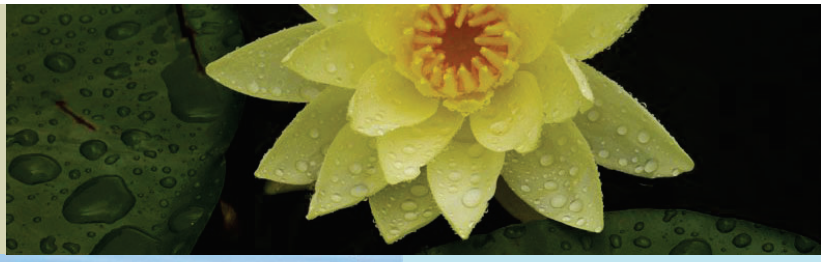
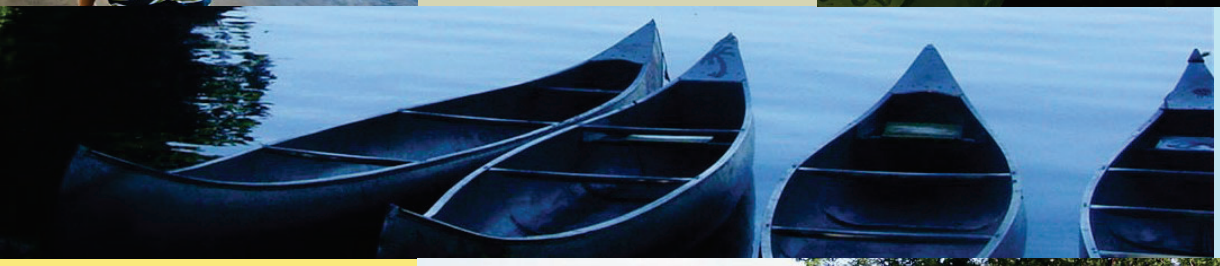
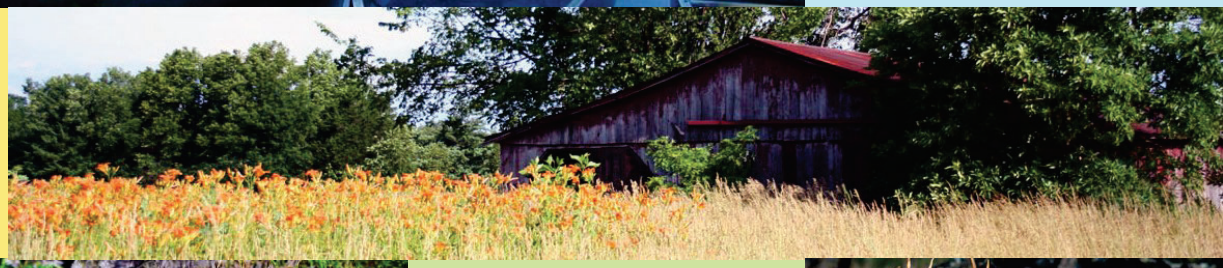
Department of the Navy
Naval Air Station Patuxent River Complex
Patuxent River, Maryland
2024

Integrated Natural Resources Management Plan

for Naval Air Station Patuxent River Complex's Naval Air Station Patuxent River, Webster Outlying Field and minor properties, Maryland

Integrated Natural Resources Management Plan

For Naval Air Station Patuxent River Complex's
Naval Air Station Patuxent River, Webster Outlying Field
And minor properties, Maryland

2024

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Naval Facilities Engineering Command - Washington Region

Document is Cleared for Public Release

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
Naval Air Station Patuxent River Complex
Naval Air Station Patuxent River, Webster Outlying Field and minor properties, Maryland

APPROVAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 U.S.C. 670a et seq.), as amended; Department of Defense Instruction 4715.03 – Natural Resources Conservation Program; Department of Defense Manual 4715.03 – Integrated Natural Resources Management Plan (INRMP) Implementation Manual; Chief of Naval Operations Operating Instruction 5090.1E – Environmental Readiness Program; and Chief of Naval Operations Operating Manual 5090.1 – Environmental Readiness Program Manual. This document was prepared and reviewed in coordination with U.S. Department of the Interior, Fish and Wildlife Service, and Maryland Department of Natural Resources in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations.

By their signatures below, or an enclosed letter of concurrence, all parties grant their concurrence with and acceptance of the following document.

For Plan Period: 2023-2028

Approving Official – U.S. Navy, Naval Air Station Patuxent River Complex

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Washington, District of Columbia

Date

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For Plan Period: 2023-2028

Concurring Agency – U.S. Fish and Wildlife Service

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
Naval Air Station Patuxent River Complex
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For Plan Period: 2023-2028

Concurring Agency – Maryland Department of Natural Resources

B. M

5/1/2024

Brian Eyler
Associate Director
Wildlife and Heritage Service
Maryland Department of Natural Resources
Annapolis, Maryland

Date

DEPARTMENT OF THE NAVY
NAVAL AIR STATION
22268 CEDAR POINT ROAD
PATUXENT RIVER, MD 20670-1154

5090
Ser N4/309
28 Sep 22

From: Commanding Officer, Naval Air Station Patuxent River
To: Mr. James R. Swift, Planning and Conservation Branch Head, Environmental Division

Subj: APPOINTMENT AS INSTALLATION NATURAL RESOURCES MANAGER

Ref: (a) OPNAVINST 5090.1E – Environmental Readiness Program Manual
(b) Sikes Act, as amended through P.L. 111-84, 28 October 2009

1. Effective immediately, you are hereby designated authority and responsibilities as Installation Natural Resources Program Manager for the Naval Air Station (NAS) Patuxent River; Webster Field Annex (WFA), St Inigoes, Maryland; and Navy Recreation Center (NRC), Solomons, Maryland. For the purpose of this appointment, "NAS Complex" refers collectively to NAS Patuxent River, WFA, and NRC.

2. Per reference (a), your duties include ensuring that the Commanding Officer (CO) is informed of natural resources issues, conditions of objectives contained within the Integrated Natural Resources Management Plans (INRMPs) pertaining to the NAS Complex, and potential or actual conflicts between mission requirements and natural resources mandates.

3. In addition, you are responsible for the inherently governmental decisions made on behalf of the NAS Complex and CO with regards to compliance with reference (b) and INRMP implementation. This includes supervision of specific technical experts to manage and/or carry out natural resources programs/responsibilities such as:

a. Providing biological expertise to assist air operations and aviation safety officers in preparing and implementing bird/animal aircraft strike hazard (BASH) plans to reduce strikes and ensure consistency with the INRMPs.

b. Protecting listed species, species at risk and species of concern, and their habitats.

c. Managing installation lands to ensure, consistent with the military mission, wetlands protection, soil conservation, floodplain management, invasive species control, environmental and economically beneficial landscaping, and agricultural out leasing.

d. Managing installation forestlands by restoration, enhancement and improvement of forest resources and related ecosystems;

e. Protecting and managing fish and wildlife resources.

f. Providing and managing outdoor recreational opportunities (e.g., hunting and fishing) consistent with installation security, military mission, and sustainable natural resources management.

4. This appointment will remain in effect until your permanent transfer from this command, or it is rescinded in writing by the CO.

D. W. KINGSLEY

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Executive Summary

Goals & Objectives

The Integrated Natural Resources Management Plan (INRMP) is to be the primary planning guide for all natural resources management on the Naval Air Station Patuxent River Complex (also referred to as NAS, the Station, or the Complex throughout this document), which includes Patuxent River (PAX), Webster Outlying Field (WOLF) and other associated properties. By integrating all natural resources management programs, this plan seeks to reduce conflicting program goals and objectives. The plan also assures that all resource management programs are conducted in a manner that is supportive of the military mission of NAS.

General Overview

To achieve the primary goal of a truly integrated natural resources management plan, the following resources are discussed as chapters with goals, objectives, and recommendations that do not create conflict among management strategies:

Land Management pertains to those activities that support the facilities of the human (military) resource on the Station. The purpose of proper land management is to maintain facility grounds in a manner that preserves the integrity of the military mission while protecting real estate, human health, and environmental quality. In addition, land conservation and rehabilitation of natural resources management involves coordination of land uses and other resources management activities in order to reduce/prevent land-use conflicts.

Forest Management pertains to those areas with forested land cover, many of which have the potential to provide commercial products, wildlife habitat, recreational opportunities, and other benefits such as noise attenuation and aesthetic value. However, these areas also have the potential to cause problems for NAS operations by impairing airfield visibility and providing habitat for nuisance species. The management of these areas should be done in such a way as to maximize the usefulness of these areas while minimizing problems for the normal operations of PAX and WOLF.

Fisheries Management on a US military base centers on the balance of responding to the military mission of the base while maintaining, protecting, and conserving the fisheries resource in terms of both quantity and diversity. As part of its stewardship of the waters entrusted to its care, a Naval facility has the additional responsibility of ensuring optimum utilization of those waters while maintaining their ecological integrity. The fisheries management chapter of this document focuses on the strategy of applying these concepts to the principles of multipurpose use and sustained yield.

The scope of *Wildlife Management* for NAS is to develop and maintain a series of natural wildlife habitats that will benefit native species found on this portion of Maryland's Coastal Plain. Additionally, the scope of the INRMP will allow continued resource use, while limiting conflicts with the intended military mission. The Plan presents a cognitive approach to understanding the natural resources and practical programs for harvesting, observation, recreation, and limiting impacts to military use.

The *Outdoor Recreation Management* chapter of the INRMP discusses management, conservation, and development of consumptive and non-consumptive outdoor recreation resources. These programs are designed to be compatible with national defense and security requirements while ensuring integrated multipurpose use of existing recreational resources.

The *Environmental Education* chapter of this INRMP addresses the Navy's approach to outreach by involving visitors as participants, rather than mere spectators. This program provides military personnel and individuals in the extended community with the knowledge to value natural resources and make a positive contribution to local conservation in a safe manner. The Station maintains an educational or interpretive system that enhances visitor enjoyment and awareness, increases their respect for both natural resources and recreational facilities, and helps them to identify and avoid biohazards such as poisonous plants and animals.

Available Resources

The Natural Resources (NR) Program, which is part of the Environmental Planning and Conservation Branch (CN), has a full-time staff of five people – three professionals and two multi-media technicians. The professional staff, which includes a natural resources manager and two natural resources specialists, is an interdisciplinary team with experience and training in fisheries, wildlife management, forestry, zoology, ecology, wetlands, and outdoor recreation. The properties of responsibility for the NR Program include PAX and WOLF, as well as Naval Recreation Center Solomons, Bloodsworth Island Range and numerous small aircraft-tracking facilities.

Staff

The permanent staff is supplemented by part-time and temporary staff when activity requirements of the CN periodically increase. Temporary staff increase is accomplished through the use of one to four seasonal temporary employees, one to two high school cooperative study students and one to two college interns per year. In recent years, these temporary employees have been brought in through the Student Conservation Association, Inc., and a Morale, Welfare and Recreation (MWR) Work Wise Teens program. The NR Program also has occasionally used special program hires such as AmeriCorps, as well as 20 to 30 volunteers. The volunteers are military (active and retired), civilian and contract personnel, as well as Station guests, who help with various NR programs such as Hunter Safety Education, fish and wildlife activities, and educational programs. The Student Conservation Association (SCA) has provided resource assistants to the NR Program since 1995. These volunteers are selected to complete specific projects, but are involved in nearly all aspects of the natural resources program.

Funding

Funding for the NR Program comes from a number of different sources. These funds are divided into two groups: appropriated funds and non-appropriated funds. Appropriated funding accounts for most of the total expenditures of the CN. Most of the appropriated funding comes from two sources: Operations and Maintenance, Navy (O&MN) and Research, Development, Test, Acquisition & Evaluation (RDTA&E) appropriations, with occasional funding from the Major Range and Test Facility Base (MRTFB) appropriation. These funding sources support salaries, material procurement, contract support, travel, and training. Environmental compliance projects

are funded by Commander, Navy Installations Command (CNIC), usually with O&MN funds. In addition, the Legacy Program was established to develop and fund natural and cultural resources stewardship projects at the regional level. Defense Legacy Program Projects are funded with Department of Defense (DOD) O&M appropriations. Current Legacy funding initiatives have been limited to multiservice or multi-property projects.

The NR Program also generates non-appropriated funds through management program accounts centrally managed at Naval Facilities Engineering Systems Command Headquarters (NAVFAC HQ). The forestry account collects proceeds from the sale of forest products on Navy lands. The agricultural outlease account collects proceeds from the leasing of Navy lands for grazing and agriculture. The NR Program at NAS deposits proceeds into both accounts and then requests disbursements from the accounts to operate the programs or fund other natural resources projects. The fish and wildlife account is maintained at NAS by MWR, which oversees proceeds from the sale of hunting and fishing permits on NAS lands. Unlike the forestry or agricultural outlease accounts, there is a legal requirement that these fee collections be spent only on fish and wildlife projects at the installation where they were generated.

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 1

Introduction

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I INTRODUCTION

1.0 Purpose

"Natural resources conservation is a vital component of our nation's environmental agenda. Our continued mission access to domestic airspace, land, and coastal waters is dependent on public confidence that we are competent and conscientious stewards of resources entrusted to our use. We must earn this confidence on an installation by installation, and on an operation by operation, basis." [Department of the Navy Natural Resources Conservation Strategic Plan (Annex I-A)]

The purpose of the Integrated Natural Resources Management Plan (INRMP) is threefold. First, the document is intended to be the primary planning guide for natural resources management at the Naval Air Station Patuxent River Complex (referred to as NAS, the Complex, or the Station throughout this document) – mainly Patuxent River (PAX) and Webster Outlying Field (WOLF). Bloodsworth Island Range (BIR) and Naval Recreation Center Solomons (NRC SOL), which have fairly unique mission and activity components, have separate INRMP documents; as such, there will need to be significant coordination between those documents and this INRMP during the planning phase of any natural resources-related matter. Secondly, the document seeks to steer natural resources management programs in a manner resulting in no net loss of military lands to support the military mission of the Complex (as described in Chapter II). The third purpose of the document is to integrate the various elements of the natural resources management program with each other and with other programs in an effort to eliminate or significantly reduce conflicting goals and objectives.

In order to accomplish this three-fold purpose, a system of goals, objectives, and recommendations has been used. A few broad goals are defined for each management chapter. Objectives that support the goals are then listed, with a reference made to the goal(s) each objective supports. Recommendations occur throughout each chapter, as they are relevant. The recommendations are followed by a reference to the objective(s) they support. Other recommendations, supporting no particular objective or requiring no expenditure of funds, also occur throughout this plan. Specific Management Recommendations (SMRs) apply to natural resources personnel, while General Management Recommendations (GMRs) pertain to other installation programs. These are identified parenthetically as such. All recommendations, whether specific or general in nature, constitute the management direction adopted by the Installation Natural Resources Program and Commanding Officer, and are expected to be implemented by existing resources and staff. In an effort to consolidate and expand upon both specific projects and general management practices presented in the INRMP, a Summary of Recommendations is included as Appendix B.

This INRMP will serve as a planning tool for the Naval Air Station Patuxent River Complex. As opportunities become available to seek funding for environmental projects or as mitigation for future activities, this Plan will serve as a priority list to better enable the Natural Resources program to practice effective ecosystem management. This Plan is not meant as a definitive list of projects that will be automatically funded upon enactment. It provides guidance to the resource managers on strategies to employ for the next five years. The Navy will implement recommendations in the INRMP within the framework of regulatory compliance, national Navy

mission obligations, anti-terrorism and force protection limitations, and funding constraints. Any requirement for the obligation of funds for projects in this INRMP shall be subject to the availability of funds appropriated by Congress, and none of the proposed projects shall be interpreted to require obligation or payment of funds in violation of any applicable federal law, including the Anti-Deficiency Act, 31 U.S.C. § 341, et seq.

Maps have been incorporated into the INRMP as a means of physically depicting information contained within the various management chapters. These maps are a static display of spatial data contained in the Station's ever-changing geographic information system (GIS), called the GeoReadiness Explorer (GRX); as such, they are accurate only at the time the images were captured from the GIS. Therefore a degree of error is inherent in all maps. These maps are distributed "AS-IS" without warranties of any kind, expressed or implied, including, but not limited to, warranties of suitability to a particular purpose or use. No attempt has been made in either the design or production of the maps to define the limits or jurisdiction of any federal, state, or local government.

The maps are intended for use only at the published scale; as such, detailed on-the ground surveys and historical analyses of sites may differ from the maps. Individuals requiring geographical information for decision-making purposes should access GRX directly in order to view the desired data in its most up-to-date form (GMR I.1/SMR I.1).

2.0 Goals

The goals of the Natural Resources Program (NR Program) and the INRMP are consistent with the use of the installation to ensure readiness and are as follows:

- **The conservation of biological diversity and rehabilitation is promoted through the restoration, development, and maintenance of balanced ecosystems;**
- **Consistent with the military mission and those objectives are fulfilled and enhanced;**
- **Multipurpose use of the land is sustainable, supported and integrated consistent with the goals listed above.**

These goals can be combined into a single mission statement that reads as follows: **The primary goal of the INRMP is to promote the conservation, restoration, development, and maintenance of balanced ecosystems that will support multipurpose use and fulfill military objectives.** This goal is accomplished through a combination of careful planning and implementation of management prescriptions. Several other resource-specific goals will be addressed in later chapters.

3.0 Philosophy of Management

There are different philosophies pertaining to natural resources management on public lands, ranging from complete preservation to intensive single-species or product-oriented management. Various user groups have expressed different, often opposing, views concerning the role of natural resources management on public lands. Natural resources managers themselves often disagree as to what constitutes responsible management and stewardship of public lands.

A past trend in management has been to select and manage single species based on their perceived importance, either as products or commodities, or their statuses as threatened or endangered. While this approach has been used successfully in many cases, single-species management, whether of a commercially valuable tree species or an endangered bird, has severe limitations (as is now widely recognized by the scientific and natural resources management communities). This type of management often favors a handful of species at the expense of overall ecosystem health and biodiversity. The health of a single species seldom is a good surrogate for the health of an entire ecosystem. Responsible stewardship calls for a management philosophy that recognizes the underlying complexities of functioning ecosystems, is proactive, and maintains options for the future.

That is not to say that wildlife management, forest management, and threatened and endangered species (TES) management are not important and will no longer be conducted on the Complex. Rather, these types of management activities will be conducted at intensity levels and on scales of time and space that are not detrimental to the ecosystem as a whole. Scientific monitoring will play a critical role in the process. In effect, ecosystem function and viability will become the standards against which proposed management activities and their impacts are evaluated and, if appropriate, implemented.

For example, forest management is a primary management tool for achieving desired stand structures and diversity over appropriate scales of time and space, and for producing ecologically acceptable levels of goods and services including timber commodities. There is, however, no established timber quota; rather the mandate is to provide sustainable multipurpose use within the overarching concept of ecosystem management.

The NR Program considers this approach to be responsible stewardship. Caution must be applied, since many of the ecological associations are not yet fully understood due to their unique and complex natures. This plan is based on the premise that responsible stewardship and ecosystem management are synonymous and compatible with integrated natural resources management.

Implementation of any type of management activity whose impacts are not fully understood will be tied directly to implementation of a corresponding monitoring program. The intent is to integrate management activities with on-going scientific monitoring to provide reliable data and identify trends and causal relationships, including both the positive and negative impacts of management activities. Acceptable levels or thresholds of management intensity will be identified for different species, taxa, ecosystems, and associations. The management guidelines and prescriptions in this plan will be updated periodically as site-specific data become available.

Each year, this INRMP and the projects contained within will be reviewed and rated against established Navy metrics by the natural resources (NR) staff and state and federal wildlife agencies. In addition, the INRMP will be updated as needed to provide on-going management direction based on scientific data and a higher level of knowledge of the Station's ecosystems and their inter-relationships. The long-term goal of the INRMP is to bring together and integrate all management activities (e.g., forestry, wildlife, and TES management) in a way that sustains, promotes, and restores the health and integrity of Station ecosystems. Integrated ecosystem

management is sound stewardship, and will, over the long term, ensure the maximum return of ecosystem goods and services at minimum cost to the public.

3.1 Ecosystem Management and Biodiversity

Department of Defense (DoD) and Office of Naval Operations (OPNAV) directives promote the conservation of biological diversity (or biodiversity) on military lands. The most effective and efficient way to accomplish this is through the applied principles of ecosystem management.

What is biodiversity and why is it important enough to attract major human resources? Meffe and Carroll (1994) define biodiversity as "the variety of living organisms considered at all levels of organization, from genetics through species, to higher taxonomic levels, and including the variety of habits and ecosystems, as well as processes occurring therein." Noss and Cooperrider (1994) define biodiversity as "the variety of life and its processes; it includes the 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." Perhaps the easiest way of thinking about biodiversity is simply "the variety of life and its processes."

In practical terms there are two aspects of biodiversity that are critical, but are frequently overlooked or misunderstood. First, biodiversity is not the same as species diversity; this is worth emphasizing.

Biodiversity ≠ Species diversity

Biodiversity is far richer and more complex than species diversity, although species diversity is certainly one component of biodiversity. We can think of biodiversity at a minimum of four levels (genetic diversity, species richness, ecosystem diversity, and landscape diversity), although there are gradations and complexities here as well.

Second, biodiversity is not just "things" and it is not static; that is to say, biodiversity depends upon and encompasses processes, as well as entities. These processes include, but are not limited to, biogeochemical cycles; biotic and abiotic disturbances; predator-prey, mutualistic, or parasitic relationships; migrations; competitive effects, and so forth. Thus, biodiversity includes all the entities of the living world at various levels of a biological organization, plus the various things that those entities do.

An introduction to ecosystem management and guidance to understand and manage biodiversity on military installations is found in *Conserving Biodiversity on Military Lands: A Guide for Natural Resource Managers 3rd Edition*. This document can be found on the DENIX website at https://denix.osd.mil/biodiversity/.

3.1.1 Assessment of Ecosystem Status and Function

As mentioned in Section I-2.0, the goal of all resource management activities is to promote conservation, rehabilitation and balanced ecosystems capable of supporting multipurpose use and military objectives. A balanced ecosystem is achieved through management that promotes

biodiversity and ecosystem integrity. An adequate treatment of ecosystem management should answer the following questions and address these issues:

- *What ecosystems were present on the lands now occupied by the Station prior to its development, and what remain today?*

Prior to European settlement of this region, the Station lands supported a coastal plain deciduous forest, palustrine wetlands in association with riverine systems, and estuarine wetlands associated with Chesapeake Bay waters. These communities and systems are further described in the Physical Description chapter of this document. All these systems, though altered, are present at the Station today.

- *What is the relative importance of these ecosystems? Are any particularly unique, rare, or rapidly declining elements in abundance from a regional or global perspective?*

From a global perspective, the coastal location of the Station's lands places it at a pivotal and strategic position. The most extensive ecosystem on the earth is the marine ecosystem. This is followed by the terrestrial ecosystem and finally the transitional palustrine and estuarine systems.[1] Recent research suggests that estuaries are the driving systems that feed the marine environment; that is, there is an outwelling of nutrients from the estuaries to the nearshore environments that drive the marine ecosystem. Therefore, the coastal location of the Station and its relation to the Chesapeake Bay is not only critical in relation to the global environment but also supports one of the more abundantly productive ecosystems.

All ecosystems on Station lands have declined or been degraded at an accelerated rate since European settlement and cultivation of the land. Though overall forest areas have increased in this region since the turn of the century, forest area is once again on the decline due to development. Historically, approximately 90 percent of Maryland was forested. Today, estimates based on the Maryland Department of Natural Resources (MDNR) 2020 Forest Action Plan indicate that Maryland forest covers approximately 2.44 million acres or 39% of the total land area (MDNR, 2020). Globally, forest decline is attributed to timber harvesting and agriculture expansion. Regional estuarine and palustrine systems were heavily impacted early in this century and through the 1970s. However, federal and state regulations have dramatically dampened this decline (especially estuarine wetland destruction). Globally, estuarine and palustrine systems are experiencing the same destructive fate as the terrestrial forests.

- *How important is the Station's role in protecting these ecosystems?*

The Station holds the largest public land acreage and greatest amount of waterfront property in public trust in St. Mary's County. As such, the Station is the steward of an important environment with abundant natural resources. Philosophies of land management have grown and greatly changed since the early 1940s when PAX was established. The advancements in ecological knowledge have given cause to re-evaluate land management approaches. The need to manage natural resources through ecosystem management represents a significant turn in these

[1] The Polar Regions could be included as estuarine systems, but they probably represent a physical engine of the global system.

philosophies. Ecosystem management is an imperative endeavor for all land stewards and especially those in the public trust.

- *What is the current functional status of each ecosystem found on the Station? Have any of these systems been irreversibly altered or degraded and, if so, in what way?*

All ecosystems and communities of the Station have been substantially impacted. Estuarine waters suffer from the presence of particulate and dissolved pollutants due to upstream land uses (agricultural runoff and urban discharges are a significant problem in the Chesapeake Bay). Estuarine and palustrine wetlands and open waters were channelized, filled, bulkheaded, and, in some instances, completely eliminated during the original construction of the Station. The result has been a general decline in the overall area occupied by these features. This has reduced the overall wildlife capacity of the remaining areas and has reduced their efficacy in water quality improvement.

Forest fragmentation has also occurred due to the development of NAS lands. Forest fragmentation is a common problem in many forested areas of the earth and particularly in the eastern United States. As a forest becomes fragmented, the ecosystem manifests the characters of island ecology mechanics. Ecosystem integrity and biodiversity begin to decline due to reduced colonization rates and the inability of certain species to survive in small wooded patches [e.g., forest interior dwelling species (FIDS)]. For many species, the severity of the decline is inversely proportional to the size of the forest patch. While particular systems have been irreversibly altered, in general, most natural areas of the Station support some level of ecosystem integrity. In many instances, this level can be improved through an ecosystem management approach.

- *Do any altered ecosystems artificially resemble other important ecosystems and do they provide important functions?*

The development of NAS lands has resulted in the creation of terrestrial communities not normally associated with the original eastern coastal plain deciduous forest. For example, the development of the airfield has created artificial grasslands and scrub/shrub communities. While airfield areas are managed to reduce the risk of aircraft strikes from certain high strike-risk species, the specially managed grass areas can be important habitat for several species of declining grassland birds. These communities were naturally rare in this forested region prior to European settlement, but are now less rare due to artificial landscape alteration which has allowed certain nonindigenous or naturally rare species to colonize this region. For instance, the PAX airfield once attracted a nesting colony of the state-threatened Least Tern (*Sternula antillarum*). This colony posed a serious air strike problem to aircraft using the field. The presence of this bird species is incompatible with the military mission of the Station.

In 2004, approximately 50 acres of airfield clear zone were cleared of all trees and woody vegetation for purposes of operational safety. Recent efforts to restore grassland habitat to native warm-season grass cover at the approaches of Runways 06 and 02 have met with success. Grasshopper Sparrows (*Ammodramus savannarum*), Eastern Meadowlarks (*Sturnella magna*), and Horned Larks (*Eremophila alpestris*) breed extensively across the airfield and large numbers of Upland and Buff-breasted Sandpipers (*Bartramia longicauda, Calidris subruficollis*) find suitable

migratory stopover habitat on airfield grasslands. The area was maintained on a once-a-month mowing schedule to ensure that trees and woody vegetation would not regenerate before a grasslands conversion could be initiated. In 2007, the area was planted with a seed mix of native warm-season grasses, including Little Bluestem (*Schizachyrium scoparium*), Big Bluestem (*Andropogon gerardii*), Indian Grass (*Sorghastrum nutans*), and a variety of wildflowers. Planting warm-season grasses in this runway area served two purposes: 1) it reduced mowing maintenance costs and 2) it provided wildlife habitat that was otherwise in short supply. Warm-season grasses can be maintained like turf grass but they grow best when maintained on a rotational burning schedule, so the area was burned cyclically in lieu of scheduled mowing. Allowing the grasses to grow also provided optimal wildlife habitat, especially for grassland bird species such as the Grasshopper Sparrow, Field Sparrow (*Spizella pusilla*), Northern Bobwhite (*Colinus virginianus*), and Eastern Meadowlark. These species of birds are not flocking birds and remain close to the ground; thus, they did not increase the Bird/Aircraft Strike Hazard (BASH) in the restoration area. The majority of this area now requires short grass (<12" tall) due to the recent installation of the instrumented land system (ILS). As such, this area is now on a periodic mowing cycle instead of a burn schedule. There are areas on the fringe of the ILS that still have native warm-season grasses, but these do not provide the same wildlife benefits.

Degraded concrete and asphalt portions of the infield now support weed growth and attract over-wintering, tundra-nesting species such as Snow Buntings (*Plectrophenax nivalis*), Lapland Longspurs (*Calcarius lapponicus*), Savannah Sparrows (*Passerculus sandwichensis*), American Pipits (*Anthus rubescens*), and Short-eared Owls (*Asio flammeus*).

Extensive tracts of shrub growth adjacent to runway clear zones and in approach paths provide near-optimum habitat for declining bird species such as Prairie Warblers (*Setophaga discolor*), Yellow-breasted Chats (*Icteria virens*), Brown Thrashers (*Toxostoma rufum*), and Gray Catbirds (*Dumetella carolinensis*). Unmowed utility corridors provide similar habitat.

These artificial habitats add an interesting dimension to the Station's biodiversity picture and opportunities for management to support rare or unique species assemblages.

- *What types and levels/degrees of manipulation or use can the ecosystems sustain before they become substantially degraded or cease to function in a valuable way?*

This is a relatively difficult question to answer and open to subjective supposition. Every degree of ecosystem alteration causes a domino chain of resulting changes or impacts to the system. Obviously, total development of an area completely removes that portion of the ecosystem. However, there are many levels of manipulation that only affect portions of a community and allow the rest to stand. For instance, a natural deciduous forest is composed of canopy, subcanopy, shrub, and herbaceous layers. Removal of one of the lower layers will alter the species composition but the area will continue to function as a forest. Conversely, removal of the canopy would alter the community to such an extent that it no longer functions as a forest. The scenarios of degrees of alteration and their relative importance to community and ecosystem integrity are too numerous to list here and are beyond the scope of this document. However, it behooves the Natural Resources

Manager of the Station to consider this question when evaluating any proposed activities and new developments that may alter natural ecosystems.

3.1.2 Guiding Principles of Ecosystem Management

In putting ecosystem management to work on the Complex, the following are offered as some guiding principles or management principles of this INRMP. They are more clearly defined in the management chapters of this document.

I. The resource base should be managed in a way that restores and maintains associations that are of local and regional importance and compatible with existing geophysical components (soil, water, etc.).
   A. The presence of different community types and ecological gradients dictates biodiversity. An ecological gradient is a gradation from one ecosystem to another when there is no sharp boundary between the two. It is the joint expression of associated community and complex environmental gradients
   B. Ecological gradients on small and large scales should be protected and restored (SMR I.2).
   C. Unnatural habitat fragmentation, isolation, and artificial boundaries and barriers should be reduced or eliminated where possible (GMR I.2/SMR I.3).

II. Damaged ecosystems may be repaired, where practicable, especially in core natural areas.

III. Native flora and fauna diversity may be restored and maintained.

IV. Altered ecosystems should be managed or maintained to provide the highest degree of function possible (SMR I.4).

V. Ecological processes, structures, and functions may be restored and maintained.
   A. Some geological and ecological processes can structure ecosystems. Of these, some are more important than others (e.g., fire) and some are unmanageable (e.g., climate).
   B. Natural disturbance is important in maintaining ecological integrity at all scales.
   C. Natural disturbances occur at different scales of intensity, time, and space (e.g., individual tree falls, hurricanes, catastrophic fire).
   D. Natural patterns of disturbance should be restored or managed disturbances that mimic natural disturbance regimes should be introduced (SMR I.5).

VI. Impacts to sensitive areas should be eliminated or reduced (GMR I.3/SMR I.6).

VII. Forest fragmentation in forest preserves should be avoided. The forest preserve is an informal, non-binding designation internal to the NR Program created to help avoid the fragmentation of large, contiguous forest blocks on the installation (GMR I.4/SMR I.7).

VIII. Station lands should be managed for viable populations.
   A. Population viability means that flora and fauna populations are sufficiently large to absorb normal random fluctuations in demography (birth-death-immigration-emigration), avoid genetic problems (preserve heterogeneity), and withstand natural and human-induced fluxes in the environment.
   B. Management activities that lead to habitat fragmentation and isolation should be avoided where practicable (SMR I.8).

C. NR should be managed for natural habitat connectivity both within the Station and between the Station and other land units such as state and natural forests (SMR I.9)

IX. Rare, threatened and endangered species should be preserved (SMR I.10).

X. The Station may allow for change and environmental variation.

XI. Ecologically appropriate perspectives of time and space should be maintained.

A. Ecosystem management is long-term (hundreds of years) and large-scale (thousands of acres).

B. Management activities should be defined in terms of spatial and temporal impacts (SMR I.11).

XII. Development should be directed to areas of lower environmental sensitivity (GMR I.5/SMR I.12).

XIII. The NAS community should be educated about the goals and objectives of the INRMP (SMR I.13).

XIV. Human use compatible with all of the above may be allowed and encouraged.

XV. Although humans are an integral part of the ecosystem, their activities should never exceed the point at which the system and its processes become dysfunctional.

XVI. Detailed information on conservation of biodiversity or ecosystem management on military lands can be found in the resources referenced in Section I-3.1.

3.2 Adaptive Management

Adaptive management, or management by experiment, offers a solution to the complexity and unpredictability of natural systems. It can provide answers to questions whether management actions or prescriptions are achieving their desired effect, and what to do if they are not. It involves monitoring, research, analysis, and feedback. When applying management prescriptions or undertaking significant actions, natural resources managers should follow steps in the model process for adaptive management, as shown below:

1. Integrate management actions and monitoring within experimental framework.
2. Develop monitoring objectives and methods based on management objectives and desired future scenarios.
3. Predict trends and results.
4. Include ecological, social, compliance, and military mission metrics.
5. Include both implementation and effectiveness metrics.
6. Implement monitoring program.
7. Integrate incoming information in contextual analysis and in models.
8. Involve experts and stakeholders in analysis of information.
9. Compare expected results to actual results.
10. Report and communicate results to decision-makers.
11. Adapt vision, policies, and models.
12. Adapt objectives, strategies, management actions, organizational structure, and monitoring protocols.

The concept and process of adaptive management are more fully described in the updated, 3rd edition of *Conserving Biodiversity on Military Lands - A Guide for Natural Resources Managers*.

4.0 Applicable Laws, Regulations, and Policies

The requirements underlying this plan arise from multiple environmental laws, regulations, and policies. The hierarchy under which these laws are structured is displayed in Figure I-1 in Annex I-B, which shows the relevant path of authority. While the DoD governs all branches of service, for the purpose of this plan, only Navy Instructions are displayed.

As a general rule, the federal government is protected from regulation by state governments by the principle of sovereign immunity. Sovereign immunity exists with respect to all state laws unless and until the federal government has affirmatively waived it. Until such a time as a waiver of sovereign immunity has occurred, Maryland's statutory authority over the federal government, including federal installations, is not binding.

The following paragraphs discuss the major legislation specifically applicable to the NAS mission to execute this INRMP.

4.1 Public Laws and Executive Orders

Conservation Programs on Military Installations (Sikes Act), as amended; Public Law 86-797, 16 United States Code (USC) 670(a) et seq., requires federal military installations with adequate wildlife habitat to implement cooperative agreements with other agencies and develop long-range integrated natural resources management plans for conservation and rehabilitation of natural resources consistent with the use of the military installation. Thereby, it is appropriate to manage natural resources for multipurpose use and provide the public access to those uses to the extent consistent with the military mission. This act also sets guidelines for the collection of fees for the use of natural resources, such as hunting, fishing, and trapping. The Sikes Act is further discussed in Chapter VI.

National Environmental Policy Act of 1969 (NEPA), as amended; Public Law 91-190, 42 USC 4321 et seq., requires federal agencies to consider the environmental impacts of their proposed activities. NEPA promotes an interdisciplinary approach in decision-making designed to identify unacceptable or unnecessary impacts to the environment and avoid or mitigate them as much as possible. It provides a forum for public input on large projects. NEPA also establishes the Council on Environmental Quality.

Coastal Zone Management Act of 1972 (CZMA), Public Law 92-582, 16 USC 1451 et seq; along with the appropriate amendments (Coastal Zone Reauthorization Amendments of 1990 and Coastal Zone Protection Act of 1996) are designed to encourage coastal states to develop coastal area management programs. Non-point source water pollution is reduced through land development regulations. Areas of regulation include sediment and erosion control, flood control, grading control, and stormwater runoff control. The Federal CZMA requires that each federal agency conducting or supporting activities, whether within or outside the coastal zone, affecting any land or water use or natural resource of the coastal zone, must do so in a manner which is (to the maximum extent practicable) consistent with the enforceable policies of the state's coastal management program. In addition, federal permits and licenses, outer continental shelf (OCS) plans, and grants-in-aid which may affect the state coastal management area must also be consistent with the enforceable policies of the state's coastal zone program. Consistency offers the

state agencies an opportunity for a positive voice in federal actions. It ensures that state concerns and policies will be considered by federal agencies in federal development projects; the issuance of federal licenses and permits; the approval of OCS plans and programs; and the award of federal grants, loans, subsidies, insurance, or other forms of federal aid.

Endangered Species Act of 1973 (ESA), as amended; Public Law 93-205, 16 USC 1531 et seq., protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. Specifically, section 7(a)(1) of the ESA charges federal agencies to aid in the conservation of listed species. ESA also requires consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanographic & Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).

Clean Water Act (CWA) of 1972, as amended, Public Law 92-500, 33 USC 1251 et seq., Section 404 establishes a program to regulate the discharge of dredged or fill material into waters of the United States and establishes a permitting program administered by the US Army Corps of Engineers.

Energy Independence and Security Act of 2007 (EISA), Section 438, requires federal agencies to minimize stormwater runoff from federal development and redevelopment projects to protect water resources using low impact development and other appropriate techniques to the maximum extent technically feasible.

National Defense Authorization Act of 1989, Public Law 101-189; Volunteer and Partnership Cost-Share Program; amends two acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.

Defense Appropriations Act of 1991, Public Law 101-511; Legacy Resource Management Program; establishes a program for the stewardship of biological, geophysical, cultural and historic resources on DoD lands.

Exotic Organisms, Executive Order (EO) 11987, requires agencies to restrict the introduction of exotic organisms into natural ecosystems on lands and waters they own, lease, or hold for purposes of administration.

Invasive Species, EO 13112, requires federal agencies to identify and prevent actions that are likely to cause or promote the introduction or proliferation of invasive species, and calls for the minimization of ecological, economic, and human health impacts caused by invasive species. In addition, this EO establishes an Invasive Species Council tasked with the preparation of a National Invasive Species Management Plan.

Floodplain Management, EO 11988, provides direction regarding actions of federal agencies in floodplains and requires permits from state and federal review agencies for any construction within a 100-year floodplain.

Protection of Wetlands, EO 11990, requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented.

Chesapeake Bay Protection and Restoration, EO 13508, recognizes the Chesapeake Bay as a national treasure and calls on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed.

Stewardship of our Ocean, the Coasts, and the Great Lakes, EO 13547, establishes a national policy to ensure the protection, maintenance, and restoration of the health of ocean, coastal, and Great Lakes ecosystems and resources.

Invasive Species, EO 13751, directs federal agencies to act to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive, non-native species that are established on federal lands.

4.2 United States Codes

Leases: Non-excess Property of Military Departments, 10 USC 2667, as amended; authorizes DoD to lease federal land that is not currently needed for public use to commercial enterprises. This law also covers agricultural outleasing programs. *Federal Land Use Policy and Management Act, 43 USC 1701-1782*, requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This act also requires consideration of commodity production such as agriculture, mining, and timbering.

Anti-Deficiency Act 31 USC § 1341, et seq., prohibits federal agencies from involving the government in any obligation to pay money before funds have been appropriated by Congress for that purpose, unless otherwise allowed by law.

4.3 Department of Defense (DoD) Directives/Instructions

DODINST 4715.03, Natural Resources Conservation Program, implements new Natural Resources Conservation metrics, develops new policy and updates policy, assigns responsibility, and prescribes procedures under DODDIR 4715.01E for the integrated management of natural and cultural resources on property under DoD control.

DODDIR 4715.01E, Environment, Safety, and Occupational Health (ESOH), establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This directive also ensures that environmental factors are integrated into DoD decision-making processes that may impact the environment, and are given appropriate consideration along with other relevant factors.

4.4 Secretary of the Navy (SECNAV)/Office of Naval Operations (OPNAV) Instructions

SECNAVINST 6240.6 (series), Environmental Protection and Natural Resources, assigns responsibility to the Chief of Naval Operations (CNO) and the Commandant of the Marine Corps

for the development and implementation of natural resources programs on all land and water areas under the jurisdiction of the Department of the Navy.

SECNAVINST 5090.8 (series), Policy for Environmental Protection, Natural Resources, and Cultural Resources Programs, re-issues policy and assigns responsibilities within the Department of Navy concerning environmental protection, natural resources, and cultural resources programs.

OPNAVINST 5090.1 (series), Environmental Readiness Program, discusses requirements, delineates responsibility, and issues implementing policy guidance for the management of the environmental resources for the Department of the Navy.

OPNAV M-5090.1 (series), Environmental Readiness Program Manual, establishes broad policy and assigns responsibilities for the Naval Natural Resources Program. Naval Facilities Engineering Systems Command is assigned overall program management responsibility with authority to establish, coordinate, and promulgate the program; to issue appropriate instructions to the Naval installations for implementation of the various natural resources programs; and to provide professional natural resources services and technical assistance, through the Facilities Engineering Commands (FECs), to Navy and Marine Corps installations. Installation Commanders/Commanding Officers are tasked with:

- Requesting and using technical assistance from the appropriate FEC in developing and maintaining an effective natural resources program;
- Requesting funding to ensure adequate support of the natural resources program;
- Applying practices set forth in approved natural resources management plans; and,
- Assigning specific responsibilities, centralized supervision, and qualified personnel to the natural resources program.

4.5 Naval Facilities Engineering Systems Command Instruction

NAVFAC Natural Resources Management Procedure Manual, P-73, Volume II; establishes the governing format under which the INRMP is structured. This document addresses all CNO natural resources program requirements, guidelines, and standards.

