 1/2-inch long.
- Carpenter ants live in damp wood where they excavate the softer wood to make a nest.
- The presence of carpenter ants usually indicates excess dampness or leaking water.
- Carpenter ants most often forage at night.
- **Carpenter Ant control is NOT done by Self-Help Program participants.**
- Put in a Work Order with the O&M Office or contact the Fort Pickett Entomology Office to arrange for control of Carpenter ants by a Pest Management Professional (PMP).

Approved Self-Help Products for Control of Ants:

Maxforce FC Professional Insect Control Ant Killer Bait Gel, EPA Registration Number 432-1264

SELF-HELP IPM Outline 4

Rodents (Mice & Rats)

A. PURPOSE

The Self-Help pest management program authorizes the use of approved Self-Help products (mechanical and physical controls only) by installation maintenance and VAARNG personnel who encounter rodents (mice and rats) during the normal course of their assigned duties.

B. RESPONSIBILITIES

- Self-Help Program participants are responsible for proper use, recording, reporting, storage and disposal of Self-Help products.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program. Contact the VAARNG IPMC (MAJ Brian Webb) for a current list of approved Self-Help products.
- **NO chemical control products (rodent baits and/or poisons) are allowed for Self-Help use at VAARNG sites.**
- Self-Help products can be obtained by submitting a Work Order to O&M.
- Rodents can harbor a number of human disease agents; among them are hantavirus and plague. Precautions must be taken when working in rodent infested areas. Rodent feces and dried urine may contain hantavirus that is transmitted when dust from these waste materials is inhaled. Precautions should also be taken when handling dead rodents in traps.

C. ACTIONS

STEP 1. Surveillance

- Identify the type of rodent, the extent of the infestation and possible entry points into the building, food sources and water sources.
- It is important to identify the type of rodent so the most effective physical and mechanical controls are used. The size of any traps used depends on the size of the rodent. Use the fact sheets attached to this outline to identify the type of rodent.
- As much as possible, determine the extent of the rodent infestation as much as possible to decide if the control needed is beyond that available to Self-Help Program participants.
- Locating where rodents are entering the building(s) and their sources of food and water is vital to long-term control of rodents. There is an end-less source of rodents outdoors. Rodent control will be a never-ending battle if rodents can easily get into the building, especially if there is readily-available food and water.

STEP 2. Decide if Self-Help is appropriate.

- The decision to use Self-Help for control of rodents is often based on personal judgement and common sense. If you have **any** doubts that the rodents can be controlled with Self-Help actions, contact the O&M Office or Fort Pickett Entomology for help with assessing the situation and/or to arrange for control by a Pest Management Professional (PMP).

STEP 3. Perform Physical and Cultural Controls.

- Seal all cracks and crevices, especially those over 1/4-inch wide where the rodents may be entering the building. Screening 1/8-inch square or smaller, steel wool and/or metal flashing can be used. Rodents will often chew through calking, although some elastomeric sealants can be used successfully to exclude mice.
- Do not leave unscreened doors and windows open.
- Regularly check objects that are brought into the building, such as boxes, furniture and equipment, to make sure they do not contain rodents.
- Seal food items in metal or rodent-proof containers.
- Store food items in the refrigerator.
- Regularly empty interior garbage cans and place garbage in secure, rodent-proof containers outside until it is removed from the site.

STEP 4. Perform Mechanical Control (trapping).

- Self-Help products for control of rodents can be obtained by submitting a Work Order request to O&M.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program.

NO chemical control products (rodent baits and poisons) are approved or allowed for Self-Help use at VAARNG sites.

- Wear gloves when performing rodent control actions such as setting traps and handling rodents.
- Wear additional Personal Protective Equipment (PPE) (such as eye and/or respiratory protection) if directed on the label or in areas where Hantavirus is known to occur.
- Do **NOT** eat, drink or smoke while performing rodent control actions.
- Read all instructions for the trap. If no instructions are provided, refer to the fact sheets attached to this outline for guidance on placing and using traps for the target pest.
- Always thoroughly wash hands with soap and water after setting or handling traps/dead rodents, and before eating, drinking or smoking.

STEP 5. Storage and Disposal of Self-Help Products.

- Store and/or dispose of any leftover Self-Help products as directed on the label and the VAARNG IPMP.
- If you have any questions on storage or disposal of the Self-Help products or disposal of dead rodents, contact the VAARNG IPMC (MAJ Webb).

STEP 6. Recording and Reporting.

- Report Self-Help product use to the VAARNG IPMC using the Pest Management Treatment Record form.
- The form recording usage should be sent to the VAARNG IPMC at the end of each month.

STEP 7. Follow-up and Assessment.

- Using trapping as the sole control method will only provide temporary control.
- Habitat modification (cleaning up food sources, removing nesting locations) and building practices (repairing holes, cracks and other paths that rodents use to enter buildings) are more permanent controls.
- If all the actions in STEP 4 have been done and there are still on-going or repeated rodent infestations at the same facility, contact the VAARNG IPMC. More extensive permanent controls may need to be done by contract.

S

RODENT CONTROL

WHY IS CONTROL NEEDED? Rodents like to live the same places and eat the same food as people do. They will contaminate food, destroy fabrics and furniture in search of nesting material and gnaw woodwork, cabinets, furniture and other materials and objects in order to gain access into buildings. They are capable of transmitting diseases to humans such as Rocky Mountain spotted fever, Hantavirus, and Bubonic plague (via the fleas they carry).

1. GENERAL BIOLOGY

See attached information sheets for each of the common rodent pests.

2. INSPECTION AND SURVEY

The normal harborages (places where they rest and nest) indoors are in spaces between walls, attics, eaves, in cabinets and other furniture, and in stored food products. Outdoors, rodents will nest in weeds, rubbish, dense vegetation or in grasslands.

Rodents are usually nocturnal and secretive. They are rarely seen during the day except when infestations are very heavy. Therefore, it is necessary to interpret signs indicating the presence of rodents. Inspection techniques will involve searching for "signs" in the areas of suspected harborage. Signs are found along walls, under piles of rubbish, behind or under storage areas, and in thick vegetation. The following signs are indicative of a rodent infestation.

Fecal droppings: Fecal droppings are usually dark, moist, soft and shiny. In a few days the droppings become dry and hard. When examined under a magnifier or microscope, hairs are usually evident in rodent droppings.

- House mouse: Droppings are typically ¼-inch or less long and are pointed at the ends.
- Norway rat: Droppings are typically ¾-inch long and have blunt ends.
- Roof rat: Droppings are typically ½-inch long and are curved with pointed ends.

Runways: Rodents are creatures of habit and will utilize the same runways between their food source, and nesting areas. Because of their well-developed sense of touch, they prefer body contact with a vertical surface such as a wall or fence and will develop a pathway that can be recognized both outdoors and indoors.

Rub Marks: Mice do not leave obvious rub marks like rats unless there is an extremely heavy infestation. The rub marks of mice will be very low to the floor, and appear more as worn paint or paper rather than oily paint or paper. If rub marks are grossly evident, then the infestation of rodents is probably rats.

Tracks: Wherever there is dust, or when powder or flour is placed out in suspected runways, the tracks left by the animals' feet can give a clue as to the direction of their nests.

3. CONTROL METHODS

Cultural:

Sanitation: Most rodent infestations can usually be traced to poor sanitary conditions that provide a source of food for rodents. A good control program should include removal of the food supply by improving refuse storage and removal.

Elimination of Shelter: Trash and waste materials should be removed to prevent their use as shelters and nesting areas. Lumber and all other materials that can be used as shelters should be stacked on platforms, at least 18 inches above the ground, and at least 18 inches away from walls. Vegetation near buildings should be removed or kept trimmed.

Physical:

Rodent Proofing: House mice can enter through openings as small as 1/4 inch. If a pencil can fit through a crack, so can a house mouse. Structural openings around pipes and electrical conduits should be sealed with metal mesh, metal flashing or steel wool. Most rodents can chew through caulking, however elastomeric sealant may be effective against mice. All openings less than 4 feet above ground should be sealed with metal plates or concrete. Doors should be self-closing and tight fitting at the bottom. Spaces at the door bottoms may be sealed by attaching metal strips.

Mechanical:

Trapping: Trapping is recommended for rodent control when physical and cultural control methods are not enough to control the population.

However, trapping alone is rarely effective. There is an unlimited supply of rodents outdoors and they will continue to enter facilities unless food sources are removed, shelter/nesting areas are eliminated and the means of accessing the facility are sealed.

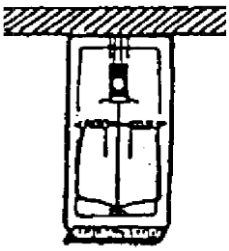
Using cultural methods (sanitation, elimination of shelter), physical methods (rodent proofing) along with mechanical methods (trapping) can control most rodent infestations.

"Old-fashioned" snap traps are highly effective and inexpensive to purchase.

A large number of snap traps should be set in the areas of rodent activity. Placing 12 traps in a room is not too many.