5.0 Scope and Duration

The INRMP addresses and provides for management (to varying degrees) of the following properties:

- Naval Air Station Patuxent River (PAX);
- Webster Outlying Field (WOLF);
- Glenn Forest housing area;
- Theodolite Stations at Bishop's Head, Chesapeake/St. James, Bay Forest, Point No Point, and Point Lookout;
- Grayson property
- Cedar Point Island
- Southampton Land
- Tulip Memorial Site; and,

- Westover Communication Station.

Additional properties that, while part of the NAS Patuxent River Complex, do not warrant inclusion in this plan are:

- Hermanville Microwave Repeater Site (permanent easement);
- Sharps Island (fully submerged lands);
- Southgate Land (permanent easement);
- Tippet's Road (permanent easement);
- Communications equipment at Seaford (Delaware), Westmoreland County (Virginia), Linkwood and Vienna (both Maryland) (leased space on communications towers); and,
- Leased buildings at Willows Road, and in Great Mills and Lexington Park (all in Maryland)

It should be noted that a small percentage of NAS lands are encumbered by numerous outleases, licenses, and use agreements. While these real estate actions prevent Navy use of these sites, the NAS Public Works Department (including NR personnel) retains oversight responsibilities. A list of the outgrants that include land areas can be found in Table I-1.

Specific procedures for executing most adopted management practices are contained in Standard Operating Procedures (SOPs), which are continually updated. Some of these procedures, particularly those with the greatest impact to natural resources, are listed in their respective management chapters and sections. However, many other procedures were not listed due to their numbers and very specific nature. The INRMP must be reviewed annually and will be revised as needed. Reviews are conducted with partner agencies using a system of metrics designed to reflect project execution, ecosystem integrity, conservation impacts to the military mission, and other elements of INRMP implementation. Every five years, new concurrence signatures must be obtained from the applicable state and federal agencies, as well as the installation commanding officer. The INRMP should be formally updated or revised in advance of these concurrence reviews (Project I.1).

Table I-1. NAS Outgrants

PROJECT NAME OR PARTY/CONTRACTOR	LAND AREA (ACRES)	OUTGRANT TYPE	AGREEMENT EXPIRATION DATE
Road (State of Maryland)	10.16	Easement-Out	NA
Sewer Pipeline (St. Mary's County Metropolitan Commission)	4.27	Easement-Out	17-MAY-2066
Agricultural Lease (Russell Brothers)	503.51	Lease-Out	31-OCT-2023
Cedar Point Federal Credit Union	0.59	Lease-Out	31-OCT-2013
	New lease in process with expiration date 2027		
Cedar Point Federal Credit Union	1.0	Lease-Out	30-NOV-2030
Recreational Area (Board of County Commissioners)	46.73	Lease-Out	30-JUN-2023
	New lease in process with expiration date 2048		
69KV Electric Utility System (Southern Maryland Electric Cooperative)	49.36	Easement-Out	13-OCT-2033
Glenn Forest (SMECO)	1.5	Easement-Out	14-MAY-2067
Electrical Substation (SMECO)	8.45	Easement-Out	09-JUN-2031

PROJECT NAME OR PARTY/CONTRACTOR	LAND AREA (ACRES)	OUTGRANT TYPE	AGREEMENT EXPIRATION DATE
Pole Archers and Down Guys (SMECO)	0.1	Easement-Out	30-JUL-2025
EO-10087 Road Widening	0.76	Easement-Out	NA
EO-10090 Road	0.16	Easement-Out	NA
WOLF (U.S. Coast Guard)	5.7	Agreement-Out	14-APR-2026
Maryland Army National Guard – PAX	12.4	Agreement-Out	NA
MDARNG – WOLF	3.5	Permit-Out	15-JUN-2036
Federal Aviation Administration	0.10	License-Out	31-Jan-2038
Public-Private Venture (Lincoln Military Housing)	53.669 (GF) 32 (LC) 27 (CP) 28 (GC) Qtrs A	NA	NA

6.0 References

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ANNEX I-A

DEPARTMENT OF THE NAVY NATURAL RESOURCES CONSERVATION STRATEGIC PLAN

Department of the Navy
Natural Resources Conservation Strategic Plan

[Promulgated on 13 June 1994 by the Honorable Robert B. Pirie, Jr., Assistant Secretary of the Navy (Installations and Environment)]

We Are...
…the users, managers, and protectors of a significant portion of the nation's most ecologically important lands. Our area of operations includes the global air, land, marine and estuarine environments.

Natural resources conservation is a vital component of our nation's environmental agenda. Our continued mission access to domestic airspace, land, and coastal waters is dependent on public confidence that we are competent and conscientious stewards of resources entrusted to our use. We must earn this confidence on an installation by installation, and on an operation by operation, basis.

Our Mission...
…is first and foremost "...to support the requirements of the Unified Commanders so that our nation can deter aggression, encourage political stability, provide forward presence, establish sea control, and project power from the sea against any threat and win." (see Note)

Implicit in this mission is a responsibility to deter aggression and encourage political stability by working to achieve ecologically sustainable development at home and abroad.

NOTE: Based on guidance contained in the Department of the Navy Strategic Plan for Fleet Support, the Department of the Navy Strategic Guidance, Vision and Guiding Principles, and the Department of the Navy white paper From the Sea.

Our Vision...
…is to be a national leader in natural resources conservation and compliance. Natural resources stewardship is emphasized because we recognize that our national security is inextricably linked to local, regional, and global ecological integrity.

Our Goals:
- Preserve our mission access to air, land, and sea resources.
- Strengthen national security by strengthening conservation aspects of environmental security.
- Preserve the opportunity for a high quality of life for present and future generations of Americans.

Critical Success Factors:
- Visionary leadership.
- Equitable allocation of staffing and funding.

- Accessible and effective training.
- Optimal organizational alignment.

Strategies (We Will):

Emphasize Stewardship of Natural Resources.

Objectives:

- Build a strong conservation ethic throughout the Department of the Navy.
- Develop and sustain strong natural resources programs at installations.
- Earn public confidence in Department of the Navy stewardship of the nation's natural heritage.

Processes:

- Prepare and implement installation integrated natural resources management plans.
- Ensure optimum utilization of land and water resources while maintaining ecological integrity.
- Plan, program, and budget for natural resources projects and functions as a cost of doing business.
- Identify all natural resources project funding requirements via the OMB Circular A106 process.
- Ensure attention to natural resources conservation opportunities and constraints when formulating land use and management decisions.
- Use geographic information systems (where available) to integrate natural resources management objectives with mission requirements on Department of the Navy lands.
- Allow public recreational access to Department of the Navy controlled lands when there is no military mission or safety constraint and when environmental attributes will not be adversely affected.
- Ensure optimal natural resources program staffing, funding, and organizational alignment at each Department of the Navy activity.
- Provide training opportunities that meet the needs of professional natural resources specialists.
- Strengthen internal audit systems regarding natural resources issues and compliance requirements.
- Encourage a personal commitment to environmental stewardship by all personnel within the Department of the Navy.
- Implement meaningful measures of merit to ascertain success/failure of stewardship initiatives and mitigation (compliance) requirements.

Preserve Biological Diversity.

Objectives:

- Preserve endemic, diverse natural habitats on Department of the Navy installations.
- Protect threatened and endangered species.

- Achieve an increase in net functional value of wetlands on Department of the Navy lands.

Processes:

- Protect old growth forests ecosystems.
- Establish ecological reserve areas and research natural areas warranting special protection because of their biological attributes.
- Implement land-use policies to support diversity of biological species, consistent with mission requirements.
- Participate in recovery efforts for threatened and endangered species.
- Manage Department of the Navy land areas to support recovery of migratory songbird populations (in partnership with the international Partners in Flight Program) and to recover waterfowl populations (in partnership with participants in the North American Waterfowl Plan).
- Adopt an ecosystem management approach on all Department of the Navy lands.
- Participate in the National Biological Survey as a federal partner.
- Complete and maintain inventories of Federally listed and proposed threatened and endangered species on all Department of the Navy lands.
- Complete and maintain inventories of Department of the Navy legally defined wetlands.
- Develop systems to track net gain/loss of wetland(s) functional value on each Department of the Navy installation.
- Use U.S. Army Corps of Engineers approved hydrogeomorphic classification methodologies to address wetlands functional value determinations.
- Implement/support initiatives to construct or enhance wetlands beyond permit mitigation requirements.

Develop Partnerships for Conservation.

Objectives:

- Solve conservation problems and enhance natural resources by inter-organizational cooperation in the application of technology, expertise, and other resources.
- Focus on ecosystem integrity issues (which may extend beyond installation boundaries).

Processes:

- Expand Department of the Navy involvement in regional ecosystem planning, management, and restoration initiatives.
- Lead Department of Defense participation in regional efforts to restore strategic estuaries of national importance.
- Conduct community outreach and educational programs on environmental issues.
- Organize collaborative, environmental problem solving, partnerships with non-Department of Defense stakeholders.

ANNEX I-B

FIGURE

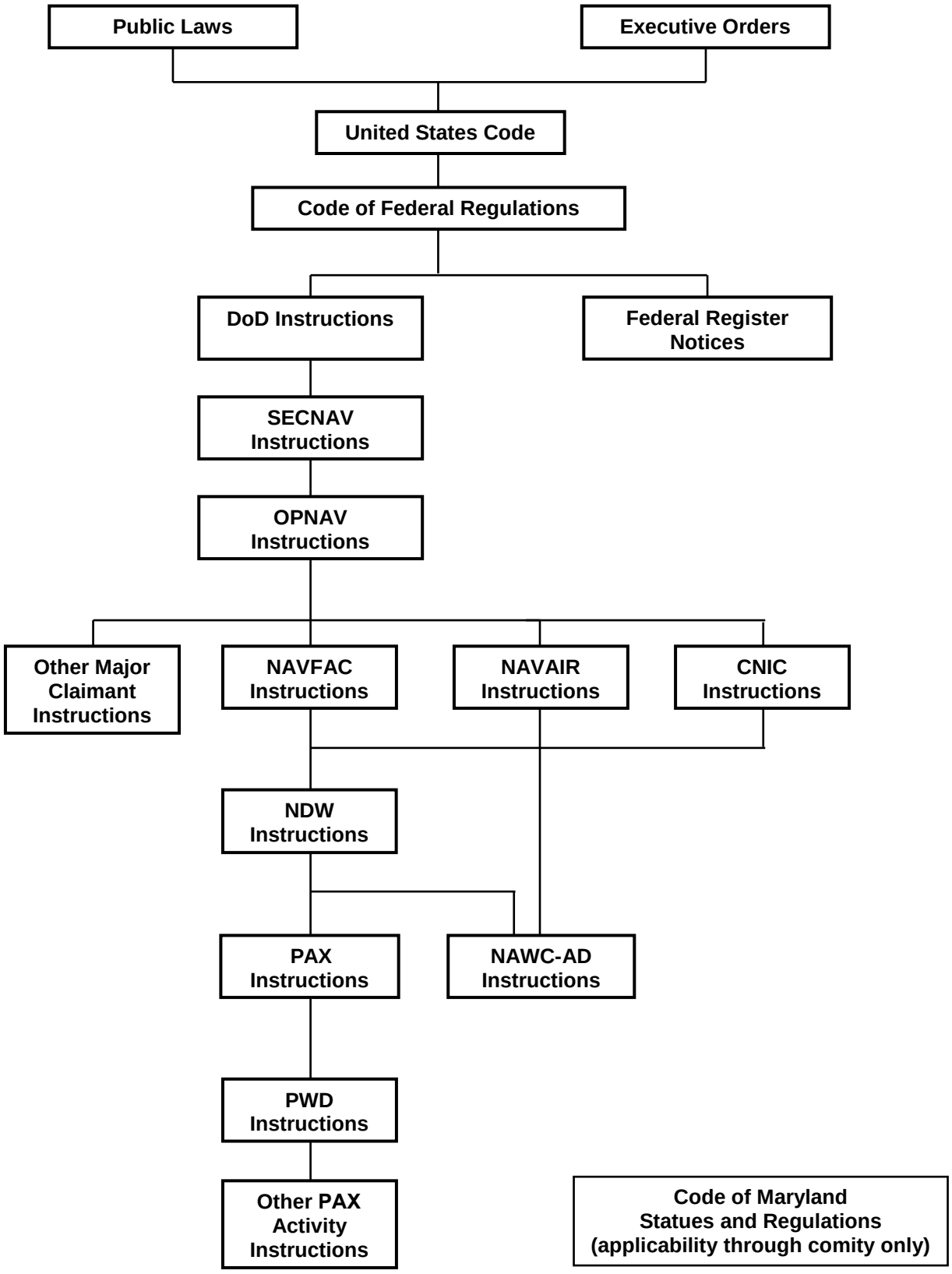

Figure I-1. Hierarchy of Laws, Regulations, and Military Instructions

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 2

Background

Table of Contents

II BACKGROUND

1.0 Military Mission

1.1 PAX Military Mission

The mission of Naval Air Station Patuxent River (PAX) is to maintain and operate facilities and provide services and materials to support operations of the Naval Air Warfare Center, Aircraft Division (NAWC-AD) and other activities and units as designated by appropriate authority. While the installation is owned by CNIC and managed by its regional division (NDW), PAX has operational oversight of the facility, including the land and natural resources upon it.

Formerly the Naval Air Test Center (NATC), NAWC-AD is a full-spectrum research, development, acquisition, test and evaluation (RDAT&E), engineering and Fleet support center for air platforms. Simply put, the facility supports those who fly and test Naval aircraft and aircraft systems. Established at PAX on January 1, 1992, NAWC-AD provides aviation products throughout their life cycles, providing Fleet customers and sponsors with high quality service engineering and testing services.

NAWC-AD is comprised of several sites at various locations, including Orlando, Florida [NAWC-TSD (Training Systems Division)]; Lakehurst, New Jersey (Naval Engineering Center); and PAX. PAX is the lead NAWC-AD site.

1.2 WOLF Military Mission

The mission of NAS Patuxent River Webster Outlying Field (WOLF) is to provide an auxiliary airfield in support of NAS/NAWC-AD missions and the material support of systems and equipment for which the Naval Air Systems Command (NAVAIR) is assigned responsibility. Assigned functions and tasks important to the mission include the testing and evaluation of electronic systems, providing in-service engineering support, development of prototype equipment modifications, and integration of electronic support systems for new ships (EDAW, 1991).

2.0 History

2.1 History – PAX

The Naval Air Station Patuxent River has a rich history of Naval aeronautical development. Beginning prior to World War II and continuing today, PAX performs a vital role in Naval operations and the national defense.

2.1.1 Naval Air Station Created

Once known for its agricultural character, Cedar Point, Maryland, became Naval Air Station Patuxent River in 1942. PAX was created to centralize air testing facilities established prior to World War II (WWII). Within one year, the first flight testing operations commenced.

Rear Admiral John S. McCain, then chief of the Navy's Bureau of Aeronautics, called Patuxent River "the most needed station in the Navy" during the commissioning ceremony on April 1, 1943.

By mid-August 1943, Flight Test, Radio Test, Aircraft Armament and the Aircraft Experimental and Development squadrons were in place at PAX; and by the end of 1944, the Service Test, Electronics Test, Flight Test and Tactical Test Divisions were established.

Naval Air Station, Patuxent River, MD. Seaplane Hangar (Steel), Trans. Area. (Project No. 4). View Looking north showing apron. Contractor Cummins Constr. Corp. and Riggs-Distler and Co. Contract NOy-5363. Date 3-1-1943 (PW# 1199)

2.1.2 Testing and Support Functions Established

NATC was established on June 16, 1945. The formation of this center divided the test and support functions of base operations.

During WWII, hundreds of combat-experienced pilots were stationed at PAX for the purpose of testing aircraft and flight operations. System controls such as radar tracking, radar fire control, and instrument landing techniques were developed. By 1948, the Test Pilot Training Division was formed, and formalized classroom instruction was initiated. The test pilots flew all types of US airplanes built for the war effort. For example, in 1944, the first US all jet-powered airplane, the XP-59A, was flight tested at PAX. In 1945, the FR-1 Fireball and the FH-1 Phantom were also tested. The FR-1 Fireball was a carrier-based fighter combining a conventional engine and a General Electric jet engine. The FH-1 Phantom was the Navy's first all jet-powered airplane to operate from a carrier.

These pilots also tested enemy aircraft captured during the war. For example, pilots tested the German Focke-Wulf 190, Dornier DO 335A, and Messerschmitt 262, as well as Japanese Kate and Tony airplanes. The most important aspect of this flight testing was to determine the flight characteristics of the aircraft and identify any vulnerability. This information was then passed to Fleet pilots.

In 1946, Lieutenant Commander James Davidson flew an FD-1 aboard the USS FRANKLIN D ROOSEVELT. This marked the first US test of the adaptability of jet aircraft to shipboard operations. In 1947, Commander Turner F. Caldwell piloted a Douglas Skystreak D-558-1 to a world's speed record of 640.663 miles per hour. In 1949, Captain W. V. Davis became the first Navy pilot to exceed the speed of sound. Test pilots were using ejection seats by 1949, barrier engagements by 1951, and a simulated angled deck on the USS MIDWAY by 1952.

2.1.3 Test Programs Expand in the 1950's and 1960's

During the Korean War, from 1950 to 1953, PAX developed jet aircraft and improved conventional weapons. Supersonic travel and guided missiles were the new challenges for PAX programs, necessitating some changes at the Installation. Thus, in 1953, the Tactical Test Division was merged with the Service Test Division. Five years later, in 1958, the US Naval Test Pilot School (TPS) was established. Finally, in 1960, consolidation of the Armament Test and Electronics Test Divisions produced the Weapons Systems Test Division.

The 1950's also saw several new airborne early warning squadrons (VWs) operating from PAX. Included were VW-2, VW-11, VW-13 and VW-15. These squadrons patrolled the Atlantic Ocean along the Distant Early Warning Line.

PAX contributed much to the nation's space race as well. Of the original seven astronauts selected for the American space program in 1959, four were TPS graduates.

In 1961, former Navy test pilot Alan Shepard became the first American in space. A year later, John Glenn, also a test pilot from PAX, became the first American to orbit the earth.

In the 1960's, ordnance testing and similar programs at PAX were escalated as a result of intensifying conflict in Vietnam. The warfare in Vietnam required more focus on conventional weapons and less on technological advancements.

2.1.4 Antisubmarine Warfare Movement

A buildup of Fleet antisubmarine warfare (ASW) squadrons started in the 1960's. Patrol Squadrons (VPs) were established to form Fleet Air Patuxent, later to be called Fleet Air Wing Five. A VP training squadron, Patrol Squadron 30, was established in 1962. In the 1970's, the ASW squadrons began to leave PAX for naval air stations in Brunswick, Maine, and Jacksonville, Florida. VP-30 was the last to leave the Installation, in 1975.

The Oceanographic Air Survey Unit, now known as the Oceanographic Development Squadron Eight, was stationed at Patuxent River in 1965. Fleet Air Reconnaissance Squadron Four was established here in 1968. The squadron originated from a TACAMO detachment left behind by Naval Air Transport Squadron One when that unit was moved to Norfolk, Virginia.

In 1967, three divisions of the test center (Flight Test, Service Test, and Weapons Systems Test) gave up assets to form the Technical Support Division. In 1968, the Computer Services Division was established when NATC's data processing was computerized.

Air Test and Evaluation Squadron One moved to NAS Patuxent River from Key West, Florida, in 1973, and the Naval Aviation Logistics Center was formed in 1977.

2.1.5 Principal Site Testing Begins

In 1975, NATC was reorganized to become the Naval Air Systems Command's principal site for development testing. Under this plan, the Flight Test, Service Test, and Weapons Systems Test Divisions were dissolved and new directorates were formed to evaluate aircraft by type and mission.

The "new" NATC was comprised of four directorates -- Strike Aircraft, Antisubmarine Aircraft, Rotary Wing Aircraft, and Systems Engineering Test. The Computer Services and Technical Support Directorates and the US Naval Test Pilot School remained intact.

In the late 1970's, PAX test facilities were upgraded with some of the largest construction appropriations in the history of the Installation. In addition, the computer revolution was rapidly improving aircraft and aircraft systems. As a result, computerized simulators became an economic way of testing new systems and aircraft.

In response to the technological growth, the 1980's saw the Computer Services Directorate become the Computer Sciences Directorate; the Technical Support Directorate become the Range Directorate; and the Antisubmarine Aircraft Test Directorate become the Force Warfare Aircraft Test Directorate.

2.1.6 Navy Realignment Brings NAWC-AD

In 1991, the Navy began consolidating its technical capabilities by creating four large warfare centers. This move was designed to improve the Navy's products and services. The Naval Air Warfare Center (NAWC), located in Washington, DC, streamlined its resources into two divisions: the Aircraft Division located at PAX and the Weapons Division at China Lake, California.

NAWC-AD at PAX was established on January 1, 1992. It integrated the Naval Air Test Center with the Naval Air Development Center, Warminster, Pennsylvania; Naval Air Engineering Center, Lakehurst, New Jersey; Naval Air Propulsion Center, Trenton, New Jersey; and Naval Avionics Center, Indianapolis, Indiana.

2.1.7 Growth Continues

The PAX mission supports numerous military operational programs including the F/A-18E/F Hornet/Super Hornet, EA-18G Growler, V-22 Osprey, Advanced Hawkeye (E-2C Follow-On and E-2D), CH-35K Super Stallion Heavy Lift, MH-60 Seahawk/Blackhawk helicopter, UH-1 Upgrade (Marine Corps AH-1Z Super Cobra attack helo and UH-1 Iroquois utility helo), Unmanned Air Systems (UASs and UAVs, including the MQ-8B Firescout helo, RQ-11 Raven, Scan Eagle, RQ-21 Blackjack and MQ-4 Triton), KC-130J Super Hercules aerial fueler, F-35 Lightning II Joint Strike Fighter (carrier modified fighter), VH-92 Presidential Helo, and P-8A Poseidon Multi-mission Maritime Aircraft.

Future operation missions are anticipated to include the A-10 Thunderbolt, F-16 Fighting Falcon, F-22 Raptor, Future Vertical Lift and MQ-25 Stingray.

2.2 History –WOLF

The property that is now WOLF was purchased and developed in 1943 to serve as an outlying field for NAS Patuxent River and as a dispersal field in the event of possible air invasion. It was originally named NAS Beachville.

2.2.1 WOLF – The Early Years

This outlying field was originally used as an emergency landing field, because of heavy air traffic at PAX during WWII; however, the Beachville Air Station (as it was called then) was also used for dive-bombing, aerial gunnery, target practice, and glider control experiments. The outlying field was renamed Webster Field in 1944 in honor of Captain Walter W. Webster, an early pioneer of naval aviation.

Early photograph of WOLF, formerly the Beachville Air Station

At the end of WWII, air activity at the outlying field decreased considerably until 1947, when the field was reactivated for use by the Naval Air Reserve Training Unit (NARTU) of NAS Anacostia.

2.2.2 Continued Change

In 1967, the real estate that is now WOLF was commissioned as the Naval Electronics Systems Test and Evaluation Facility (NESTEF) and was transferred from PAX to the Naval Electronics Systems Command (NAVELEX). This was done with the understanding that NATC/PAX would still have use of the airspace at NESTEF for training of Fleet Squadrons, Test Pilot School, NATC test requirements, small propeller and vertical and short takeoff and landing (VSTOL) aircraft, and special test projects within the airfield.

In addition to the transfer there was an agreement that no future construction could degrade or interfere with the capabilities to operate aircraft from the existing runways. The NATC/PAX use of NESTEF was to be coordinated with the Commanding Officer of NESTEF and all equipment/personnel for air operations use would be furnished from NATC/PAX assets.

In 1974, NESTEF was designated as a detachment and renamed the Naval Electronic Systems Test and Evaluation Detachment (NESTED). In January of 1978, the Activity was renamed the Naval Electronic Systems Engineering Activity (NESEA). Then, in October of 1995, NESEA was formally annexed by PAX and renamed NAS Patuxent River, Webster Field Annex. In 2022, the installation was renamed Webster Outlying Field (WOLF).

WOLF now supports several mission-critical commands including NAVAIR/NAWCAD 4.5, PMA-213 (Air Traffic Control and Combat ID Systems), and other UAV Operations, as well as the US Coast Guard and the Maryland Army National Guard.

3.0 History of The Natural Resources Management Program

The earliest recognizable conservation force on PAX was the Mattapany Rod and Gun Club, which was chartered in 1954. For nearly seven decades, the Club has remained active in conservation management.

In 1963, the Conservation Committee was formed to direct the Conservation Program, and, in 1964, PAX entered into its first cooperative agreement with the Bureau of Sports Fisheries and Wildlife and the State of Maryland's Department of Natural Resources. This agreement was updated in 1979 and most recently in 1986.

A Conservation Officer was appointed in 1966. Two years later, a civilian was hired to assist him with wildlife management and game warden duties.

The Office of Environmental Protection Coordinator was established in 1971. It was assigned as a collateral duty to the Public Works Officer. In April of 1973, the Environmental Protection Office (EPO) was formed, bringing all of PAX's environmental programs into one organization. It was created with the positions of Environmental Protection Coordinator, Natural Resources Manager, Pollution Abatement Specialist, and Wildlife Technician.

The EPO was responsible for developing and implementing programs regarding all aspects of environmental quality. It also reviewed all Environmental Impact Assessments, prepared by the various activities on the Complex for the purpose of avoiding any action that may adversely affect the quality of the environment, and ensured that all projects and actions complied with federal, state, and local environmental regulations. Furthermore, the Environmental Protection Coordinator advised the Commanding Officer on environmental matters.

During the summer of 1972, PAX was selected to be the subject of an unprecedented study designed to assess the environmental impact of Navy operations on Navy lands, and to develop a method for incorporating environmental protection into operations management. The results of this investigation were published in December 1974 as the Ecological-Environmental Study on the Naval Air Station Patuxent River, authored by Mary Margaret Goodwin. Indigenous species

preservation, use of regenerative reforestation techniques, and establishment of a recycling program are just a few of the report's numerous recommendations that were implemented and are still being practiced by the Natural Resources Program.

The PAX Conservation Committee, created to advise the Commanding Officer on conservation matters, was reconstituted in December of 1973, and its scope was broadened as the PAX Environmental Protection Committee, with further changes made in its membership and its duties in 1975. The purpose of this committee was to serve as a point of contact for PAX detachments and organizations, and to serve as an advisory committee.

The PAX Environmental Protection Committee served as:

- a means whereby personnel who are especially concerned with the Environmental Protection and Enhancement Program may have an opportunity to contribute to the Program;
- a means whereby concerned personnel may be made aware of the functioning of the Program; and,
- an organization that may advise the Commander, NAVAIRTESTCEN, and the Commanding Officer, PAX, as it sees fit upon the maintenance of the environment on and around PAX.

The committee was comprised of the following members:

- Environmental Protection Officer (Chairman),
- Environmental Protection Coordinator,
- Natural Resources Manager,
- Pollution Abatement Specialist,
- Public Works Officer,
- Public Works Maintenance Control Division Director,
- Head of Public Works General Services Division,
- Supply Officer (Head of Supply Department Fuels Division),
- Air Operations Officer,
- NAVAIRTESTCEN Assistant for Technical Facilities,
- Security Officer,
- Recreation Officer, and
- Presidents of Navy-sponsored clubs who desired membership.

In 1986, the EPO underwent reorganization. The Environmental and Energy Offices merged into an Environmental/Energy Division, which was divided into three branches: (1) Energy, (2) Environmental Protection, and (3) Natural Resources. The natural resources staff was expanded to include natural resources manager (branch head), wildlife biologist, forest technician, and clerk/typist.

In 1993, the organization was once again reworked into an Environmental and Natural Resources Division with three branches: (1) Environmental Programs, (2) Environmental Compliance, and (3) Natural and Cultural Resources.

In 1996, the Environmental Review Board (ERB), headed by the Office of Environmental Planning (OEP), was established to take the place of the Environmental Protection Committee. OEP later became the NAWCAD Ranges Sustainability Office (SO). Reorganization in 1996 placed the Natural and Cultural Resources Branch under the Environmental Support Group. Further organizational restructuring took place in 2003, with the Navy's attempt to eliminate redundancies and increase efficiencies by creating a new major claimancy whose purpose was running bases – Commander, Naval Installations Command (CNIC). CNIC was given ownership of all real estate and real property assets, including environmental services. CNIC was divided into regions, each with an environmental support staff and shared regional responsibilities. The NAS Complex falls within Naval District Washington (NDW) region.

Most recently in 2007, what became the Environmental Division was realigned into the Public Works Department as part of Naval Facilities Engineering Systems Command within the Washington region. The Natural Resources Program (NR Program) is now within the Environmental Planning and Conservation Branch, along with Cultural Resources, NEPA, and Environmental Restoration. N45 duties were removed from CNIC and realigned under N45 NAVFAC.

4.0 Natural Resources Management Plan History

4.1 Natural Resources Management Plan History – PAX

This document will be the third INRMP for PAX and WOLF. The original Integrated Natural Resources Management Plan (February 2002) was the first to integrate the numerous sets of separate management plans.

Prior to the 2002 INRMP there was a Forest Management Plan, Wildlife Management Plan, Fisheries Management Plan, Land Management Plan, and Outdoor Recreation Management Plan prepared between 1981 and 1987. The accomplishments for each of these resources (described above) are the result of programs from 1988 to 1990, as excerpted from the 1990 Natural Resources Conservation Report.

The individual plans that made up the first INRMP were fully updated and implemented first in 2017 and now in 2022. The INRMP integrates all the elements of resources management into one cohesive plan. Central to operational integrity of the INRMP is the geographic information system (GIS), which is currently operational at NAS under the GeoReadiness Explorer (GRX). This system is the central clearinghouse for all natural resources information and the primary planning tool for all natural resources management decisions.

4.2 Natural Resources Management Plan History – WOLF

The *Integrated Natural Resources Conservation Plan (INRCP) for Naval Electronic Systems Engineering Activity, St. Inigoes* (NAS WFA after October 1995, now WOLF) was drafted in September 1994 with a 10-year duration in mind. While it contains a structure similar to this

document, it was necessary to incorporate the management of PAX and its annexed properties into one umbrella document. Therefore, the 1994 INRCP was superseded with the implementation of the first INRMP.

Prior to 1994, the natural resources management program at WOLF received chain-of-command direction from the Facilities Planning and Project Support Division of NAVFAC Washington. The NR Program at PAX provided support upon request and as necessary. As of 1994, the office now known as Environmental Planning and Conservation Branch (CN) performs all natural and cultural resources functions at what is now WOLF in similar fashion to the functions performed at PAX.

5.0 Organization Structure

5.1 Organization Structure – PAX

PAX hosts the NAWC-AD headquarters and technical facilities, along with more than 50 tenant activities. There are seven departments within PAX that operate the facility and help support NAWC-AD and the tenant activities.

- *Administration Department* provides staff, administrative, clerical and general management support services.
- *Air Operations Department* operates the airfield and seadrome and provides air traffic control services. It also provides explosive handling and storage, ground electronic equipment maintenance, aircraft crash support, firefighting, and helicopter search and rescue.
- *Physical Security/Public Safety Department* administers the overall security program and the public safety program, which covers activities including military, recreational, and residential life for PAX.
- *Occupational Safety and Health Department* administers the occupational safety and health program, and houses the Hazardous Materials Program Office for PAX.
- *Public Works Department* manages the planning, design, and construction of new facilities and provides maintenance to existing facilities. The department also includes the Environmental Division, which supports the natural resources program within CN.
- *Supply Department* provides logistical supply support for everything from the Servmart to aircraft consumables and components.
- *Morale, Welfare and Recreation Department* provides recreation for military and civilian employees and their families.

5.2 Organization Structure –WOLF

The seven departments listed above that operate PAX also operate WOLF and help support the mission and tenant activities. Tenant activities at WOLF include the Naval In-Service Engineering Detachment (NISE-EAST DET), St. Inigoes, United States Coast Guard (USCG) Station, St. Inigoes and the Maryland Army National Guard (MDANG), St. Inigoes.

6.0 Roles and Responsibilities

The NAS Patuxent River Conservation Director is primarily responsible for implementing this INRMP and coordinating with other personnel on the installation. Some of the implementation responsibilities include identifying personnel, internal or external to the installation, with expertise to perform the work identified; identifying the appropriate funding source to accomplish the projects; and ensuring installation personnel are familiar with the contents of this INRMP. The Conservation Director is also responsible for ensuring this plan is reviewed in coordination with the U.S. Fish and Wildlife Service (USFWS) and the Maryland Department of Natural Resources (MDNR).

The roles and responsibilities for Navy natural resources management are described in OPNAVINST 5090.1 (series) and in the Navy guidance for INRMP development and implementation. A summary of responsibilities for natural resources management at NAS Patuxent River follows.

Chief of Naval Operations (CNO) is the Echelon I command and serves as the principal leader to provide policy, guidance, and resources for the development, revision, and implementation of INRMPs. CNO also represents the Navy on issues and resolves high-level conflicts regarding development and implementation of INRMPs.

Commander, Navy Installations Command (CNIC) is the Echelon II command under CNO responsible for Navy-wide shore installation management. CNIC has overall shore installation management responsibility and authority as the budget submitting office for installation support and is the Navy point of contact for installation policy and program execution oversight. CNIC must ensure the programming of resources necessary to maintain and implement INRMPs; participate in the development and revision of INRMPs; and provide oversight for all natural resources program elements.

The DoD Regional Environmental Coordinators (REC) support the DoD/Navy mission through coordination, communication, and facilitation of environmental issues and activities when these activities affect two or more DoD installations within an Environmental Protection Agency (EPA) region. Commander, Navy Region Mid-Atlantic (CNRMA) is the DoD/Navy REC for military installations within Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and Washington, D.C.

Naval Facilities Engineering Systems Command Washington (NAVFAC Washington) is the regional facilities command and supports the mission of CNIC and NDW with technical authority, project management, and contracts management as requested. NAVFAC Washington also provides technical oversight for natural resources projects, facilitates agency review and stakeholder agreement of INRMPs, and reviews and signs INRMPs to ensure technical sufficiency.

The responsibilities of the Commanding Officer, NAS Patuxent River are to ensure preparation, completion, and implementation of the INRMP and to systematically apply conservation practices set forth in the plan. It is his/her responsibility to act as steward of installation natural resources and integrate natural resources requirements into the day-to-day decision-making process; involve

appropriate operational and training commands in the INRMP review process to ensure no net loss of military mission; and endorse INRMPs via Commanding Officer signature.

6.1 Staff Resources

The Station's Natural Resources (NR) Program has a full-time staff of five people – three professionals and two multi-media technicians. The professional staff, which includes one natural resources manager and two natural resources specialists, is an interdisciplinary team with education, experience and training in fisheries, wildlife management, forestry, zoology, ecology, wetlands, and outdoor recreation. The responsibilities of the NR Program include PAX and WOLF, as well as NRC SOL, BIR and numerous satellite properties.

The permanent staff is supplemented by part-time and temporary staff when activity requirements of CN periodically increase. This is accomplished through the use of one to four seasonal temporary employees, one to two high school cooperative study students and one to two college interns per year. In recent years, these temporary employees have been brought in through the Student Conservation Association, Inc., and an MWR Work Wise Teen program. The NR Program has also used special program hires such as AmeriCorps, as well as 20 to 30 volunteers. The volunteers are military and civilian personnel (active and retired) who help with various NR programs such as Hunter Safety Education, fish and wildlife activities, and the Educational Program. The Student Conservation Association (SCA) has provided resource assistants to the NR Program since 1995. These volunteers are selected to complete specific projects, but are involved in nearly all aspects of the natural resources program.

7.0 Natural Resources Program Funding Resources

Funding for the NR Program comes from a number of different sources. These moneys are divided into appropriated and non-appropriated funds.

7.1 Appropriated Funds

Appropriated funding accounts for most of the total expenditures of the NR Program and comes from two sources: (1) Operations and Maintenance, Navy (O&MN), and (2) RDAT&E appropriations. These funding sources support salaries, materials procurement, contracts support, travel, and training.

7.1.1 Environmental Compliance Projects

Environmental compliance projects are funded by CNIC, usually with O&MN funds. In general, the cost of environmental, natural resources, and cultural resources compliance is part of the NR Program operating budget. There are three compliance classes that establish the funding priority of each project:

- Class I projects are those in which facilities are currently out of compliance with established regulatory deadlines,
- Class II projects are those in which facilities will be out of compliance at a specific, impending, published deadline if action is not taken. If not accomplished by the deadline, projects become Class I projects,

- Class III projects are those needed to meet DoD, Assistant Secretary of the Navy (Installations & Environment), CNO and/or claimant goals related to the environmental protection, pollution prevention, cost effectiveness, environmental quality, or enhancement initiatives. Although not mandated by law, these requirements demonstrate federal leadership and goodwill.

7.1.2 Legacy Resource Management Program

Congress passed legislation establishing the Legacy Resource Management Program in 1990. The program provides financial assistance to the DoD efforts to preserve the natural and cultural heritage.

As stated in A Reference Guide for the Legacy Resources Management Program (Department of Defense, Legacy Resource Management Program, revised May 2012), a Legacy project may involve regional ecosystem management initiatives, habitat preservation efforts, archaeological investigations, invasive species control, Native American consultations, and/or monitoring and predicting migratory patterns of birds and animals.

Three principles guide the Legacy program: stewardship, leadership, and partnership. Stewardship initiatives assist DoD in safeguarding its irreplaceable resources for future generations. By embracing a leadership role as part of the program, the Department serves as a model for respectful use of natural and cultural resources. Through partnerships, the program strives to access the knowledge and talents of individuals outside of DoD.

In order to support these principles, the Legacy Program emphasizes five areas:

- Legacy incorporates an ecosystem approach that assists DoD in maintaining biological diversity, and the sustainable use of land and water resources for mission and other uses.
- The program also implements an interdisciplinary approach to resource stewardship that takes advantage of the similarities between DoD's natural and cultural resource plans. Often, the same person is responsible for managing both natural and cultural resource plans on an installation. Legacy strives to take advantage of this by sharing management methodologies and techniques across natural and cultural resource initiatives.
- Legacy promotes understanding and appreciation for natural and cultural resources by encouraging greater awareness and involvement by both the military and the public.
- Additionally, the program takes advantage of similar ecosystems by applying resource management initiatives in broad regional areas. Legacy supports projects such as the Sonoran Ecosystem Management Initiative, the Gulf Coast Plain Ecosystem Partnership, the Great Basin Initiative, the Chesapeake Bay Program, and Partners in Flight.
- Finally, Legacy pursues the identification of innovative new technologies that enable more efficient and effective management.

Legacy funds are generally not used for Class I or II compliance projects, but rather to fund projects that meet certain criteria and would otherwise go unfunded.

7.2 Non-Appropriated Funds

Non-appropriated funds are raised through user fees, timber sales, and land leases (e.g., agricultural outleasing) and are not appropriated by Congress. These funds do not expire at the end of each fiscal year as do most appropriated funds. NR Program has three funds from which to work -- the Forestry Account, the Agricultural Outlease Account, and the Fish and Wildlife Account. Procedures on how these accounts are managed are contained in NAVFAC P-73.

7.2.1 Forestry Account

The forestry account collects proceeds from the sale of forest products on Navy lands and is managed by Naval Facilities Engineering Systems Command (NAVFACENGCOM). The NR Program deposits proceed into this account and then requests disbursements from the account to fund forestry projects. The Station generally spends more forestry account funds than it generates. A portion of all sales proceeds is also disbursed to the state in which the sale takes place.

7.2.2 Agricultural Outleasing Account

This account collects proceeds from the leasing of Navy lands for grazing and agriculture, and is also managed by NAVFACENGCOM. NR Program deposits proceeds into this account and then requests disbursements from the account to fund agricultural outlease improvements or administration costs and other natural resources projects. The Station generally spends more agricultural outlease account funds than it generates. The Station can accept in-kind services from farmers in lieu of lease payments. Examples of these services include vegetation removal in areas outside of the grounds maintenance contract, as well as invasive species control.

7.2.3 Fish and Wildlife Account

The fish and wildlife account collects proceeds from the sale of hunting and fishing permits on Navy lands. Fees from NAS permit sales are maintained at NAVFAC HQ. Unlike forestry and agriculture outlease accounts, federal law requires that these fee collections be spent on fish and wildlife projects for the installation where they were generated.

8.0 Partnerships and Availability of Technical Assistance

The Station takes advantage of a number of partnerships and cooperative agreements for technical assistance. The NR Program staff is very active with outside community boards, professional societies, and local conservation groups. This has greatly opened and facilitated communications between NAS and the community, developing trust and building true partnership relationships. The overall philosophy of NR Program is one of active partnering and sharing of information and resources with other resource management agencies and organizations including federal, state, or local agencies, and private organizations. In many instances, the NR Program has made NAS lands available as research natural areas to outside agencies and organizations.

Agreements involving government entities take the form of Memoranda of Understanding (MOU), Memoranda of Agreement (MOA), and cooperative agreements. Some agreements are executed between NAVFAC Washington and partner groups, while other agreements are executed directly between PAX and its partners.

In addition, there are broader agreements made between the DoD/DoN and groups like The Nature Conservancy, Ducks Unlimited, and American Bird Conservancy. It is highly recommended that the installation and its professional staff remain engaged and active in larger partnerships supported by DoD, such as Partners in Flight (PIF) and Partners in Amphibian and Reptile Conservation (PARC) – involving various government agencies (federal and state) and non-governmental organizations.

Technical assistance is available from the following sources, listed in order of frequency of use by the NR Program:

- NAVFAC Washington
- Federal/State Resources Management Agencies (MDNR, NOAA, USDA, USFWS, USGS)
- Universities/Colleges
- CNRMA or NAVFAC Mid-Atlantic
- NAVFAC Headquarters and CNIC.

The NR Program is also in regular contact with the PAX Central Library (which is an official Federal Repository for publications of the US Government Printing Office) and the St. Mary's County Library, accessing both in-house literature and interlibrary loans. Other library reference collections are available at nearby St. Mary's College and the Patuxent Wildlife Research Center (US Geological Survey/Biological Resources, Department of the Interior), in Laurel, Maryland.

The USACE Engineer Research and Development Center (ERDC) maintains an online catalog including technical reports on natural resources management. The catalog can be accessed via the website: https://erdclibrary.on.worldcat.org/discovery.

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Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 3

Physical Description

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III PHYSICAL DESCRIPTION

1.0 Location of PAX and WOLF

NAS Patuxent River Complex is comprised of several properties that are collectively termed NAS or the Station in this Chapter. The major facilities comprising the Station include the main base (PAX), 6,781 acres; Webster Outlying Field (WOLF), 859 acres; Bloodsworth Island Range (BIR), 6,013 acres; and the Naval Recreation Center Solomons (NRC SOL), 282 acres. These acreages are inclusive of the tidal water bodies/basins associated with each facility.

The Complex includes 19 distinct properties in 5 Maryland counties, totaling approximately 15,000 acres. In addition to the major facilities listed above, there are numerous smaller parcels. These include Pine Hill Run; Glenn Forest Housing Area; Chesapeake, Point-No-Point, and Bay Forest Theodolite Stations; Point Lookout Tracking Station; and a microwave repeater station at Bishop's Head in Dorchester County. These sites comprise approximately 1,200 additional acres in the vicinity of PAX and along the Chesapeake Bay to the south at the confluence with the Potomac River (Map III-2 in Annex III-B). A comprehensive list of all NAS satellite properties, as well as outleases, licenses and agreements of NAS lands, can be found in Table III-C-1 in Annex III-C. This table also notes which properties are actively managed under this INRMP.

PAX is located in the southern portion of St. Mary's County, Maryland, at latitude 38°17'N and longitude -76°25'W, approximately 70 miles southeast of Washington, DC. St. Mary's County is the southernmost part of Maryland's western shore and consists of a peninsula surrounded by tidal water on all but the northwestern boundary. PAX occupies a smaller peninsula and broad headland known as Cedar Point at the confluence of the Patuxent River and Chesapeake Bay in the eastern portion of the county (Map III-1 in Annex III-B). This main site, which comprises approximately 6,781 acres, is bounded by the Patuxent River to the north, the Chesapeake Bay to the east, and the town of Lexington Park, Maryland, to the south and west.

WOLF is located on 859 acres on the eastern shore of the St. Mary’s River at latitude 38°08'N, longitude -76°25'W, in St. Mary’s County, Maryland. It is three miles south of historic St. Mary’s City, eight miles south-southwest of PAX, and approximately 75 miles southeast of Washington, DC. Map III-1 in Annex III-B shows its location in relation to Washington, DC; Baltimore, Maryland; and PAX. St. Mary’s River bounds WOLF on the west, with St. Inigoes Creek and Molls Cove forming the northern boundary. In 2014, the Navy acquired approximately 52 acres of land (referred to as the Grayson property) just east of WOLF. This mostly forested parcel lies under a runway approach; thus, the acquisition prevents development on the property and allows for management of the airfield clear zone at WOLF. In addition, the Navy maintains a 116-acre perpetual navigational easement adjacent to the northeast corner of WOLF. Farms, forests, and light residential development occur to the east and south.

As both PAX and WOLF are coastal facilities, it is important to define the extent of Navy control over the nearshore environments. The State of Maryland owns the bottoms of all tidal water bodies on or adjacent to the installations from the mean high tide line; however, NAS has security control on some of this submerged land. Both installations have coastal security zones that extend 75 yards

from their shorelines. At PAX, access to and use of Goose, Harper's, and Pearson Creeks and Pine Hill Run are controlled by the Navy. At WOLF, the same is true for Langley Hollow, Priest's Inlet, and Fort Point and Chapel Coves. In terms of ecosystem region, or ecoregion, the Station lies within the Outer Coastal Plain Mixed Forest Province in the Subtropical Division of the Humid Temperate Domain (Bailey, 1995). This ecoregional distinction is an important way to discern zonal differences in climate, vegetation, etc. This area is further described as the Middle Atlantic Coastal Plain physiographic region (Glaser, 1968) (Map III-3 in Annex III-B). These broader ecological distinctions are very important from a management perspective, as described later in this document.

2.0 Geology

NAS occupies a unique, yet characteristic, landscape feature associated with the western shore of the Chesapeake Bay. Holocene erosion into Tertiary and earlier Quaternary deposits with subsequent submersion has resulted in a landscape having typical coastal plain characteristics. Table III-C-2 in Annex III-C outlines the geologic formation of Southern Maryland, as depicted in Map III-4 in Annex III-B.

The geological deposits underlying St. Mary's County are thick, unconsolidated beds of sand, silt, clay, and gravel laid down as marine deposits. Because these formations are entirely sedimentary in nature, they are extremely vulnerable to erosion. "The physiographic features of Southern Maryland have developed largely in response to Pleistocene sea-level changes" (Glaser, 1968). The major portion of the Station is underlain with a Matapeake-Mattapex-Sassafras soil association with smaller areas of a Sassafras-Beltsville association and Othello-Mattapex association. The specific soils encountered on NAS are described in Section 6.0 of this chapter.

The region is underlain by Cretaceous-age sediments, which consist of Arundel, Patapsco, Raritan, Magothy, Matawan, and Monmouth formations. The deposits that outcrop in St. Mary's County were deposited during the Tertiary and Quaternary Periods. The Pamunkey group lies within the Tertiary system and consists of the Aquia, Marlboro, and Nanjemoy formations. The Chesapeake is the second or younger group, which lies within the Tertiary system. The dominant surface of the area consists of sediments deposited during the Quaternary Period, primarily Sunderland, Wicomico, and Talbot deposits.

3.0 Topography

3.1 Topography – PAX

The terrain at PAX has a low relief, rising gradually from the Chesapeake Bay shoreline westward to an elevation of 120 feet above sea level. About 70 percent of PAX is level, but fairly well-drained. Some low areas are somewhat poorly drained to poorly drained, and become intermittently flooded and/or saturated. The southwestern portion of PAX is hilly, with the highest elevations occurring in this area. The original topography of the site that is now PAX is displayed in Maps III-5a through III-5i, Annex III-B. These maps are paper hard copies with digital metafiles.

The current relief of PAX represents a dramatic alteration of the original site topography (Map III-6 in Annex III-B), particularly on the eastern half of the Station. This change resulted from extensive regrading associated with original Navy construction in the 1940s.

3.2 Topography –WOLF

The topography of WOLF is characterized by relatively level terrain ranging from sea level to 22 feet, with no slopes exceeding 15 percent (NAVFACENGCOM, 1980). The highest elevations are found in the southwest portion of the property. The current topography of developed areas and runways are the result of minimal grading. Map III-7 in Annex III-B shows the current topography of WOLF.

4.0 Climate

NAS lies in a region midway between the harsher northern climates and the milder southern climates; specifically, within the Humid Temperate, Semi-Continental Climate Zone. The atmospheric flow in this region is from west to east across North America, and there are four distinct seasons. The local climate is also affected by the proximity to the Patuxent and Potomac Rivers, the Chesapeake Bay, and their tributaries. Prevailing winds are from the west, except during the warm months, when they are more southerly. Average wind speeds are approximately six miles per hour (mph), although winds may reach 50 to 60 mph or higher on rare occasions. Late winter and early spring are the windiest periods in this region. Damaging storms such as tornadoes, hurricanes, nor'easters, and blizzards occur during other seasons, but are very rare.

Normal temperatures for the region range from an average low of 30°F and an average high of 45°F in January (the coldest month) to an average low of 71°F and an average high of 87°F in July (the warmest month). The growing season, the time between the last killing frost (28°F) in the spring (March 20) and the first killing frost (28°F) in the fall (November 28) as measured at NAS, averages 254 days[1].

The annual mean precipitation for the area is approximately 43 inches, with approximately 16 inches of this amount occurring as snowfall. Precipitation occurs evenly throughout the year, with some increases occurring in June through August. In summer, precipitation occurs mostly through thunderstorms, which occur on an average of 33 days per year. Drought may occur in any season but is most likely to occur in the summer.

The degree of visibility is an important factor in the operation of airfields. Early morning ground fog somewhat limits visibility an average of 158 days per year. This condition occurs intermittently throughout the year.

Climatic conditions associated with NAS are represented in Figure III-1, Annex III-A.

[1] Source: NRCS Agricultural Applied Climate Information System (AgACIS) website, linked to St. Mary's County, MD growing season table for Patuxent River NAS, MD at [http://agacis.rcc-acis.org/?fips=24037]. Data derived at 50% probabilities.

4.1 Climate Change

The Maryland Commission on Climate Change (MCCC), made up of numerous state agency heads and General Assembly members, was established in 2007 by state executive order. In 2015, the MCCC was codified into law and is chaired by Maryland Department of the Environment (MDE). The main goal of the MCCC was to develop and maintain a Climate Action Plan (CAP) that addressed climate change drivers and potential state impacts, and established mitigative goals and recommendations. The executive order and subsequent CAP (completed in 2008) call attention to Maryland's specific susceptibility to sea level rise; increased storm intensity, wind and rainfall events; and extreme droughts and heat waves. Human activities such as coastal development, fossil fuels usage, and increasing greenhouse gas (GHG) emissions are all highlighted as contributing factors to climatic instability. From a natural resources perspective, Maryland will likely see impacts to terrestrial and aquatic ecosystems, forest resources, fisheries, agriculture, and the drinking water supply. The State already lists more than 600 species of plants and animals as endangered, threatened, in need of conservation, or in danger of extirpation – climate change will undoubtedly compound the existing habitat loss and degradation stressors that impact these species.

The CAP includes the *Comprehensive Assessment of Climate Change Impacts in Maryland* (Chapter 2), produced by the Commission's Scientific and Technical Working Group (STWG), which is based on extensive literature review and supercomputer model projections to estimate future climatic conditions in Maryland. Two GHG emission scenarios were used to project the degree of climate change – a higher rate that assumes unchecked increases, and a lower rate based on slower growth and eventual decline in emissions. The comprehensive assessment was revisited in 2016 to modify projections of future climactic conditions in Maryland based on new research findings. This assessment resulted in a number of key findings related to natural resources:

- Chesapeake Bay and coastal ecosystem restoration goals will likely be more difficult to achieve;
- Rising sea level will likely result in significant loss of tidal wetlands to inundation;
- Living resources will very likely change in species composition and abundance as warming continues;
- Aquatic ecosystems will likely be degraded by increased temperatures and flash-runoffs;
- Northern hardwood trees (maple, birch, beech) will likely disappear, replaced by oak, hickory and pines; and
- Biodiversity of Maryland's forests (both plants and animals) will likely decline.

The STWG also contributed the *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change, Phase I: Sea-level rise and coastal storms* (Chapter 5) to the CAP, and later (Boicourt et al. 2011) produced *Phase II: Building societal, economic, and ecological resilience*.

Phase I provides recommendations for risk reduction through legislative and policy actions. One particular recommendation that should continue to be implemented at NAS is the protection of natural shorelines and associated resources, including tidal wetlands and vegetated buffers (SMR III.1).

The Phase II strategy resulted from collaboration of governmental, non-profit and private sector experts. Two key points made in this document are that 1) climate change will alter distributions of species and habitats, exacerbating existing stressors at an uncertain rate and degree; and 2) strategically focused land management in "climate-sensitive" areas may increase ecosystem resilience and aid in maintaining biodiversity. The strategy outlines adaptation recommendations across a wide range of resource areas, including:

- Agriculture,
- Forests and Terrestrial Ecosystems,
- Bay and Aquatic Ecosystems, and
- Water Resources.

In an effort to comprehensively integrate those recommendations that are pertinent to NAS, they have been incorporated throughout the INRMP in the appropriate management chapters. Future adaptation strategies specific to Maryland, as well as climate change tools and guidance produced by DoD Legacy Program efforts, will be reviewed for inclusion in the INRMP as annual updates are conducted (SMR III.2).

5.0 Hydrology

5.1 Watersheds and Hydrological Features – PAX

Several major drainage areas on PAX collect precipitation runoff from PAX. This runoff goes directly to one of four areas: (1) Patuxent River, (2) Chesapeake Bay, (3) estuary areas, or (4) freshwater creeks and ponds and associated wetland areas. All of the runoff from PAX eventually flows to the Chesapeake Bay. Map III-8 in Annex III-B illustrates these watersheds.

Major alterations to site hydrology occurred during Base construction in association with the land-grading effort described in Section 3.1 of this chapter. During construction, large tidal creeks were dredged and filled in the areas of East and West Patuxent Basins and the area of Hangar 115. Gardiner's Pond and Sacawaxhit Pond are also remnants of a large tidal creek that was filled. Goose Creek, now a brackish estuary, was once known as Fresh Pond until the inlet opened, allowing tidal exchange.

Other alterations have occurred as well. In the 1950s and '60s, over seven miles of PAX streams were ditched, blasted, or channeled for mosquito control. Also, the southwestern portion of PAX shows evidence of drainage channels carved into the hillsides either through natural or artificial processes.

Stream Habitat – a hydrological feature at PAX.

There are six constructed ponds located in the southern and western areas of PAX. These impoundments were created in the 1950s by construction of earthen dams and range in size from 1 to 33 acres. These ponds not only control runoff from higher elevations, but also provide fish and wildlife habitats, recreation, and a source of water for firefighting. Gardiner's Pond (formerly Pond 1) and Sacawaxhit Pond (formerly Pond 5) eventually drain to the Patuxent River, while Sewall, Holton, and Calvert Ponds (formerly Ponds 2, 3, and 4, respectively) drain into Pine Hill Run. Richneck Pond (formerly Pond 6), which is located on the eastern side of the base, is used as a golf course irrigation pond and drains into Pearson Creek. Map III-9 in Annex III-B depicts the hydrological features, including groundwater seeps and springs, on PAX. In addition to these water bodies, there are lowlying areas throughout PAX that tend to act as temporary water storage areas, helping to control runoff rates and downstream flooding while providing water quality benefits.

5.2 Watersheds and Hydrologic Features –WOLF

A majority of the precipitation runoff from WOLF is deposited into one of the following waterways: the St. Mary's River; St. Inigoes Creek; Molls Cove; or other surrounding creeks, tidal ponds, lagoons, and artificial freshwater ponds. But some areas of the Station are very poorly drained, holding water for extended periods after heavy rains. All of the runoff eventually flows to the Potomac River and then to the Chesapeake Bay. Map III-10 in Annex III-B illustrates the watersheds of WOLF.

Some alterations to the original hydrology occurred with the construction of runways and structures. Areas south of Runway 7-25 are poorly drained and prone to flooding, probably as a result of associated grading. The low-lying areas are beneficial in that they assist in the control of

flooding and rapid runoff that can cause erosion. Map III-11 in Annex III-B depicts the hydrological features on WOLF.

6.0 Soils

Special features of the soils found at PAX and WOLF are categorized in the following sections and are symbolized (where appropriate) as shown.

6.1 Soils of the NAS Complex

The soils mapped on the Station are discussed below including the relative coverage of each type or series on the Station and special considerations for their use. The locations of these soil types at PAX and WOLF are depicted in Maps III-12 and III-13 in Annex III-B, respectively. Symbols preceding soil type descriptions are explained in Section 6.2 of this chapter.

Alluvial Land (Aa) - This material was washed from uplands and is usually found in depressions or at the bases of slopes. The soil texture is variable, ranging from clay to sand. These soils are moderately well-drained to well-drained. These soils constitute approximately 12 acres (0.2%) on PAX. They are not present on WOLF.

❁❁ *Alluvial Land, Wet (Ad)* - This material was washed from uplands and is found in floodplains, draws, and depressions. The dominant textures are silty, but some may be fairly sandy. These soils are somewhat poorly drained to poorly drained and are generally flooded once or more each year. These soils constitute 40 acres (0.6%) on PAX. They are not present on WOLF.

❁ *Beach (Be)* - These are strips of land along some shores of tidal creeks and the Bay. Typically, this soil type is loose, sandy material that has been worked and reworked by wave and tidal action. There is no soil development and very little vegetation in these areas. These soils constitute 62 acres (1%) on PAX. They are not present on WOLF.

Beltsville - These are described as moderately well-drained soils found in uplands. This soil type is moderately deep and found on level to moderately sloping lands. These soils have a fragipan at a depth of less than 30 inches. They formed in silty and moderately sandy material containing moderate amounts of clay. These soils constitute 557 acres (10.3%) on PAX. They are not present on WOLF.

> ✯ *(BlA)* - Beltsville Silt Loam, 0 to 2 percent slopes - Depth to the fragipan is more than 24 inches. The water table is seasonably high. These soils constitute almost 17 acres (0.3%) on PAX.
>
> ✯ *(BlB2)* - Beltsville Silt Loam, 2 to 5 percent slopes, Moderately Eroded - Depth to the fragipan is between 22 and 28 inches. The water table is seasonably high. These soils constitute approximately 529 acres (10%) on PAX.
>
> *(BlC3)* - Beltsville Silt Loam, 5 to 10 percent slopes, Severely Eroded - Gullies are common in the soil type and in many areas the fragipan is exposed. In areas where the fragipan is not exposed it is within 18 inches of the surface. The water table is seasonally high. These soils constitute approximately 10.6 acres (0.2%) on PAX.

❁❁ *Bibb* - These are described as poorly drained soils of floodplains. These soils are flooded at irregular intervals. They formed in recently deposited alluvium that was washed mainly from uplands.

(Bm) - Bibb Silt Loam - In a few places slopes are more than one percent. The water table is at the surface for long periods and undrained areas are seasonally ponded. Some inclusions have a sandy loam surface layer. These soils constitute approximately 43.2 acres (0.7%) on PAX. They are not present on WOLF.

Caroline - These are described as well-drained soils of uplands. This soil type is deep and found on gently sloping to strongly sloping lands. These soils formed in old, unconsolidated deposits of clay, silt, and sand. These soils constitute approximately 22.85 acres (0.41%) on PAX. They are not present on WOLF.

✓ *(CaB2)* - Caroline Silt Loam, 2 to 5 percent slopes, Moderately Eroded - This soil type is described as representative of the series. In nearly all cleared areas, some surface soil has eroded away. These soils constitute 2.2 acres (0.04%) on PAX.

¶ *(CaC2)* - Caroline Silt Loam, 5 to 10 percent slopes, Moderately Eroded - Most of the original surface layer has eroded away. These soils constitute approximately 4.65 acres (0.07%) on PAX.

❁ *(CaD2)* - Caroline Silt Loam, 10 to 15 percent slopes, Moderately Eroded - Shallow gullies commonly occur and subsoil materials are exposed in plowed areas. These soils constitute approximately 6 acres (0.1%) on PAX.

❁ *(CaD3)* - Caroline Silt Loam, 10 to 15 percent slopes, Severely Eroded - This soil type is gullied nearly everywhere and the subsoil materials are commonly exposed. These soils constitute approximately 9 acres (0.2%) on PAX.

Chillum - These are described as well-drained soils of uplands. These soils are found on level to moderately sloping ridgetops and the upper slopes of ridges. These soils formed in silty sediments over deposits of dense gravelly material. These soils constitute 159 acres (2.2%) on PAX. They are not present on WOLF.

✓ *(ChB2)* - Chillum Loam, 2 to 6 percent slopes, Moderately Eroded - These soils are somewhat droughty during dry seasons. Some inclusions have a silt loam or fine sandy loam surface layer. These soils constitute 74 acres (1%) on PAX.

¶ *(ChC2)* - Chillum Loam, 6 to 12 percent slopes, Moderately Eroded - This soil type has a thin surface layer that, in some inclusions, is silt loam or fine sandy loam. These soils constitute approximately 71 acres (1%) on PAX.

(ChC3) - Chillum Loam, 6 to 12 percent slopes, Severely Eroded – These soils have lost most of the surface layers, leaving the gravelly substrata at shallow depths. Gullies have formed in some places. These soils constitute approximately 14 acres (0.2%) on PAX.

❁ *Croom* - These are described as well-drained, gravelly soils of uplands. These soils are found on level to strongly sloping lands. They were formed in old fluvial deposits containing some sand and clay. These soils constitute approximately 194 acres (3%) on PAX. They are not present on WOLF.

(CrD2) - Croom Gravelly Sandy Loam, 10 to 15 percent slopes, Moderately Eroded - This soil type is somewhat droughty, and some shallow gullies are present. Included in these soils are areas where the subsoil is redder than typically found and areas where the subsoil is less compact than typically found. These soils constitute approximately 124 acres (2%) on PAX.

(CrD3) - Croom Gravelly Sandy Loam, 10 to 15 percent slopes, Severely Eroded - These soils have very little surface layer. The subsoil is exposed and gullies are often deep. These soils constitute approximately 70 acres (1%) on PAX.

Cut and Fill (Cu) - These areas consist of places where grading and similar operations have cut away some of the soil and the remaining areas are filled with mixed soils or other materials. These areas also include places where the fill is solid waste and areas that are paved. These soils constitute approximately 1,275 acres (20%) on PAX and approximately 12 acres (1%) on WOLF.

❁ *Elkton* - These are described as deep, poorly drained soils of wetlands found on nearly level lands. This soil type occurs in areas bordering major rivers and on higher upland flats. The subsoil has a fine texture. These soils formed in old deposits of very clayey marine and alluvial sediments.

(Ek) - Elkton Silt Loam - Some areas may be gently sloping. The water table is at or near the surface and some areas are ponded for long periods. These soils constitute approximately 4 acres (0.06%) on PAX. They are not present WOLF.

Evesboro - This soil type is described as excessively drained and very deep. These soils are found on level to steep uplands and some lower elevation areas. They formed in old marine deposits of sand that have been partially reworked by wind and water. These soils constitute approximately 860 acres (14%) on PAX. They are not present on WOLF.

(EvB) - Evesboro loamy sand, 0 to 8 percent slopes - This soil type is very droughty in low rainfall seasons. Some inclusions are underlain by an impermeable clayey substratum at 50 inches, causing a seasonal, moderately high water table. These soils constitute approximately 113 acres (2%) on PAX.

(EvC) - Evesboro Loamy Sand, 8 to 15 percent slopes - These soils are found on uplands, ridges, sides of sandy hills, and depressions. They are very droughty during periods of low rainfall. Some inclusions are very gravelly. These soils constitute approximately 54 acres (0.9%) on PAX.

❁ *(EwD2)* - Evesboro-Westphalia Complex, 6 to 12 percent slopes, Moderately Eroded - This complex consists of mixed areas of Evesboro (60%) and Westphalia (40%) soils. Shallow gullies can be found in Westphalia soils. Sassafras soils are also included. These soils constitute approximately 98 acres (2%) on PAX.

❁ *(EwE2)* - Evesboro-Westphalia Complex, 20 to 45 Percent Slopes, Moderately Eroded - This Evesboro and Westphalia soils mixture is cut by many deep ravines. Small areas of Marr and Sassafras are also included. These soils constitute 595 acres (10%) on PAX.

❁ *Gravel Pit (Gp)* - These are described as excavations where gravel and/or sand has been removed for construction purposes. These soils constitute 16 acres (0.3%) on PAX. They are not present on WOLF.

¶ *Keyport* - These are described as deep, moderately well-drained soils of wetlands. This soil type is found on nearly level to moderately sloping lands near major rivers or in higher uplands. These soils formed in old marine and alluvial deposits having mostly clayey texture. These soils constitute approximately 25 acres (0.4%) on PAX. They are not present on WOLF.

(KrA) - Keyport Silt Loam, 0 to 2 percent slopes - Found in lower elevations, the surface layer of these soils often appear thicker than normal due to erosion from adjacent soils. These soils constitute approximately 8 acres (0.1%) on PAX.

(KrB2) - Keyport Silt Loam, 2 to 5 percent slopes, Moderately Eroded - These soils have lost surface layer in nearly all cleared areas. Subsoil is exposed in a few small areas and some gullies are present. These soils constitute approximately 17 acres (0.3%) on PAX.

Matapeake - This series consists of deep, well-drained soils found on level to moderately sloping uplands and terraces above major rivers. These soils formed in loamy deposits over older and coarser sediments. These soils constitute approximately 2,056 acres (32%) on PAX and 19.5 acres (2%) on WOLF.

✓ *(MmB2)* - Matapeake Fine Sandy Loam, 2 to 5 percent slopes, Moderately Eroded - These soils have lost much surface layer, and plowing turns up finer subsoil materials. Some inclusions are underlain by a discontinuous impermeable iron pan at a depth of 40 to 50 inches. These soils constitute 217 acres (3%) on PAX. They are not present on WOLF.

ü *(MnA)* - Matapeake Silt Loam, 0 to 2 percent slopes - Some inclusions are underlain by a discontinuous impermeable iron pan at a depth of 50 to 60 inches. These soils constitute approximately 1,699 acres (27%) on PAX and approximately 9.5 acres (3%) on WOLF.

✓ *(MnB2)* - Matapeake Silt Loam, 2 to 5 percent slopes, Moderately Eroded - These have lost some surface layer. Some inclusions are underlain by a discontinuous impermeable iron pan at a depth of 40 to 50 inches. These soils constitute approximately 72 acres (1%) on PAX and approximately 5 acres (1%) on WOLF.

(MnC3) - Matapeake Silt Loam, 5 to 10 percent slopes, Severely Eroded - These soils are found on uplands and in some isolated lower terraces and have lost most of the original surface layer. Deep gullies have formed in places. Some inclusions are underlain by a discontinuous impermeable iron pan, some of which have been exposed. These soils constitute approximately 68 acres (1%) on PAX and approximately 5 acres (1%) on WOLF.

Mattapex - These are described as deep, moderately well-drained soils found on level to moderately sloping wetlands in slightly elevated areas bordering major rivers. They formed in silty deposits underlain by older, coarser sediments. The water table is seasonally high. These soils constitute approximately 373 acres (6%) on PAX and approximately 195 acres (23%) on WOLF.

✓ *(MtA)* - Mattapex Fine Sandy Loam, 0 to 2 percent slopes - Some inclusions are underlain by a substratum of clay or clay loam at about 48 inches depth. Though they are not present on PAX, these soils constitute 47 acres (5%) on WOLF.

✓ *(MtB2)* - Mattapex Fine Sandy Loam, 2 to 5 percent slopes, Moderately Eroded - These soils have a seasonal, moderately high water table. Some inclusions are underlain by a substratum of clay or clay loam at about 48 inches depth. Though they are not present on PAX, these soils constitute approximately 63 acres (7%) on WOLF.

✓ *(MuA)* - Mattapex Silt Loam, 0 to 2 percent slopes - Some inclusions are underlain by a substratum of clay or clay loam at about 48 inches depth. These soils constitute approximately 360 acres (6%) on PAX and 78 acres (9%) on WOLF.

✓ *(MuB2)* - Mattapex Silt Loam, 2 to 5 percent slopes, Moderately Eroded - These soils have a seasonal, moderately high water table and, in places, shallow gullies have formed. Some inclusions are actually somewhat steeper than 5 percent and are severely eroded. These soils constitute approximately 7 acres (0.1%) on PAX and 2 acres (0.2%) on WOLF.

¶ *(MuC2)* - Mattapex Silt Loam, 5 to 10 percent slopes, Moderately Eroded - These soils have a seasonal, moderately high water table. These soils constitute approximately 5 acres (0.1%) on PAX and approximately 5 acres (1%) on WOLF.

✓¶ *Othello* - This series consists of deep, poorly drained soils found on nearly level, low terraces adjacent to major rivers. These soils formed in silty deposits that are underlain by older sediments. The water table is seasonally high during winter and early spring, and the soils are wet for long periods of time. These soils constitute approximately 243 acres (4%) on PAX and 579 acres (68%) on WOLF.

(On) - Othello Fine Sandy Loam - The water table is at or near the surface for long periods, and some areas are seasonally ponded. Though they are not present on PAX, these soils constitute approximately 225 acres (26%) on WOLF.

(Ot) - Othello Silt Loam - The water table is at or near the surface for long periods, and some areas are seasonally ponded. This soil type is not as easily drained or worked as On. These soils constitute approximately 243 acres (4%) on PAX and approximately 354 acres (42%) on WOLF.

¶ *Rumford* - This series consists of deep, somewhat excessively drained soils found on level to moderately sloping uplands. These soils formed in stratified, sandy marine deposits containing small amounts of silt and clay and variable amounts of fine gravel.

(RuB) - Rumford Loamy Sand, 0 to 5 percent slopes - The surface layer of this soil type contains a considerable amount of medium and coarse sand. It is somewhat droughty in

dry seasons. Some inclusions have a thin surface layer where plowing has revealed some subsoil materials. These soils constitute approximately 12 acres (0.2%) on PAX, but are not present on WOLF.

Sassafras - This series consists of deep, well-drained soils found on nearly level to strongly sloping uplands and lower terraces bordering major rivers. These soils formed in loose deposits of loamy and sandy sediment of marine and alluvial origin. These soils constitute approximately 68 acres (1%) on PAX and approximately 21 acres (2%) on WOLF.

✓ *(SaA)* - Sassafras Sandy Loam, 0 to 2 percent slopes - Some inclusions are underlain by a discontinuous iron pan. Though they are not present on PAX, these soils constitute 3 acres (0.3%) on WOLF.

✓ *(SaB2)* - Sassafras Sandy Loam, 2 to 5 percent slopes, Moderately Eroded - These soils have a thin surface layer often exposed by plowing. Some inclusions are severely eroded with shallow gullies or are underlain by a discontinuous iron pan. These soils constitute approximately 38 acres (<1%) on PAX and approximately 18 acres (2%) on WOLF.

¶ *(SaC2)* - Sassafras Sandy Loam, 5 to 10 percent slopes, Moderately Eroded - Plowing exposes this soil type's subsoil material, creating a spotty appearance. Some inclusions have a loam surface area or are intermixed with Chillum loam. These soils constitute approximately 26 acres (<1%) on PAX. They are not present on WOLF.

(SaC3) - Sassafras Sandy Loam, 5 to 10 percent slopes, Severely Eroded - Plowing exposes the subsoil material of this soil, creating a spotty appearance. These soils constitute approximately 4 acres (0.07%) on PAX. They are not present on WOLF.

❁ ☸ *Tidal Marsh (Tm)* - This series consists of many small areas and a few larger, level areas that are periodically covered by tidal water from bays or tidal rivers. The water ranges from almost fresh to strongly brackish, and the soils range from sand to clay. In places the soil may be peaty or mucky. These soils constitute approximately 137 acres (2%) on PAX and approximately 20 acres (2%) on WOLF.

Due to the past grading practices and intermixing, cutting and filling operations, it is important to obtain site-specific soils data prior to drawing any conclusions regarding the properties and restrictions of particular portions on the Station (GMR III.1/SMR III.3). The NAS GIS soils data is the best source for this information.

6.2 Soil Types

6.2.1 Restrictive Soils ☸

The following soil types should be considered restrictive for development purposes on the Station based on their physical characteristics: Alluvial (*Ad*), Beach, Bibb, Caroline (*CaD2*, *CaD3*), Croom, Evesboro-Westphalia, Gravel Pits, Othello, and Tidal Marsh. Maps III-14 and III-15 in Annex III-B show the restrictive soils for PAX and WOLF, respectively.

6.2.2 Hydric Soils ⊛

The following soil types, which are found on the Complex (Maps III-14 and III-15 in Annex III-B), are considered to be hydric in St. Mary's County by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS): Alluvial Land (*Ad*), Beach (*Be*) Bibb (*Bm*), Elkton (*Ek*), Othello (*On*, *Ot*), and Tidal Marsh[2]. The list of hydric soils is continually updated based on computer modeling and additional studies on soil characteristics of individual mapping units and soils series.

6.2.3 Prime and Unique Farmland Soils

The Farmland Protection Policy Act (FPPA) requires the identification and protection of the most important farmland soils of the nation - those with highest use and value to society should be for food production rather than development or some other use. Two classes of soils are categorized -- prime farmland soils (of national importance) and unique farmland soils (of statewide importance). Maps III-14 and III-15 in Annex III-B give the locations of these soils on PAX and WOLF, respectively.

In early 2011, the installation Environmental Division worked with the USDA Natural Resources Conservation Service to formally complete Farmland Conversion Impact Rating reviews for soils at PAX and WOLF. Each property scored below the threshold for which protection is required. Therefore, installation soils (and projects that impact them) are not subject to FPPA. As a result, while conversion of prime farmland soils will still be avoided to the extent possible, these impacts (in and of themselves) no longer trigger the OPNAV 5090.1 (series) requirement for a NEPA Environmental Assessment (EA).

6.2.3.1 Prime Soils ✓

The USDA produces a list of soils that are considered nationally important for agriculture. These are known as prime farmland soils and are classified based on a combination of physical and chemical characteristics that are superior for the maintenance of sustained high yields of food, feed, forage, fiber, and oilseed crops. These lands do not necessarily have to be in agriculture; they are best thought of as **potential** prime farmland if in some use other than developed land or open water. These soils include the following, all of which are present on the Station: Caroline (*CaB2*); Chillum (*ChB2*); Matapeake (*MmB2*, *MnA*, *MnB2*); Mattapex (*MtA*, *MtB2*, *MuA*, *MuB2*); Othello (*On*, *Ot*), if drained; and Sassafras (*SaA*, *SaB2*).

6.2.3.2 Unique Soils ¶

The State of Maryland also produces a list of soils that are considered important in the state. Of these "Soils of Statewide Importance," the following are found on the Station: Beltsville (*BlA*, *BlB2*, *BlC2*), Caroline (*CaC2*), Chillum (*ChC2*), Keyport, Mattapex (*MuC2*), Othello, Rumford, and Sassafras (*SaC2*).

[2] Source: NRCS Soil Data Access (SDA) Hydric Soils List, 2022, online at: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1316620.html; St. Mary's County, MD soils list from 'Maryland' link.

7.0 Wetlands, Floodplains and Surface Waters

These land features contain aquatic resources as well as the resources that are transitional between aquatic and terrestrial habitat types. They are important for maintaining the water quality of the Chesapeake Bay, as well as for protecting aquatic habitats and biodiversity.

7.1 Wetlands

Wetlands are generally considered to be ecosystems that are transitional zones between terrestrial and aquatic ecosystems, and are flooded and/or saturated near the ground surface for extended periods. Physical, chemical, and biological features indicative of hydrological conditions characterize these areas.

Tidal shores, vegetated and unvegetated near-shore habitats, open tidal waters, and wetlands are regulated by the U.S. Army Corps of Engineers (USACE) under Section 10 of the Rivers and Harbors Act of 1899 (33 United States Code [U.S.C.] 401 and 403) and Sections 401, 402, and 404 of the Clean Water Act of 1972, as amended in 1977 (CWA)(33 U.S.C. 1344). Section 10 applies to tidal waters, while Sections 401, 402, and 404 apply to those areas that meet the federal regulatory definition of "Waters of the United States" (33 CFR 320 et seq. and 40 CFR 230 and 50 CFR 400-600). Additionally, the Maryland Department of the Environment (MDE) serves as the State's Section 401 Certification processer for both tidal and nontidal impacts permitted under Section 404 of the CWA. This is legislated through Environment Article Title 5, Subtitle 5-901 through 5-911; Annotated Code of Maryland; Code of Maryland Regulations (COMAR) 26.23.

The discharge of dredged or fill material within regulated areas (including areas identified as wetlands) requires a permit prior to action. Wetlands are defined by the USACE and EPA as: *"...those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and 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.*"

The first large-scale wetland delineations for PAX and WOLF were performed with data collection between June and October 1995. The field delineations used the techniques for Routine Determinations described in the 1987 Corps of Engineers (COE) Wetland Delineation Manual (Environmental Laboratory Technical Report Y-87-1). Mapping produced is preliminary in nature; that is, the boundaries were not verified as accurate by the USACE. Field delineations were developed using the regulatory definitions and delineation techniques approved for use in 1995 as listed in the Public Notices from the USACE dated September 26, 1990; October 4, 1990; and September 4, 1991.

In order for an area to be classified as a wetland under this methodology, it must manifest characteristics and positive field indicators of (1) Hydric Soils, (2) a Prevalence of Hydrophytic Vegetation, and (3) Indicators of Wetland Hydrology.

This technique produced an unverified wetland delineation that was a conservative approximation of jurisdictional boundaries that probably included some upland (unregulated) areas. This preliminary delineation should provide helpful information to planners and contractors who are

seeking new construction sites, or expanding existing sites near shorelines, waterways and in broad, flat areas. However, this delineation information should only be used in the planning phase. These delineations were not flagged or surveyed in the field; therefore, they should be considered rough estimates. Additionally, the data is outdated, and regulatory procedures have changed significantly since 1995. If a project is planned near a wetland system, the wetlands in the immediate area should be delineated, flagged and survey-located for accuracy. If construction is planned, and impacts to jurisdictional resources including shores, beaches, waterways, ponds, or wetlands are anticipated, an application must then be submitted to the USACE for a Jurisdictional Determination (JD) and the appropriate permit prior to initiating any construction activity that involves land disturbance (GMR III.2). In 1996, U.S. Army Corps of Engineers issued the first Maryland State Programmatic General Permit (MDSPGP). Pursuant to Section 404e of the CWA and Section 10 of the Rivers and Harbors Act, the U.S. Army Corps has the authority to issue general permits, which can operate in conjunction with a state regulatory program. The MDSPGP delegates the authority for specified projects and project thresholds to the state for issuance. In Maryland, 40 Nationwide Permits (NWP) are suspended in Maryland while the MDSPGP is in effect. The MDSPGP is reviewed every 5 years in conjunction with the reissuance of the NWPs. The MDSPGP-6 was just issued by the U.S. Army Corps and expires September 30, 2026.

In December 2008, the Baltimore District USACE issued a special public notice (08-77) announcing the publication and one-year trial implementation period of the Atlantic and Gulf Coastal Plain Interim Regional Supplement to the 1987 Wetland Delineation Manual (Supplement). Effective January 3, 2009, the Supplement must be applied to all wetland delineations conducted within the Atlantic and Gulf Coastal Plain Region. The Atlantic and Gulf Coastal Plain Region includes the portions of Maryland that fall within the Inner Coastal Plain, Northern Coastal Plain, and Outer Coastal Plain Land Resource Regions (LRR).

According to the USACE, the intent of the Supplement is to improve the accuracy of delineations conducted in the region and it is not intended to greatly expand the boundaries of jurisdiction. However, some of the revisions and new indicators included in the Supplement have the potential to significantly affect wetland delineations by potentially increasing the areal extent of jurisdictional wetlands. The most significant of these changes include the deletion of FAC-wetland indicator status plants as non hydrophytes, changes in field indicators of wetland hydrology, and mandatory implementation of field indicators of hydric soils as identified using the National Technical Committee for Hydric Soils (NTCHS) *Field Indicators of Hydric Soils in the United States*.

Several broad wetland types were identified on PAX and WOLF in 1995, as part of the original INRMP preparation effort. These included Forested Wetlands, Scrub/Shrub Wetlands, Saline Marshes, Freshwater Tidal Marshes, Nontidal Marshes, and Open Water/Emergent Wetlands. In the years since, wetland delineations have categorized somewhat differently, as seen in Table III-1 below. Through a series of delineations conducted from 2008-2011, all of WOLF has been surveyed for wetlands. Due to it's significantly larger size, however, delineations at PAX are generally only conducted as potential development sites are identified. These data are displayed in Maps III-9 and III-11 in Annex III-B.

People have influenced many of the wetland areas on NAS – directly, through filling and dredging activities; and indirectly, by erosion and sedimentation, stormwater and drainage management, ditching, and other hydrological modifications.

Table III-1. Acreage of Wetlands at PAX

PAX	NUMBER OF ACRES
Palustrine	284
Estuarine	145.8
Riverine	48
uncategorized	85

Table III-2. Acreage of Wetlands at WOLF

WOLF	NUMBER OF ACRES
Forested Wetlands	78.71
Scrub/Shrub Wetlands	11.39
Saline Marshes	13.63
Freshwater Tidal Marshes	0
Nontidal Marshes	42.88
Open Water/Emergent Wetlands	20.70

7.2 Floodplains

A floodplain is defined as the flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the **floodway**, which consists of the stream channel and adjacent areas that carry flood flows, and the **flood fringe**, which are areas covered by the flood, but which do not experience a strong current. The extent of a floodplain is usually expressed as the elevation equal to the return year interval. Most important of these elevations is the 100-year floodplain -- the area that will be inundated during a storm with an occurrence frequency of once every 100 years. These floodplain areas are very important in providing protection to property, water quality, and wildlife habitat. The area within a 100-year floodplain is typically associated with federal mandates for their regulation.

The 100-year regulatory floodplains have been mapped along the major water bodies of PAX and WOLF (Maps III-16 and III-17 in Annex III-B), including Patuxent River, St. Mary's River, Chesapeake Bay, Pine Hill Run, Harper's Creek, Pearson Creek, Goose Creek, St. Inigoes Creek, and Molls Cove. Minor floodplains also occur along other permanent and temporary water bodies and watercourses.

As the soils in these floodplain areas are typically alluvial and are extremely dynamic, development is restricted. Detailed floodplain mapping should be verified on a site-specific basis prior to implementing any type of land disturbing activity (GMR III.3).

7.3 Open Waters

Major bodies of open water occur along NAS boundaries and minor bodies of open water occur on Station (Maps III-9 and III-11 in Annex III-B). These important aquatic resources at PAX include: Patuxent River, Chesapeake Bay, Pine Hill Run, Goose Creek, Pearson Creek, Harper's Creek, and the six freshwater ponds. These open water areas range from brackish to freshwater systems and support a variety of fish and wildlife resources.

There are also major bodies of open water that occur along the boundaries of WOLF. These waters include the St. Mary's River, St. Inigoes Creek, and Molls Cove. The Chapel Cove in the area of Chapel Field has opened and closed over time, resulting in a brackish environment that is closed to the tide most of the time. Langley Hollow, Priest's Inlet, and Fort Point Cove are all tidal areas. These water bodies are adjacent to the shoreline and at times have been fed by the St. Mary's River and St. Inigoes Creek. There are also two freshwater ponds (Finger Pond and Fishing Pond) on the property.

Calvert Pond – one of several hydrological features at PAX.

7.4 Streams

PAX and WOLF contain many miles of intermittent and perennial headwater streams (Maps III-9 and III-11 in Annex III-B). Streams usually occupy well-defined channels where topographic gradients are steeper or where channels have been intentionally dredged. In level, low-lying areas, streams often occupy split or braided channels. Those streams occurring in densely forested areas have not all been detected by photo interpretation nor have they been definitively mapped at NAS.