Where the snap traps are placed is very important. Snap traps should be placed in runways along walls, and not in the open. The traps should be placed against the wall, back-to-back with the triggers facing out and/or perpendicular to the wall, with the trigger portion near the wall.

TWO SNAP TRAPS WITH TRIGGERS FACING OUT



SNAP TRAP WITH TRIGGER NEAR WALL

Another effective method of setting snap traps is to place a board so it leans against the wall to make a shadowy "tunnel" and place the traps under the board with the trigger against the wall. Several traps can be set in a row with a ½-inch space between each trap to capture rodents that attempt to jump over the traps.

Peanut butter is a popular and easy to use bait for snap traps. Bacon, chocolate and nuts are also good baits (tie solid baits to the trap trigger with dental floss).

Commercial rodent trap lure baits (that do not contain a pesticide) are available in convenient syringes or squeeze bottles, but are not necessarily better than the above food baits. However, they do not contain any peanut products, which protects individuals with peanut allergies in the vicinity of the baited traps.

Rodents (especially rats) may be scared of new objects in their environment and may not go near the trap at first. To help overcome this, traps can be pre-baited (bait the trap, but do not set the trigger) for a couple of days to get rodents accustomed to the trap. Then rebait and set the trigger.

Rodents can become trap shy if the trap is triggered but they are not caught. Changing the bait often helps. For example, changing to bait from peanut butter to bacon (tied to the trap trigger

with dental floss) can be effective for trap-shy rodents. Changing the location of the traps may also help.

Traps should be inspected daily. Remove and dispose of dead rodents. Always wear proper PPE when handling rodents.

In addition to snap traps, several other rodent traps can be used successfully. Other traps are usually metal boxes with one or more openings, with trade names like "Ketch-all" or "Tin Cat". These traps rely on rodent curiosity and the rodents enter the trap to explore what is inside. Some of these traps have snap devices to kill and collect the rodents as they enter, and others are constructed so that rodents cannot escape once they are inside the trap. The traps must be inspected frequently to dispose of dead or trapped rodents.

Sticky Traps: Sticky traps (aka glue traps or glue boards) are not as effective as mechanical traps for rodents. Although sticky traps are simple to use, mice often can free themselves, and this type of trap is ineffective with adult rats.

Sticky traps are not recommended for trapping rodents in most instances.

Sticky traps should **never** be placed outdoors or in areas where non-target wildlife (such as birds, bats or snakes) may be accidentally trapped. If non-target wildlife is found alive on a sticky trap, talcum powder, cornstarch or vegetable oil can be applied to the exposed glue around the trapped wildlife and the animal can then usually free itself. For birds and bats, it is best to immediately take the trap, without attempting to remove the animal, to a licensed wildlife rehabilitator for assistance.

Ultrasonic and/or Electromagnetic Rodent Repellent Devices: These devices have been proven to be ineffective and may NOT be used.

Chemical:

Rodent Baits: Rodent baits are **NOT** allowed as part of the Self-Help Program. In nearly all instances, trapping of rodents is the preferred control over using toxic baits. Rodents do not immediately die from ingesting bait, and often die in walls and other enclosed spaces where the carcasses cannot easily be removed. The resulting unpleasant odors may persist for three or more months. Also, many baits are still active in the bodies of rodents even after they have died. Any other animal that scavenges and eats the rodent can also be killed by the toxic ingredient in the bait.

HOUSE MICE

- House mice are about 6 inches long, including the tail. The length of the head and body together is about 3 inches. The tail is almost naked and about as long as the head and body combined. The color of mice ranges from dark gray to light brown and most are dusky gray with lighter bellies. A mouse's head and feet are proportional to its body size. A young rat will have a head and feet that look way too big for its body.
- In areas where facilities are next to open fields or wooded areas, deer mice may enter buildings. Deer mice are slightly larger than house mice, have big ears and eyes, and are usually reddish brown in color. Because of the association of deer mice with Hantavirus (which can be easily spread to humans and causes death), immediately call the Environmental Office for assistance in identification and take appropriate steps to protect human health if you think you have this species present.
- Adult mice usually live 1/2 to 3 years. Mice become sexually mature at about 35 days. The average female has about 8 litters in her lifetime and litter average about 6 young.
- The house mouse is found throughout the world and is the most domesticated of all rodents. They prefer to live in association with humans and man-made structures, but the house mouse can live outside as a field rodent.
- Mice are nibblers compared to the voracious appetite of rats.
- The house mouse can survive in dry habitats and metabolize water from its food source. They do not always need a source of water.
- Mice can enter a structure through holes in walls, floors and the foundation. They can also enter through cracks and crevices around doors and windows. All it takes for a mouse to enter a structure is a 1/4 inch square hole.
- House mice eat and contaminate human food. They urinate and defecate continually. They gnaw and destroy furniture, woodwork, books, paper products, clothing and fabrics. Their urine and feces stain these objects. House mice are also capable of transmitting *Salmonella*, other bacterial diseases, roundworms, and tapeworms.

NORWAY RATS

- Norway rats (*Rattus norvegicus*) are stocky burrowing rodents, about 16 inches long, including the tail. They were unintentionally introduced to North America around 1775 and have spread throughout the contiguous 48 states. Also called the brown rat, house rat, barn rat, sewer rat, gray rat, or wharf rat, it is a slightly larger animal than the roof rat.
- The nose of a Norway rat is blunt, the ears are small, close set and do not reach the eyes when pulled down. The tail is scaly, semi-naked and shorter than the head and body combined.
- Adult Norway rats weigh about one pound, with coarse fur that is usually is brownish or reddish-gray above, and whitish-gray on the belly. Blackish individuals occur in some locations.
- Norway rats live in close association with people. They burrow to make nests under buildings and other structures, beneath concrete slabs, along stream banks, around ponds, in garbage dumps, and at other locations where suitable food, water and shelter are present. In urban areas they live in and around residences, in basements, warehouses, docks, and in sewers. Although they can climb, Norway rats tend to inhabit the lower floors of multi-story buildings.
- Norway rats will eat nearly any type of food. When given a choice, they select a varied diet and choose fresh foods over stale or contaminated foods. They prefer cereal grains, meats and fish, nuts, and some types of fruit.
- Rats require 1/2 to 1 ounce of water daily when feeding on dry foods but need less when moist foods are available. Food items in household garbage offer a fairly balanced diet and also satisfy their moisture needs.
- Norway rats are primarily nocturnal and usually become active around dusk. Some individuals may be active during daylight hours when the rat population is high, when disturbed (weather change, construction, etc.) or when their food source is threatened.
- Norway rat territories are usually 50-150 feet surrounding nests. In populations where there is plenty of food and shelter, the territories are smaller. However, rats will travel 300 feet or more to obtain their food and water if necessary. In urban areas most rats

remain around the buildings and areas that provide their necessities, and do not move great distances unless disturbed.

- Rats have poor eyesight beyond 3-4 feet, relying more on their hearing and excellent senses of smell, taste and touch. Norway rats are very sensitive to motion up to 30-50 feet away, but are considered colorblind.
- Rats use their keen sense of smell to locate food items and to recognize other rats. Norway rats also have an excellent sense of touch due to very sensitive body hairs and whiskers they use to explore their environment. Much of a rodent's movement in a familiar area relies heavily on the senses of touch and smell to direct it around its home range.
- Rodents prefer a stationary object on at least one side of them as they travel, so they commonly move along walls. This is helpful in deciding where to place traps.
- Rats' sense of taste is excellent, and they can detect some contaminants in their food at levels as low as 0.5 parts per million. This highly developed taste sensitivity can lead to bait rejection if the rodent baits are contaminated with insecticide odors or other chemicals.
- Norway rats typically construct nests in below-ground burrows or at ground level that may be lined with shredded paper, cloth, or other fibrous material.
- Litters of 6 to 12 young are born 21 to 23 days after conception. Newborn rats are naked and their eyes are closed, but they grow rapidly and start eating solid food at 2½ to 3 weeks. They become completely independent at about 3 to 4 weeks and reach reproductive maturity at 3 months of age, sometimes as early as 8 weeks.
- Female Norway rats may come into heat every 4 or 5 days, and they may mate within a day after a litter is born. The average female rat has 4 to 6 litters per year and may successfully wean 20 or more offspring annually.

ROOF RATS

- The roof rat (*Rattus rattus*) is distinguished between Norway rats and roof rats by pulling the tail back over the body. The tail of a roof rat will reach the nose. The tail of the Norway rat will not reach beyond the ears.