The flow regime (e.g., ephemeral, intermittent and perennial) of a stream often needs to be determined by quantitative methods for regulatory purposes. Some ditches, particularly those excavated for drainage purposes, also require flow regime determinations for regulatory purposes. Impacts to streams above a minor threshold typically require mitigation; therefore assessments to determine actual flow type in channels may be required for future projects at NAS.

8.0 Vegetative Communities

There are several general types of vegetative communities or habitats found on PAX and WOLF. These include Forests, Agricultural Fields, Old Fields, Marshes and Other Aquatic Communities, and Scrub/Shrub Areas. Table III-C-3 in Annex III-C lists the abundant and common plant species found in these habitats. These general vegetative types can be further subdivided into more specific vegetation categories, such as Rare, Threatened and Endangered Plants; and Non-native and Invasive Plants.

It is worth noting here that the plant communities on Station are of a dynamic nature – changes come about through inadvertent introduction of non-indigenous species as well as through the natural decline of others, due to vegetative succession. The NAS NR Program continually updates its understanding of plants now known to be present, as well as those claimed to occur here based on past inventories and reports for which no vouchers were collected or retained. A list of all plants known to occur on NAS is found in Table C-8 in the Biodiversity Database in Appendix C.

8.1 Forested Areas

A forest is defined as a biological community dominated by trees and other woody plants. Forested areas comprise 2,346 acres on PAX and 215 acres on WOLF. Several specific forest types are found on PAX and WOLF. These types are further divided according to a variety of characteristics, such as size, species composition, canopy closure, and height (Maps III-18 and III-19 in Annex III-B).

8.2 Agricultural Fields

Agricultural fields represent tilled and intensively managed lands for the production of agricultural commodities such as corn (*Zea* spp.), Soybeans (*Glycine max*), wheat (*Triticum* spp.), Barley (*Hordeum vulgare L.*), and Grain Sorghum (*Sorghum bicolor*).

These comprise 390 acres on PAX and 122 acres on WOLF. During periods of active farming, an agricultural crop dominates each of these areas with some annual and perennial weed species present. When not in production, cover crops are used in the fields. When left fallow, these fields can support dense herbaceous growth of species typical of young successional (seral) stages, such as crabgrass (*Digitaria* spp.), ragweed (*Ambrosia* spp.), asters (*Aster* spp.), and Yellow Foxtail (*Setaria lutescens*) (Maps III-20 and III-21 in Annex III-B).

These parcels are very important to the maintenance of desirable vegetation surrounding the airfield and are described further in Chapter V.

8.3 Old Fields

Old field areas are found primarily as linear features associated with agriculture and abandoned wildlife food patch development areas, utility rights-of-way, and recent timber clearcuts. Perennial grasses and composites, with legumes (Fabaceae family) and sedges (Cyperaceae family) as associates, dominate these disturbed areas. These cover types comprise 238 acres on PAX (Map III-22 in Annex III-B). There are no old fields on WOLF.

8.4 Marshes and Other Aquatic Communities

Both tidal and nontidal marsh systems occur on PAX and WOLF (Maps III-9 and III-11 in Annex III-B). Nontidal marsh systems, associated mostly with freshwater ponds and stream systems, comprise 25 acres on PAX and 43 acres on WOLF. Tidal marsh systems are associated with drowned stream systems that now rely on the ebb and flow of the Chesapeake Bay tidal cycle. The tidal marsh areas comprise 63 acres on PAX, mainly along Pearson Creek, Goose Creek, Harper's Creek, and Pine Hill Run. On WOLF, tidal marshes comprise approximately 14 acres along Chapel Cove, Langley Hollow, Priest's Inlet, and Fort Point Cove. These marshes are also classified as wetlands, and, as such, are also described in Section 7.1 of this chapter.

Aquatic vegetation is associated, to some degree, with all of the aquatic resources on PAX and WOLF, as described in Section 7.0 of this chapter. This vegetation type ranges from submerged aquatic vegetation (SAV) to emergent wetlands vegetation, based on the depth and duration of flooding.

8.5 Scrub/Shrub Areas

Scrub/shrub areas have some herbaceous vegetation like that occurring in old field communities, but mostly shrubs and young trees. This successional cover type represents an advanced old field and, without management, will naturally progress into a young woodland cover type. Scrub/shrub communities comprise 931 acres on PAX and 19 acres on WOLF (Maps III-23 and III-24 in Annex III-B).

8.6 Rare, Threatened and Endangered Plants

No federally listed threatened or endangered plant species are known to occur on PAX or NAS WOLF, but several state-listed species have been found. Maps III-25 and III-26 in Annex III-B illustrate the locations in which the state-listed species have been found, and Tables III-C-4 and III-C-5 in Annex III-C list these species for PAX and WOLF, respectively. Refer to Chapter 8 (Wildlife Management), Section 9.2 (Species Management) for a more complete discussion on rare, threatened and endangered species (inclusive of both flora and fauna), as well as species at risk (SAR) and species of concern (SOC). An effort should be made to continue to identify state and federally listed plant species and map their locations in the Station GIS as they are found (SMR III.4).

Currently, threatened and endangered surveys take place on an as-needed basis and potential project sites are investigated as part of the environmental review process. Sufficient details of this sensitive data will be made available to the Station PWD Planning Checklist to prevent impacts to rare, threatened, and endangered species.

8.7 Non-Native and Invasive Plants

Non-native plants are those introduced by humans to locations where they were not previously found. Not all non-native plants are invasive. Invasive plants can be detrimental to the structure and function of natural ecosystems, and have the potential to rapidly reproduce, spread, and eventually displace more desirable native vegetation, resulting in a significant loss of biodiversity. The milder winters associated with climate change are likely to favor the spread of existing invasive species, and aid in the establishment of new ones.

Kudzu (Pueraria lobata) – a once-common invasive plant species now kept in check at PAX.

Invasive species at PAX have always been considered a significant management problem worthy of further attention. Colonies and populations of non-native (alien) and invasive plant species have been identified in several priority areas. Several areas on the Station have also been identified as having a dominant plant cover of invasive species, but comprehensive or systematic surveys had been lacking.

In 2001 and 2004, NAS completed studies to document the presence and distribution of nuisance and invasive species and to provide management recommendations for their control in response to Executive Order 13112 (ESA, Inc, 2001; 2004). In 2007-2008, surveys were conducted for the presence of non-native, invasive plant species at three areas of the Station: WOLF (854 acres), NRC SOL (272 acres), and approximately 297 acres in specified areas of PAX. The results of the surveys were documented in 2009. Also included in the 2009 survey results were the results of the 2001 and 2004 studies. Areas supporting nuisance and invasive plants that were damaging native habitats or native species were identified, mapped and photographed. In 2019, an invasive species survey and management plan updated previous efforts. The comprehensive survey of non-native, invasive plant species occurred in 2018 and followed the same methodology as the 2009 plan. The 2019 plan focused on assessing distribution of invasive species within the areas previously surveyed and areas treated for invasive species. Table III-3 lists all common nuisance and invasive plant species encountered on PAX and WOLF during these surveys. Since NRC SOL has its own separate INRMP those results are not included here. The invasive species are mapped in Map III-27 and III-28 in Annex III-B for PAX and WOLF, respectively.

The NR Program should continue to identify, locate and map all nuisance or invasive plant species at all Station properties. Areas having invasive species should be resurveyed every 5 to 10 years (Project III.1).

Three of these invasive species -- Porcelain-berry (*Ampelopsis brevipendunculata*), English Ivy (*Hedera helix*), and Kudzu (*Pueraria Montana*) -- are major problems in certain forested and forest edge areas. These fast-growing, high-climbing, woody vines quickly cover and kill trees and other slower growing vegetation types. While most of the Kudzu on base has been eradicated, the

historic sites must be monitored for potential recurrence. Another invasive herbaceous vine, Mile-a-minute (*Polygonum perfoliatum*), is a threat to sensitive communities of herbaceous plants that occur along floodplains, as well as in upland areas.

Japanese Honeysuckle (*Lonicera japonica*) is characterized as a climbing or trailing vine or shrubby herb whose stem freely roots at the nodes. This species is found on disturbed road and forest edges, in hedgerows, and scrubby areas, and is naturalized in many forested landscapes. This species, where abundant, can overwhelm and outcompete native vegetation.

Common Reed (*Phragmites australis*) is a tall, robust grass that spreads mainly through creeping rhizomes and stolons. This species quickly spreads and displaces native vegetation in disturbed areas, especially where soils are wet, such as marshes, ponds, and streams. It typically forms large colonies that quickly become very difficult to control and/or eradicate.

Multiflora Rose (*Rosa multiflora*) and Autumn Olive (*Elaeagnus umbellate*) are shrubs commonly planted in the past to enhance wildlife habitat. These species are common at PAX. Being dispersed by birds, both species tend to be very difficult to control, and near-impossible to eradicate when present in large numbers.

Bradford pear (*Pyrus calleryana*) is a cultivar of the Callery pear that is widely used to landscape residential developments, parking lots and roadsides. The original 'Bradford' cultivar was introduced to Maryland in the early 1900s and had sterile fruits. However, new hybrids, developed to correct the tendency of the tree to split and fall apart under wind and snow events, were not sterile. Bradford pear has escaped plantings and is invading natural habitats in the eastern United States. The NR Program spent several years removing landscape pears and, at some locations, replaced them with other species. Field efforts are also targeting volunteer trees in forested and shrub areas.

Table III-3. Common Invasive Plant Species at PAX and WOLF

Common Name	Scientific Name	State Rank	I-Rank	Location
Tree-of-heaven	*Ailanthus altissima*	2, 3	Med/Low	PAX, WOLF
Mimosa	*Albizia julibrissin*	-	Med/Low	PAX, WOLF
Porcelain-berry	*Ampelopsis brevipendunculata*	2, 3	Med/Low	PAX
Small carpgrass	*Arthraxon hispidus*	-	Med/Low	PAX
Paper mulberry	*Broussonetia payrifera*	-	Insignificant	WOLF
Canadian thistle	*Cirsium arvense*	1, 2, 3	High/Med	PAX
Asiatic dayflower	*Commelina communis*	-	NYA	PAX
Autumn olive	*Elaeagnus umbellate*	2	High	PAX, WOLF
English ivy	*Hedera helix*	2	High/Med	PAX, WOLF
Chinese lespedeza	*Lespedeza cuneata*	-	Medium	PAX, WOLF
Privet	*Ligustrum* spp.	-	High/Med	PAX, WOLF
Japanese honeysuckle	*Lonicera japonica*	2	High/Med	PAX
Bush honeysuckle	*Lonicera* spp.	2	High/Med	PAX

Common Name	Scientific Name	State Rank	I-Rank	Location
Japanese stilt grass	*Microstegium vimineum*	2	High/Med	PAX
White mulberry	*Morus alba*	2	High/Med	WOLF
Princess tree	*Paulownia tomentosa*	-	Med/Low	WOLF
Common reed	*Phragmites australis*	1, 2, 3	High	PAX, WOLF
Bamboo	*Phyllostachys* spp.	2	Med/Low	PAX
Japanese knotweed	*Polygonum cuspidatum*	2	High/Med	PAX
Mile-a-minute	*Polygonum perfoliatum*	2	Medium	PAX
Kudzu	*Pueraria montana*	2, 3	Medium	PAX
Bradford pear	*Pyrus calleryana*	2, 3	Med/Ins.	PAX, WOLF
Multiflora rose	*Rosa multiflora*	2, 3	Med/Low	PAX, WOLF
Wineberry	*Rubus phoenicolasius*	-	Med	PAX, WOLF
Johnson grass	*Sorghum halepense*	1, 2, 3	High/Med	WOLF

Source: Invasive Plant Species Survey and Management Plan for Naval Air Station Patuxent River, Webster Field Annex, and Naval Recreation Center Solomons. July 2019.

State rank code: 1) Currently regulated,
2) Recognized to have negative ecological effects,
3) Recognized to have negative economic impacts on agricultural or natural resources.

Some species of native vegetation have been identified as a potential management concern by virtue of their being an aggressive colonizer of disturbed areas or otherwise damaging to native plants due to density. Examples of this type of plant includes Sweetgum (*Liquidambar styraciflua*), a native deciduous forest tree species. It is usually not considered an invasive species. However, this pioneer tree species was observed to be a common colonizer within pine plantation areas. Sweetgum [and to a lesser extent, Red Maple (*Acer rubrum*)] is often one of the first tree species to establish within recently logged or cleared areas. If not controlled in the pine plantations, it will compete with the pine seedlings and saplings and reduce yields. Black Locust (*Robinia pseudoacacia*), another pioneer species, is particularly problematic in openings and cutover areas where, due to its competitive edge in open sun, tends to get established in high numbers in disturbed sites such as cutover areas, hedgerow edges and old field habitats. Other examples include native grapes (*Vitis* spp.), Trumpet Creeper (*Campsis radicans*), Virginia Creeper (*Parthenocissus quinquefolia*), and greenbriars (*Smilax* spp.).

Additional common, non-native plant species also inhabit the Station. These species, although not all invasive, can displace more desirable native species from the habitats they occupy. This displacement may result in the loss of certain native species that may be important in maintaining biodiversity. The loss of native plant species may also result in the loss of native animal species. Many other, less-common non-native plant species are present in variable numbers on the Station, and most typically in disturbed areas. These are listed in Table III-4.

Based on the studies, invasive plant species at NAS were ranked according to the order in which they may damage, outcompete, or displace native vegetation. In 2001, ten non-native, invasive species were identified that matched these criteria (Environmental Systems Analysis, Inc. [ESA], 2001). In 2004, the number of non-native, invasive species reached 12 (ESA, 2004), and during

the 2009 survey, 18 invasive species were documented at NAS (Geo-Marine Inc., 2009). The 2019 plan documented 13 priority invasive species at NAS (Marstel Day, 2019).

Table III-4. Additional Non-native Invasive Plant Species at NAS

Scientific Name	Common Name
Acer plantanoides	Norway Maple
Achillea millefolium	Yarrow
Albizzia jullibrissin	Mimosa
Bidens Spp.	Sticktights
Brassica Spp.	Mustards
Cardamine hirsuta	Hoary Bittercress
Celatrus orbiculatus	Asiatic Bittersweet
Cirsium vulgare	Bull Thistle
Cyperus esculentus	Chufa
Cynodon dactylon	Bermuda Grass
Daucus carrota	Queen Anne's Lace
Echinochloa crusgalli	Barnyard grass
Equisetum arvense	Field Horsetail
Eragrostis curvula	Weeping Lovegrass
Festuca elatior	Kentucky fescue
Malus angustifolia	Southern Crabapple
Malus pumila	Apple
Plantago lanceolata	Narrow Leaf Plantain
Quercus acutissima	Sawtooth Oak
Salix babylonica	Weeping Willow
Verbascum Thapsus	Mullein
Xanthium strumarium	Cocklebur

8.8 Other Vegetated Areas

There are also many minor vegetative community types such as hedgerows, clearings, lawns, landscaped areas, and a golf course. Discussion of these areas can be found in Chapter 5.

9.0 Fish and Wildlife

Various aquatic and terrestrial habitat types can be found at PAX and WOLF, supporting a variety of fish and wildlife species typical of the Holarctic Atlantic and Gulf Coastal Plain Provinces (terrestrial species) and the Virginian Western Aquatic Realm (aquatic species).

These species include both game and non-game animals that inhabit various vegetative communities or habitat types, such as forest, scrub/shrub, old field, marshes, beaches, open fresh water, and open saline water systems.

Juvenile Red Fox (*Vulpes vulpes*) sit at a den entrance.

Some of the more familiar animals include White-tailed Deer (*Odocoileus virginianus*), Gray Squirrel (*Sciurus carolinensis*), Eastern Cottontail (*Sylvilagus floridanus*), Red Fox (*Vulpes vulpes*), Muskrat (*Ondatra zibethicus*), River Otter (*Lontra canadensis*), Mink (*Mustela vison*), Beaver (*Castor Canadensis*), Northern Bobwhite, Mourning Dove (*Zenada macroura*), and American Woodcock *(Scolopax minor*). Various species of fish, such as bass, sunfish, bluefish, perch, and catfish, can be found in local waters. Additionally, a variety of birds, including songbirds, ducks, geese, raptors, shorebirds, and marsh birds, can be found within the area.

Known terrestrial and aquatic animal species are listed in the Biodiversity Database for NAS Patuxent River Complex (Appendix C).

9.1 Species with Known or Probable Occurrence

Most of the vertebrate species of wildlife at PAX and WOLF, as larger and more conspicuous faunal elements, have been surveyed and are fairly well documented. They include 49 species of mammals, 283 species of birds, 39 species of reptiles, 24 species of amphibians, 24 species of saltwater fishes, and 18 species of freshwater fishes.

Invertebrates at NAS are a relatively understudied group of organisms. Exceptions to this generalization are a few taxonomic insect orders (e.g., *Lepidoptera, Coleoptera, Odonata*, and *Hymenoptera*) which have been documented, as listed in the Biodiversity Database for NAS Patuxent River Complex (Appendix C). Another exception is those species that are commercially or economically important to man, either for food (in the case of shellfish or crabs) or as agricultural and household pests.

9.2 Rare Animal Species

A number of rare species of wildlife, including both state and federally listed threatened or endangered species, have been documented on PAX; however, the occurrence of federally listed species to date have been considered to be transient or vagrant, or were dead strandings (aquatic species). None of these listed species' occurrences (federal or state) seriously impedes successful execution of the military mission. Map III-29 in Annex III-B shows the known rare species'

habitats at PAX. Some are summer breeding season residents, some are seasonal winter visitors, some are migratory transients, some are year-round residents, and others are casual visitors or vagrants from other areas. No occurrence of federally listed wildlife species has been documented for WOLF; however, there are several State-listed animals known to occur there. Tables III-C-6 and III-C-7 in Annex VIII-C list those rare animal species known or likely to occur at PAX and WOLF, as well as those that might possibly occur (but have not been documented). Annex III-D provides an explanation of global and state species ranks and statuses that are relevant to this document. A complete discussion of the rare, threatened and endangered animals can be found in Chapter 8 (Wildlife Management) which includes descriptions of rare, threatened and endangered plants and animals, as well as SARs and SOCs.

10.0 Cultural Resources

Given its location on the Chesapeake Bay, NAS was inhabited by Native Americans for an extended period of time prior to recorded history. It is known from recorded history that Euro-Americans, the first settlers of the Maryland colony, settled in this vicinity by 1634, with a relatively large population by 1642.

The installation's first cultural resources management plan was completed in September 2002 and included as a chapter in the original INRMP. Later, the ICRMP was revised and produced as a separate document containing information on landscape resources at NAS that are of a cultural, historic and architectural nature. The ICRMP was most recently updated in 2018. The following two sections briefly discuss cultural resources at PAX and WOLF.

10.1 Cultural Resources – PAX

During the last half of the seventeenth century, the site that is currently PAX served as the location of important events in the early history of the State of Maryland. Following this, the region settled into agricultural production, with tobacco being the major economic pursuit. Other minor industries that developed in the area prior to establishment of PAX included oystering and fruit growing/packing. Three major farms existed in the area and included 17th century plantations.

Prior to PAX construction, the small community of Pearson existed in the area of the present Navy Exchange gas station. This community consisted of a few residences, a post office, a store, Bell Motor Company automobile dealership, and the Cedar Point Methodist Church (ICRMP, 2011). The locations of Pearson and other historic sites are shown on Map III-30 in Annex III-B.

Numerous surveys have discovered and described various archaeological and architectural resources on PAX. These include prehistoric and historic archaeological sites, 17th to mid-20th century structures, and WWII-era and Cold War-era historic Naval structures. Due to the sensitive nature of archaeologically rich areas, maps of these locations will not be included in this document. Should access to archaeological site maps be required, please contact the Cultural Resources Program manager directly.

10.2 Cultural Resources –WOLF

The area that is now WOLF was first colonized in 1634 by 300 English settlers who founded St. Mary's City. In 1637, the WOLF site was acquired as a headquarters for the Jesuits, who

constructed several manor houses around the property. Two are believed to have been located near the WOLF main gate in an area known as Old Chapel Field. The Priest's House was constructed in the early 1700s to allow for the continuation of religious practice, which was permissible in private homes during this period and prior to the American Revolution. The house, located approximately ½ mile from the entrance to WOLF, played an important role in incidents during the American Revolution and the War of 1812. The St. Ignatius Church, located just outside the WOLF main gate, was built in 1785, and remains one of the oldest Catholic churches in the State of Maryland. Also located off-station is the Tulip Monument, standing just northwest of WOLF, which serves to memorialize the USS TULIP. Map III-31 in Annex III-B shows the locations of these cultural sites.

11.0 Scenic Resources

PAX and WOLF are each located in rural areas with six and three miles of bay/river shoreline, respectively. Along the shoreline, there are extensive areas of native vegetation, moderate elevation changes, and abundant wildlife, all of which provide enjoyable sceneries within the Station. Maps III-32and III-33 in Annex III-B show those areas of PAX and WOLF that offer landscape and wildlife viewing potential, as well as the various recreational areas such as campsites and hiking trails located throughout PAX.

Notable scenic resources at PAX include vistas along the Patuxent River and Chesapeake Bay, drives along several roadways, and numerous natural areas and recreation areas accessible by walking.

The area between the PAX boundary and the eastern side of the West Patuxent River Basin offers views of the scenery from several accessible points along the shoreline. The area between the East Patuxent River Basin and the Chesapeake Bay Basin also offers scenic views. These can be enjoyed by driving along Cedar Point Road from the approach end of Runway 14 to Goose Creek, and along Johnson Road from the vicinity of Runway 32 to the area near Hangar 201.

Along the same route, Cedar Point Road also offers an enjoyable scenery of native vegetation, especially various forest types and an open water/marsh system associated with Goose, Harper's and Pearson Creeks. Other scenic drives include Shaw and Tate Roads between the hunter check station and Buse Road (which offers views of native forests and Holton's Pond), and Cedar Point Road from Gate 2 to the intersection with Tate Road (which offers pleasant views of tree-lined streets and well-landscaped structures).

Sunset at PAX illustrates one of the many available scenic resources.

Other secondary and tertiary roadways within PAX offer scenic views of native vegetation, open water, marshes, and brush lands with the increased potential for wildlife viewing. Various recreational areas such as campsites and hiking trails throughout PAX also offer scenic views and wildlife viewing potential.

Views of St. George Island across the St. Mary's River, vegetated tidal wetlands, and views across St. Inigoes Creek to the red clay cliffs of Dennis Point are the most notable scenic resources at WOLF. In addition, the St. Mary's River offers a pleasing vista in the winter, as it serves as a stopover point for migrating waterfowl.

12.0 Land Use Patterns

The land use patterns of PAX and WOLF are divided into developed, agricultural, and natural lands. The following sections describe these general categories.

12.1 Developed Lands

Developed lands are those lands disturbed by man for the purpose of constructing the airfield and associated support structures. These developed lands comprise approximately 2,534 acres (40%) of PAX and approximately 381 acres (45%) of WOLF.

Developed lands are scattered throughout PAX, with the exception of a large forested area on the southern portion (Map III-34 in Annex III-B). At WOLF, developed lands are concentrated along the northern and western boundaries (Map III-35 in Annex III-B).

12.2 Agricultural Lands

Agricultural lands are those lands that are manipulated by man to produce an agricultural commodity. This does not include commercial forestlands. These agricultural lands comprise

approximately 385 acres (6%) of PAX and 129 acres (14%) of WOLF, as shown on Maps III-21 and III-22 in Annex III-B.

The agricultural areas at PAX are mainly located south of the airfield, and in the area around Pearson and Harper's Creeks north of the airfield. Agricultural areas at WOLF are situated near the runways, in the central portion of the installation.

12.3 Natural Lands

Natural lands are those lands that exhibit, as the dominant cover type, native vegetation communities, including forests, scrub/shrub, old field, open water, and marshes. These natural lands comprise approximately 3,526 acres (56%) of PAX and 316 acres (37%) of WOLF.

The natural lands are scattered throughout NAS and are intermixed with the developed and agricultural areas. Two major areas of natural lands exist on the southern portion of PAX and the southeast portion of WOLF (Maps III-36 and III-37 in Annex IIIB).

13.0 Facilities Development

The areas surrounding PAX and WOLF contain a wide range of transportation, community, and utility facilities that are utilized by NAWC-AD and other tenant activities. Transportation facilities are defined as roads, bus terminals, railroads and airports; community facilities consist of schools, parks, fire protection, health facilities, libraries, and religious facilities; and utility facilities include those which provide services such as water supply, sewage disposal, electricity, and telephone.

Real Estate Ground Lease and Conveyance of Facilities became effective 01 August 2005. With that, DoD leveraged private investment with DoD participation through a Public/Private Venture (PPV) in accordance with DoD Directive 4165.62.

This program conveyed existing housing and ancillary support facilities to Liberty Military Housing, a PPV Limited Liability Company (LLC), on a 50-year business agreement to use a variety of private sector approaches to reconstruct, renovate and manage a current inventory of 744 family housing units. The PPV LLC demolished 414 units and replaced 169 others on DoD land, and constructed an additional 217 units on non-federal property.

The PPV LLC now operates six housing communities - three on PAX, one on off-station DoD property, and two on PPV LLC-owned land. There is also a single unit on NRC Solomons. The neighborhood distribution of the 744 units is as follows:

- Glenn Forrest - 238 units (off base - DoD land);
- Lovell Cove - 169 units (on PAX);
- Carpenter Park - 100 units (on PAX);
- Gold Coast - 20 homes (19 on Pax, 1 on Solomons);
- Columbia Colony - 92 homes (off base - PPV LLC land);
- Challenger Estates - 125 homes (off base - PPV LLC land).

13.1 Transportation Facilities

St. Mary's County, Maryland is traversed by a number of State roads. Route 5 extends in a north-south direction and connects with U.S. Route 301, Interstate Route 95, Interstate Route 495, and other major highways. Route 235, which borders PAX, parallels Route 5 to the north, and is connected to it via Route 246 between Great Mills and Lexington Park. The majority of peak hour traffic in Lexington Park, Maryland, is generated by PAX.

Although the automobile is the primary mode of transportation in the county, bus service to PAX is available from some portions of the surrounding region. In addition, taxi service is available 24 hours a day.

No rail service is currently available in the county, although there is an abandoned rail line that previously connected PAX with Washington, DC. This line also previously connected with the Penn Central tracks at Brandywine in Prince George's County.

In addition to several private airstrips, there is a general aviation airport in St. Mary's County that leases hangar and tie-down spaces for privately owned aircraft. This airport also houses a charter service, and may, in the future, offer scheduled airline flights. Civilian passenger service is available at nearby Ronald Reagan National, Dulles International, and Baltimore Washington International airports.

13.2 Community Facilities

St. Mary's County public school system maintains (as of the 2021-2022 school year) 18 elementary, 1 public charter, 4 middle, and 3 high schools, as well as several other educational program venues for approximately 17,480 students. The system also supports a career and technical center; a science, technology, engineering and mathematics center; a finance academy; an adult education center; and, most recently, the Fairlead Academy for gifted students. There are also several private secondary and high schools serving the county.

Higher education facilities within the region include Saint Mary's College and College of Southern Maryland, with a new Academic Center. Within a 100-mile radius of NAS, there are also at least 50 accredited institutions of higher education and seven universities. Several higher education programs are also offered to Navy personnel through Florida Institute of Technology, Embry Riddle Aeronautical University, University of Tennessee, and University of Maryland.

St. Mary's County maintains a variety of public and private parks as well as school recreation areas that are generally available to the public. Many parks and recreation areas are also available on PAX for use by Navy personnel.

Sixteen volunteer fire companies handle fire protection in St. Mary's County. Additionally, a military fire department based at PAX and WOLF provides support to the county on a reciprocal basis.

Public health facilities are located in St. Mary's County, Maryland, as well as a county hospital, a day care and development center for the intellectually disabled, and a county nursing home. PAX

also contains the Naval Clinic which provides limited medical care, as well as a dental clinic, family service center, day camp, child development center, and Red Cross facility.

There are approximately 81 religious congregations located in St. Mary's County, representing many denominations. A chapel on PAX provides daily Roman Catholic masses, hearing of confessions, a general Protestant service, Christian doctrine classes, religious and marital counseling, and Bible studies. The chapel is also available for weddings, baptisms, confirmations, and other religious ceremonies.

13.3 Utilities

Approximately 50% of the county's water users obtain potable water from on-site wells. The remaining supply comes from small private systems in individual communities as well as the Leonardtown and Lexington Park public systems.

Water supply on PAX and WOLF is handled by the NAS Public Works Department (PWD), which operates and maintains several Navy-owned wells and storage facilities, through a private contractor.

A substantial amount of development within St. Mary's County utilizes individual, on-lot septic systems for sewage disposal. Major central sewage disposal systems service Lexington Park and Leonardtown. Sewage from PAX is treated at the Pine Hill Run Wastewater Treatment Plant, which is operated by the St. Mary's County Metropolitan Commission. At present, PAX retains 20% of the wastewater treatment capacity at this plant. WOLF has a Navy Owned Treatment Works (NOTW), upgraded in April 2011, for enhanced nutrient removal, used for wastewater management at that property.

Electrical utilities were privatized on 01 October 2009. Electrical power is provided to the area by the Southern Maryland Electric Cooperative (SMECO) and by Potomac Edison Power Company. For PAX and WOLF, electrical power is provided only by SMECO. Also, electrical maintenance and distribution at NAS is conducted by SMECO as a result of the recent privatization of this utility.

Telephone service in the area as well as at PAX and WOLF is provided by Verizon Communications.

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ANNEX III-A

FIGURE

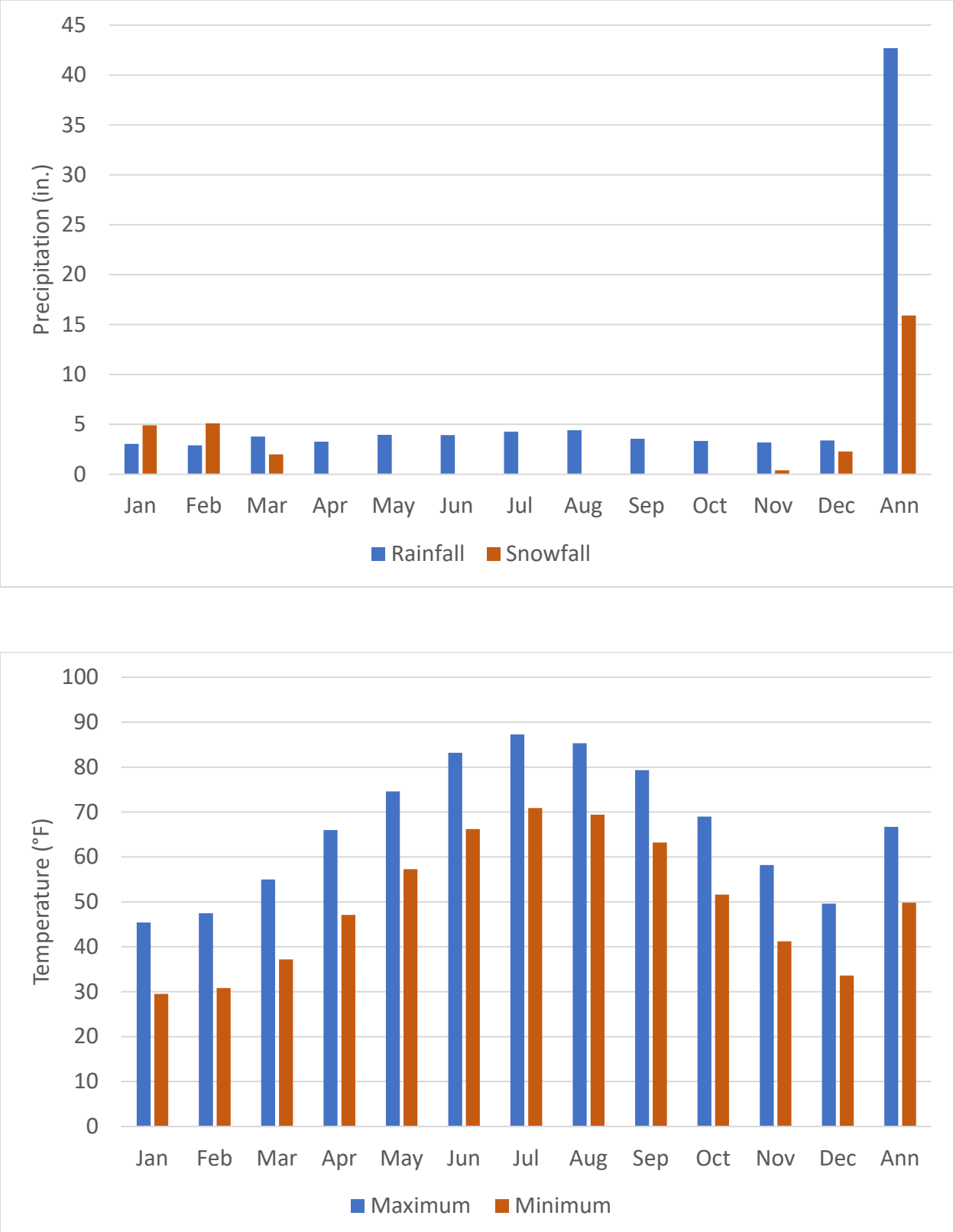
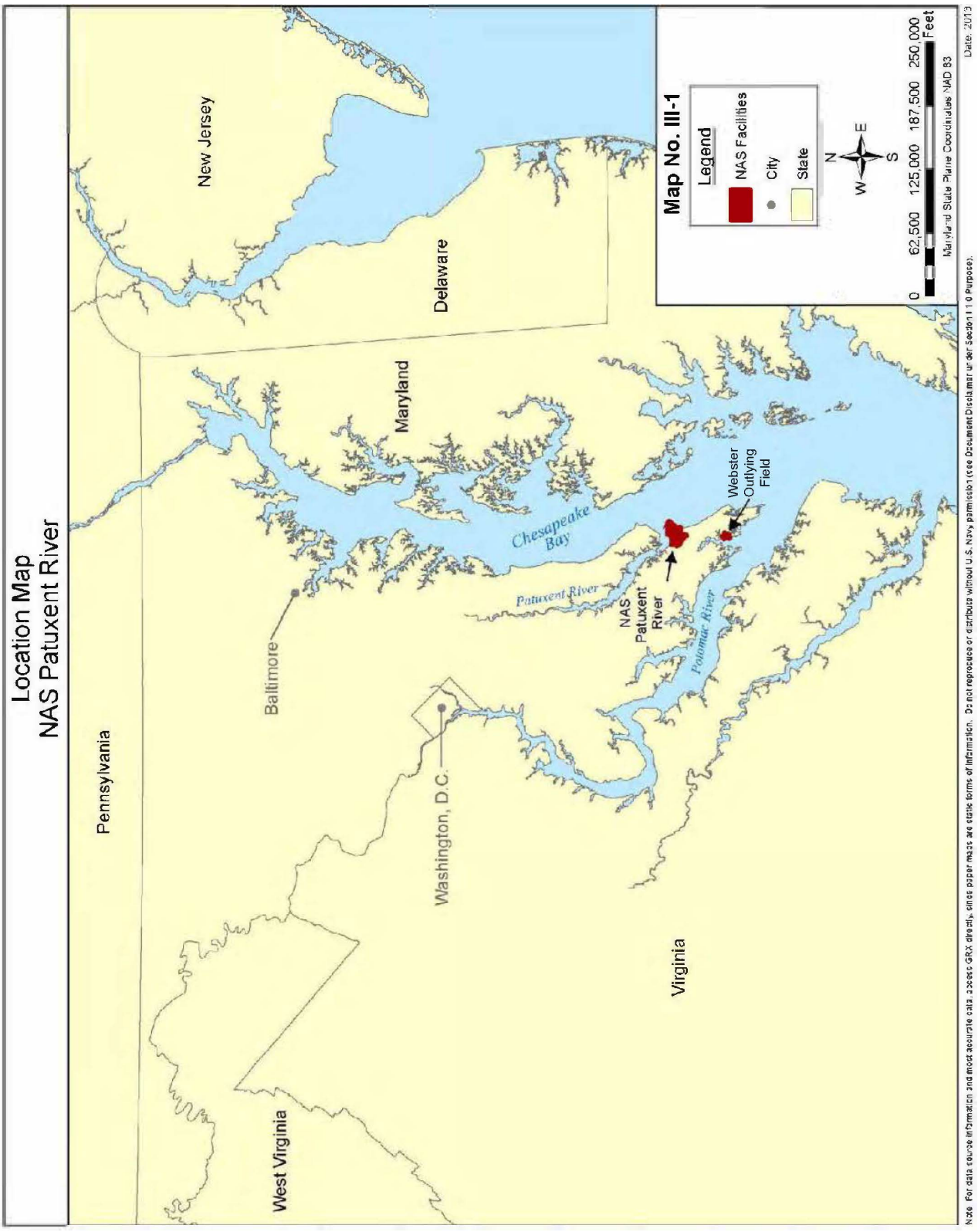
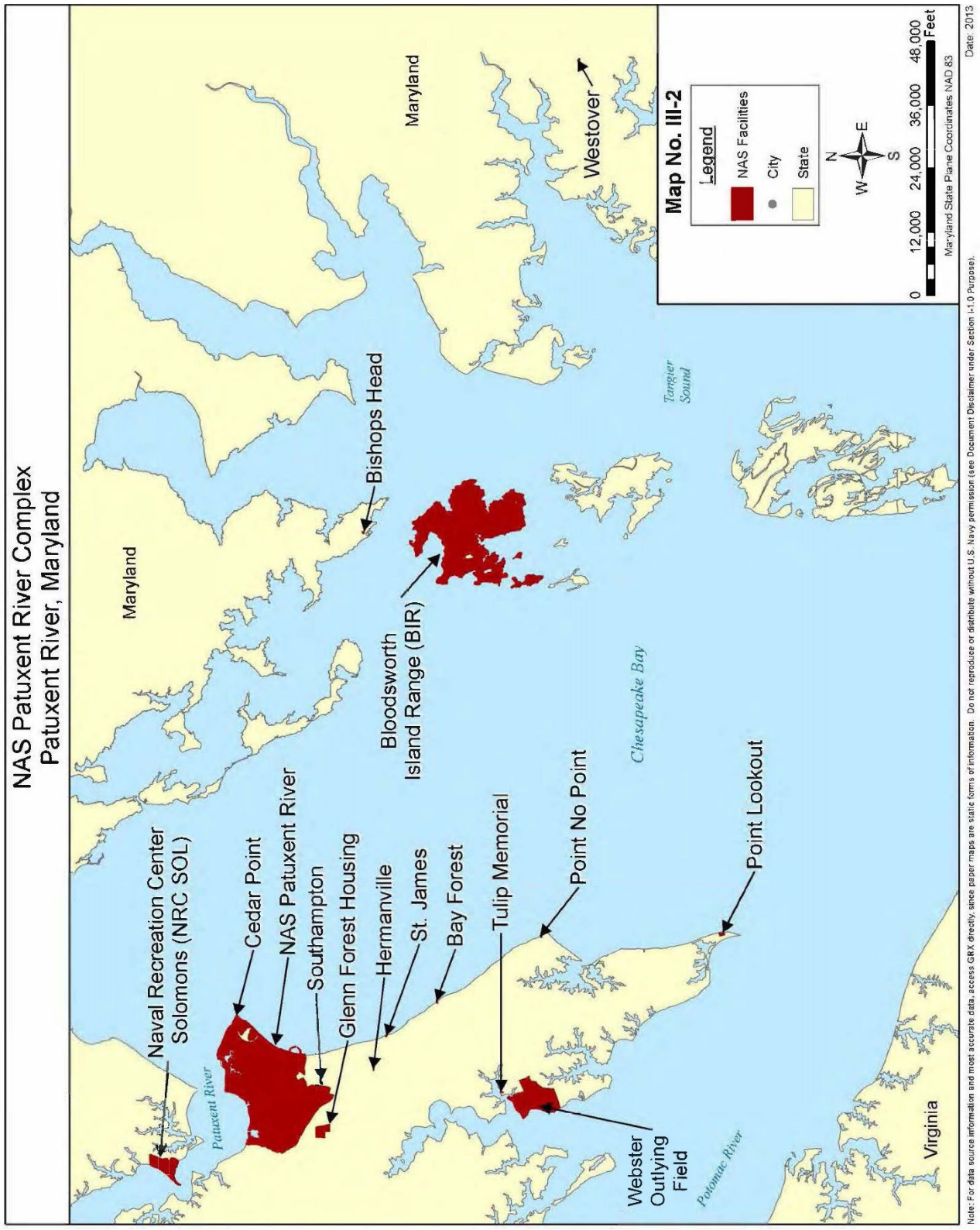


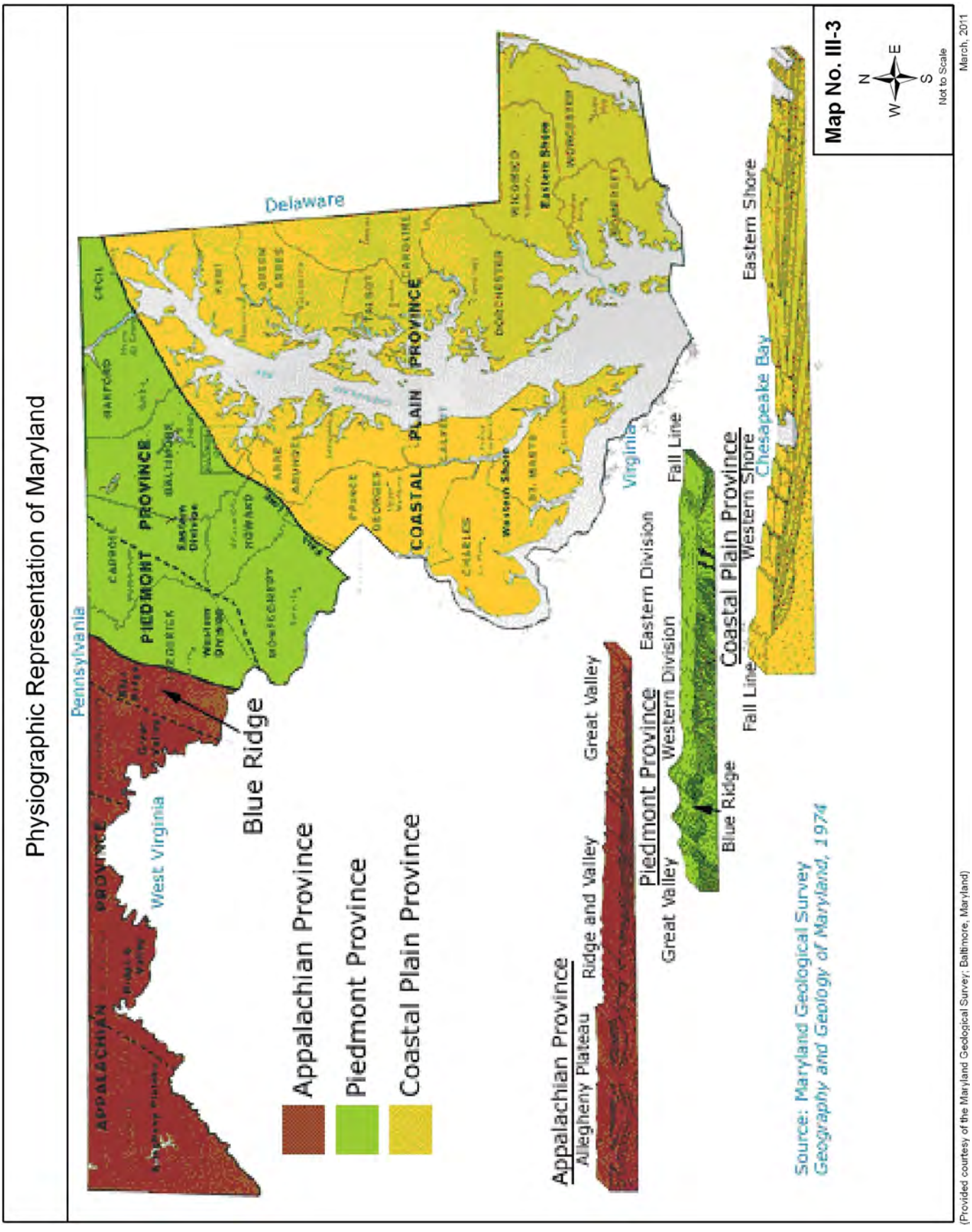
Figure III-1. Average Monthly Climate Data from 1991 to 2020 (NRCC 2023)

ANNEX III-B

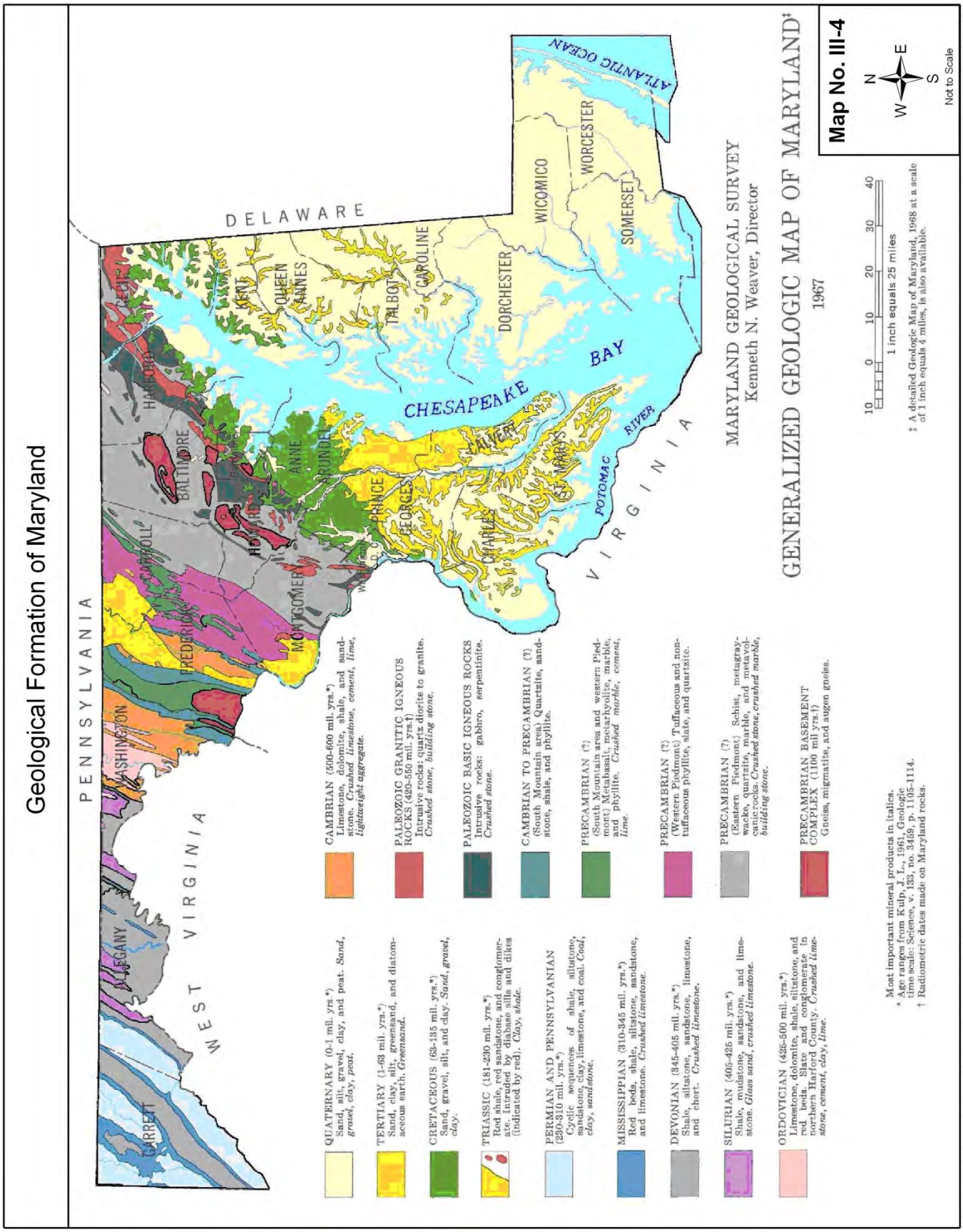
MAPS


Location Map
NAS Patuxent River
Map No. III-1
Legend
NAS Facilities
City
State
N
W
E
S
0
62,500
125,000
187,500
250,000
Feet
Maryland State Plane Coordinates NAD 83
New Jersey
Delaware
Maryland
Pennsylvania
West Virginia
Virginia
Baltimore
Washington, D.C.
Chesapeake Bay
Patuxent River
Potomac River
NAS Patuxent River
Webster Outlying Field


NAS Patuxent River Complex
Patuxent River, Maryland
Maryland
Maryland
Virginia
Naval Recreation Center Solomons (NRC SOL)
Cedar Point
NAS Patuxent River
Southampton
Glenn Forest Housing
Hermanville
St. James
Bay Forest
Tulip Memorial
Point No Point
Point Lookout
Bloodsworth Island Range (BIR)
Bishops Head
Westover
Webster Outlying Field
Patuxent River
Potomac River
Chesapeake Bay
Tangier Sound
Map No. III-2
Legend
NAS Facilities
City
State
N
W
E
S
0
12,000
24,000
36,000
48,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2013
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).

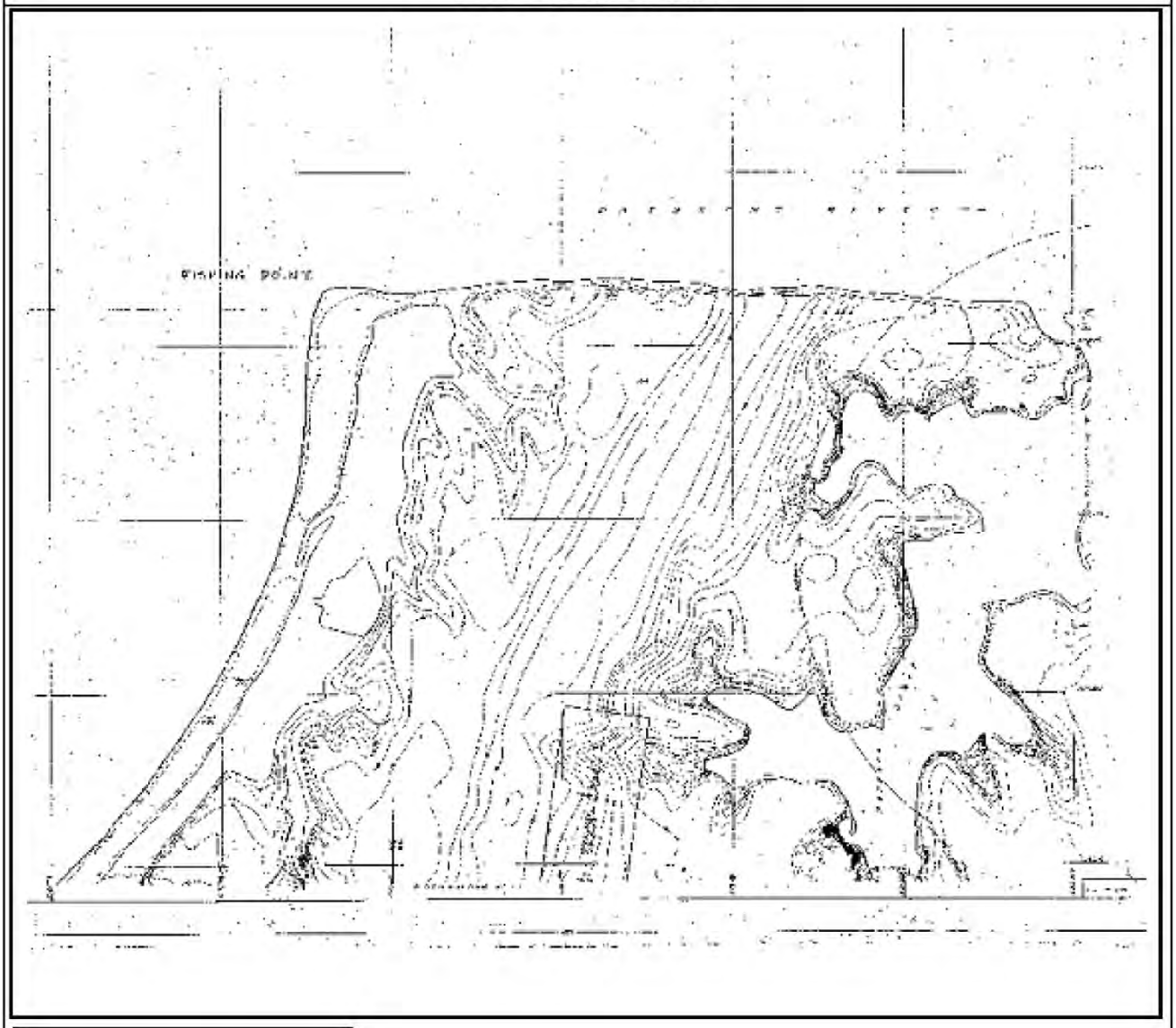

Physiographic Representation of Maryland
Pennsylvania
West Virginia
Delaware
Virginia
Blue Ridge
Appalachian Province
Piedmont Province
Coastal Plain Province
Appalachian Province
Allegheny Plateau
Ridge and Valley
Great Valley
Piedmont Province
Great Valley
Western Division
Eastern Division
Blue Ridge
Fall Line
Coastal Plain Province
Western Shore
Eastern Shore
Chesapeake Bay
Fall Line
Source: Maryland Geological Survey
Geography and Geology of Maryland, 1974
Map No. III-3
N
E
S
W
Not to Scale
March, 2011
(Provided courtesy of the Maryland Geological Survey; Baltimore, Maryland)

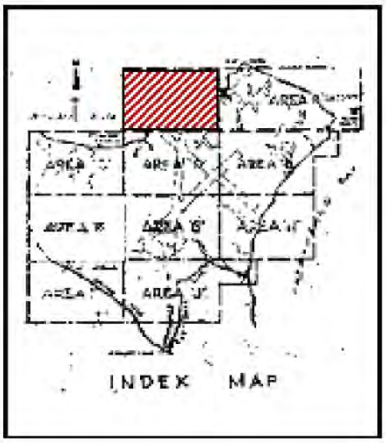
Geological Formation of Maryland



(Provided courtesy of the Maryland Geological Survey; Baltimore, Maryland) March, 2011

Original Topography - Area A
NAS Patuxent River





Map No. III-5a

N
W E
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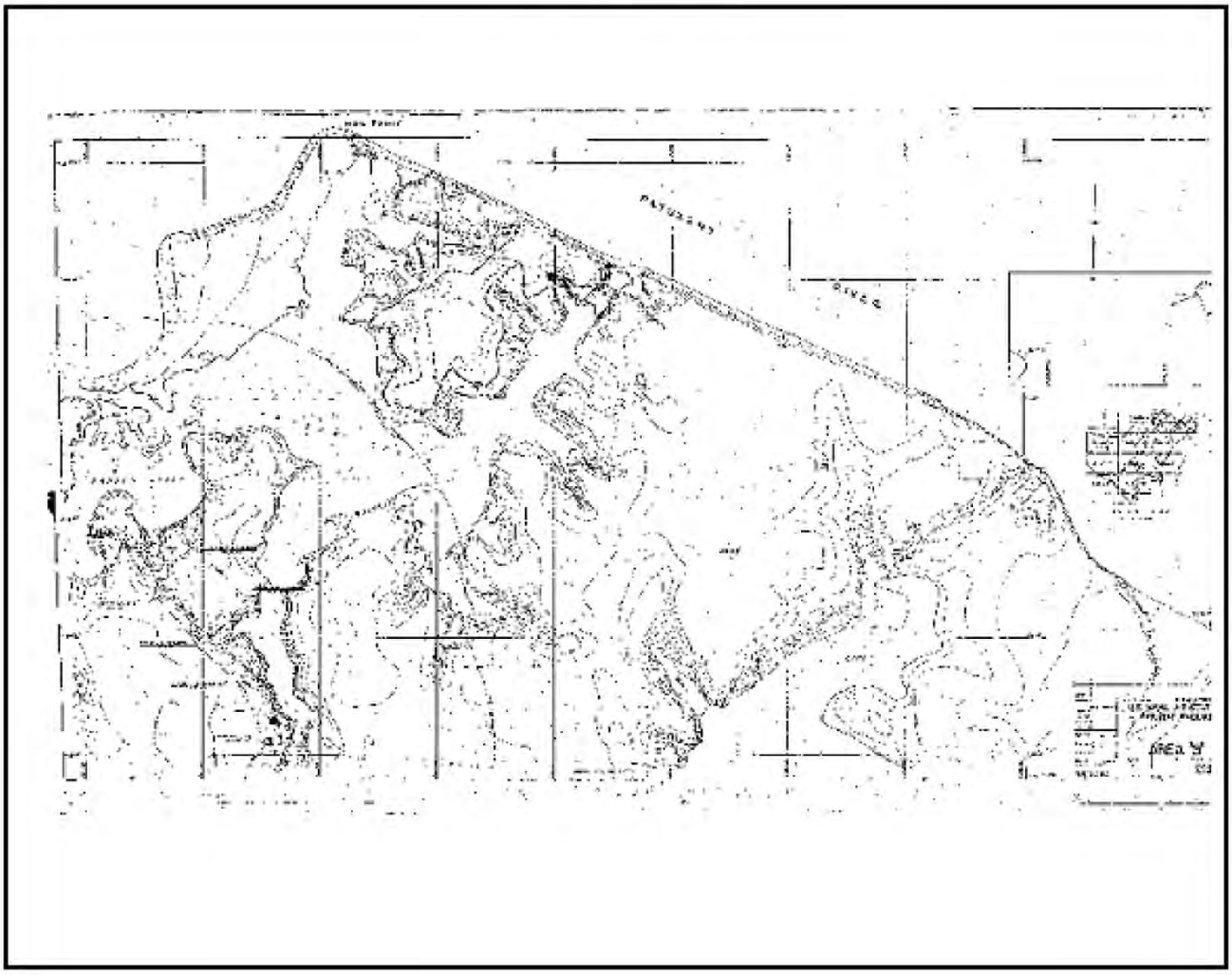
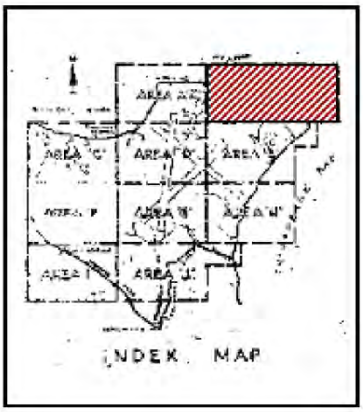
Not to Scale

March, 2011

Original Topography - Area B
NAS Patuxent River





Map No. III-5b

N
W E
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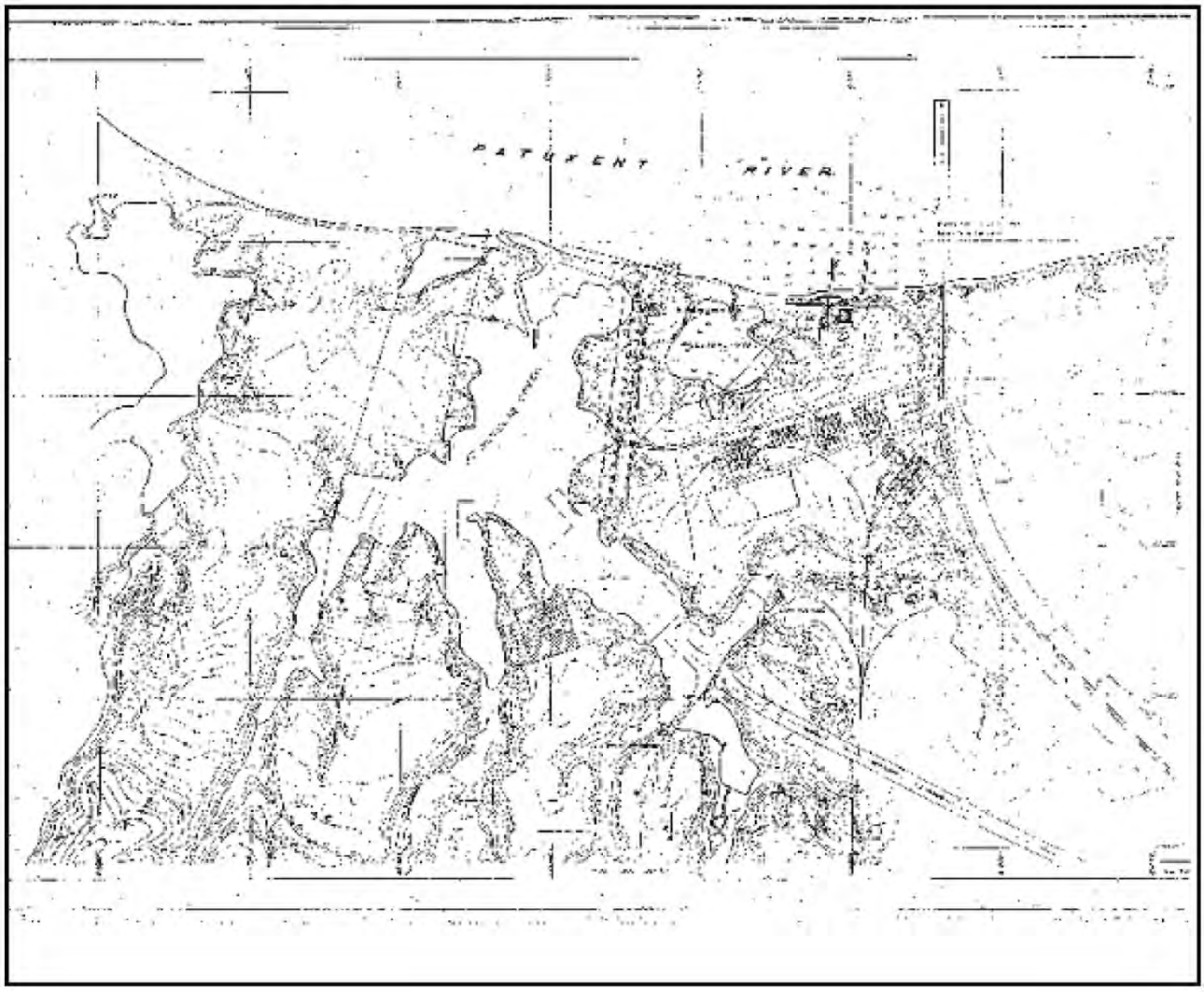
Not to Scale

March, 2011

Original Topography - Area C
NAS Patuxent River



Map No. III-5c

N
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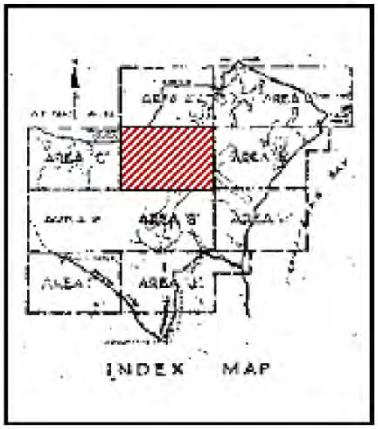
Not to Scale

March, 2011

Original Topography - Area D
NAS Patuxent River



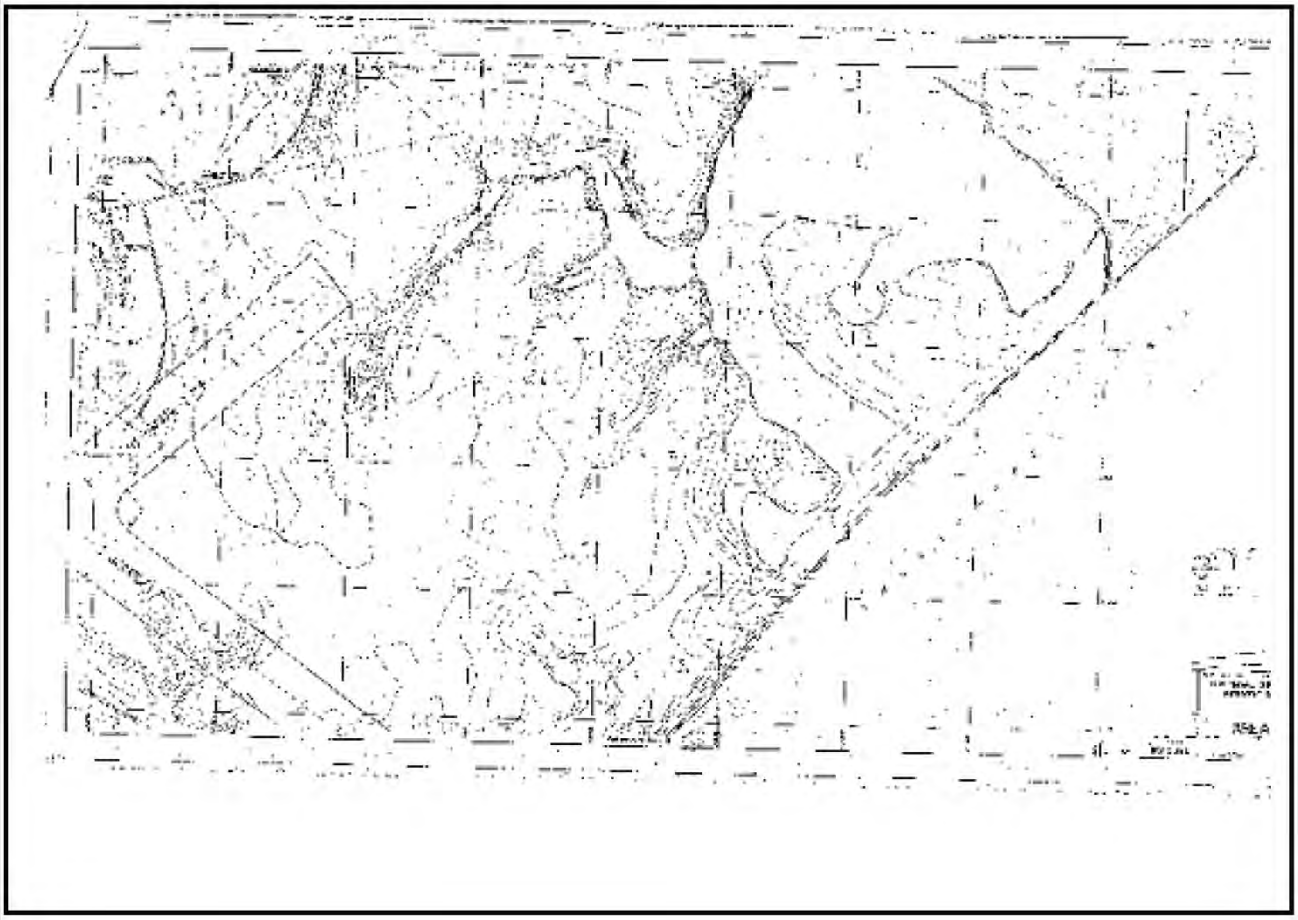
Map No. III-5d

N
W E
S

Not to Scale

March, 2011

Original Topography - Area E
NAS Patuxent River



Map No. III-5e

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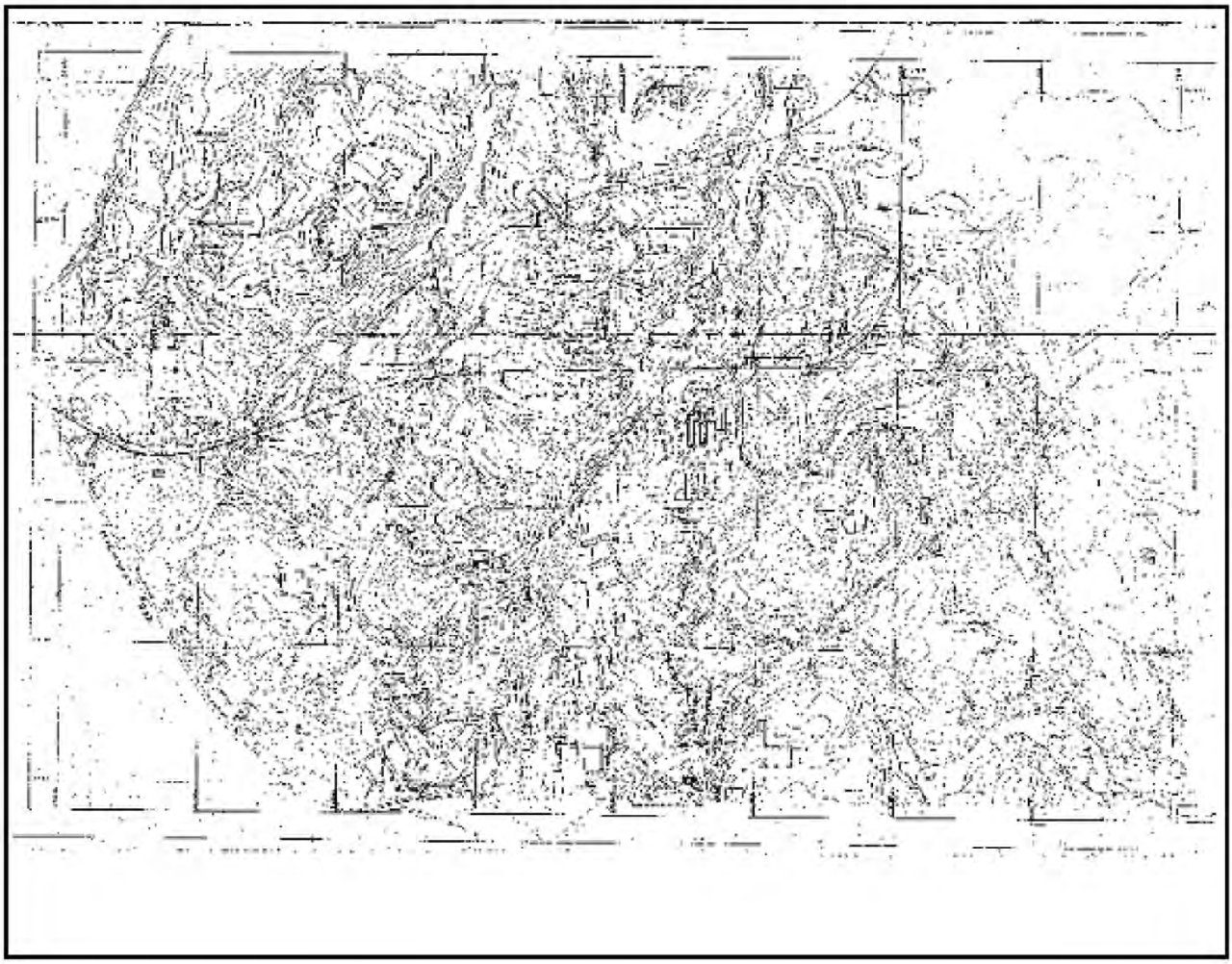
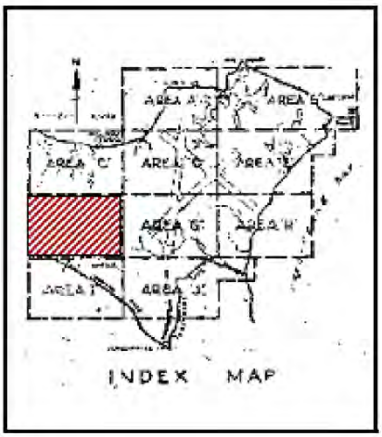
Not to Scale

March, 2011

Original Topography - Area F
NAS Patuxent River





Map No. III-5f

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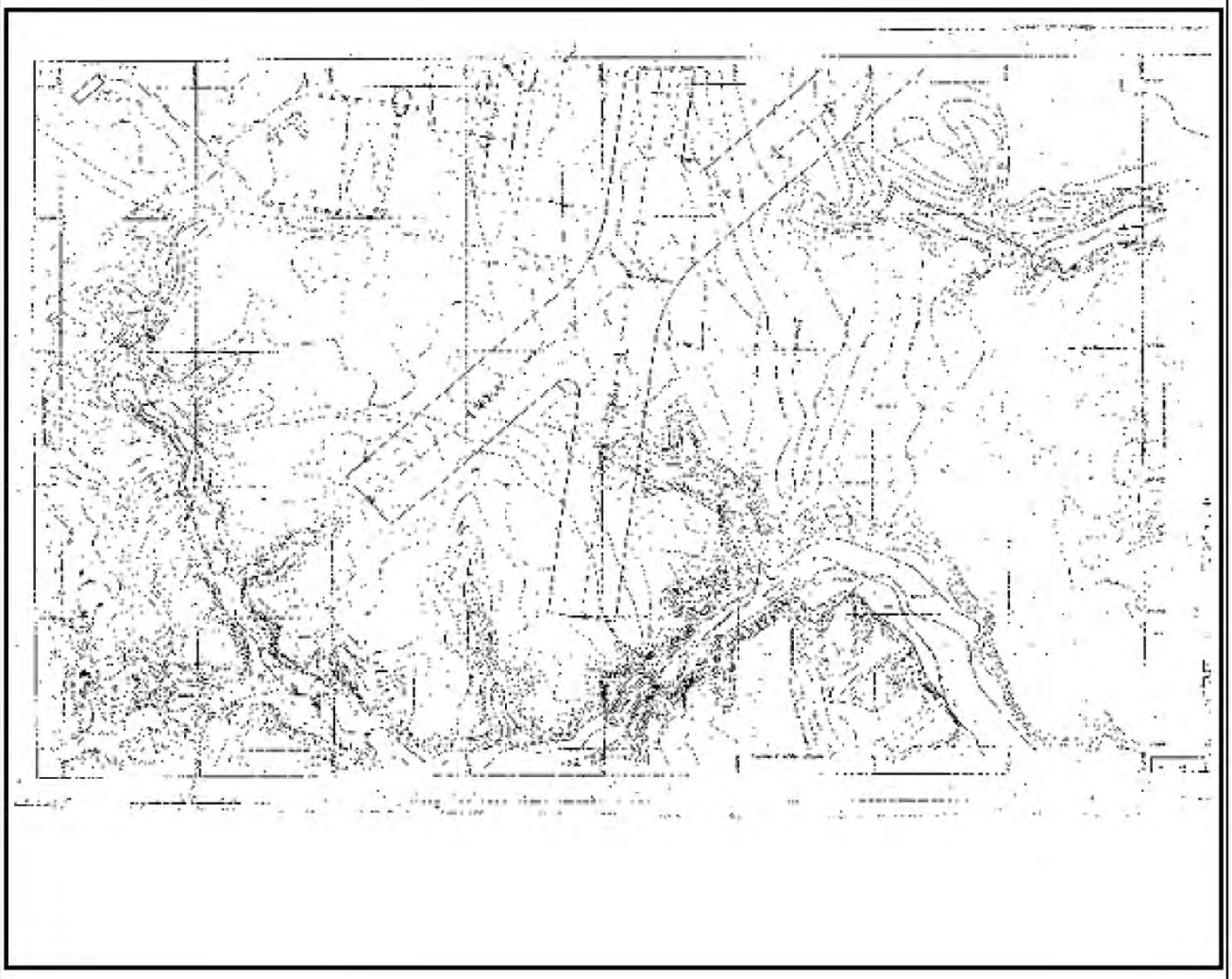
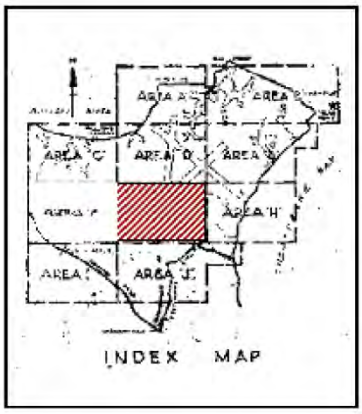
Not to Scale

March, 2011

Original Topography - Area G
NAS Patuxent River





Map No. III-5g

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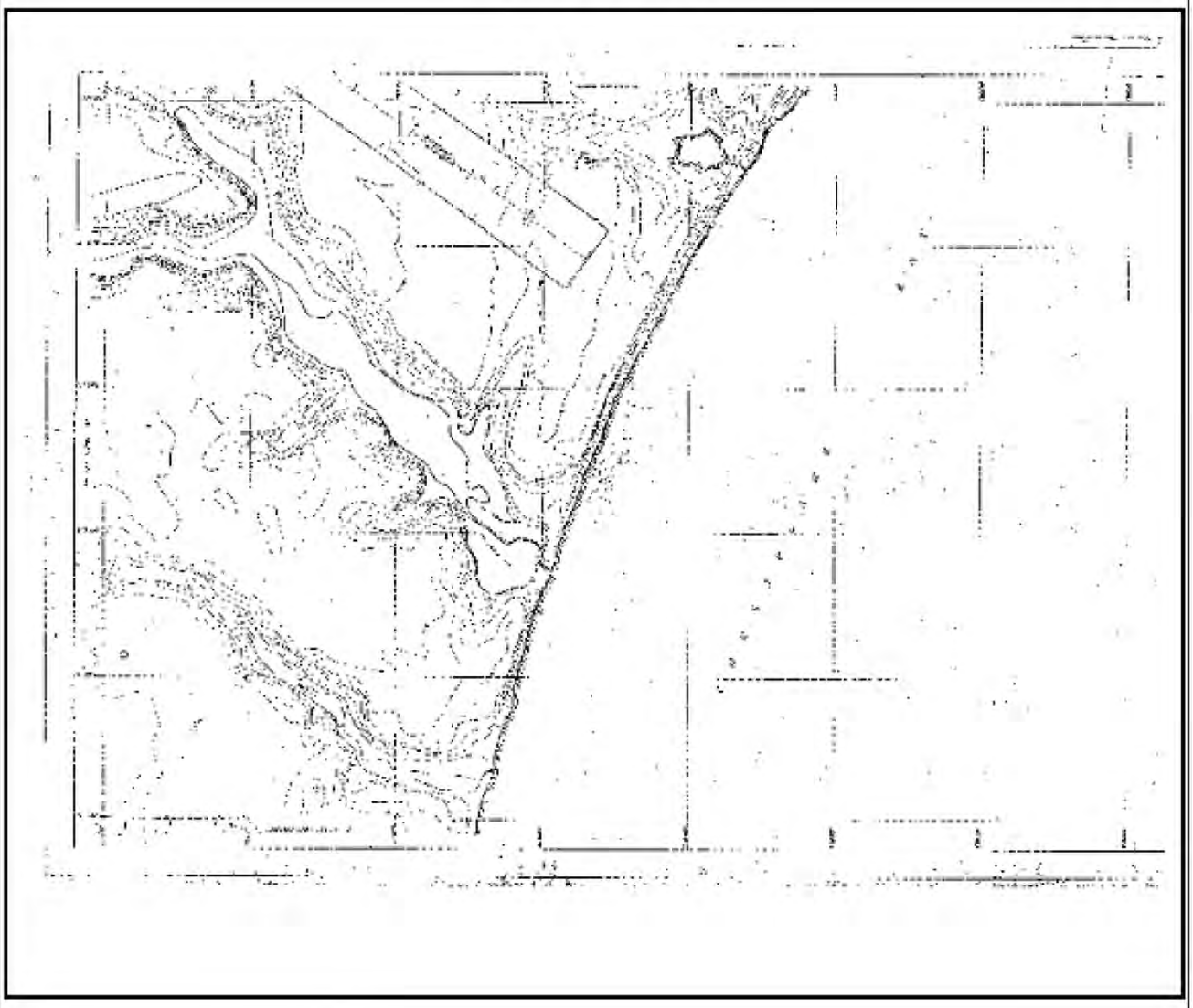
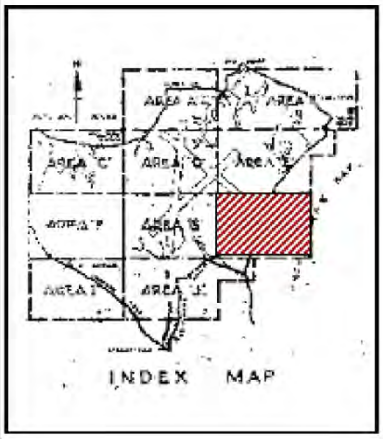
Not to Scale

March, 2011

Original Topography - Area H
NAS Patuxent River





Map No. III-5h

N
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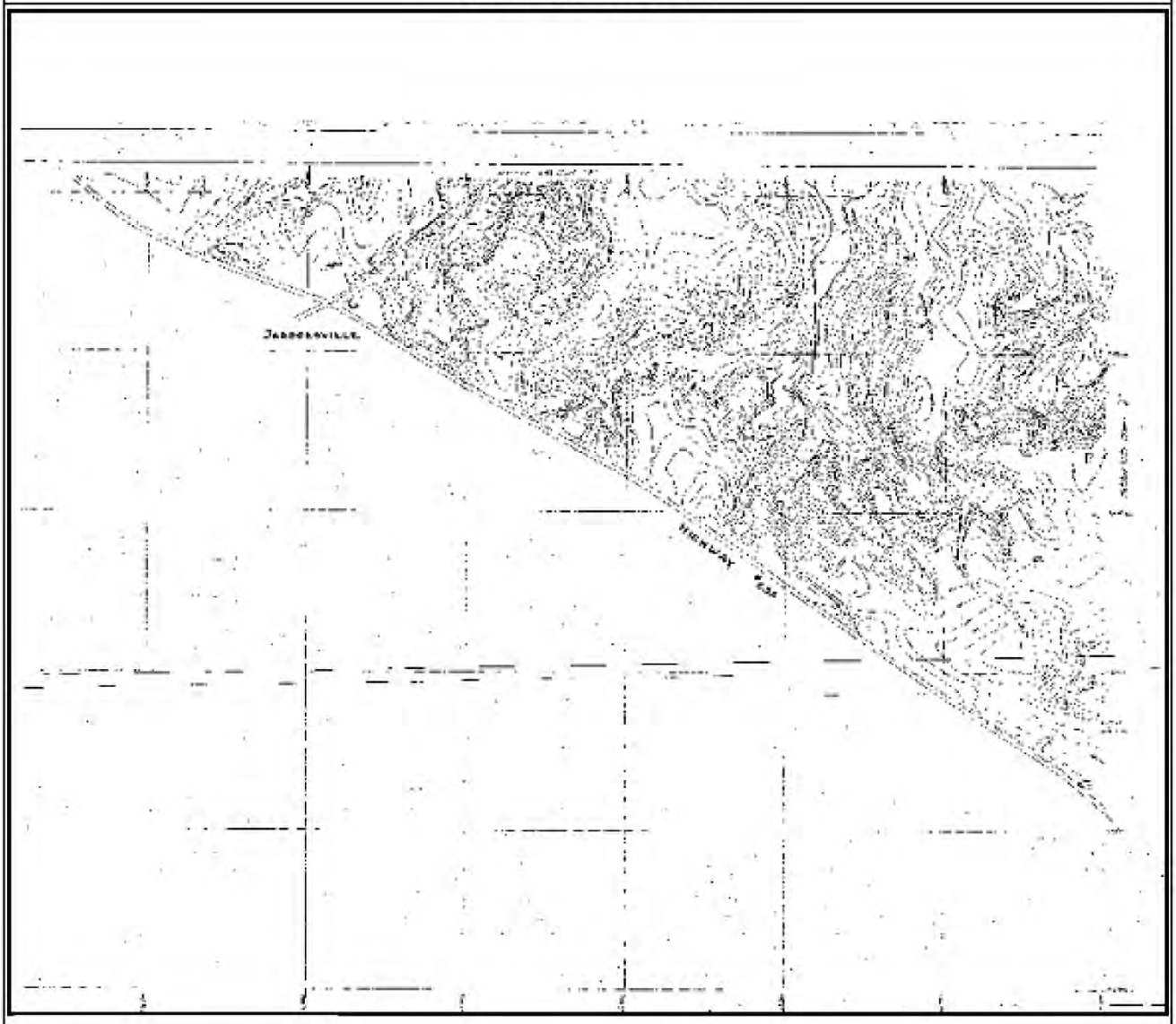
Not to Scale