- Roof rats range along the lower half of the East Coast and throughout the Gulf States and upward into Arkansas. They also exist along the Pacific Coast and are found on the Hawaiian Islands. Occasionally isolated populations are reported from areas not within their normal distribution range, but these instances are rare.
- Roof rats prefer higher areas than Norway rats and often will live in trees or on vine covered fences. Landscaped areas and vegetation along waterways provide good habitat. Being agile climbers, roof rats frequently enter buildings from the roof or openings near utility lines that they use to travel from area to area. They have been found in sewer systems, but this is not very common.
- The food habits of roof rats resemble those of tree squirrels. They mainly eat fruit and nuts, but also feed on a variety of ornamental and native plant materials. Like the Norway rat, they are omnivorous and will feed on most anything if hungry. Roof rats usually require water daily, though their local diet may provide an adequate amount if high in water content.
- Litters containing 5-8 young are born about 21 to 23 days after conception. The young rats are naked and their eyes are closed when born, but develop rapidly, growing hair within a week. When they are 9 to 14 days old, their eyes open and they begin to explore for food and move about near their nest. In the third week they begin to take solid food.
- The young may continue to nurse until 4 or 5 weeks old. Young rats generally cannot be trapped until about 1 month old. At about 3 months of age, they are completely independent of the mother and are reproductively mature.
- In tropical or semitropical regions, the breeding season may be nearly year-round. Usually the peaks in breeding occur in the spring and fall.

- Roof rats usually begin searching for food shortly after sunset. If the food is in an exposed area and too large to be eaten quickly, they often carry it to a safe hiding place before eating it. Many rats will hoard considerable amounts of solid food, which they may or may not eat later.
- When necessary, roof rats will travel considerable distances for food. They can often be seen at night running along overhead utility lines. They may live in trees or attics and climb down to a food source.
- All rats see poorly, relying more on smell, taste, touch and hearing. They are considered to be colorblind, responding only to the degree of lightness and darkness of colors. Roof rats also have an excellent sense of balance. They use their tails for balance while traveling along overhead utility lines and are very agile climbers.
- From the standpoint of pest control, traditional trapping on the ground or floor will not catch many roof rats. Traps are best set along roof rafters and beams that show signs (rub marks) of frequent roof rat travel.
- Roof rats have a strong tendency to avoid new objects in their environment and this can influence control efforts. These rats may take several days before they will approach a trap.
- Roof rats can be very difficult to trap and their control may often be beyond the scope of the Self-Help program.

Approved Self-Help Products for Control of Mice:

Snap Traps

SELF-HELP IPM Outline 5

Weeds

A. PURPOSE

The Self-Help pest management program authorizes the use of approved Self-Help products (low-toxicity, ready-to-use herbicides) by installation maintenance and VAARNG personnel who control weeds during the normal course of their assigned duties.

B. RESPONSIBILITIES

- Self-Help Program participants are responsible for proper use, recording, reporting, storage and disposal of Self-Help products.
- **All** label instructions must be read and followed – **The Label is the Law!**
- A Safety Data Sheet (SDS) should accompany the Self-Help product and be readily available to personnel using the product and working in the area where the product is used.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program. Contact the VAARNG IPMC (MAJ Brian Webb) for a current list of approved Self-Help products.

C. ACTIONS

STEP 1. Estimate the area of the weeds to be treated.

If the area to be treated is more than 500 square feet or 200 linear feet of fenceline/roadside/building foundation, a Pest Management Professional (PMP) may be needed to control the weeds. The number of weeds in the area should also be considered.

STEP 2. Self-Help products for weeds can be obtained by submitting a Work Order request to O&M. Only use products that are low-toxicity, ready-to-use (do not require dilution or mixing) and pre-approved for use in the VAARNG Self-Help Program.

STEP 3. Receive training on the proper use of the pesticide upon pick-up from the O&M Warehouse. Sign a Self-Help training Acknowledgement of Understanding (Page E-5) and return the form to the IPMC before applying any pesticides.

STEP 4. Read the entire product label. **The Label is the Law!**

- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do **NOT** eat, drink or smoke while using any pesticide.
- Use product as directed on the label for control of the weed.
- Always thoroughly wash hands with soap and water after using product and before eating, drinking or smoking.

STEP 5. Store and/or dispose of any leftover Self-Help products as directed on the label and the VAARNG IPMP. If you have any questions on storage or disposal of the Self-Help products, contact the VAARNG IPMC (MAJ Webb).

STEP 6. Report Self-Help product use to the VAARNG IPMC using the Pest Management Treatment Record form. The form(s) recording usage should be sent to the VAARNG IPMC at the end of the month.

STEP 7. If the Self-Help control methods in this outline do not control the weeds to acceptable levels, put in a Work Order with the O&M Office or contact the Fort Pickett Entomologist.

Approved Self-Help Products for Control of Weeds:

EPA Reg No.	Label Name	Active Ingredient
42750-66-7401	Kilz all (Gly Star)	Glyphosate-isopropylammonium
67760-47-9688	(Glyfos) Ultra-Kill Ready-To-Use 1.92% Weed & Grass Killer	Glyphosate-isopropylammonium
71995-33	Roundup Weed & Grass Killer Ready-to-Use Plus	Glyphosate-isopropylammonium

SELF-HELP IPM Outline 6

Flies

A. PURPOSE

The Self-Help pest management program authorizes the use of approved Self-Help products (including traps and baits) by installation maintenance and VAARNG personnel who encounter flies during the normal course of their assigned duties.

B. RESPONSIBILITIES

- Self-Help Program participants are responsible for proper use, recording, reporting, storage and disposal of Self-Help products.
- **All** label instructions must be read and followed – **The Label is the Law!**
- A Safety Data Sheet (SDS) should accompany the Self-Help product and be readily available to personnel using the product and working in the area where the product is used.
- Only use products that are pre-approved for use in the VAARNG Self-Help Program. Contact the VAARNG IPMC (MAJ Brian Webb) for a current list of approved Self-Help products.
- Approved Self-Help products are tools to assist Self-Help Program participants with the control of flies in their work and billeting areas. These Self-Help control efforts supplement fly control done at the site by Pest Management Professionals (PMPs).
- Flies can carry and transmit several diseases and parasites that can cause sickness in humans. All flies, including non-biting flies, can transmit disease organisms by tracking them from their source onto food or people.

C. ACTIONS

STEP 1. Surveillance.

- Identify the type of flies and, if possible, where they are breeding.
- It is important to identify the type of flies so the most effective controls are used. Sanitation is the best control method for some types of flies, and others are more effectively controlled by traps and habitat modification.
- Use the fact sheets attached to this outline to identify the type(s) of flies.

STEP 2. Decide if Self-Help is appropriate.

- After identifying the flies using the information in this outline and it is determined control of that type of fly is **NOT** appropriate for Self-Help Program, or additional control measures are needed, contact the O&M Office or Fort Pickett Entomology to arrange for control by a Pest Management Professional (PMP).
- Approved Self-Help products are tools to assist Self-Help Program participants with the control of flies in their work and billeting areas. These Self-Help control efforts

supplement fly control done at the site by Pest Management Professionals (PMPs). Attempting to control flies with methods that are not effective for the type of fly will result in loss of work time, higher costs and unnecessary exposure of VAARNG personnel to pesticides.

STEP 3. Perform Physical and Cultural Controls.

- Using pesticides as the only control method will rarely provide effective control of fly infestations.
- Habitat modification (removing sources of food and fly breeding locations) is vital in controlling flies.
- If all the actions in STEP 3 and 4 have been done and there are still on-going significant fly infestations at the same facility, contact the VAARNG IPMC (MAJ Webb). Further assessment and more extensive control methods may need to be implemented by contract or the CFMO.

STEP 4. Perform Chemical Control (trapping with chemical baits).

- Self-Help products for flies can be obtained by submitting a Work Order request to O&M. Only use products that are pre-approved for use in the VAARNG Self-Help Program.
- Read the entire product label. **The Label is the Law!**
- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.
- Do **NOT** eat, drink or smoke while using any pesticide.
- Use product as directed on the label for baiting of flies.
- See Chemical Control options below for further guidance on using fly baits and traps.
- Always thoroughly wash hands with soap and water after using product and before eating, drinking or smoking.
- Use of chemical controls will rarely provide sufficient control of flies. Habitat modification by removing food sources and fly breeding areas provides additional control.

STEP 5. Storage and Disposal of Self-Help Products.

- Store and/or dispose of any leftover Self-Help products as directed on the label and the VAARNG IPMP.
- If you have any questions on storage or disposal of the Self-Help products, contact the VAARNG IPMC.

STEP 6. Recording and Reporting.

- Report Self-Help product use to the VAARNG IPMC using the Pest Management Treatment Record form.
- The form recording usage should be sent to the VAARNG IPMC at the end of the calendar month.

STEP 7. Follow-up and Assessment.

- If the Self-Help control methods in this outline do not control the flies to acceptable levels within 30 days, put in a Work Order with the O&M Office or contact the Fort Pickett Entomologist.

FLY CONTROL

WHY IS CONTROL NEEDED?

Flies can carry and transmit several diseases and parasites that can cause sickness in humans. All flies, including non-biting flies, can transmit disease organisms by tracking them from their source onto food or people.

Some flies, such as drain flies, can be a human health hazard due to respiratory problems associated with inhalation of fly hairs and body parts.

Other flies, such as deer flies, horse flies and stable flies, can inflict painful bites.

Besides their ability to transmit numerous diseases, the presence of flies can also be very annoying and distracting to personnel.

1. GENERAL BIOLOGY

Domestic flies are those that are commonly found in close association with people and the animals associated with humans.

House flies and other domestic flies may fly into buildings through open doors and windows. In some cases, they may also crawl in through holes, cracks, and crevices.

Flies can reproduce very quickly and in large numbers. For example, house flies will lay about 500 eggs in their lifetime. If all the offspring of a single female house fly survived and reproduced, in five months there would be approximately 191,010,000,000,000,000,000 flies.

Flies will not usually breed in structures unless garbage is present for longer than one week, or there is a dead animal in an attic, crawl space, or other interior area.

Flies generally reproduce outdoors, but they will enter homes or buildings in search of food, moisture and shelter. If there is suitable decaying organic material available, they will reproduce indoors.

The life cycle of most flies is completed in 1-4 weeks, but it depends on the type of fly and weather conditions. The females generally lay around 150 eggs at a time. The legless white larvae (maggots) hatch, feed on the decaying animal or plant material and develop into pupae in about 7-14 days. The adult emerges from the pupae in three or more days.

See the attached information sheets for more information on types of flies that can be commonly found in work areas.

2. INSPECTION AND SURVEY

Identify the type of flies using the fact sheets attached to this outline. It is important to identify the type of flies so the most effective controls are used.

Sanitation is the best control method for some types of flies and others are more effectively controlled by traps and habitat modification.

Visual Sighting:

- Observation of adult flies hovering around trash containers and resting on walls and cabinets near trash containers.
- Observation of fly larvae (maggots) in trash or trash containers.
- Adult drain flies often congregate on walls and windows of rooms containing drains where drain flies are breeding
- Locate the drain(s) from which drain flies are emerging in order to target their breeding sites.
- Adult fruit flies are usually seen near fruit or other rotting foods.

Trapping:

- Sticky (adhesive) fly strips (that do not contain a pesticide) can be used for fly surveillance.
- For drain flies, seal suspected drain openings with a glue board, masking tape, or inverted plastic cup overnight to trap adult drain flies if they are present.

3. CONTROL METHODS

House Flies

An occasional fly in a building is not out of the ordinary, but continual fly problems are not normal. Sanitation and exclusion are the best methods for controlling house flies.

Cultural:

Sanitation: Removing feeding and breeding sites is critical for effective house fly control.

- House flies often breed in dirty trash containers.
- Cover outdoor trash containers with tight-fitting lids.
- Empty trash containers frequently.
- Clean and sanitize trash containers that have accumulated organic material.
- Clean dumpsters regularly.

Physical:

Exclusion:

- Seal cracks and other openings around doors and windows.
- Use tight-fitting screens on windows and doors.
- Do not leave unscreened doors and windows open.

Mechanical:

Trapping:

- Ultraviolet light traps may be used to reduce adult fly populations inside buildings. Light traps may not be used outdoors.
- Do not place light traps so they are visible from outside the structure since it can attract flies into the building.
- Light traps by themselves are unlikely to control heavy fly infestations.
- Do not use electric bug zappers that electrocute flies inside food-preparation areas or eating facilities. At these sites, only use light traps that collect flies on sticky traps.

Fly Swatters: Fly swatters are an effective control method for small numbers of flies that are inside buildings.

Sticky Fly Strips:

- Sticky fly strips that **do not** contain pesticides can also be used to help control flies inside buildings.
- Use one or two strips per room.
- Do not place strips in the kitchen or food preparation areas.
- **NEVER** use fly strips that contain pesticides in occupied areas.
- Ultrasonic and/or Electromagnetic Repellent Devices: These devices have been proven to be ineffective and may NOT be used.

Chemical:

Trapping: Traps containing chemical bait (lures) may be used outside of buildings to reduce fly populations. However, there is a never-ending source of flies outside and sanitation/exclusion are more effective methods of house fly control in most circumstances.

Self-Help Chemical Control of House Flies using Chemical-Baited Traps:

- Jar traps, such as the Farnam Terminator or Captivator, with Starbar Fly Trap Attractant, are an effective system for trapping house flies in most instances.
- Read the entire product label. **The Label is the Law!**
- Wear appropriate Personal Protective Equipment (PPE) as directed on the label.

- Do NOT eat, drink or smoke while using any pesticide product.
- Use correct number, spacing and placement of fly traps as directed on the label.
- Use correct number of baits (lures) per trap as directed on the label.
- Place traps around refuse containers and other places that attract flies.
- Do not use traps/baits indoors or use in outdoor areas where flies are not already present because the bait may attract flies to an otherwise fly-free area.
- The bait (lure) usually has a strong, unpleasant odor and traps are best placed away from windows that are regularly kept open and areas where personnel congregate.
- Empty trap(s) regularly and add additional bait (lure), as directed on the label, throughout the fly breeding season.
- Always thoroughly wash hands with soap and water after using Self-Help products and before eating, drinking or smoking.

Always follow the label directions for the use, placement and disposal of pesticide-containing products.

Fruit Flies

An occasional fruit fly in a building is not out of the ordinary, but continual fly problems are not normal. Sanitation and eliminating food sources are the best methods for controlling fruit flies.

Cultural:

Sanitation: Eliminating feeding and breeding sites is critical for effective house fly control.

- Empty trash containers daily to prevent the buildup of decaying foods that can attract fruit flies.
- Fruit flies are attracted to moist fermenting foods. They require only a moist film of decaying organic matter to breed.
- Keep garbage disposals, empty bottles and cans, trash containers, mops and cleaning rags clean to prevent fruit flies from using them as breeding sites.
- The bottom and sides of trash containers, especially large dumpsters, should be periodically steam-cleaned or washed to remove accumulation of organic matter.

Eliminate Food Sources:

- Fruit flies are attracted to gases produced by ripening fruit.
- Store fruit in the refrigerator in order to avoid attracting fruit flies and other pests.
- Cover outdoor trash containers with tight-fitting lids.
- Empty trash containers frequently.
- Clean and sanitize trash containers that have accumulated organic material.

Physical:

Exclusion:

- Seal cracks and other openings around doors and windows.
- Use tight-fitting screens on windows and doors.
- Do not leave unscreened doors and windows open.

Mechanical:

Fly Swatters: Fly swatters are an effective control method for small numbers of flies inside buildings.

Sticky Fly Strips:

- Sticky fly strips that **do not** contain pesticides can also be used to help control flies inside buildings.
- Use one or two strips per room.
- Do not place strips in the kitchen or food preparation areas.
- **NEVER** use fly strips that contain pesticides in occupied areas.

Ultrasonic and/or Electromagnetic Repellent Devices: These devices have been proven to be ineffective and may **NOT** be used.

Chemical:

- If the cultural, physical and mechanical methods do not control fruit flies to acceptable levels, contact the O&M Office to arrange for control by a Pest Management Professional (PMP).

Drain Flies

Sanitation and eliminating breeding sites are the best methods for controlling drain flies.

Cultural:

Sanitation: Eliminating breeding sites is critical for effective drain fly control.

- Drain flies breed in accumulated organic matter that accumulates inside interior drain pipes.
- Remove this material with over-the-counter drain cleaners.
- Scrubbing drains with a stiff brush may be necessary to remove heavy buildup.

Physical:

Exclusion:

- Seal cracks and other openings around doors and windows.
- Use tight-fitting screens on windows and doors.
- Do not leave unscreened doors and windows open.

Mechanical:

Fly Swatters: Fly swatters are an effective control method for small numbers of flies inside buildings.

Sticky Fly Strips:

- Sticky fly strips that **do not** contain pesticides can also be used to help control flies inside buildings.
- Use one or two strips per room.
- Do not place strips in the kitchen or food preparation areas.
- **NEVER** use fly strips that contain pesticides in occupied areas.

Ultrasonic and/or Electromagnetic Repellent Devices: These devices have been proven to be ineffective and may **NOT** be used.

Chemical:

- If the cultural, physical and mechanical methods do not control fruit flies to acceptable levels, contact the O&M Office to arrange for control by a Pest Management Professional (PMP).

Fungus Gnats

An occasional gnat in a building is not out of the ordinary, but continual fly problems are not normal. Eliminating breeding habitat in indoor potted plants is the best method for controlling fungus gnats.

Cultural:

Eliminate Breeding Sites: Eliminating feeding and breeding sites is critical for effective fungus gnat control.

- Avoid overwatering potted plants. Allow the surface of the soil to dry between waterings.
- Dump excess water out the saucer/tray under plants after watering indoor plants.

- Use only sterilized potting soil in indoor plants. Unless potting soil is pasteurized first, it is often infested with fungus gnats.
- Do not move potted plants that are infested with fungus gnats to new areas where flies can infest other pots.
- In some cases, the best control is to dispose of severely infested plants.