March, 2011

Original Topography - Area I
NAS Patuxent River

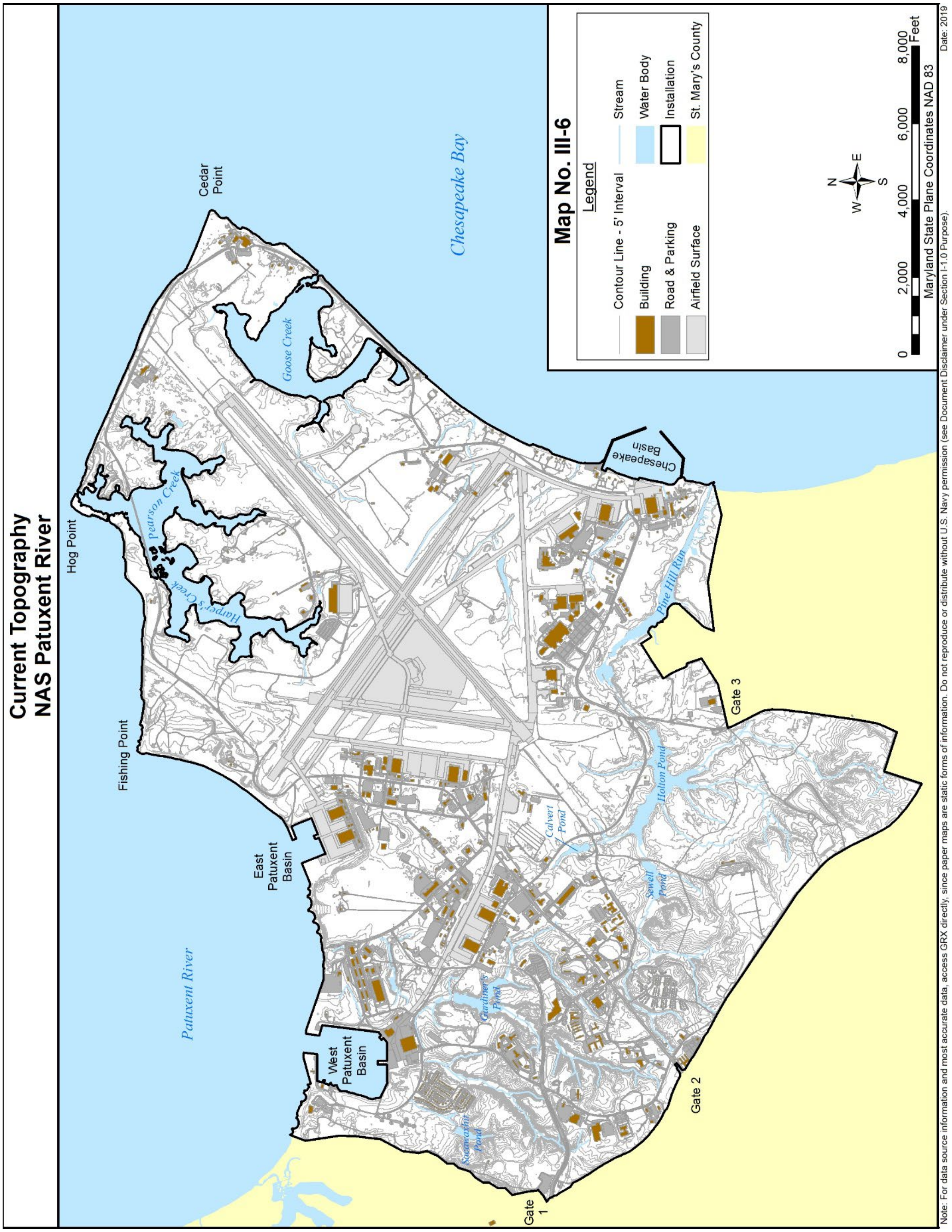


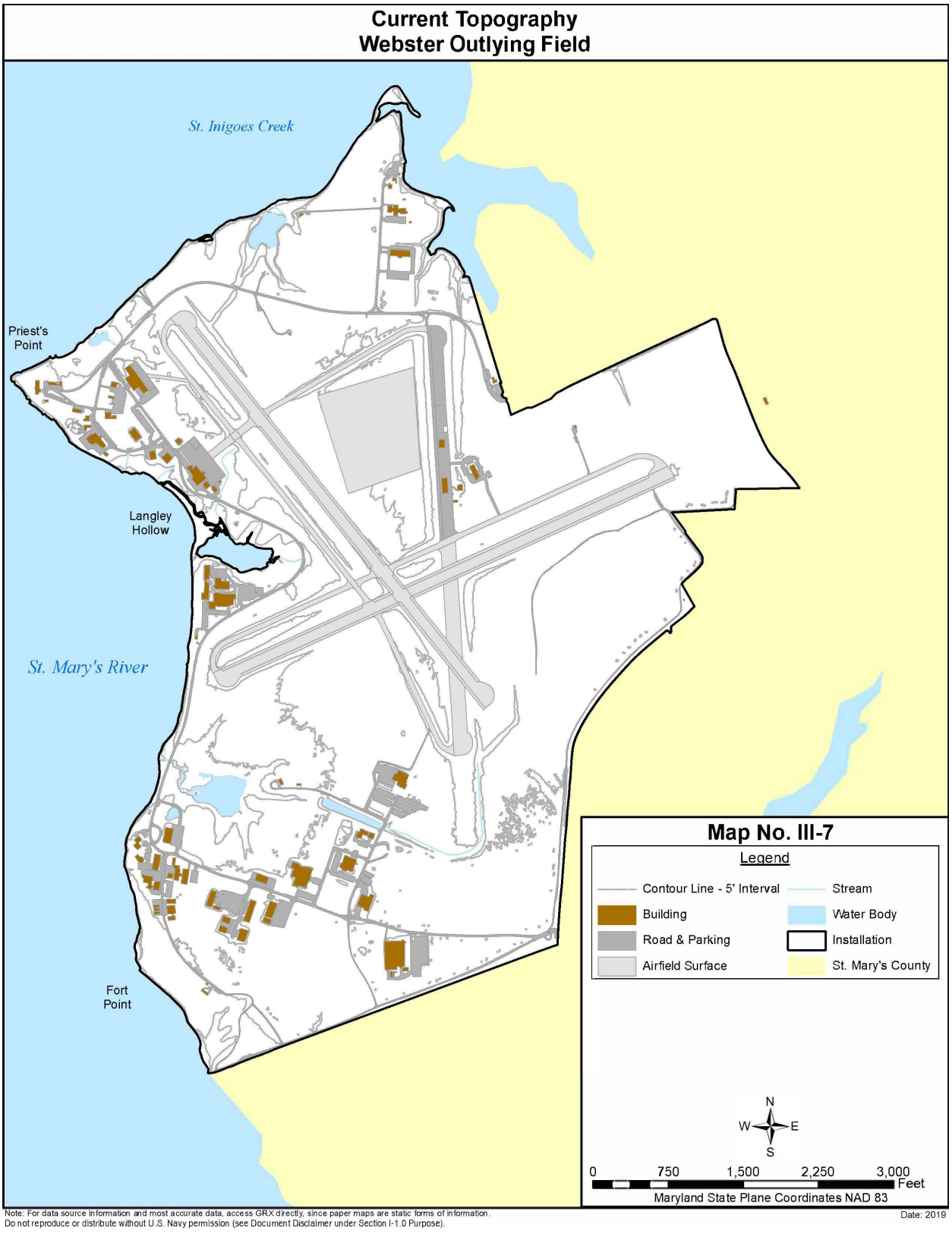
Map No. III-5i

N
W E
S

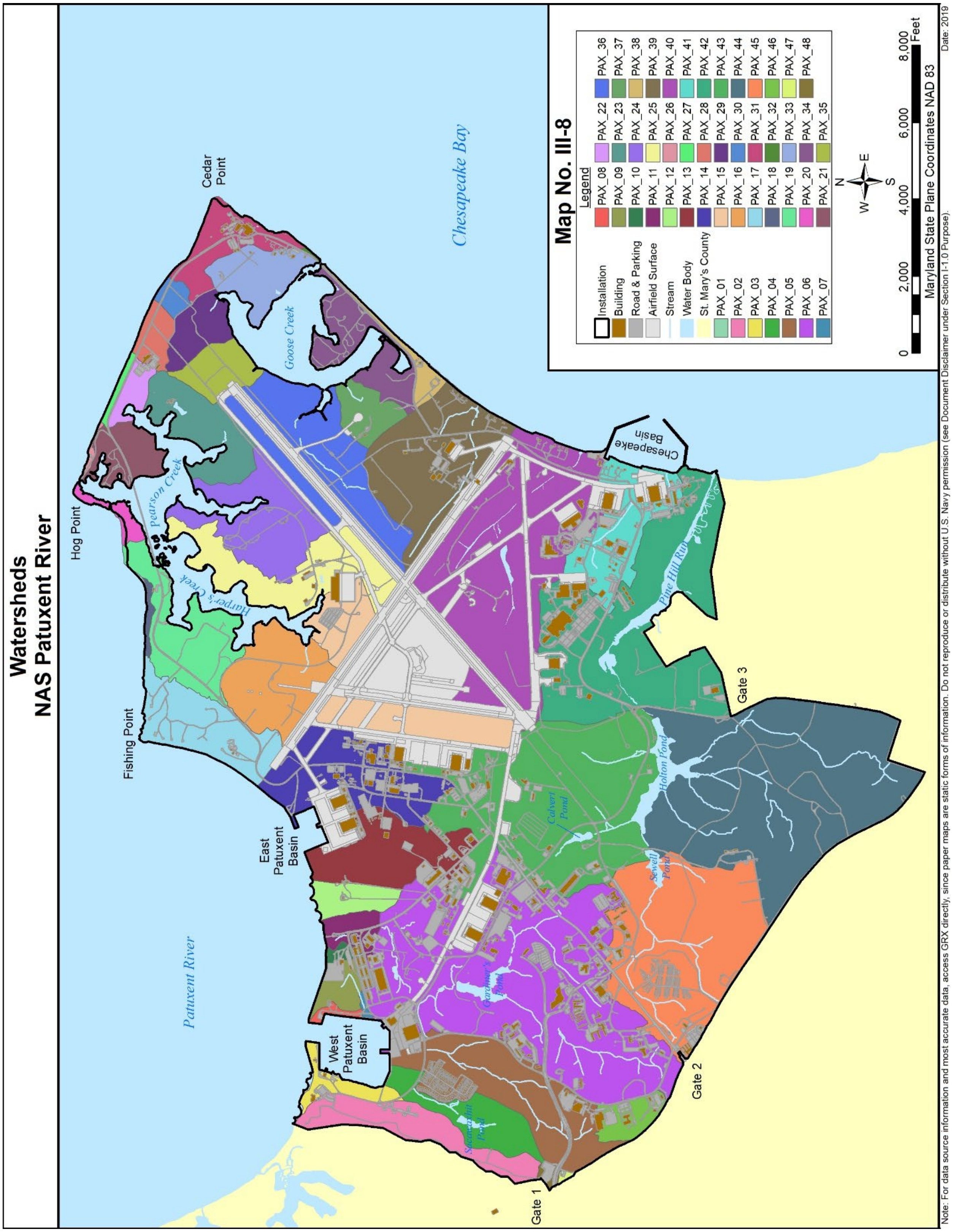
Not to Scale

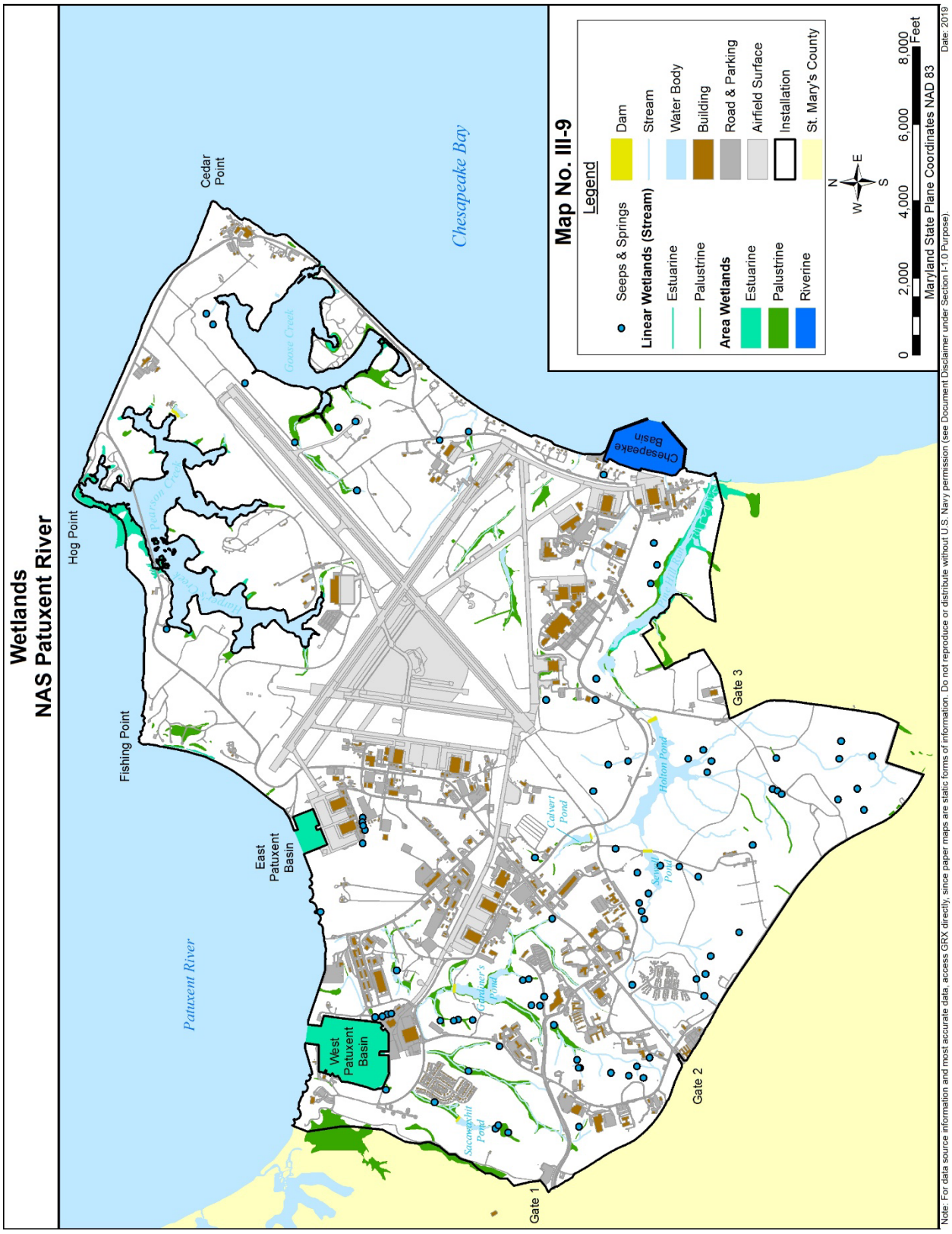
March, 2011


Current Topography
NAS Patuxent River
Map No. III-6
Legend
Contour Line - 5' Interval
Stream
Building
Water Body
Road & Parking
Installation
Airfield Surface
St. Mary's County
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Date: 2019
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Hilton Pond
Calvert Pond
Sewell Pond
Gardiner's Pond
Gate 1
Gate 2
Gate 3



Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.


Watersheds
NAS Patuxent River
Map No. III-8
Legend
Installation
Building
Road & Parking
Airfield Surface
Stream
Water Body
St. Mary's County
PAX_01
PAX_02
PAX_03
PAX_04
PAX_05
PAX_06
PAX_07
PAX_08
PAX_09
PAX_10
PAX_11
PAX_12
PAX_13
PAX_14
PAX_15
PAX_16
PAX_17
PAX_18
PAX_19
PAX_20
PAX_21
PAX_22
PAX_23
PAX_24
PAX_25
PAX_26
PAX_27
PAX_28
PAX_29
PAX_30
PAX_31
PAX_32
PAX_33
PAX_34
PAX_35
PAX_36
PAX_37
PAX_38
PAX_39
PAX_40
PAX_41
PAX_42
PAX_43
PAX_44
PAX_45
PAX_46
PAX_47
PAX_48
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Holton Pond
Calvert Pond
Sewell Pond
Gate 1
Gate 2
Gate 3


Wetlands
NAS Patuxent River
Map No. III-9
Legend
Seeps & Springs
Dam
Stream
Linear Wetlands (Stream)
Estuarine
Palustrine
Water Body
Building
Road & Parking
Airfield Surface
Installation
St. Mary's County
Area Wetlands
Estuarine
Palustrine
Riverine
N
S
E
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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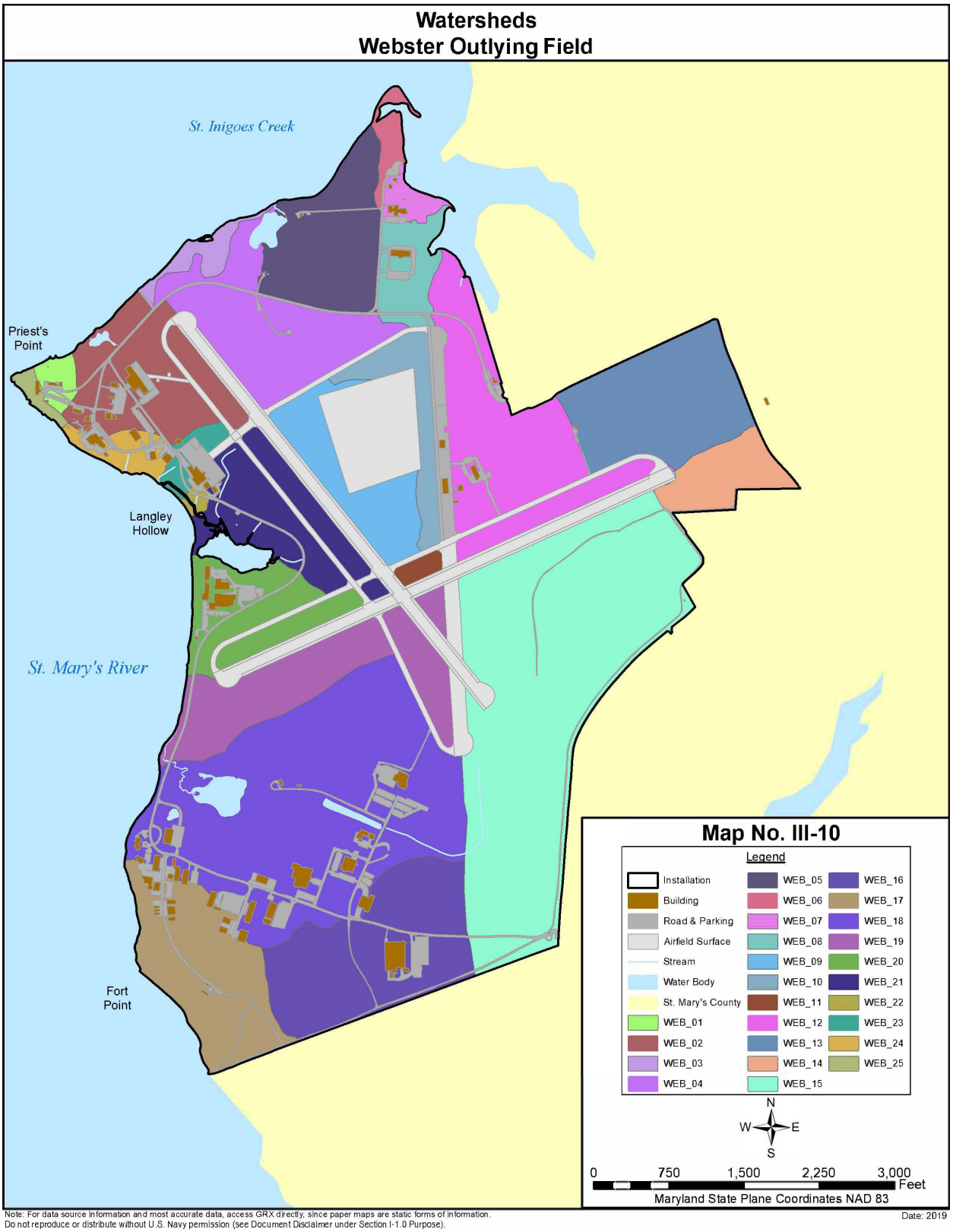
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Goose Creek
Patterson Creek
Chesapeake Basin
East Patuxent Basin
West Patuxent Basin
Gate 1
Gate 2
Gate 3
Saccarappi Pond
Gardner's Pond
Calvert Pond
Sandy Point
Holton Pond



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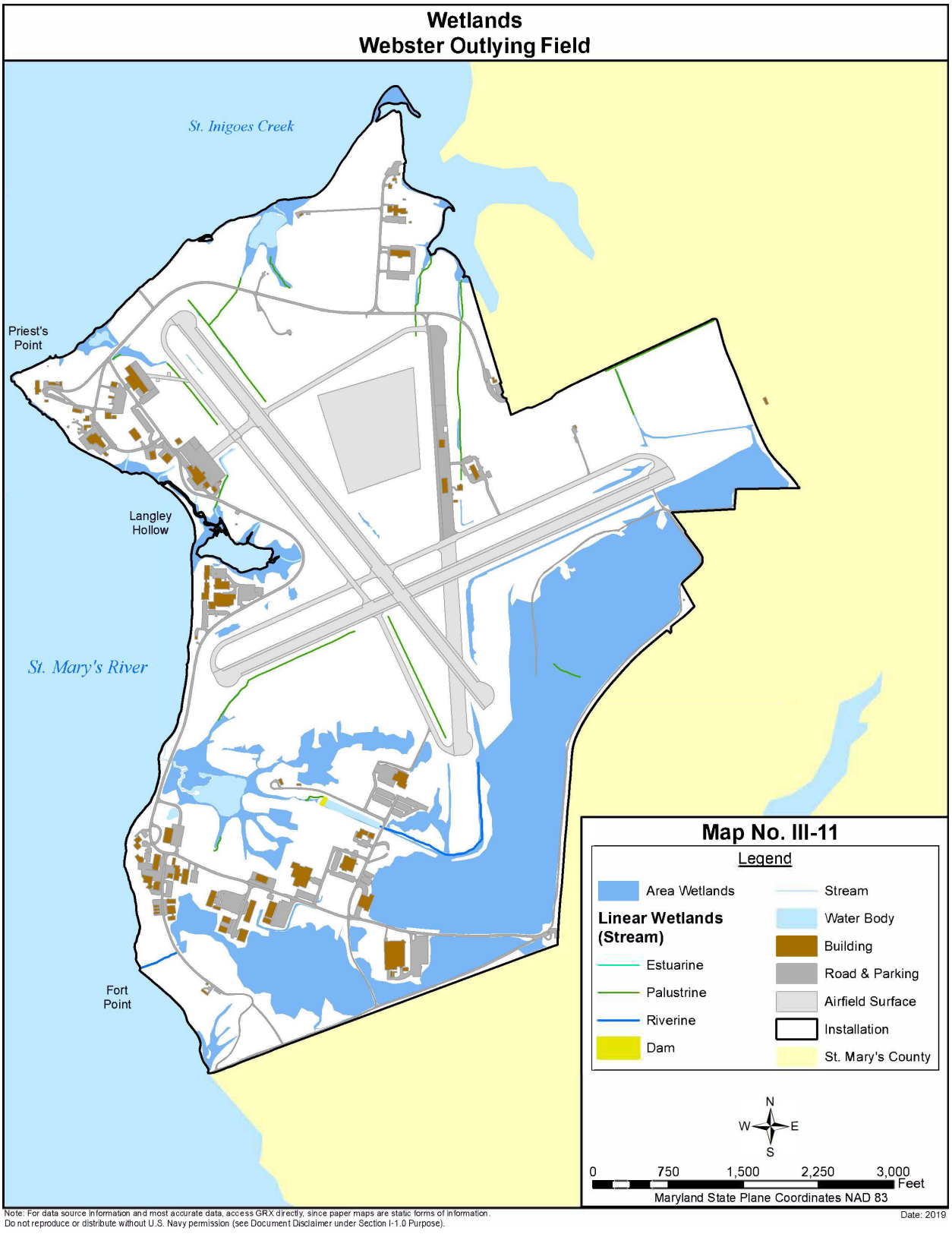

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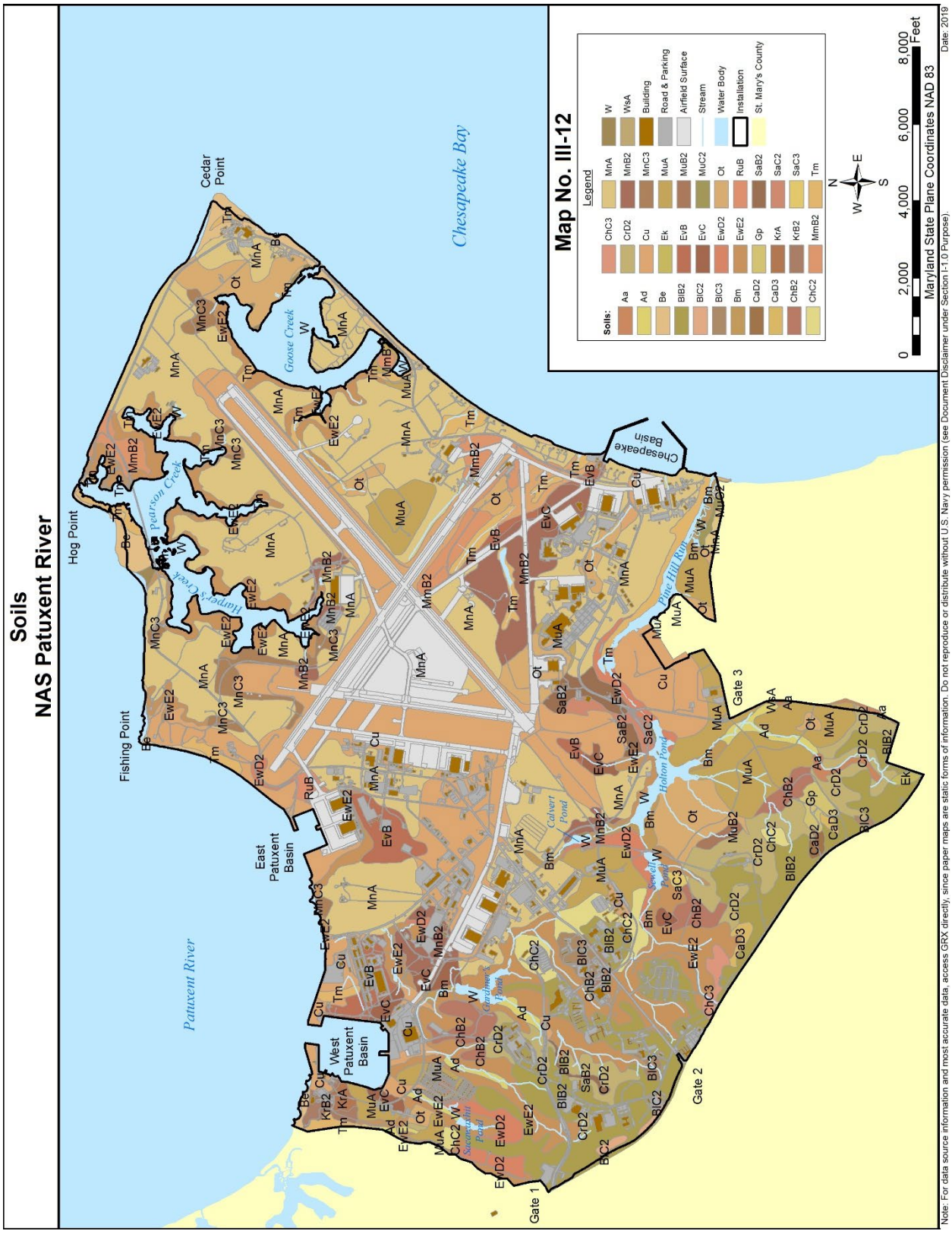
Soils
NAS Patuxent River
Map No. III-12
Legend
Soils:
Aa
Ad
Be
BlB2
BlC2
BlC3
Bm
CaD2
CaD3
ChB2
ChC2
ChC3
CrD2
Cu
Ek
EvB
EvC
EwD2
EwE2
Gp
KrA
KrB2
MmB2
MnA
MnB2
MnC3
MuA
MuB2
MuC2
Ot
RuB
SaB2
SaC2
SaC3
Tm
W
WsA
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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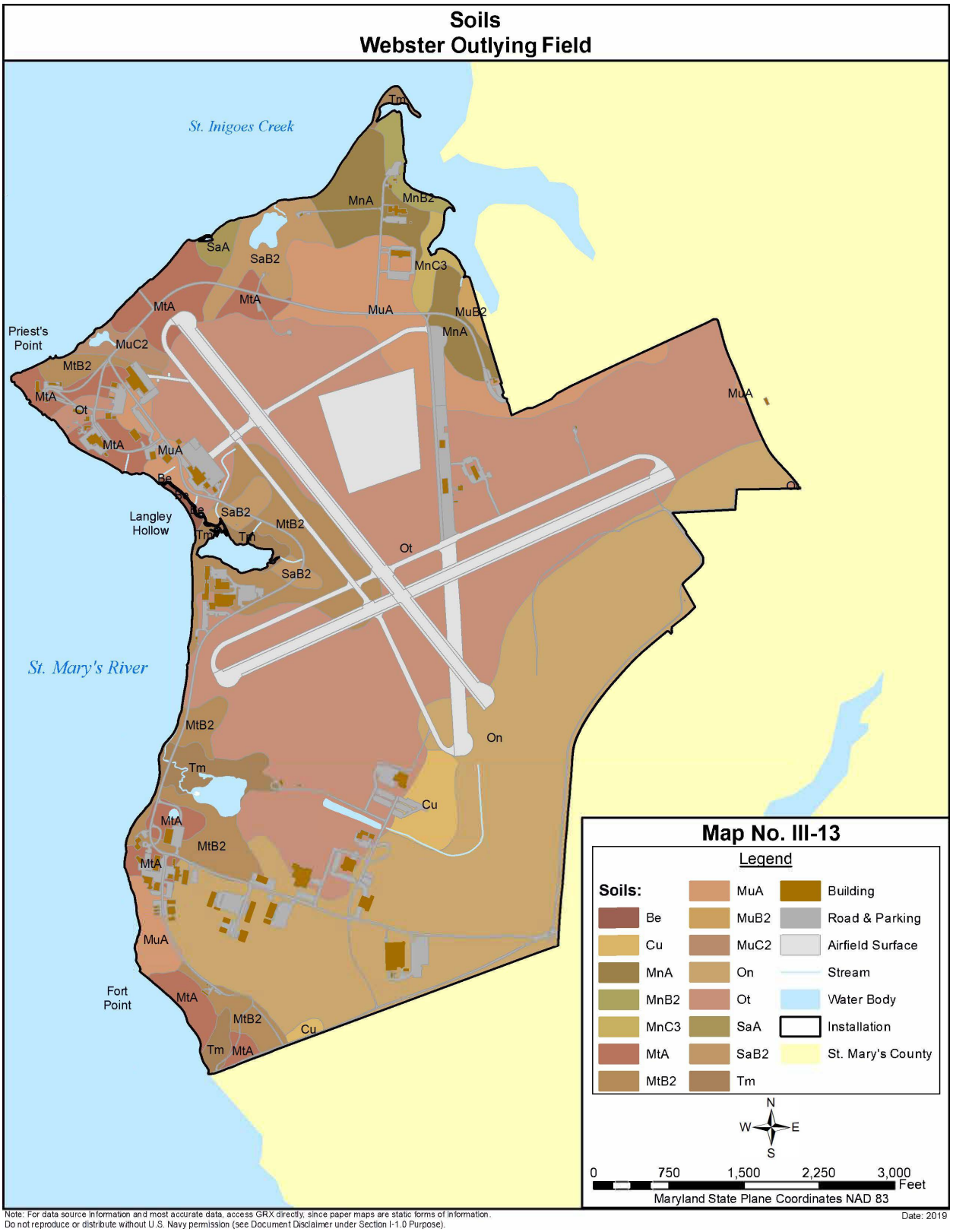
Chesapeake Bay
Patuxent River
Hog Point
Fishing Point
Cedar Point
Chesapeake Basin
Pine Hill Run
Goose Creek
Pearson Creek
Harper's Creek
East Patuxent Basin
West Patuxent Basin
Calvert Pond
Halton Pond
Sewell Pond
Gardiner's Pond
Sassafrass Pond
Gate 1
Gate 2
Gate 3



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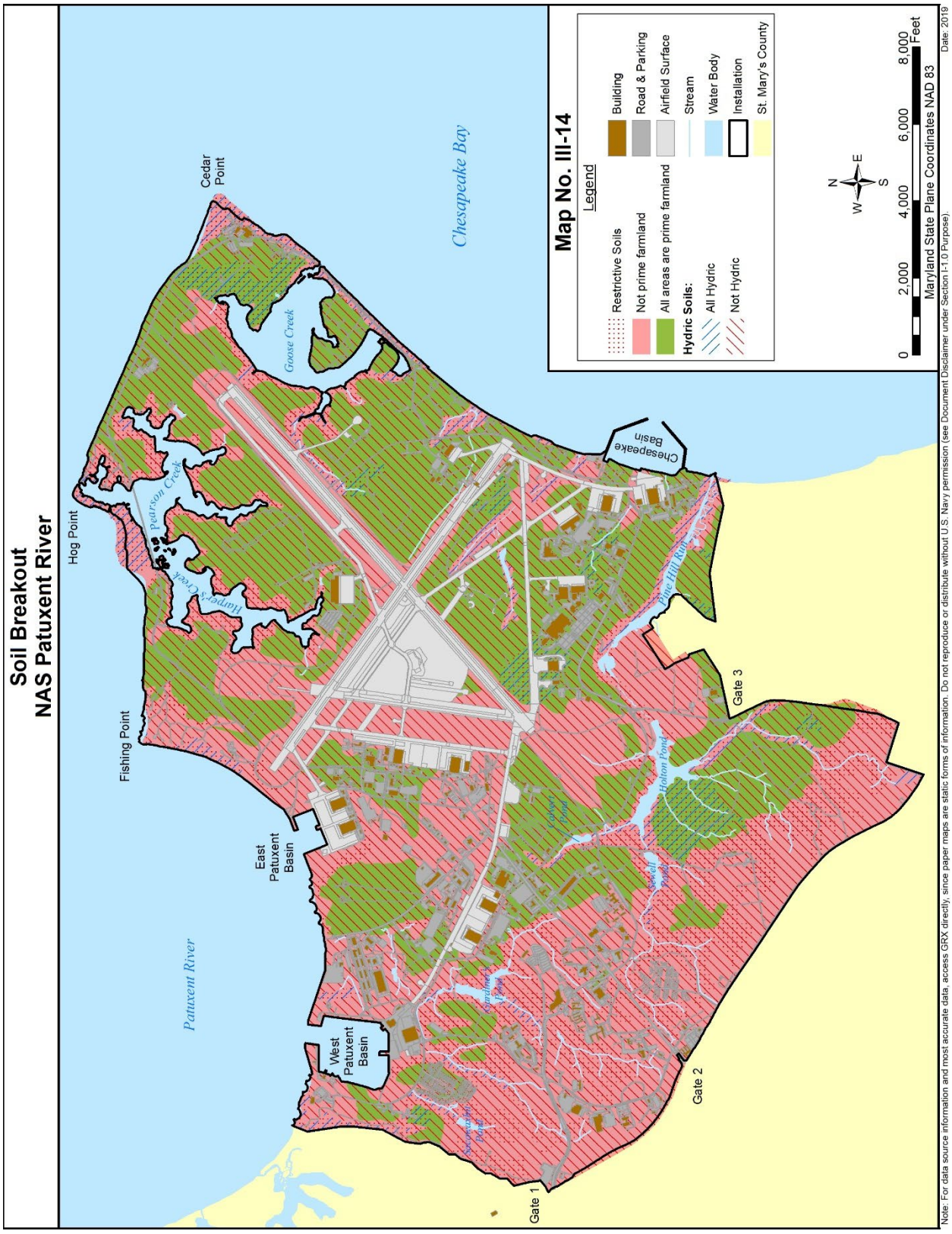
Soil Breakout
NAS Patuxent River
Map No. III-14
Legend
Restrictive Soils
Not prime farmland
All areas are prime farmland
Hydric Soils:
All Hydric
Not Hydric
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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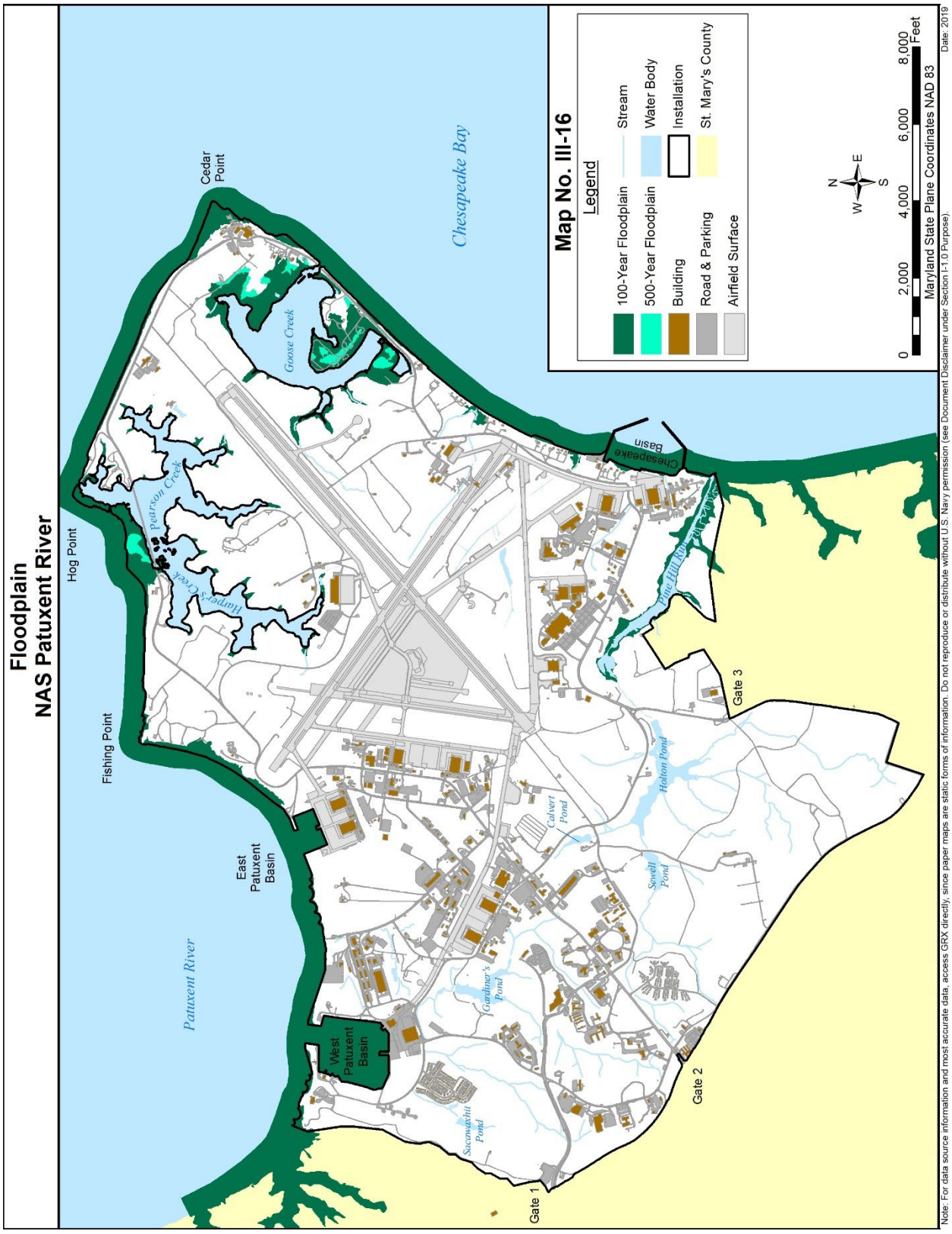
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Goose Creek
Pearson Creek
Hungers Creek
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Pine Hill Run
Halton Pond
Gate 1
Gate 2
Gate 3


Floodplain
NAS Patuxent River
Map No. III-16
Legend
100-Year Floodplain
500-Year Floodplain
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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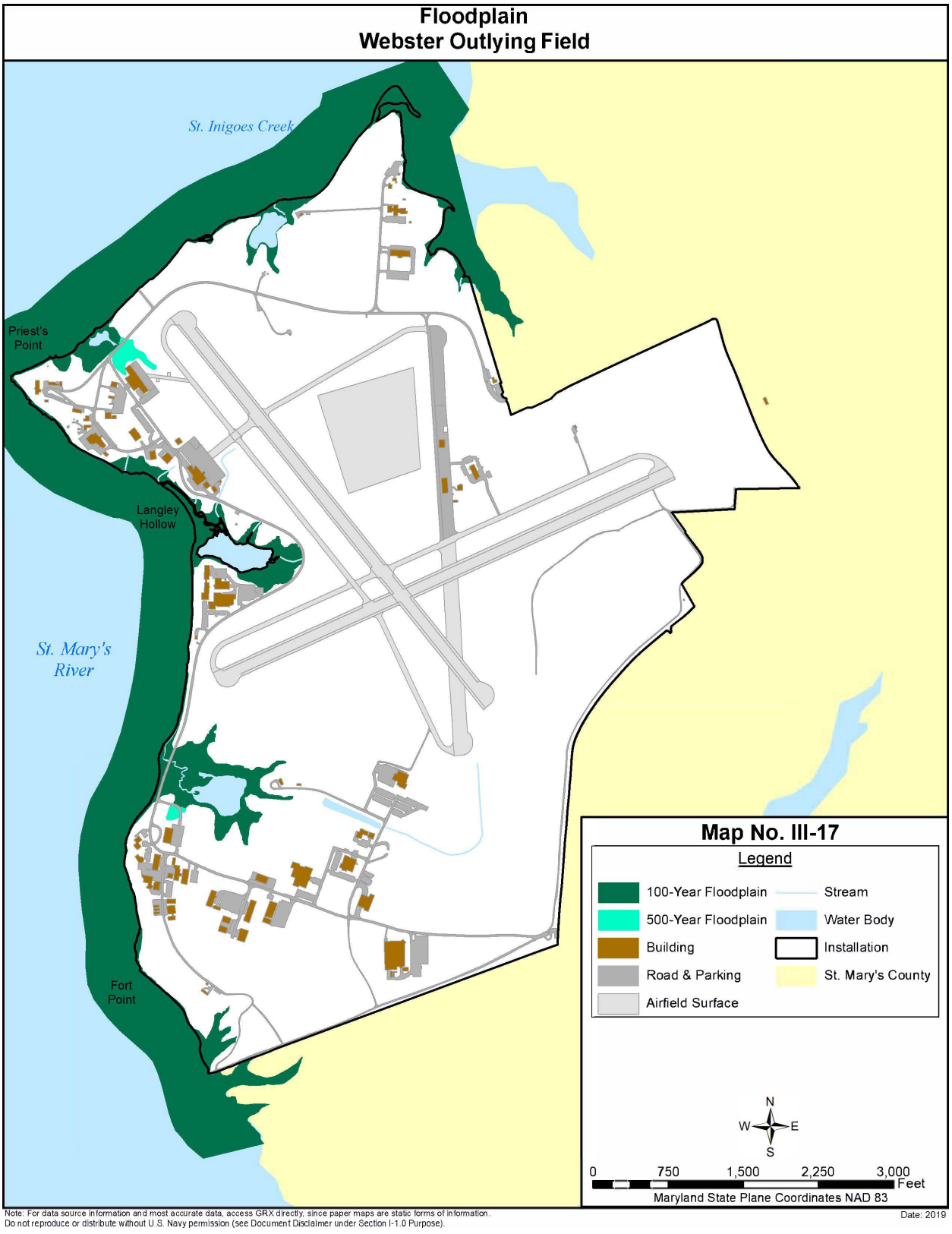
Chesapeake Bay
Patuxent River
Hog Point
Fishing Point
Cedar Point
Goose Creek
Pearson Creek
Hunter's Creek
Chesapeake Basin
Pine Hill Run
Shoal Creek
East Patuxent Basin
West Patuxent Basin
Gate 1
Gate 2
Gate 3
Gardiner's Pond
Calvert Pond
Holton Pond
Sewell Pond
Sacawakhit Pond