Physical:

Exclusion:

- Seal cracks and other openings around doors and windows.
- Use tight-fitting screens on windows and doors.
- Do not leave unscreened doors and windows open.

Mechanical:

Sticky Fly Strips or Sticky (Glue) Traps:

- Sticky fly strips that **do not** contain pesticide or glue traps can also be used to help control adult fungus gnats after their removing breeding sites.
- Attach strips or sticky (glue) traps (they can be cut into smaller pieces) to wooden skewers or sticks and place in potted plants that are infested with fungus gnats.
- Do not place sticky traps in the kitchen or food preparation areas.
- **NEVER** use fly strips that contain pesticides in occupied areas.
- Sticky (glue) traps should never be placed outdoors or in areas where non-target wildlife (such as birds, bats or snakes) may be accidentally trapped. If non-target wildlife is found alive on a sticky trap, talcum powder, cornstarch or vegetable oil can be applied to the exposed glue around the trapped wildlife and the animal can then usually free itself. For birds and bats, it is best to immediately take the trap, without attempting to remove the animal, to a licensed wildlife rehabilitator for assistance.

Ultrasonic and/or Electromagnetic Repellent Devices: These devices have been proven to be ineffective and may **NOT** be used.

Chemical:

- If the cultural, physical and mechanical methods do not control fungus gnats to acceptable levels, contact the O&M Office to arrange for control by a Pest Management Professional (PMP).

Biting Flies

Biting flies are most commonly encountered outdoors and are difficult to control since they breed outside where there is a nearly unlimited source of flies and breeding sites. Trapping and use of repellents are also not as effective with these flies as with other flies and insects.

Cultural:

Eliminate Breeding Sites: The most effective and economical method for reducing stable fly numbers is to eliminate their breeding sites.

- Remove or compost grass clippings.
- Properly maintain compost piles, by periodically turning the pile, to prevent them from becoming breeding areas for flies.

Physical:

Exclusion:

- Use tight-fitting screens on windows and doors.
- Do not leave unscreened doors and windows open.

Mechanical:

Fly Swatters: Fly swatters are an effective control method for small numbers of flies inside buildings.
Ultrasonic and/or Electromagnetic Repellent Devices: These devices have been proven to be ineffective and may **NOT** be used.

Chemical: Chemical control methods that can be used for Self-Help are not effective for biting flies.

Trapping: Using traps for biting flies is not an effective control method since, unlike house flies, they are not attracted to traps using odor-based lures. Light traps may not be used outdoors.
Insect Repellents: Insect repellents are not typically effective for biting flies. Covering exposed areas of the body is preferred.

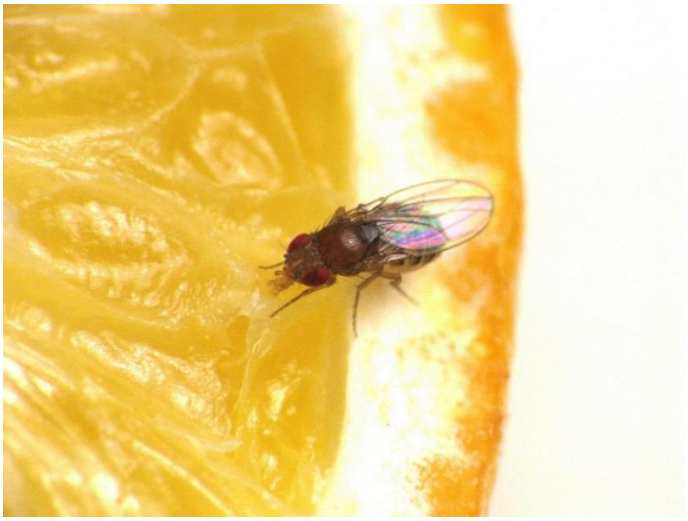
4. AFTER TREATMENT SURVEILLANCE

Fly strips that **do not** contain pesticide and sticky (glue) traps can be used to determine the effectiveness of fly control.
If there is a reduction in the number of flies, Self-Help control efforts are working. If using traps, continue to empty and bait traps until the end of the fly breeding season.
If there is not a reduction in the number of flies after 14 days of starting control efforts, put in a Work Order with the O&M Office or contact the Fort Pickett Entomologist for Pest Management Professional (PMP) assessment and possible additional control measures.

House Flies

- House flies (*Musca domestica*) are 3/16 to 1/2-inches long and have two wings. They have large compound eyes and their bodies are usually striped. Their color varies from light gray to metallic shades of green, blue, and blue-green.
- House flies have sponging mouthparts and eat solid food by first liquefying it with their saliva. House flies can also regurgitate onto a solid food to assist with the liquefying process.
- Like all flies, house flies have a four-stage life cycle: egg, larva, pupa, and adults.
- Female flies deposit eggs in animal feces, carrion or moist organic material where the larvae (maggots) complete their development.
- The rate of house fly development is dependent upon temperature; and under summertime conditions, flies may develop from egg to adult in as little as 7 days. Once the female fly has mated, she can lay several batches of eggs, typically containing over 100 eggs each.
- House flies cannot bite because they have sponging mouthparts.
- House flies can carry a number of disease organisms that they pick up while feeding on animal feces, animal body secretions, or kitchen waste and they can then deposit onto human foods during feeding.
- House flies leave dark fecal and regurgitation spots on wall surfaces where they rest.

Fruit Flies



- Fruit fly adults are small (about 1/8-inch long), yellow or brownish flies that usually have red eyes.
- Fruit flies are attracted to ripened fruits and vegetables. They can also breed in drains, garbage disposals, empty bottles and cans, trash containers, mops and cleaning rags.
- Fruit flies lay large numbers of eggs on fruit and the larvae feed on the fruit.
- Fruit flies are active during periods of warm weather, and a single generation may develop in less than a week when temperatures are between 80° and 89°F.
- Temperatures above 105°F kill adult fruit flies in a few minutes.
- Infestations can originate from over-ripened fruits or vegetables that were previously infested and brought inside.
- The adults can also fly in from outside through inadequately screened windows and doors.
- Fruit flies are primarily nuisance pests. However, they also have the potential to contaminate food with bacteria and other disease-producing organisms.

Drain Flies

- Drain flies, also called moth flies, are about 1/8-inch in length and often dark-colored. Their wings are covered with fine hairs that gives them a moth-like appearance.
- Drain flies rest on surfaces with their wings held over their back in a roof-like manner
- They are not good flyers, and usually fly with short hopping flights.
- Female drain flies lay eggs in wet organic matter, usually in sink or shower drains.
- Drain flies may also be found developing in wet animal manure, sewage or compost.
- Very large numbers of these flies in one area probably indicates a breeding site bigger than a few indoor drains.
- The life cycle of drain flies can be as short as 8 days, but can take as long as 24 days, depending on the temperature.
- Drain flies do not bite people or animals, and they cause no damage to structures or plants.
- However, because drain flies develop in decaying organic matter, they can carry disease organisms from their development sites to areas where sterility is important, such as health care facilities and food preparation areas.
- Drain flies may also affect human health when present in high numbers, because the bodies of dead flies may disintegrate to form potential allergens.

Fungus Gnats

- Fungus gnats (Orfelia and Bradysia species) are very small (1/8 to 1/16-inch long), dark flies that are similar in appearance to tiny mosquitoes. Adult fungus gnats have slender legs with segmented antennae that are longer than their head.
- Fungus gnats live in dirt, potting mix, and other sources of organic-rich soil.
- The source of fungus gnat infestations are usually potted plants.
- Fungus gnat larvae primarily feed on fungi and organic matter in soil, but can also chew on plant roots.
- Adult fungus gnats may emerge from indoor houseplants and become a nuisance.
- Adult fungus gnats are attracted to light and they are often seen flying near windows. They may also remain near potted plants and can be seen resting or moving on the soil or plant leaves.
- Females lay tiny eggs in moist organic debris or potting soil. The larvae have a shiny black head and an elongated, whitish-to-clear, legless body. If conditions are especially moist, the larvae may leave slime trails on the surface of soil that look like trails from small snails or slugs.
- Adult fungus gnats don't usually damage plants or bite people. Their presence is primarily considered a nuisance.
- Adult fungus gnats are short-lived and a generation of fungus gnats (from female to female) can be produced in about 17 days depending upon temperature.

Biting Flies

- There are numerous flies that bite people and animals, including deer flies (pictured above), horse flies and stable flies.
- Deer flies range in size from about 1/4 to 1/3-inches long. Their wings are clear with dark bands or patches, and their bodies are gray or light brown and some species have yellow and black striping. They have large, often brightly colored, eyes and their antennae are usually longer than their head.
- Horse flies range in size from 3/4 to 1-1/4-inches long and usually have clear or solidly-colored wings and brightly colored eyes.
- Like mosquitoes, it is the female deer fly and horse fly that bites. Females require a meal of blood in order to produce eggs.
- The female deer fly bites with two pairs of mouthpart "blades" that cut the skin. Once the skin is cut, the female fly then laps up the blood from the wound.
- Deer flies feed on a variety of mammals, including humans, pets, livestock and deer. They usually bite moving targets and attack the top half of the body, such as the head or neck.
- Horse flies feed the same way as deer flies, but prefer biting lower half of the body, such as the legs, and tend to attack stationary targets.
- Deer fly females will continue to return and bite repeatedly if their feeding behavior is interrupted.
- Male deer flies and horse flies are mainly pollen and nectar feeders.
- Deer and horse flies are most likely encountered in hot summer and early fall weather, and are active during daylight hours.

Approved Self-Help Products for Control of Flies:

(Whitmire) PT (Prescription Treatment) 565 Plus XLO (Formula 2) (WB), EPA Registration Number 499-290.

Appendix F – IPM Points of Contact

VAARNG

MAJ Brian Webb Integrated Pest Management Coordinator	Phone 804-436-3784 Email brian.j.webb14.mil@mail.mil
Donald "Donnie" McDaniel VAARNG Entomologist	Phone 434-480-2120 Email donald.w.mcdaniel9.nfg@mail.mil
Brandon Martin Natural Resources Manager	Phone 434-292-2292 Email brandon.t.martin26.nfg@mail.mil
Susan Smead Cultural Resources Manager	Phone 434-298-6411 Email susan.e.smead.nfg@mail.mil
Ken Oristaglio Conservation Manager	Phone 434-298-6416 Email kenneth.l.oristaglio.nfg@mail.mil
Matt Thompson Environmental Compliance Manager	Phone 434-298-6402 Email matthew.thompson50.nfg@mail.mil
Pam Coleman Environmental Program Manager	Phone 434-298-6445 Email pamela.w.coleman.nfg@mail.mil
COL Charlton Dunn CFMO	Phone 434-298-6423 Email charlton.t.dunn.mil@mail.mil
Dave Short O&M Chief	Phone 434-292-2612 Email david.k.short.nfg@mail.mil
Derrick Hall Architecture and Engineering Manager	Phone 434-298-6232 Email derrick.hall11.nfg@mail.mil
Rebecca Moses Safety/Occupational Health Manager	Phone 434-298-5927 Email rebecca.m.moses5.nfg@mail.mil
Fort Pickett Fire and Rescue	Phone 434-292-2217

Other Resources

DOD Pesticide Hotline 410-436-3773 / DSN 312-584-3773
usarmy.apg.medcom-phc.mbx.pesticide-hotline@mail.mil

CHEMTREC

Emergency Number 1-800-424-9300
(For assistance in a chemical emergency involving a spill, leak, or exposure.)

Non-emergencies 1-800-262-8200

National Pesticide Telecommunications Network

Provides up-to-date technical reference material on toxicity, human and environmental effects, disposal, and proper use of pesticides.

http://npic.orst.edu/ 1-800-858-7378

Mobile Access to Pesticides and Labels (MAPL)

US EPA-sponsored pesticide and label finding tool for mobile devices.

http://pi.ace.orst.edu/mapl/

Enviro tracking #	ARNG ENVIRONMENTAL CHECKLIST	State ARNG
FY17VAFM70		VAARNG

PART – A PROJECT INFORMATION

1. Project name: Integrated Pest Management Plan (IPMP)

2. Project number: (MILCON if applicable) | 3. Date prepared: 21 September 2017

4. Description and location of the project/proposed action.

a. Location (Include a detailed map if applicable):

The proposed action is for all Army National Guard locations across the state of Virginia.

b. Description:

Update the 2008 VA ARNG Integrated Pest Management Plan (IPMP) to include new regulatory updates and changes to current ARNG operations on Virginia facilities. Updated IPMP will codify pesticide procurement, use, storage, training, and reporting for all VA ARNG personnel and facilities and will be valid for 5 years. Format will follow the approved template developed by NGB for new IPMPs and incorporate all federal and state regulatory requirements to ensure that personnel and the environment are protected during all pest management actions within the organization. The implementation of the new IPMP will result in a reduction of historic pesticide usage by up to 50% through mechanical, cultural, and biological approaches.

c. The proposed action will involve (check all that apply):

- ☐ Training activities/areas
- ☐ Construction
- ☐ Natural resource management
- ☐ Maintenance/repair/rehabilitation
- ☐ Real estate action
- ☒ Environmental plans/surveys
- ☐ Innovative readiness training project
- ☐ Other (Explain): New Equipment Fielding and Training

d. Project size in acres: *(if applicable)* Acres of proposed new surface disturbance: *(if applicable)*

5. Start date of proposed action (dd-mmm-yy): January 2018 *NOTE: this must be a future date.*

6. Programmed fiscal year: FY 18

7. End date (if applicable):

PART B – DECISION ANALYSIS GUIDE

To use a categorical exclusion, the project must satisfy the following three screening criteria: no segmentation, no exceptional circumstances and a qualifying categorical exclusion that covers the project. The following decision tree will guide the application and documentation of these three screening criteria. The criteria were extracted from 32 CFR Section 651.29 and represent the most common screening conditions experienced in the ARNG. NOTE: Each question in Part B must have an applicable block checked for concurrence with REC.

1. Is this action segmented (the scope of the action must include the consideration of connected, cumulative, and similar actions)? ☐ Yes (go to #30) ☒ No (go to #2)

2. Is there reasonable likelihood of significant environmental effects (direct, indirect, and cumulative)? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question.
☐ Yes (go to #30) ☒ No (go to #3)

3. Is there a reasonable likelihood of significant effects on public health, safety or the environment? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question.
☐ Yes (go to #30) ☒ No (go to #4)

4. Is there an imposition of uncertain or unique environmental risks? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question. ☐ Yes (go to #30) ☒ No (go to #5)

5. Is the project of greater scope or size than is normal for the category of action? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question.
☐ Yes (go to #30) ☒ No (go to #6)

6. Does the project introduce or employ unproven technology? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question.
☐ Yes (go to #30) ☒ No (go to #7)

7. Will there be reportable releases of hazardous or toxic substances as specified in 40 CFR Part 302? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question.
☐ Yes (go to #30) ☒ No (go to #8)

8. If proposed action is in a non-attainment or maintenance area, will air emissions exceed de minimus levels or otherwise require a formal Clean Air Act (CAA) conformity determination? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question.
☐ Yes (go to #30) ☐ No (go to #9) ☒ N/A (go to #9)

9. Will the project have effects on the quality of the environment that are likely to be highly controversial? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question.
☐ Yes (go to #30) ☒ No (go to #10)

10. Will the project establish a precedent (or make decisions in principle) for future or subsequent actions that are reasonably likely to have future significant effects? If action meets screening criteria but is assessed in an existing EA or EIS, check NO and proceed to the next question. ☐ Yes (go to #30) ☒ No (go to #11)

11. Has federal funding been secured for the Innovative Readiness Training (IRT) project?
☒ Not applicable (go to #13) ☐ Yes (go to #13) ☐ No (go to #12)

12. NOTE: IRT projects not currently funded can secure approved NEPA documentation. However, once funding is secured State ARNG is required to coordinate with ARNG-ILE-T to complete natural and cultural surveys via proponent funding. ☐ Confirmed (go to #27)

13. Do you have a species list from the U.S. Fish and Wildlife Service that is less than 90 days old?
☐ Yes (go to #14) ☞ Date of list: ☒ No (update species list, return to #13)

14. In reviewing the species list, what determination was made by the State ARNG?
- ☐ No species present (go to #16)
- ☒ No affect (go to #16)
- ☐ May affect but not likely to adversely affect ☞ Date of USFWS concurrence (go to #16)
- ☐ May affect likely to adversely affect (go to #15)

15. Does an existing biological opinion cover the action? ☐ Yes ☞ Date of BO: (go to #16) ☐ No (go to #30)

16. Have the Endangered Species Act, Section 7 requirements been completed?
☐ Yes ☞ Date of documentation: 11 February 2016 (go to #17) ☒ No (complete documentation, return to #16)

17. Does the project involve an undertaking to a building or structure that is 50 years of age or older?
☐ Yes (go to #18) ☒ No (go to #20)

18. Has the building or structure been surveyed for the National Register of Historic Places?
☐ Yes (go to #19) ☐ No (complete inventory, return to #18)

19. Is the building or structure eligible for or listed on the National Register of Historic Places?
☐ Yes (go to #20) ☐ No (go to #20)

20. Does the action involve ground disturbing activities? ☐ Yes (go to #21) ☒ No (go to #22)

21. Has an archaeological inventory or research been completed to determine if there are any archaeological resources present? ☐ Yes (go to #22) ☐ No (complete inventory, return to #21)

22. In reviewing the undertaking, under the National Historic Preservation Act (NHPA) (for both above and below ground resources), what determination was made by the State ARNG?
- ☐ No 106 undertaking; no additional consultation required under NHPA (go to question #27)
- ☒ No properties affected ☞ Date of SHPO concurrence: See item 23a., below (go to #24)
- ☐ No adverse effect ☞ Date of SHPO concurrence: (go to #24)
- ☐ Adverse effect (go to #23)

23. Has the State ARNG addressed the adverse effect?
☐ Yes (place date of MOA or existing PA and explanation of stipulations below, go to #24) ☐ No (go to #30)

23a. Date of MOA or PA and explanation:

The action covered by this REC is an undertaking as defined in 36 CFR Part 800 (NHPA Section 106) at 800.16(y): ". . . a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval." However, according to 36 CFR Part 800.3(a)(1), the undertaking has no potential to cause effects on historic properties so VaARNG has no further obligations under Section 106; and this is consistent with the VaARNG PA, executed DEC 2016 (Ref. *Programmatic Agreement Among the Virginia Army National Guard, the National Guard Bureau, Virginia State Historic Preservation Office, and the Advisory Council on Historic Preservation Regarding Routine Operations, Maintenance, Development, and Training Actions at Virginia Army National Guard Properties Throughout Virginia*), as set forth at II.A.1.a. As set forth in the IPMP, treatments to be carried out under it will be coordinated under the PA and according to the Section 106 process where applicable.