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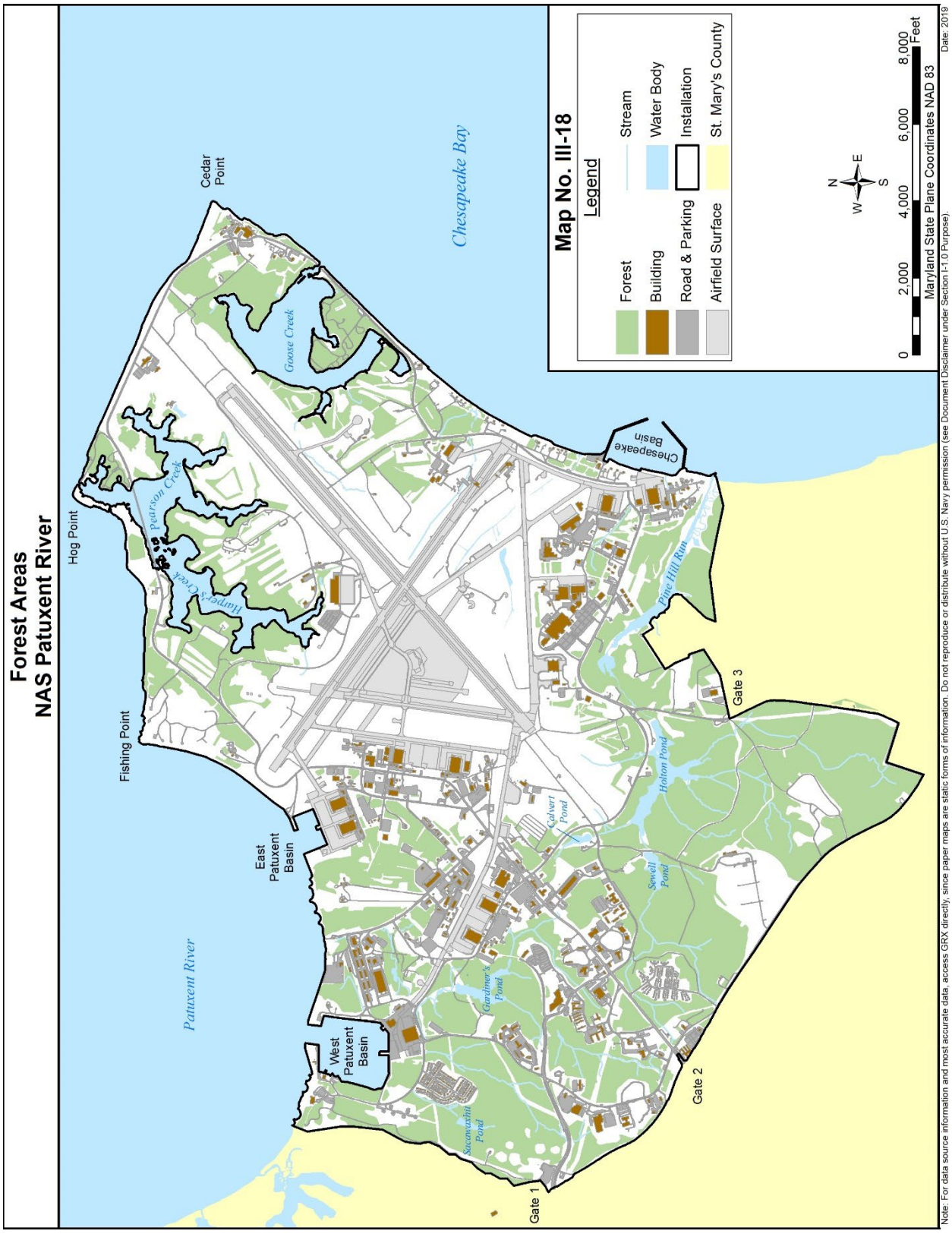
Forest Areas
NAS Patuxent River
Map No. III-18
Legend
Forest
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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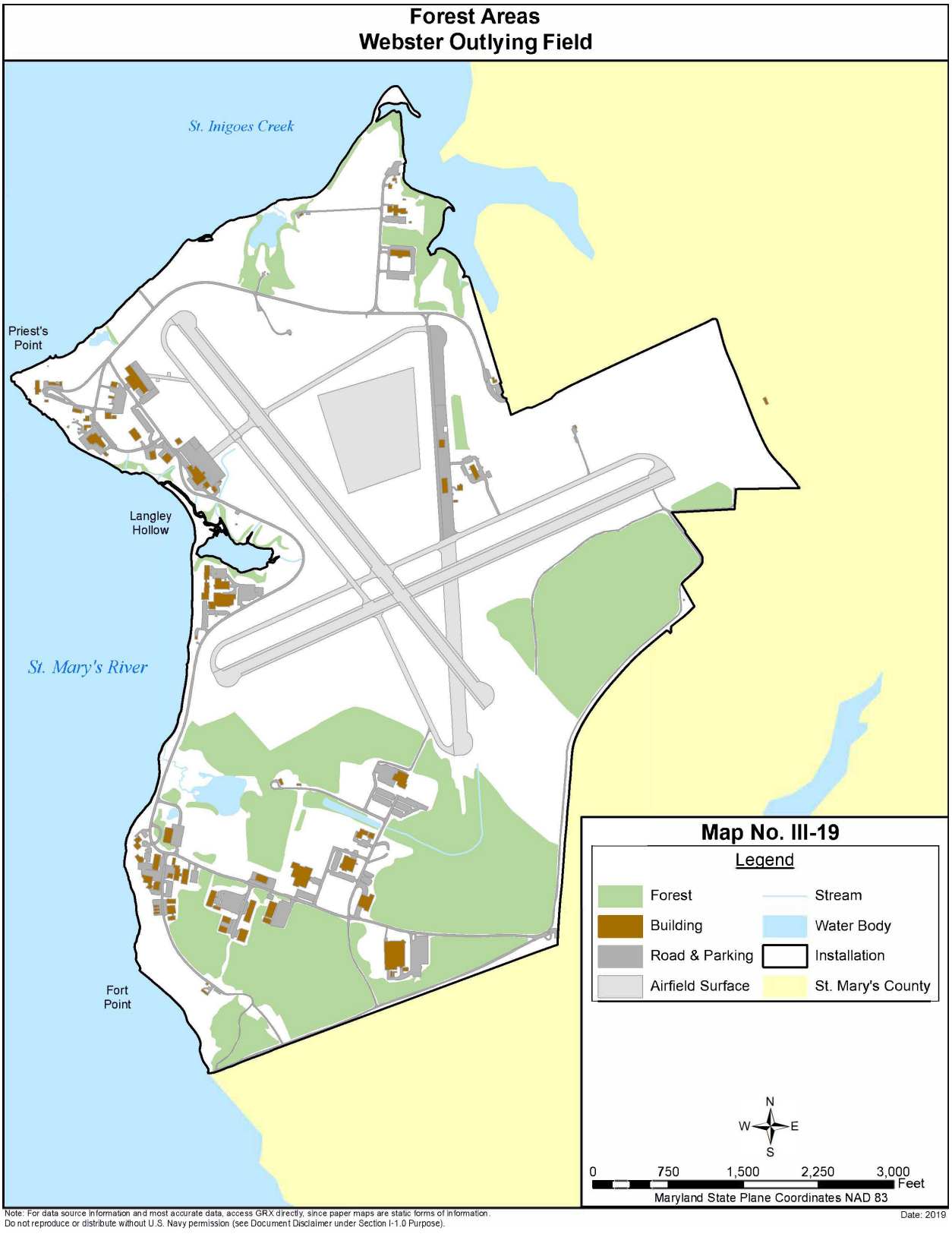
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Goose Creek
Pearson Creek
Humphrys Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Calvert Pond
Holton Pond
Sewell Pond
Gardiner's Pond
Sacawaxin Pond
Gate 1
Gate 2
Gate 3


Forest Areas
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. III-19
Legend
Forest
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
750
1,500
2,250
3,000
Feet
Maryland State Plane Coordinates NAD 83
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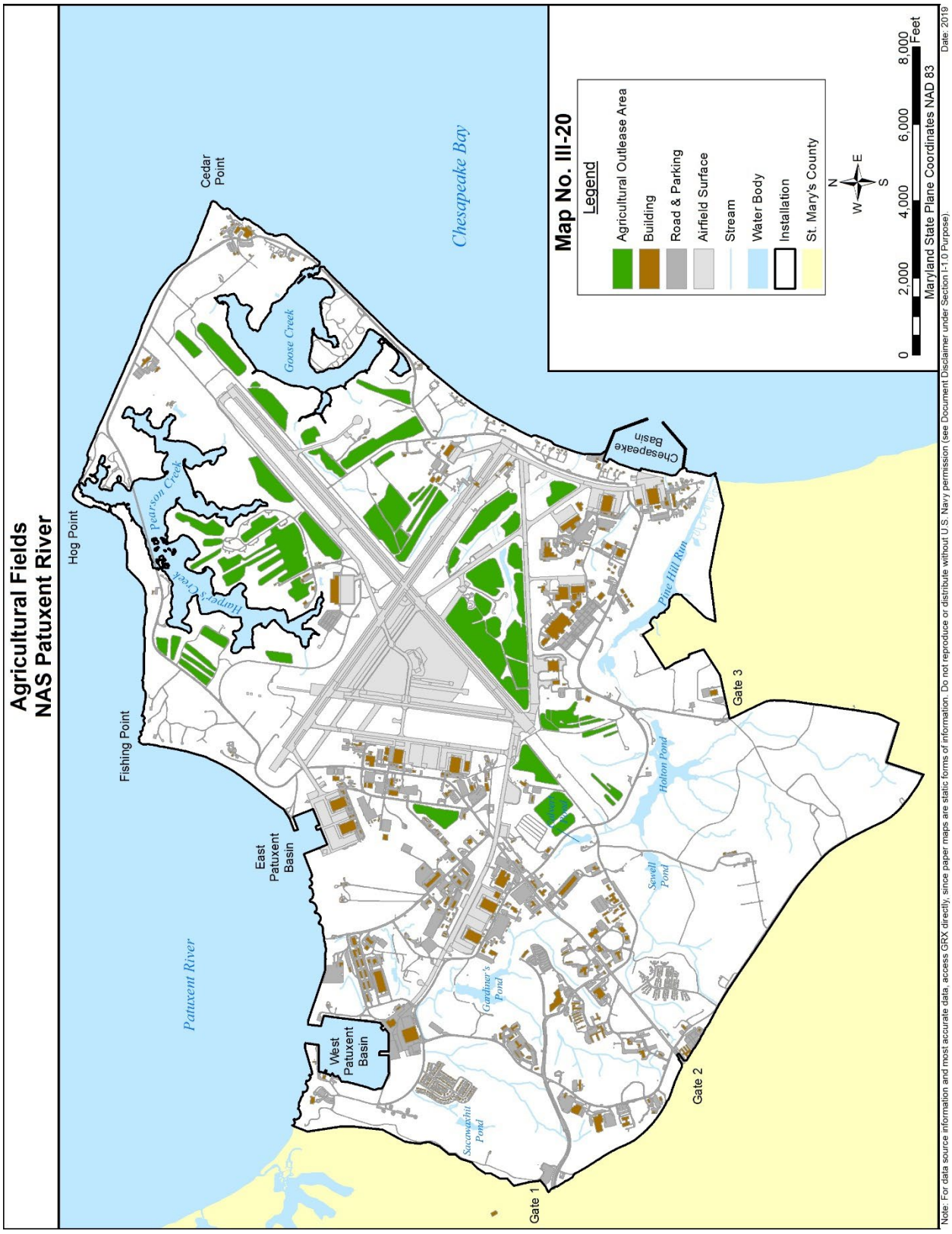
Date: 2019


Agricultural Fields
NAS Patuxent River
Map No. III-20
Legend
Agricultural Outlease Area
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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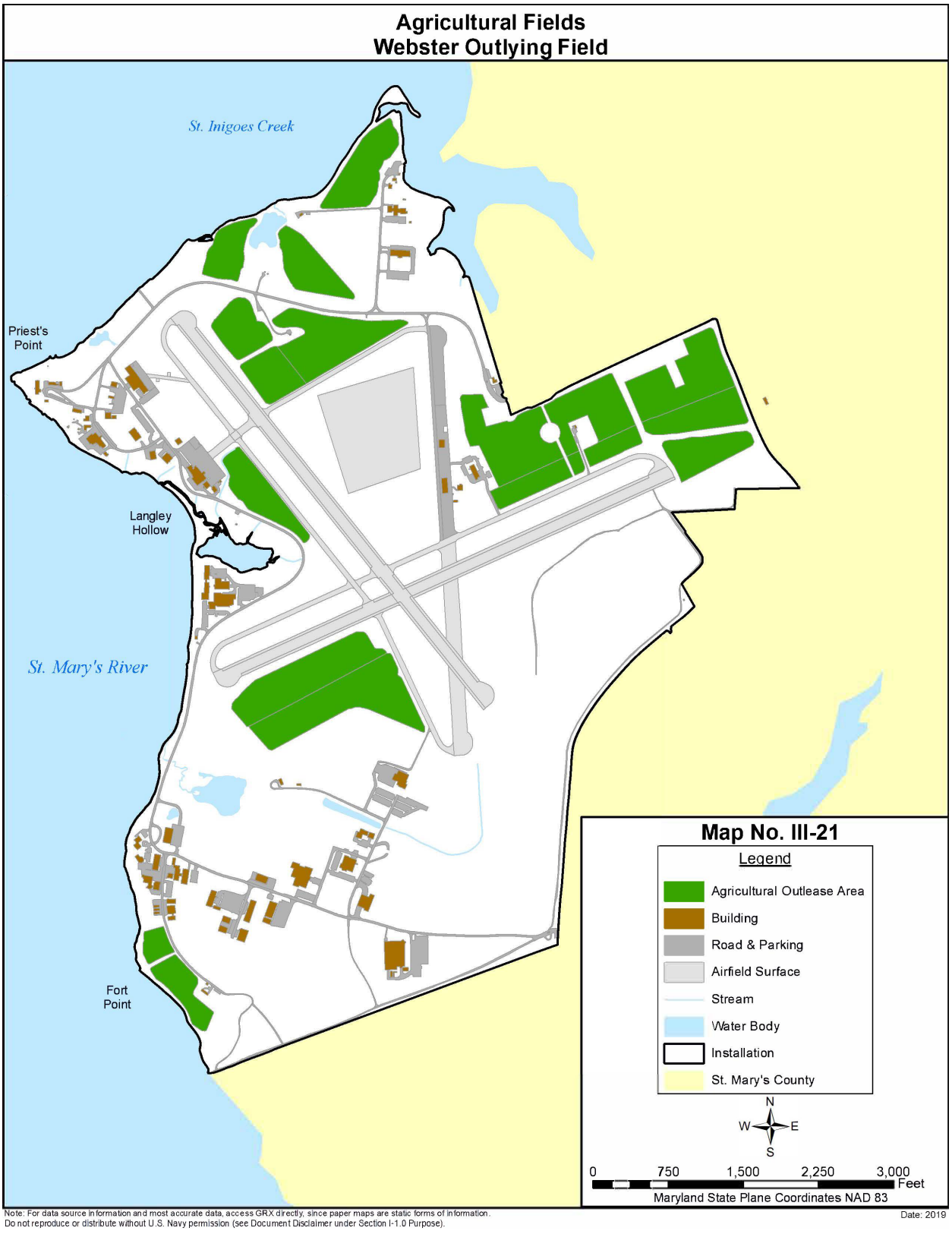
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
Goose Creek
Pearson Creek
Humphrys Creek
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Pine Hill Run
Holton Pond
Sewell Pond
Gardiner's Pond
Saccawichit Pond
Gate 1
Gate 2
Gate 3


Agricultural Fields
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. III-21
Legend
Agricultural Outlease Area
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
750
1,500
2,250
3,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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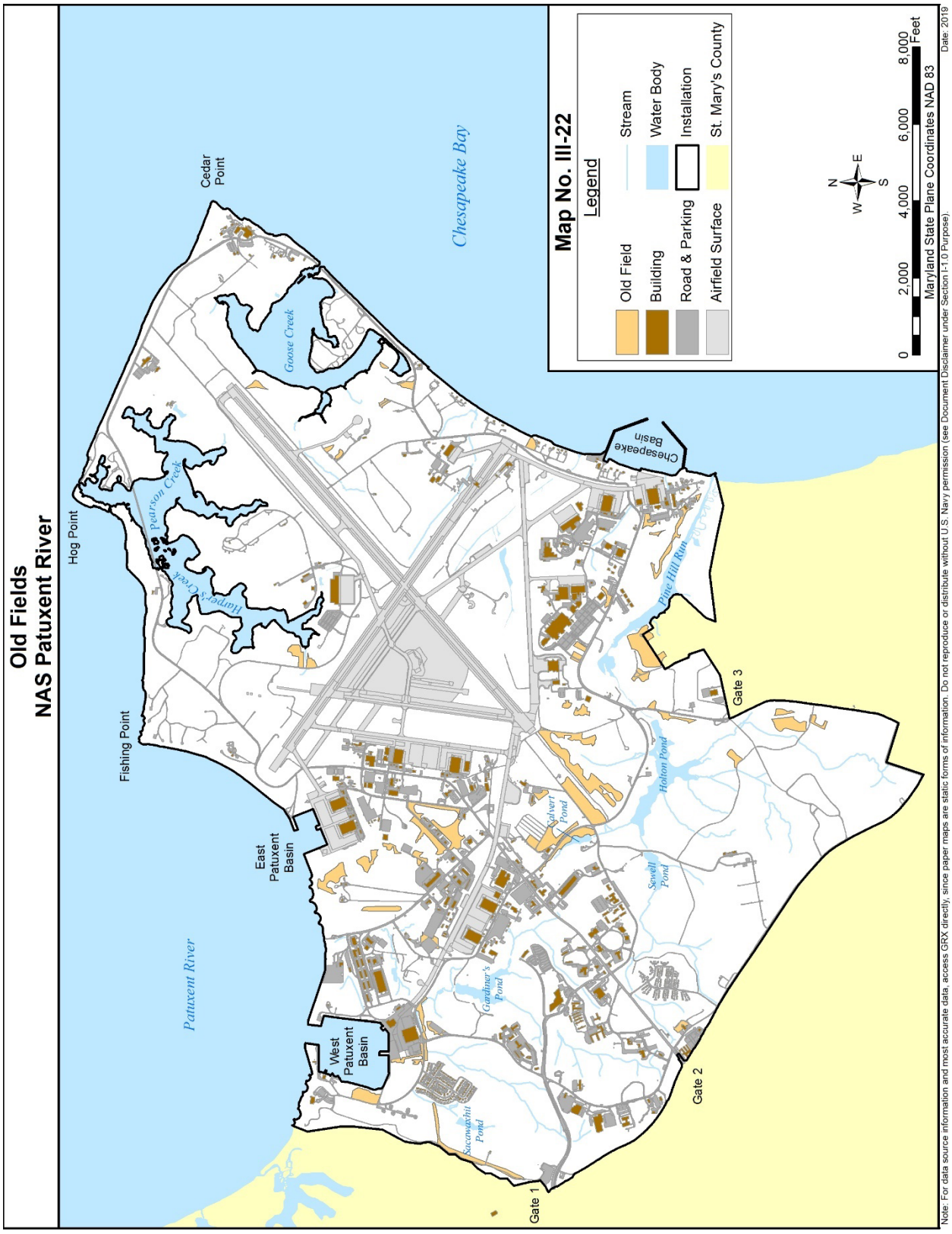
Old Fields
NAS Patuxent River
Map No. III-22
Legend
Old Field
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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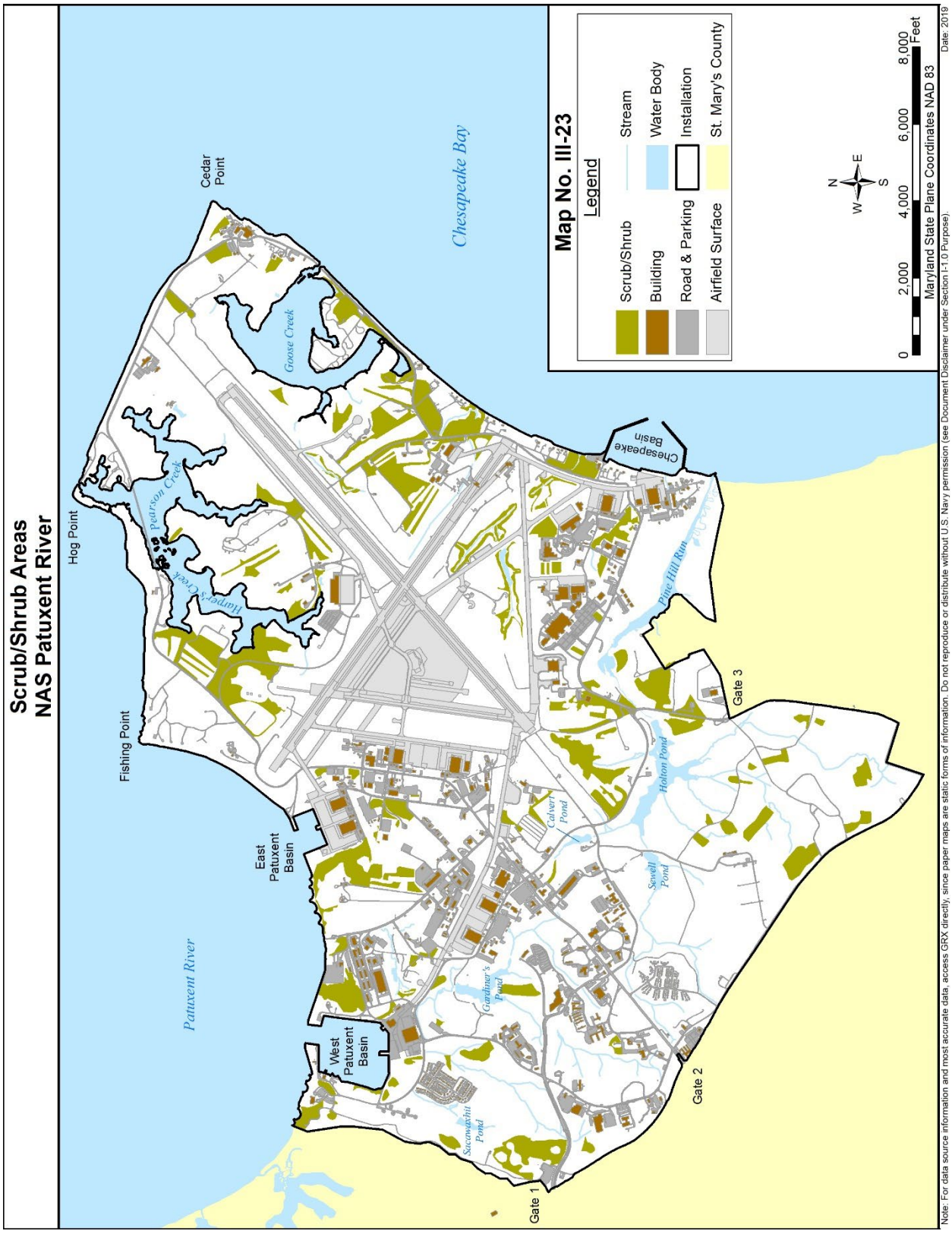
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Pearson Creek
Hungers Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Gate 1
Gate 2
Gate 3
Gardiner's Pond
Calvert Pond
Holton Pond
Sewell Pond
Saccawkhit Pond


Scrub/Shrub Areas
NAS Patuxent River
Map No. III-23
Legend
Scrub/Shrub
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
N
S
E
W
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Goose Creek
Pearson Creek
Hungers Creek
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Pine Hill Run
Gate 1
Gate 2
Gate 3
Saccarappi Pond
Gardiner's Pond
Calvert Pond
Sewell Pond
Holton Pond
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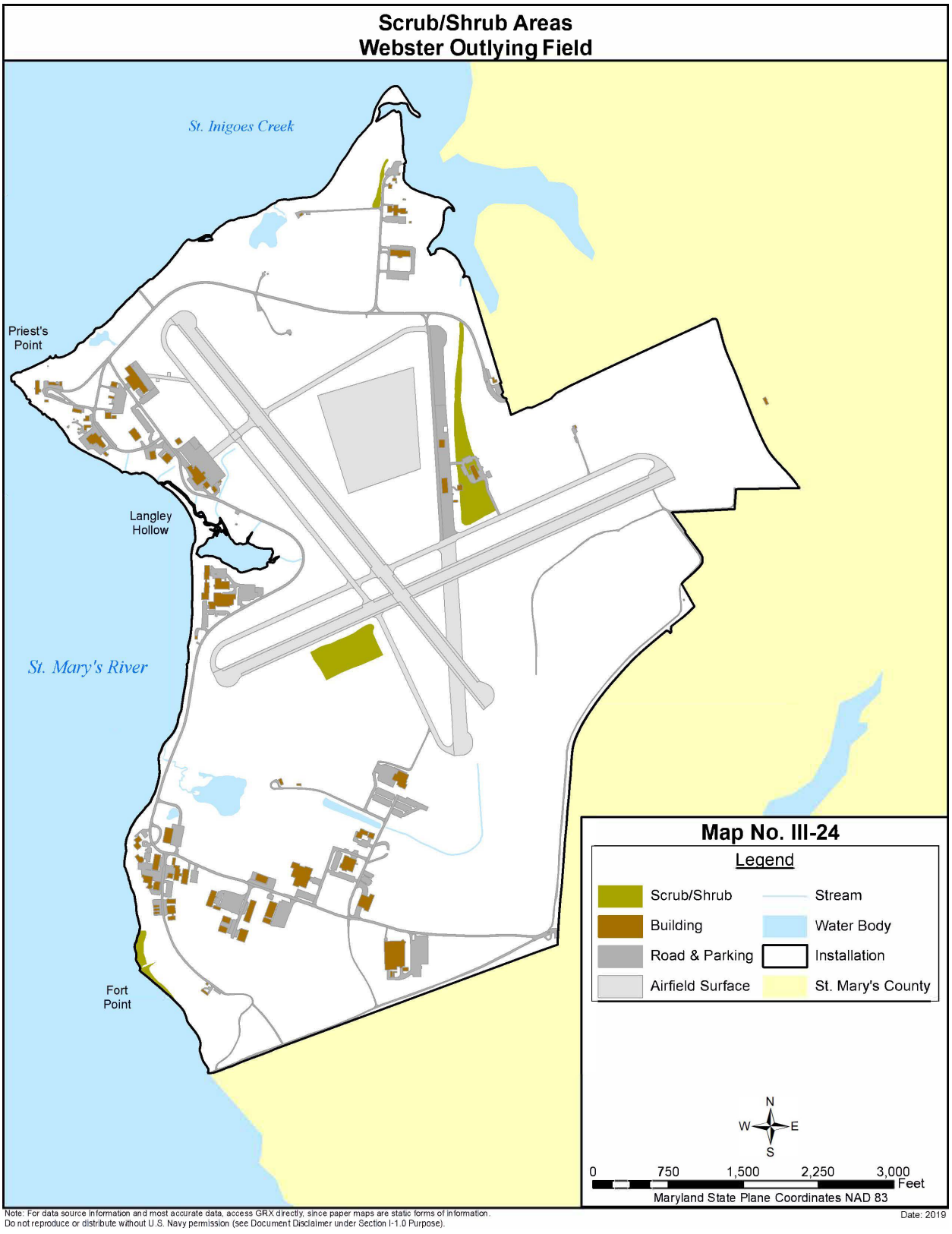
Date: 2019



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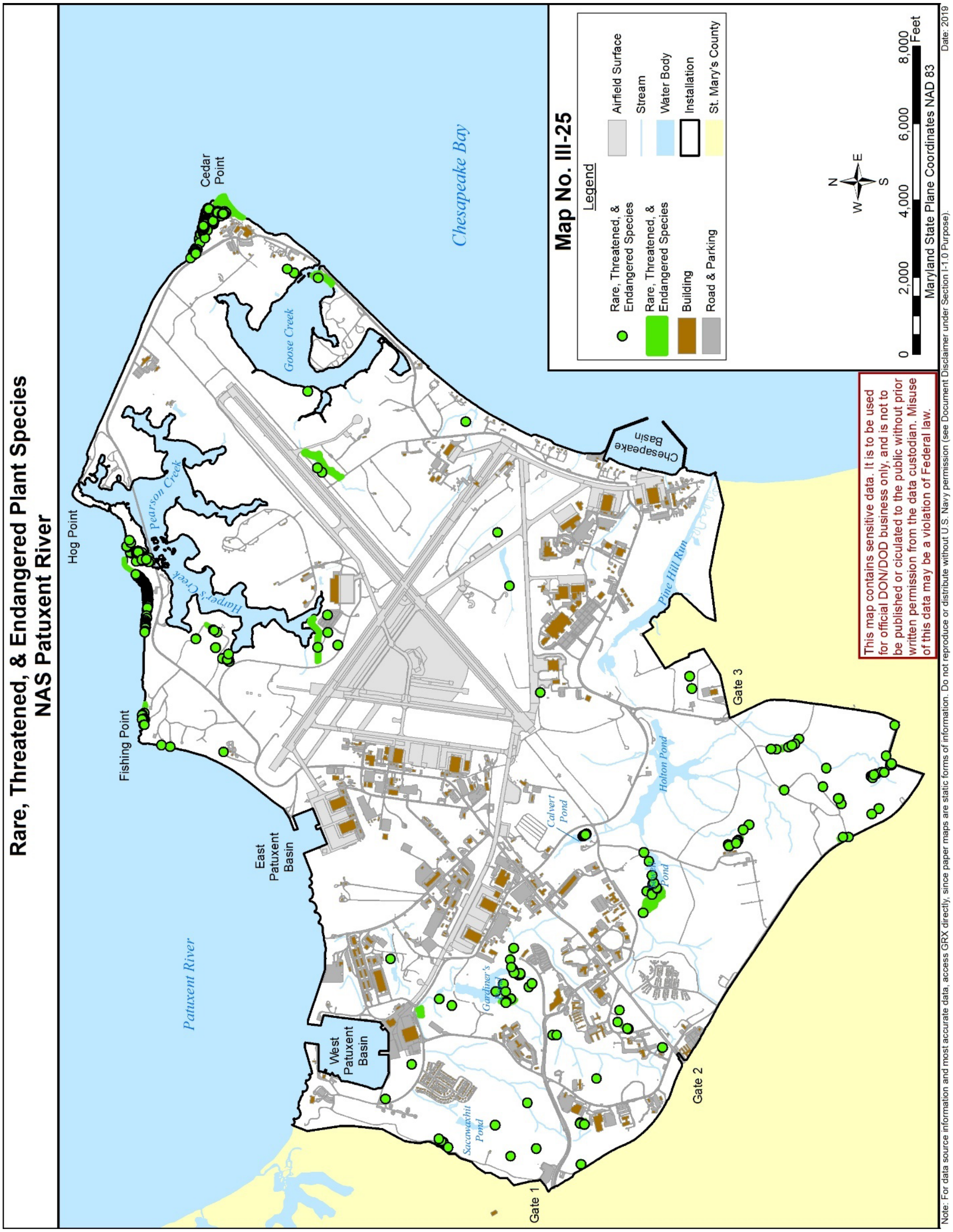
Rare, Threatened, & Endangered Plant Species
NAS Patuxent River
Map No. III-25
Legend
Rare, Threatened, & Endangered Species
Rare, Threatened, & Endangered Species
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0 2,000 4,000 6,000 8,000 Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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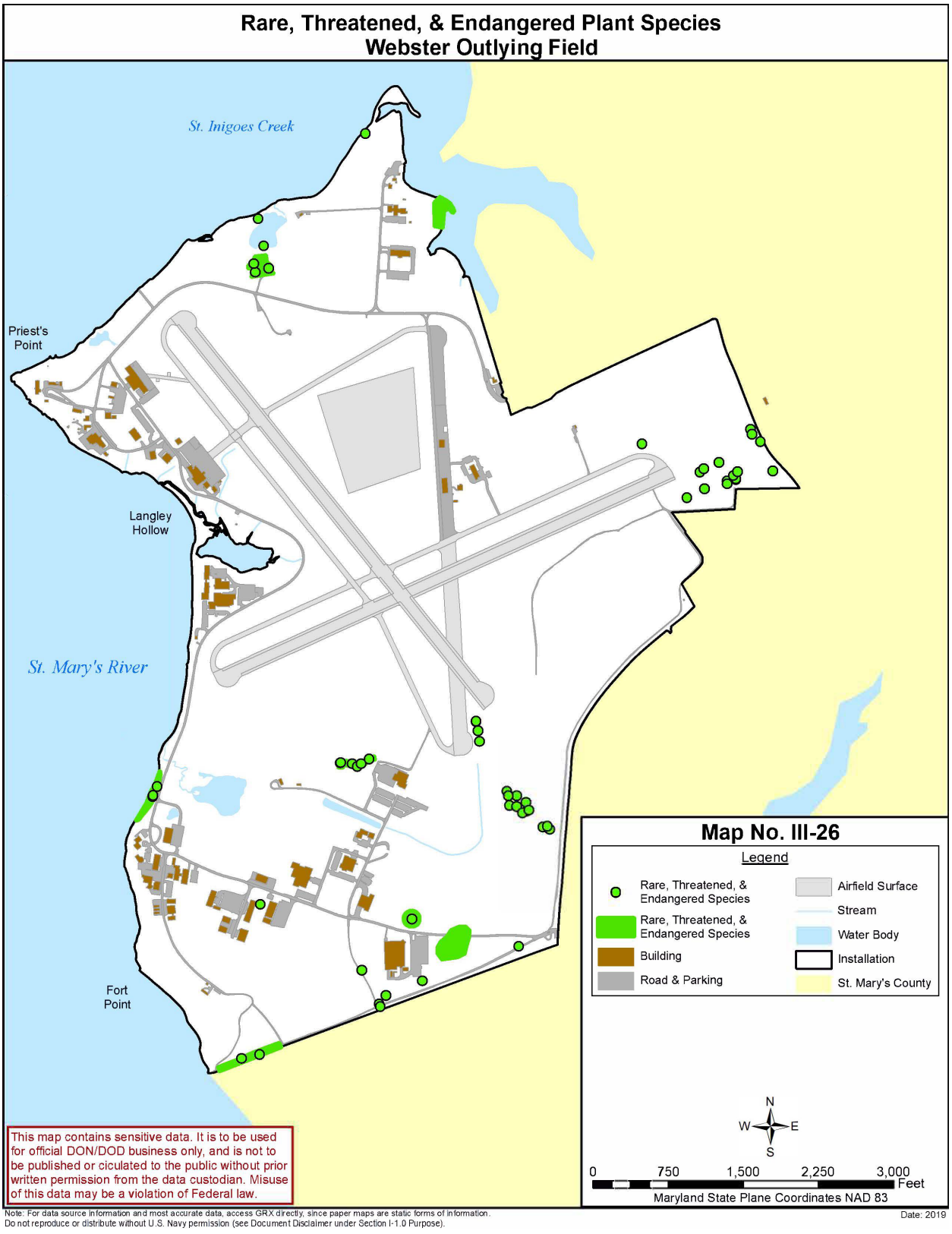
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Holton Pond
Calvert Pond
Gardiner's Pond
Sacawaxhit Pond
Gate 1
Gate 2
Gate 3