24. Per DoDI 4710.02 did the state ARNG determine that tribal consultation was necessary for this project?
☐ Yes (go to #25) ☒ No (Provide reason in block below, go to #27)

24a. Reason for no consultation:
According to ongoing consultation with Federal and State Tribes, this is a type of project that would not be of interest to Tribes for routine consultation, since it does not involve an action that has the potential to cause effects on historic properties. As set forth in the IPMP, treatments to be carried out under it will be coordinated with Tribes as needed and as appropriate.

25. Did the Tribes express an interest or respond with concerns about the project?
☐ Yes (go to #26) ☐ No ☞ Date of MFR: (go to #27)

26. Has the State ARNG addressed the Tribal concerns?
☐ Yes (place date of MOU or explanation in box below, go to #27) ☐ No (address concerns, return to #26)

26a. Date of MOU or explanation of how State addressed tribal concerns:

27. Does the project involve an unresolved effect on areas having special designation or recognition such as those listed below? For any yes responses go to #30 otherwise go to #28. If any No response is a result of negotiated and/or previously resolved effects please describe resolution in box 27a below.

Type	Unresolved Effects?	Type	Unresolved Effects?
a. Prime/Unique Farmland	☐ Yes ☒ No	e. Wild/Scenic River	☐ Yes ☒ No
b. Wilderness Area/National Park	☐ Yes ☒ No	f. Coastal Zones	☐ Yes ☒ No
c. Sole-Source Aquifer	☐ Yes ☒ No	g. 100-Year Floodplains	☐ Yes ☒ No
d. Wetlands	☐ Yes ☒ No	h. National Wildlife Refuges	☐ Yes ☒ No
27a. Resolution:			

28. Is this project addressed in a separate EA or EIS review?
☒ Yes (complete information below, go to Part C, Determination) ☐ No (go to #29)
Document Title: 2008 VA ARNG Integrated Pest Management Plan (IPMP) Environmental Assessment
Lead Agency: VA ARNG
Date of Decision Document: 2008

29. Does the project meet at least one of the categorical exclusions listed in 32 CFR 651 App B?
☒ Yes (complete information below, go to Part C, Determination) ☐ No (go to #30)
Primary CAT EX code: (b)(1)
Reason why CAT EX code applies: Proposed action is the update to the 2008 VA ARNG Integrated Pest Management Plan (IPMP)

30. At this time your project has not met all the qualifications for using a categorical exclusion under 32 CFR 651. Unless the scope of the project is changed, it will require an Environmental Assessment or possibly an Environmental Impact Statement. If you feel this is in error, please call your NEPA Regional Manager to discuss. If needed, go to Part C Determination.

Additional information (if needed):

PART C – DETERMINATION

On the basis of this initial evaluation the following is appropriate:

☐ In accordance with 32 CFR 651 Appendix B, the proposed action qualifies for a categorical exclusion that does not require a record of environmental consideration.
☒ A record of environmental consideration.
☐ An environmental assessment.
☐ A notice of intent to prepare an environmental impact statement.

Signature of Proponent (requestor)
Name: Webb, Brian MAJ
Date: 26 OCT 2017

Signature of Environmental Program Manager
Name: Pamela Coleman
Date: 27 Oct 17

Other concurrence (as needed):

Signature
Name: COL Charlton Dunn
Title/Division: Facilities Management Officer
Date:

Enviro tracking #	**ARNG RECORD OF ENVIRONMENTAL CONSIDERATION**	State ARNG
FY17VAFM70		VAARNG

1. Project name: Integrated Pest Management Plan (IPMP)	
2. Project number: (MILCON if applicable)	3. Date prepared: 21 September 2017
4. Start date of proposed action (dd-mm-yy): January 2018	*NOTE: this must be a future date.*
5. Programmed fiscal year: FY18	
6. End date (if applicable):	

7. Description and location of the project/proposed action.

a. Location (Include a detailed map if applicable):

The proposed action is for all Army National Guard locations across the state of Virginia.

b. Description:

Update the 2008 VA ARNG Integrated Pest Management Plan (IPMP) to include new regulatory updates and changes to current ARNG operations on Virginia facilities. Updated IPMP will codify pesticide procurement, use, storage, training, and reporting for all VA ARNG personnel and facilities and will be valid for 5 years. Format will follow the approved template developed by NGB for new IPMPs and incorporate all federal and state regulatory requirements to ensure that personnel and the environment are protected during all pest management actions within the organization. The implementation of the new IPMP will result in a reduction of historic pesticide usage by up to 50% through mechanical, cultural, and biological approaches.

8. Choose one of the following:

☒ An existing environmental assessment* adequately covers the scope of this project. Attach FNSI if EA was completed by another federal agency (non-ARNG).
Date of EA (dd-mmm-yy): 9 August 2004 Lead Agency: VA ARNG
☐ An existing environmental impact statement* adequately covers the scope of this project.
Date of EIS (dd-mmm-yy): Lead Agency:
☒ After reviewing the screening criteria and completing the ARNG environmental checklist, this project qualifies for a categorical exclusion (select below).
CAT EX Code: (b)(1): Preparation of regulations, procedures, manuals, and other guidance documents that implement, without substantive change, the applicable HQDA or other federal agency regulations, procedures, manuals, and other guidance documents that have been environmentally evaluated
CAT EX Code:
CAT EX Code:
☐ This project is exempt from NEPA requirements under the provisions of:
Cite superseding law:
**Copies of the referenced environmental assessment or environmental impact statement can be found in the ARNG Environmental Office within each state.*

9. Remarks (if needed):

Signature of Proponent (requestor)
Name: Webb, Brian, MAJ
Date: 26 OCT 2017

Signature of Environmental Program Manager
Name: Pamela Coleman
Date: 27 Oct 17

Proponent Information
10. Proponent: NGVA-VAFM-E
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12. POC:
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APPENDIX I: GLOSSARY OF TERMS

Association: The basic unit of vegetation. A plant community that is united physiognomically as well as floristically.

Best Management Practices: Resource management decisions that are based on the latest professional and technical standards for the protection, enhancement, and rehabilitation of natural and cultural resources.

Biodiversity: The variety of life forms, processes, and the environment in which they occur. Biodiversity includes the number and variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting.

Clean Air Act (CAA) (42U.S.C.§§7401-7671g): The comprehensive federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.

Clean Water Act (CWA) (33 U.S.C. 1251 et seq.): Amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to waters of the United States.

Climate: The meteorological conditions, including temperature, precipitation and wind that characteristically prevail in a particular region.

Coastal Plain: Any flat low-lying geographical region near the sea. Coastal plains are extensions of the submerged continental shelf.

Cover Type: A forest classification defined by the dominant plant species presently occupying the site.

Critical Habitat: (Endangered Species Act, Section 4), The specific areas within the geographical area occupied by a federally endangered or threatened species, when it is listed, which contain the physical or biological features 1) essential to the conservation of the species and 2) which may require special management considerations or protection. Critical habitat may also include specific areas outside the geographical area occupied by the species when it is listed if those areas are essential for the conservation of the species [(ESA Section 3(5A))]. Critical habitat is described and designated by the lead Federal regulatory agency making status determinations for a species. Designations usually accompany final listing decisions but may be delayed to allow comprehensive review of the necessary technical data.

Cultural Resources: Historic properties as defined by the NHPA, cultural items as defined by Native American Graves Protection and Repatriation Act (NAGPRA), archeological resources as defined by Archaeological Resources Protection Act of 1979 (ARPA), sacred sites as defined by EO 13007 to which access is afforded under AIRFA, and collections and associated records defined in 36 CFR 79.

Environmental Assessment: Environmental Assessment. This is a document mandated by the National Environmental Policy Act (NEPA), defined as a concise public document for which a Federal agency is responsible that serves to: 1) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact, 2) aid an agency's compliance with NEPA when no

environmental impact statement is necessary, and 3) facilitate preparation of a statement when one is necessary. Environmental Assessments include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E) of NEPA, of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

Ecology: The study of the relationship among and between organisms and their environment.

Ecosystem: A discrete system that includes all the organisms and their environment within which they occur. All living and non-living parts, interacting to form a stable system.

Endangered Species: "…any species [including subspecies or qualifying distinct population segment] that is in danger of extinction throughout all or a significant portion of its range." [ESA Section 3(6)]. The lead federal agency for the listing of a species as endangered (e.g. the U.S. Fish and Wildlife Service, or the National Marine Fisheries Service) is responsible for reviewing the status of the species on a five-year basis.

Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.): An act to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions.

Environmental Impact Statement (EIS): This is a document mandated by the National Environmental Policy Act (NEPA), which includes a detailed written statement as required by section 102(2)(C) of NEPA. It is the most detailed and comprehensive environmental analysis specified under NEPA. An EIS focuses on significant environmental impacts of a proposed action and/or alternatives, including short-term and long-term effects.

Exotic Species: Species that occur in a given place, area, or region as the result of direct or indirect, deliberate or accidental introduction of the species by human activity.

Fauna: the animal life of a region or geological period.

Finding of No Significant Impact (FNSI): A document prepared by a federal agency showing why a proposed action would not have a significant impact on the environment and thus would not require preparation of an Environmental Impact Statement. A FNSI is based on the results of an environmental assessment.

Flora: all the plant species that make up the vegetation of a given area.

Greenscaping: encompasses a set of landscaping practices that can improve the health and appearance of your lawn and garden while protecting and preserving natural resources. Greenscaping can save time, money, eliminates unnecessary water and chemical use, and reduces yard waste.

Gully: a feature of surface erosion that develops from the run-off of a violent torrent that bites deeply into topsoil and soft sediments.

Habitat: The place where a population (e.g., human, animal, plant, and microorganism) lives and its surroundings include both living and non-living things.

Herbaceous: Relating to or characteristic of an herb as distinguished from a woody plant.

Hydric Soils: Soils that are saturated, flooded, or ponded for long enough during the growing season to develop oxygen-deficient conditions in their upper part.

Hydrology: The science dealing with the properties, distribution and circulation of water.

Hydrophytic Vegetation: Plants that have an affinity for wetlands and are found at least 50 percent of the time in wetlands.

Indigenous Wildlife: Native to an area, not imported.

Integrated Pest Management (IPM): A comprehensive approach to pest control or prevention that considers various chemical, physical, and biological suppression techniques; the habitat of the pest; and the interrelationship between pest populations and the potential to cause economic or environmental harm.

Mitigation: Lessening the adverse effects an undertaking may cause relative to natural or cultural resources. Mitigation can include limiting the magnitude of the action; repairing, rehabilitating, or restoring the affected resource; avoiding the effect altogether; reducing or eliminating the effect over time by preservation and maintenance operations during the life of the action; and/or compensating for the effect by providing substitute resources or environments.

Native Americans: American Indians, Eskimos, Aleuts, and Native Hawaiians.

Natural Resources: All elements of nature and their environments of soil, air, and water. Those consist of two general types:

(1) Earth Resources: Nonliving resources such as minerals and soil components

(2) Biological Resources: Living resources such as plants and animals.

National Environmental Policy Act (NEPA): The Act as amended articulates the Federal law that mandates protecting the quality of the human environment. It requires Federal agencies to systematically assess the environmental impacts of their proposed activities, programs and projects including the "no action" alternative of not pursuing the proposed action. NEPA requires agencies to consider alternative ways of accomplishing their missions in ways which are less damaging to the environment (Pub. L. 91-190, 42 U.S.C. 4321-4347).

National Historic Preservation Act of 1966 (16 U.S.C.§§470 et seq.): An act to establish a program for the preservation of historic properties throughout the Nation, and for other purposes, Approved October 15, 1966 (Public Law 89-665; 80 STAT.915; 16 U.S.C. 470) as amended by Public Law 91-243, Public Law 93-54, Public Law 94-422, Public Law 94-458, Public Law 96-199, Public Law 96-244, Public Law 96-515, Public Law 98-483, Public Law 99-514, Public Law 100-127, and Public Law 102-575).

National Register of Historic Places (National Register): A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.

National Wetland Inventory: A database from the U.S. Fish and Wildlife Service that produces information on the characteristics, extent and status of the Nation's wetlands and deepwater habitats.

Native Species: A species indigenous to an area; i.e. not introduced from another environment or area.

Physiognomy: the form and structure of natural communities.

Planning Level Survey: An inventory of "sensitive and significant resources" that must be identified to integrate legal and stewardship requirements with military requirements so that defense preparedness is maintained.

Rare Species: A species that has a small number of individuals and/or has a limited distribution. A rare species may or may not be endangered or threatened.

Riparian Habitat: Areas adjacent to rivers and streams with a differing density, diversity and productivity of plant and animal species relative to nearby uplands.

Runoff: That part of precipitation, snowmelt or irrigation water that runs off the land into streams or other surface-waters.

Sikes Improvement Act of 1997 (16 U.S.C. 670a et seq.): An Act to promote effectual planning, development, maintenance and coordination of wildlife, fish, and game conservation and rehabilitation on military reservations.

Stewardship: The management of resources entrusted to one's care in a way that preserves and enhances the resources and their benefits for present and future generations.

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.).

Threatened Species: "…any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" [Section 3(19) of the ESA]. The lead federal agency for the listing of a species as threatened, (e.g., the U.S. Fish and Wildlife Service, or the National Marine Fisheries Service) is responsible for reviewing the status of the species on a five-year basis.

Topography: The physical features of a surface area including relative elevations and the position of natural and man-made (anthropogenic) features.

Undertaking: Any federal, federally-assisted, or federally-licensed action, activity, or program, new or continuing that may have an effect on National Register resources and thereby triggers procedural responsibilities under Section 470 et seq. of 16 U.S.C.

Vegetative Cover: The proportion of an area covered by the vertical projection of plant crowns or basal area to the ground surface.

Wetlands: Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

APPENDIX J: ACRONYMS

AR	Army Regulation
ARNG	Army National Guard
ARNG I&E	Army National Guard Installations and Environment
ARPA	Archaeological Resources Protection Act of 1979
BBNWR	Back Bay National Wildlife Refuge
BCR	Bird Conservation Regions
BGS	Below the Ground Surface
BMP	Best Management Practice
BO	Biological Opinion
CAA	Clean Air Act
CCB	Center for Conservation Biology
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	The Code of Federal Regulations
ChalleNGe	National Guard Youth Challenge Program
CMI	Conservation Management Institute
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
CZM	Coastal Zone Management Program
CZMA	Coastal Zone Management Act
DA	Department of the Army
DCR	Virginia Department of Conservation and Recreation
DEQ	Virginia Department of Environmental Quality
DMA	Department of Military Affairs
DNH	Department of Recreation Division of Natural Heritage
DoD	Department of Defense
DODM	Department of Defense Manual
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management System
EO	Executive Order
EPA	United States Environmental Protection Agency

ESA	Endangered Species Act
ESOB	Environmental State Operating Budgets
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FNSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
FY	Fiscal Year
INRMP	Integrated Natural Resource Management Plan
IPAC	Information for Planning and Consultation
IPM	ntegrated Pest Management
IPMP	Integrated Pest Management Plan
ITAM	Integrated Training Area Management
IUCN	International Union for Conservation of Nature
JFHQ	Joint Forces Headquarters
JROTC	Junior Reserve Officer Training Corps
LCA	Land and Community Associates
MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NASO	Naval Air Station Oceana
NASO-DNA	Naval Air Station Oceana – Dam Neck Annex
NAVFAC	Naval Facilities Engineering Command
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
NGB-ARE	Environmental Division of the National Guard Bureau
NGVA-FMO-ENV	Virginia Army National Guard-Facilities Management Office-Environmental
NGVA-MTC-OP	Departments of Training and Security
NGVA-MTC-PW	Department of Public Works
NHPA	National Historic Preservation Act of 1966
NLEB	Northern long-eared bat

NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NSN	Naval Station Norfolk
O&M	Operations and Maintenance
ROTC	Reserve Officer Training Corps
SAIA	Sikes Act Improvement Act
SAV	Submerged Aquatic Vegetation
SMR	State Military Reserve
STEP	Status Tool for the Environmental Program
TOYR	Time of Year Restriction
USACE	United States Army Corps of Engineers
U.S.C.	Unites States Congress
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VAARNG	Virginia Army Reserve National Guard
VACRMP	Virginia Coastal Resources Management Program
VDACS	Virginia Department of Agriculture and Consumer Services
VDGIF	Virginia Department of Gaming and Inland Fisheries
VDMA	Virginia Department of Military Affairs
VMRC	Virginia Marine Resources Commission
VPA	Virginia Pollution Abatement
VPDES	Virginia Pollutant Discharge Elimination System
VSMP	Virginia Stormwater Management Program
WEG	Williamsburg Environmental Group, Inc.