Rare, Threatened, & Endangered Plant Species
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. III-26
Legend
Rare, Threatened, & Endangered Species
Rare, Threatened, & Endangered Species
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
750
1,500
2,250
3,000
Feet
Maryland State Plane Coordinates NAD 83
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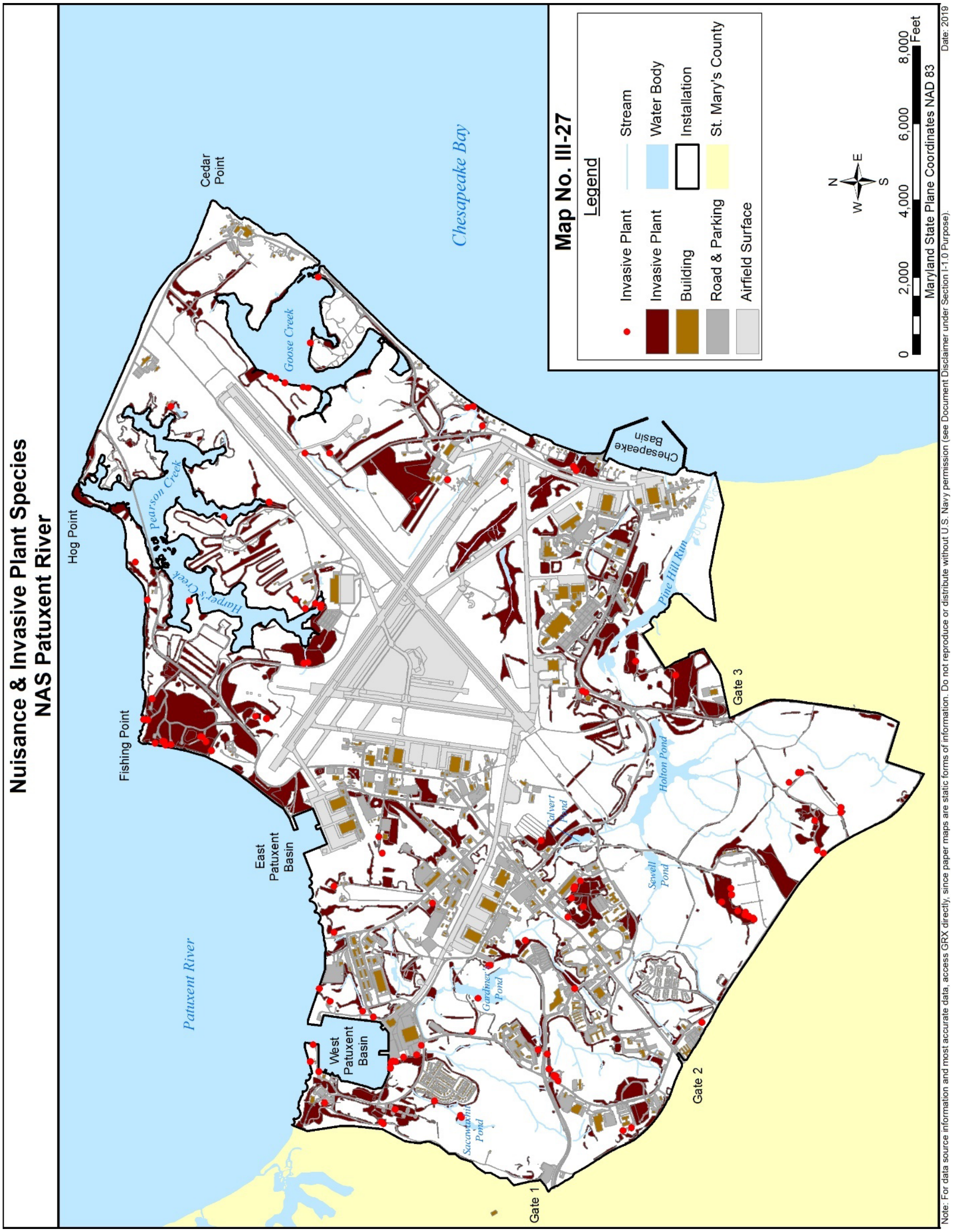
Nuisance & Invasive Plant Species
NAS Patuxent River
Map No. III-27
Legend
Invasive Plant
Invasive Plant
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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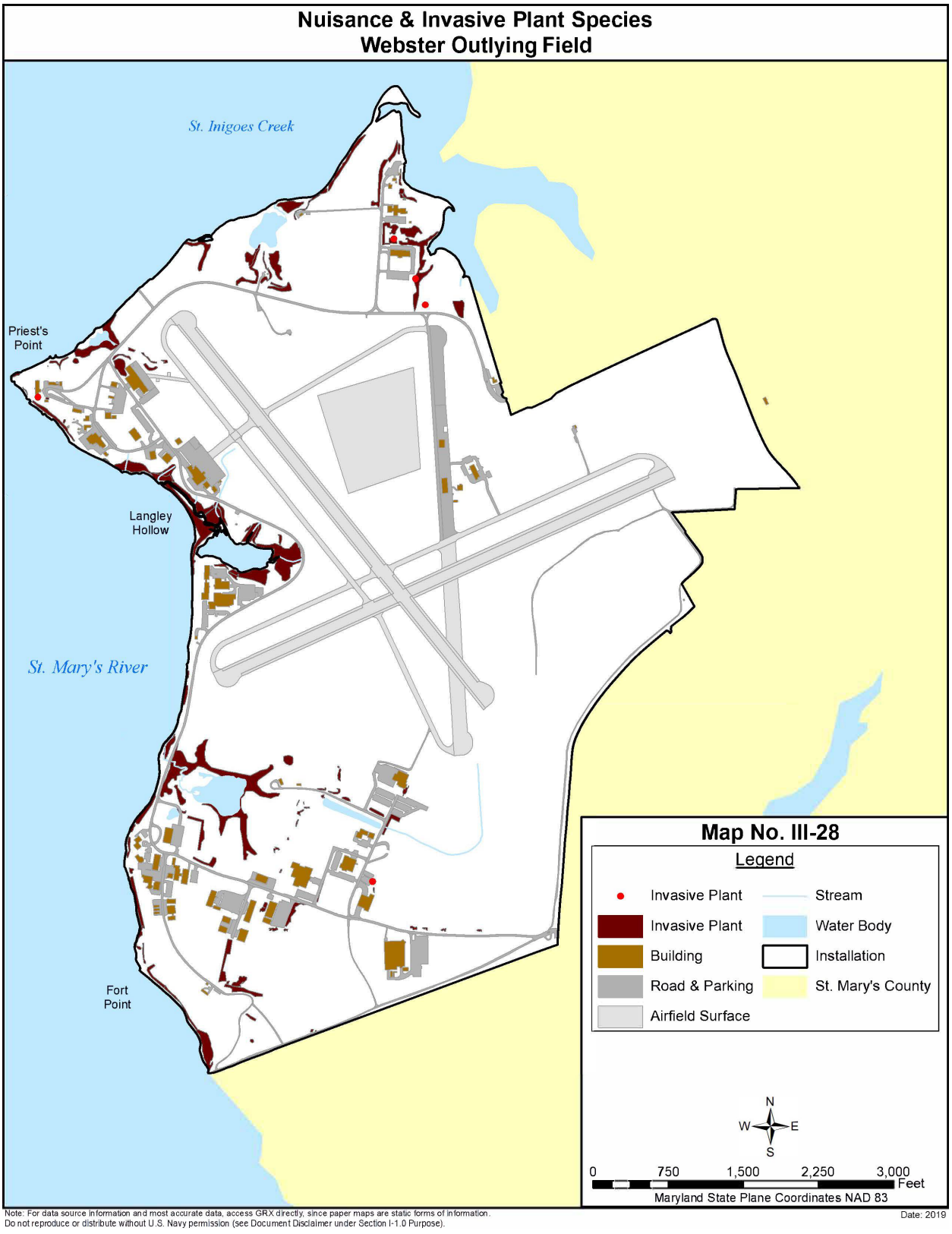
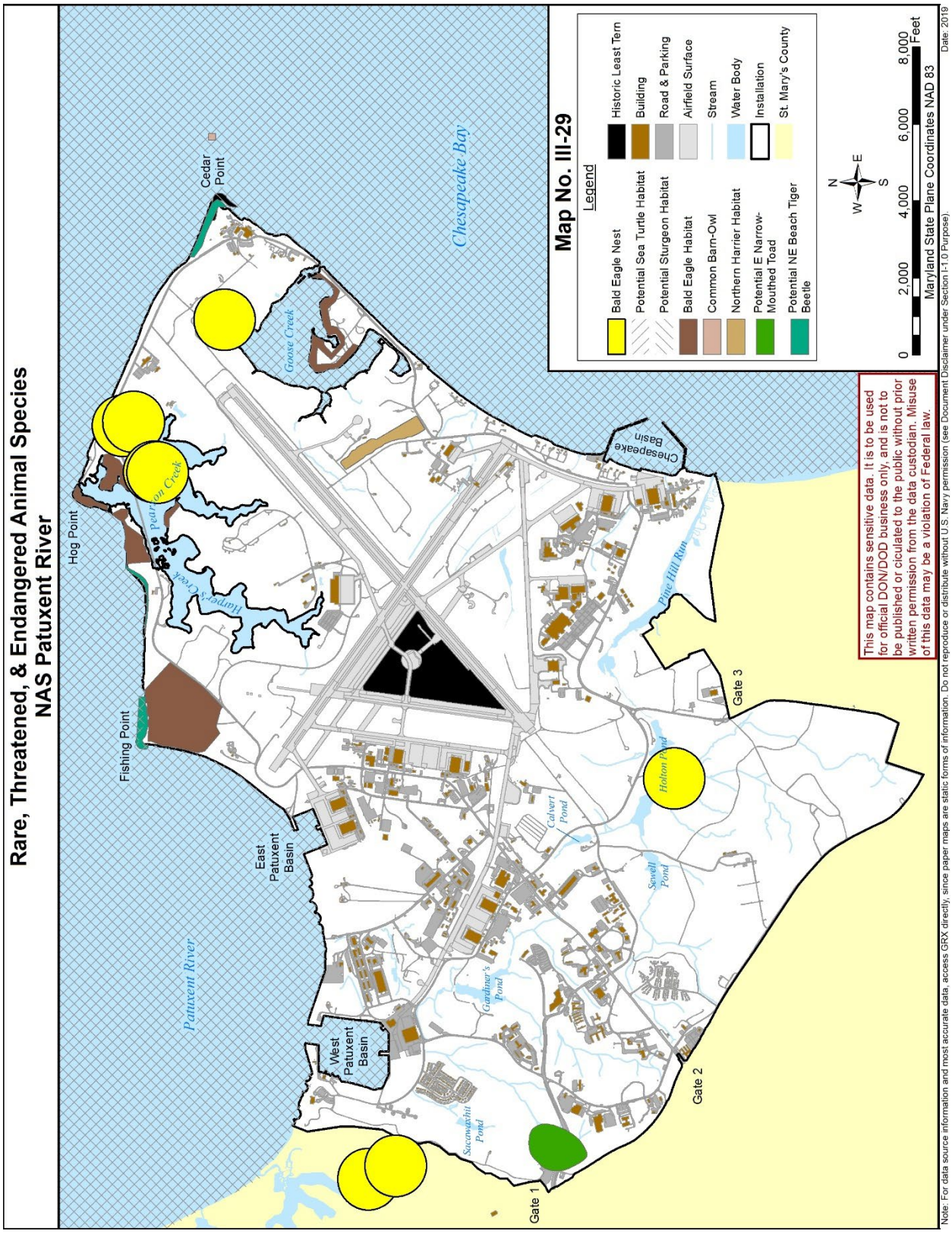
N
S
E
W
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Holton Pond
Sewell Pond
Gardner Pond
Gate 1
Gate 2
Gate 3



Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.


Rare, Threatened, & Endangered Animal Species
NAS Patuxent River
Map No. III-29
Legend
Bald Eagle Nest
Potential Sea Turtle Habitat
Potential Sturgeon Habitat
Bald Eagle Habitat
Common Barn-Owl
Northern Harrier Habitat
Potential E Narrow-Mouthed Toad
Potential NE Beach Tiger Beetle
Historic Least Tern
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0 2,000 4,000 6,000 8,000 Feet
Maryland State Plane Coordinates NAD 83
N W E S
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
Pearson Creek
Hungers Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Gate 1
Gate 2
Gate 3
Saccarappi Pond
Gardiner's Pond
Calvert Pond
Holton Pond
Sewell Pond
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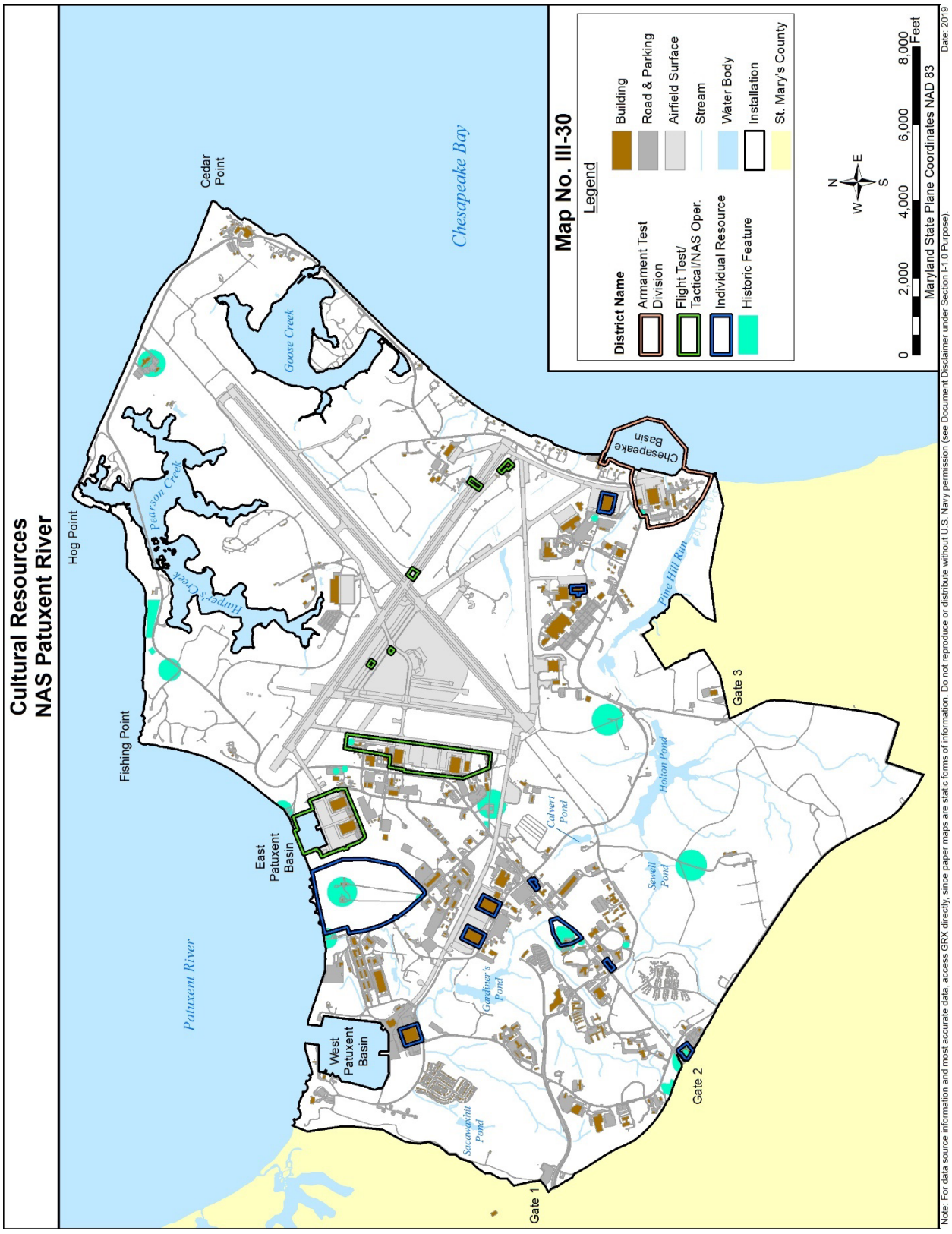
Date: 2019


Cultural Resources
NAS Patuxent River
Map No. III-30
Legend
District Name
Armament Test Division
Flight Test/ Tactical/NAS Oper.
Individual Resource
Historic Feature
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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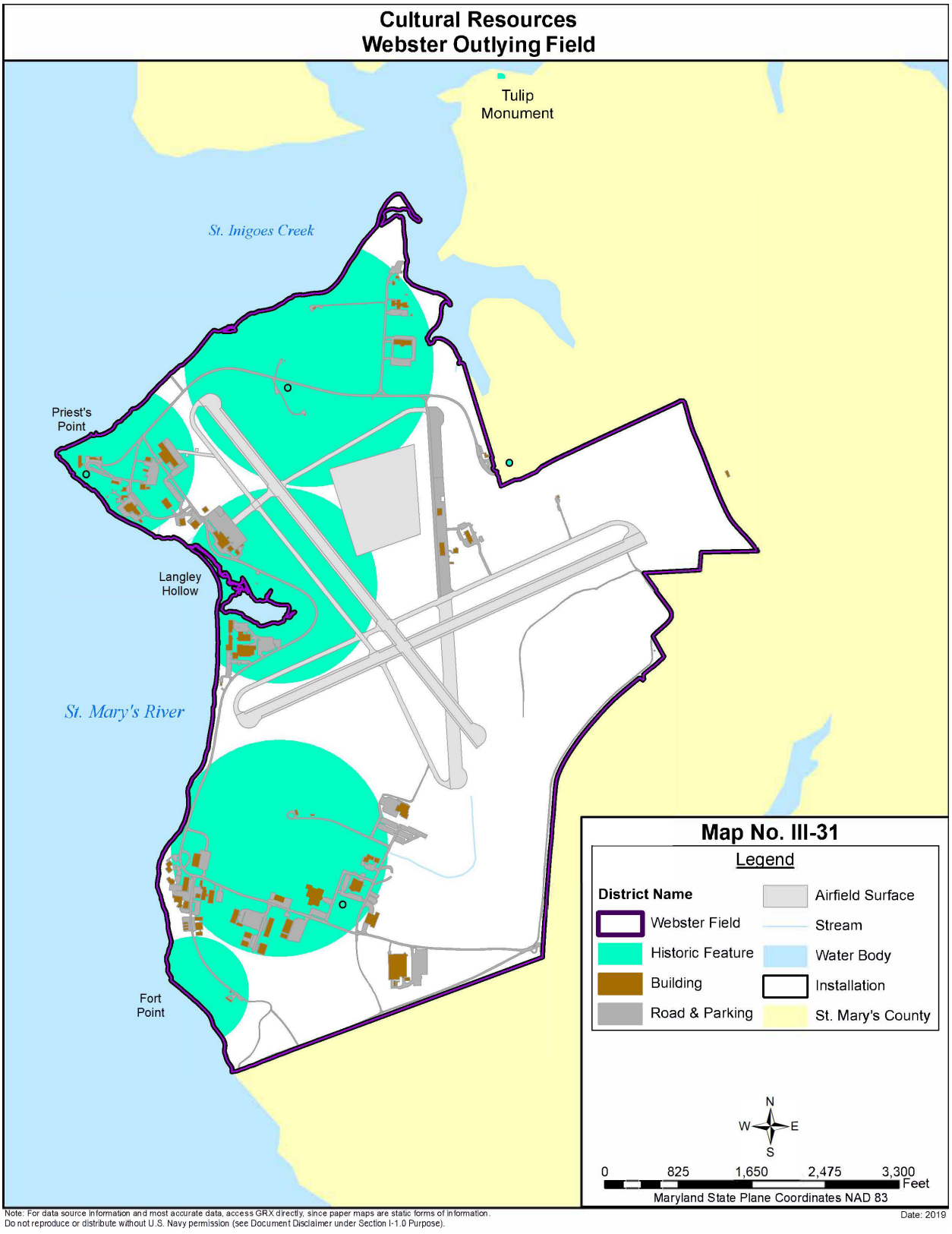
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Goose Creek
Pearson Creek
Hungers Creek
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Pine Hill Run
Calvert Pond
Gardiner's Pond
Sewell Pond
Holton Pond
Saccawkhil Pond
Gate 1
Gate 2
Gate 3



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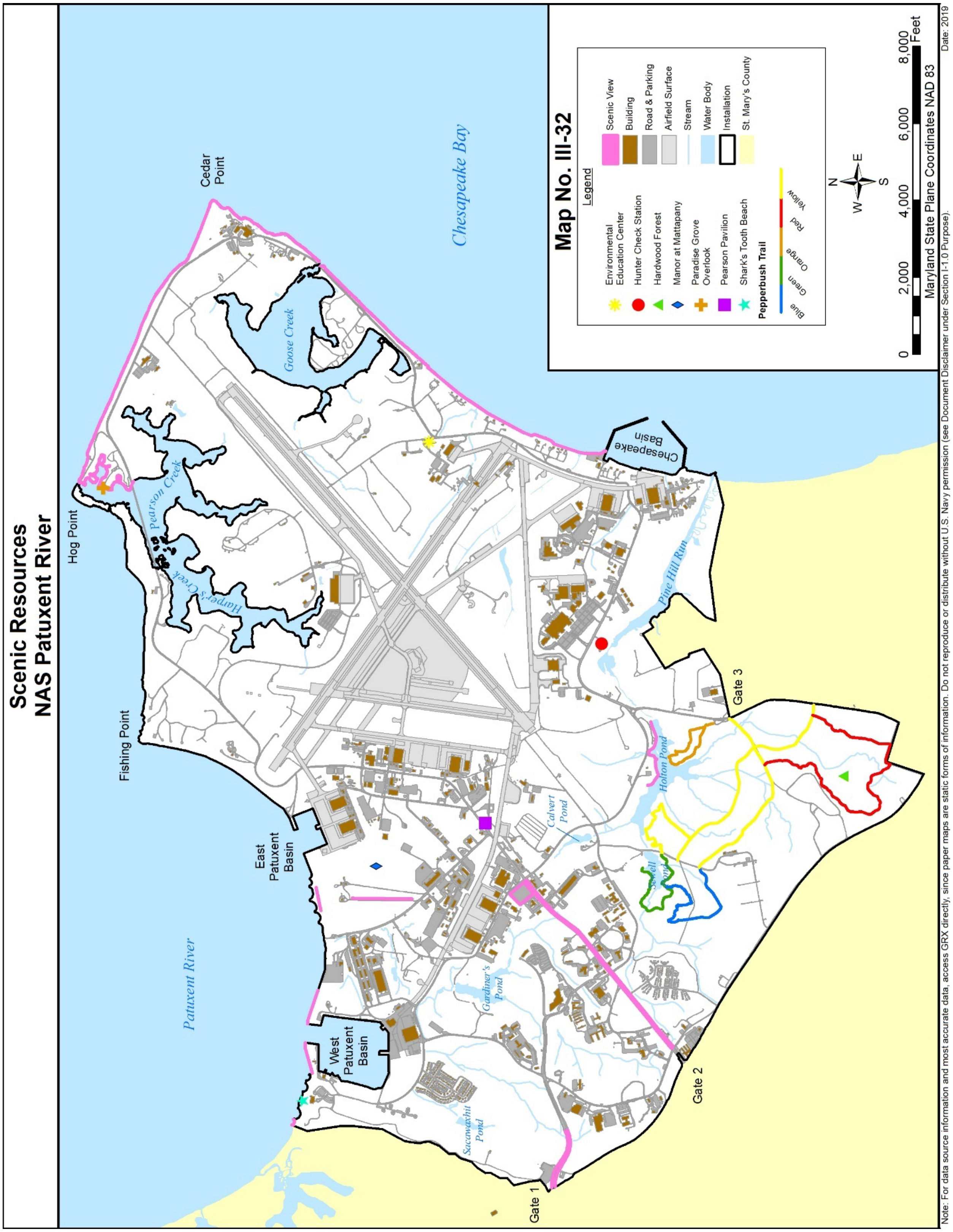
Scenic Resources
NAS Patuxent River
Map No. III-32
Legend
Environmental Education Center
Hunter Check Station
Hardwood Forest
Manor at Mattapany
Paradise Grove Overlook
Pearson Pavilion
Shark's Tooth Beach
Pepperbush Trail
Blue
Green
Orange
Red
Yellow
Scenic View
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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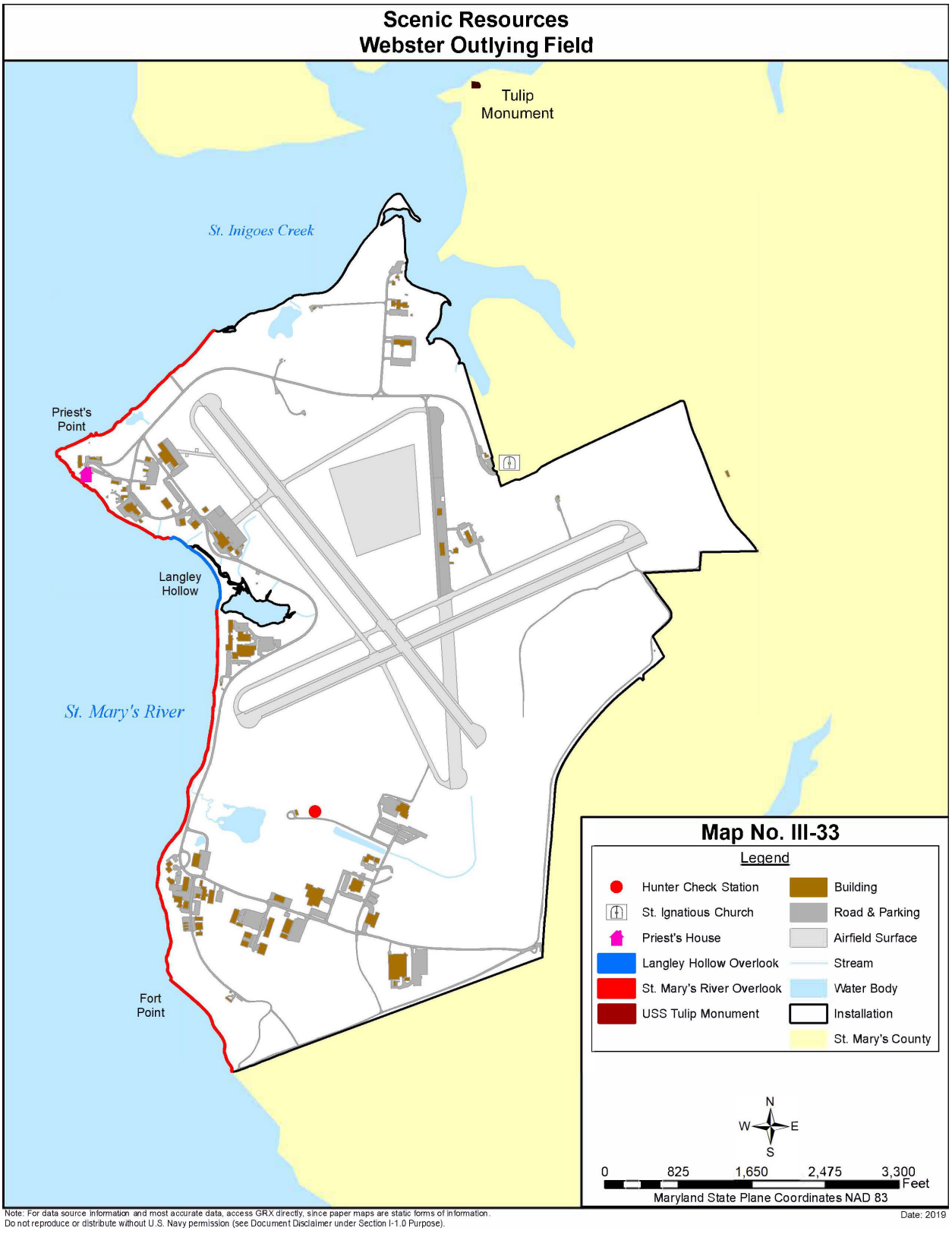
Chesapeake Bay
Cedar Point
Goose Creek
Chesapeake Basin
Pine Hill Run
Hog Point
Pearson Creek
Harper's Creek
Fishing Point
East Patuxent Basin
Patuxent River
West Patuxent Basin
Holton Pond
Calvert Pond
Gardiner's Pond
Sacawaxhi Pond
Gate 1
Gate 2
Gate 3


Scenic Resources
Webster Outlying Field
Tulip Monument
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. III-33
Legend
Hunter Check Station
St. Ignatious Church
Priest's House
Langley Hollow Overlook
St. Mary's River Overlook
USS Tulip Monument
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
825
1,650
2,475
3,300
Feet
Maryland State Plane Coordinates NAD 83
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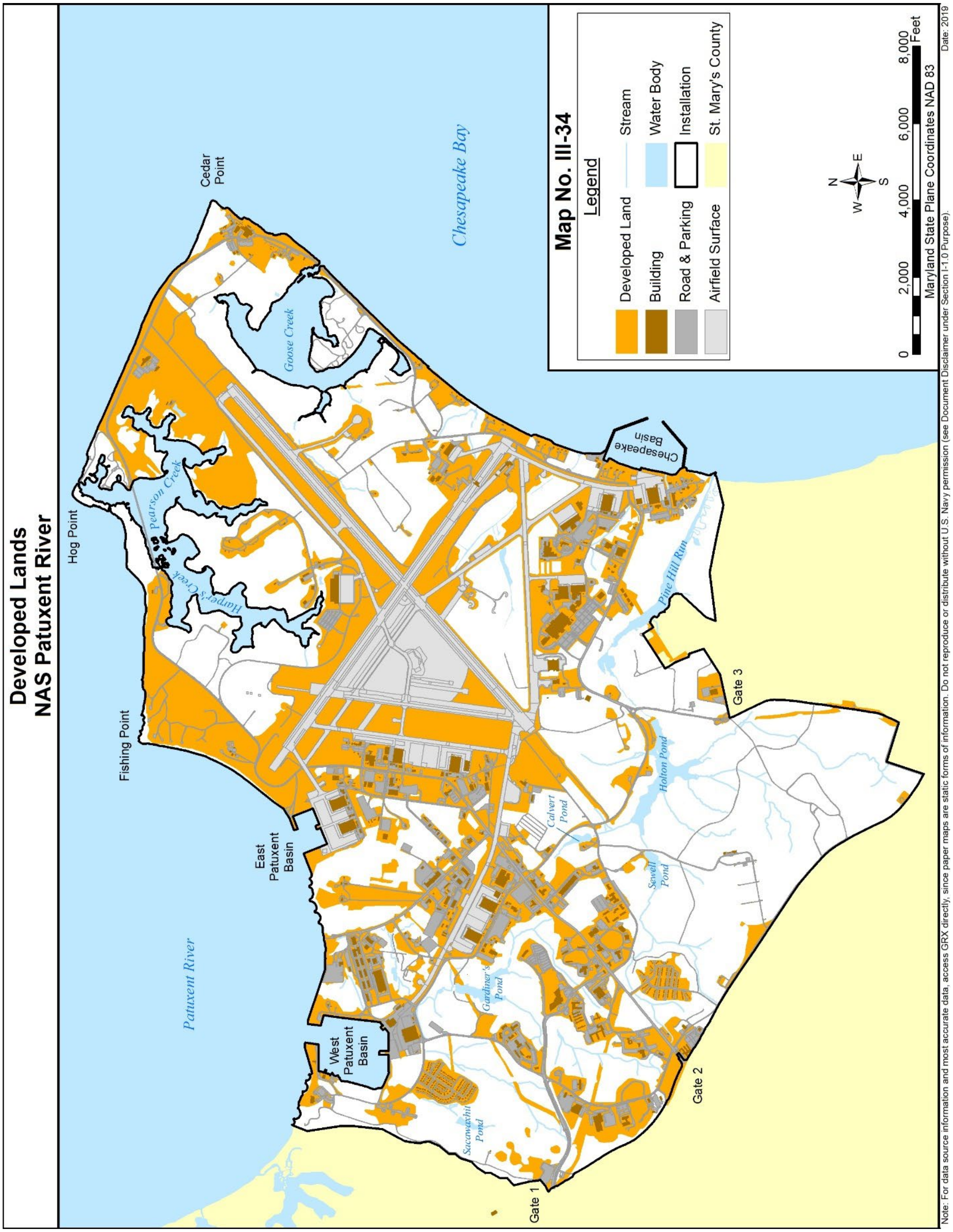
Date: 2019


Developed Lands
NAS Patuxent River
Map No. III-34
Legend
Developed Land
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Holton Pond
Calvert Pond
Sewell Pond
Gardiner's Pond
Pond
Gate 1
Gate 2
Gate 3
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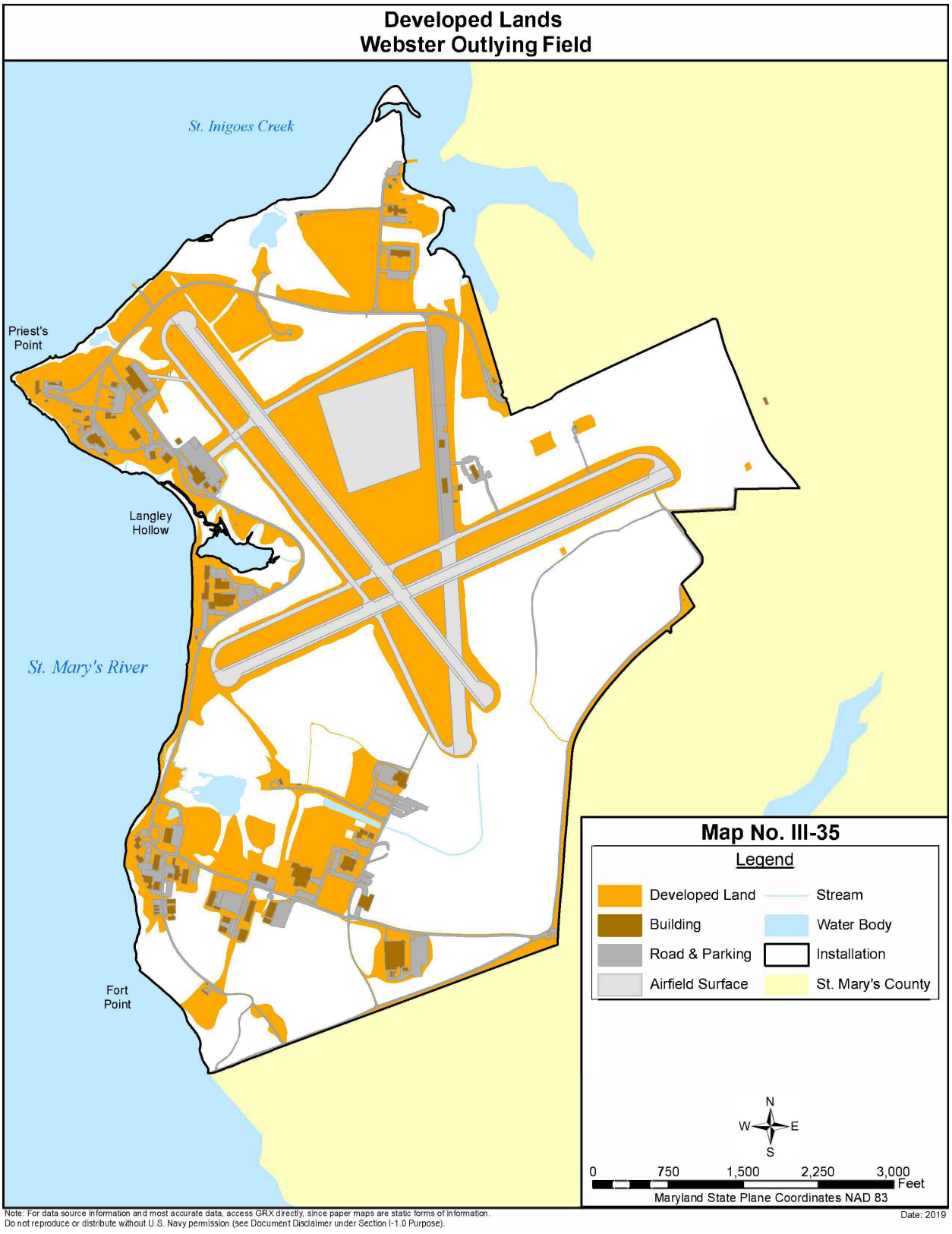

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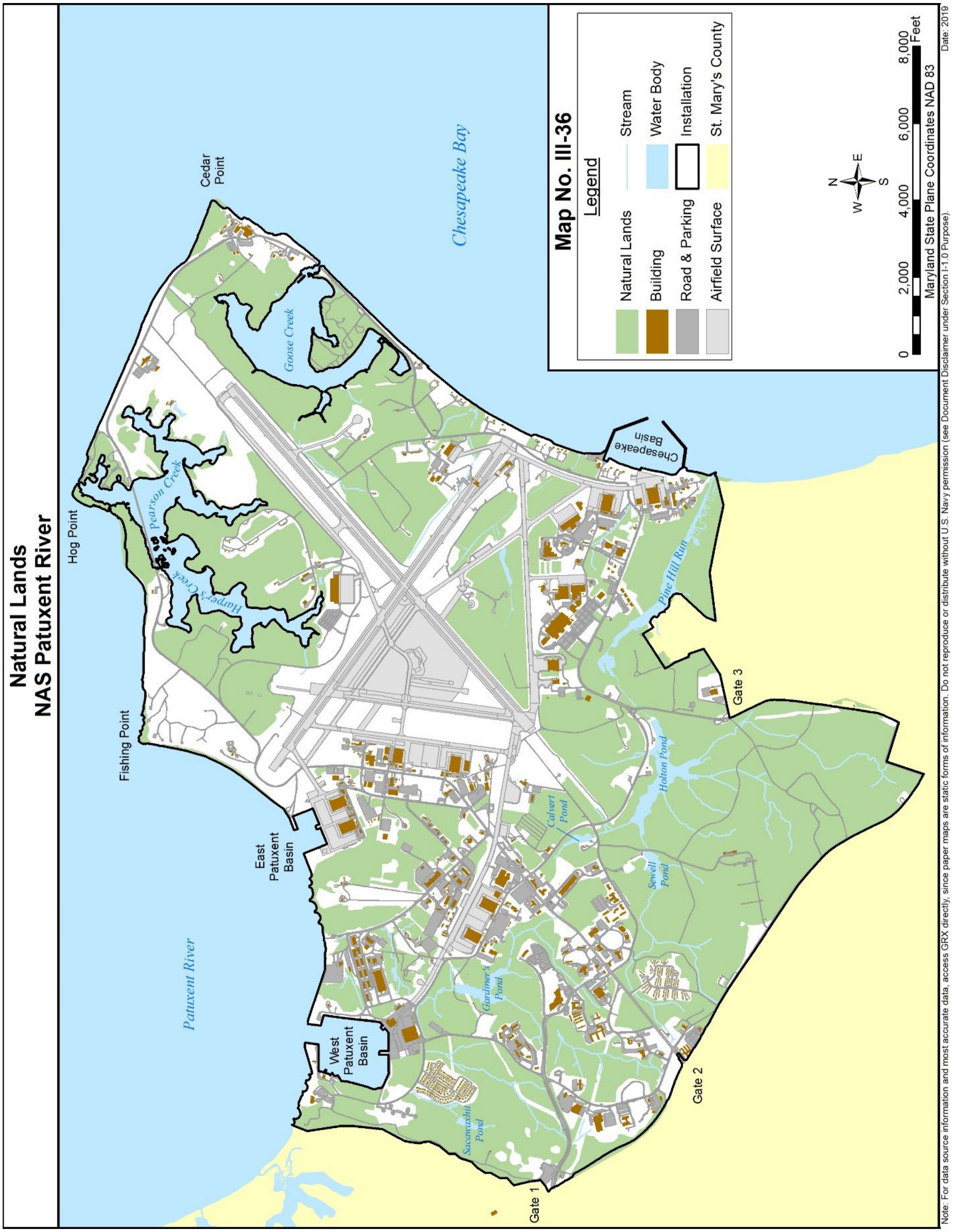
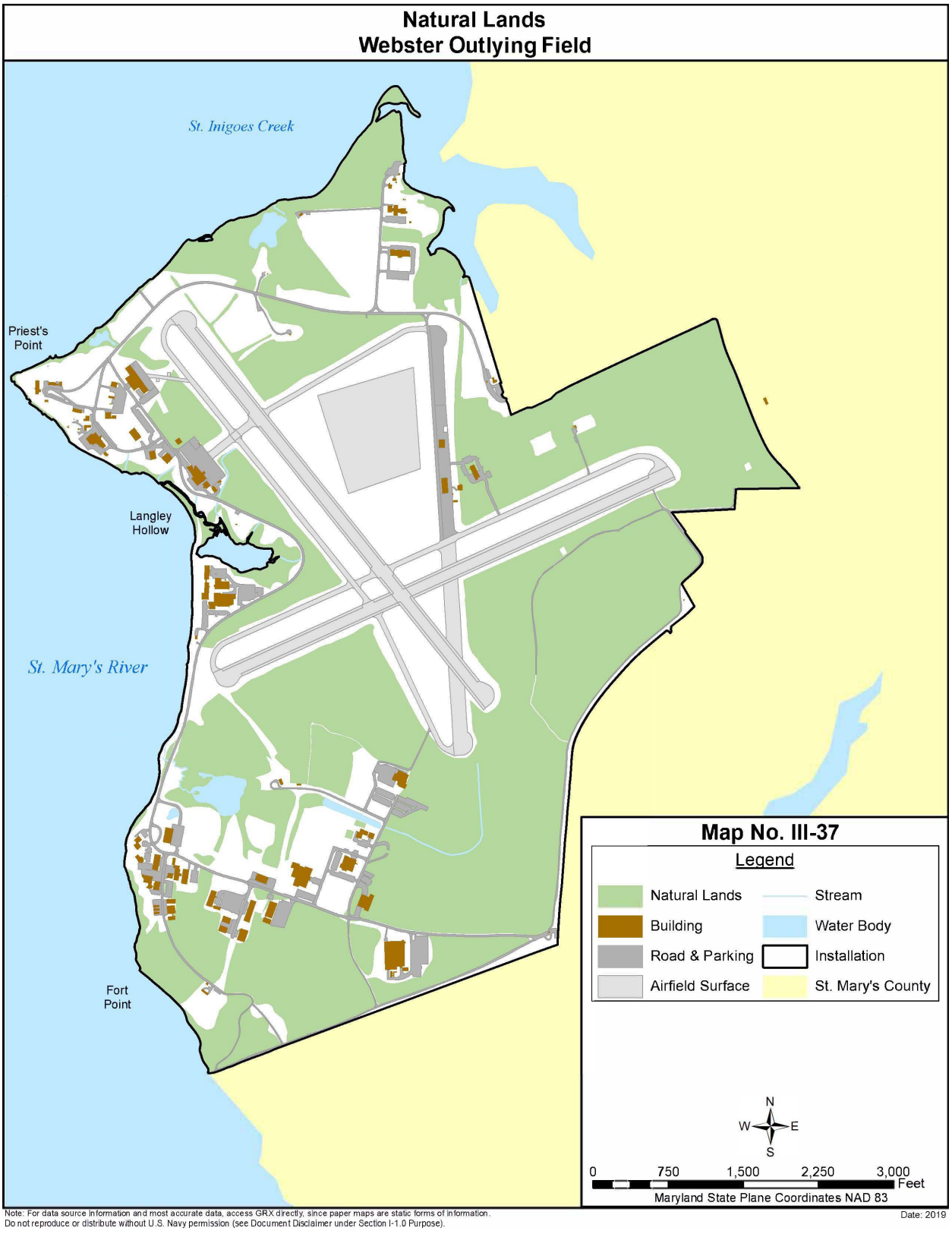

Natural Lands
NAS Patuxent River
Map No. III-36
Legend
Natural Lands
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Holton Pond
Calvert Pond
Sewell Pond
Gardiner's Pond
Sacawaxhit Pond
Gate 1
Gate 2
Gate 3
N E S W
0 2,000 4,000 6,000 8,000 Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).


Natural Lands
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. III-37
Legend
Natural Lands
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
750
1,500
2,250
3,000
Feet
Maryland State Plane Coordinates NAD 83
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Date: 2019

ANNEX III-C

TABLES

Table III-C-1. NAS Patuxent River Complex Properties.				
Special Area	**Plan***	**Facility Name**	**Acres**	**Leased? (if yes, end date provided)**
BAY FORREST	B	Bay Forrest Theodolite Station	0.5	No
BISHOPS HD DORCHESTER	B	Bishops Head Radar Site	1.55	No
BLOODSWORTH IS MD	A2	Bloodsworth Island, MD	6013.02	No
CEDAR POINT ISLAND	B	Cedar Point Island	1.54	No
CHESAPEAKE BAY	C	Chesapeake Bay Bombing Range	649.09	License - 9/9/9999
GLENN FOREST	C	Glenn Forest Housing Area	138.97	All leased out
		SMECO	1.5	5/14/2067
		BOCC (park)	46.72	2073
		PPV	**53.669**	2055
HERMANVILLE	D	Hermanville Microwave Repeater Site	1.03	Perm easement
NAVAL AIR STATION PATUXENT RIVER	A1	Naval Air Station Patuxent River	6294.39	No
		Pax (includes Pine Hill Run South property)	5841.95	N/A
		St. Marys	0.78	11/14/2049
		Cedar Pt. Fed. Credit Union	1	11/30/2030
		State of MD	4.13	10/13/2065
		Cedar Pt. Fed. Credit Union	0.59	2027
		METCOM	2.77	1/17/2066
		MD St. Rds. Comm.	0.5	1/12/2065
		FAA	0.1	1/31/2038
		State of MD SRC	0.05	12/31/9999
		SMECO	0.01	12/31/9999
		MD Army Natl. Guard	12.4	9/9/9999
		USPS	0.14	2/1/2045
		SMECO	8.45	6/9/2031
		METCOM	1.5	5/14/2067
		Russell Bros. (ag outlease)	382.97	10/31/2022
		PPV	113	2055
POINT LOOKOUT	B	Point Lookout	4.45	no
POINT NO POINT	B	Point No Point Theodolite Station	0.5	no
SHARPS ISLAND	D	Sharps Island	6.5	underwater
SOLOMONS ISLAND, MD	A3	Naval Recreation Center Solomons	281.54	no
SOUTHAMPTON	C	Southampton Land	2.69	no
SOUTHGATE	D	Southgate Land	18.47	Perm easement
ST JAMES	B	St. James or Chesapeake Theodolite Station	0.28	no
TIPPET'S ROAD	D	Tippet's Road	0.12	Perm easement
TULIP MEM ST INIGOES	A1	Tulip Memorial Site	0.53	no
WEBSTER FIELD	A1	Webster Outlying Field	852	no

Table III-C-1. NAS Patuxent River Complex Properties.				
Special Area	**Plan***	**Facility Name**	**Acres**	**Leased? (if yes, end date provided)**
		Pax/WOLF	712.85	n/a
		USCG	5.7	4/14/2026
		Russell Bros. (ag outlease)	120.54	10/31/2022
		Army Natl Guard	3.75	6/15/2036
WESTOVER MD	B	Westover Communication Station	0.68	no
WILLOWS ROAD	D	leased buildings	n/a	rental
LINKWOOD MD	D	leased space on comm tower	n/a	rental
VIENNA MD	D	leased space on comm tower	n/a	rental
LEXINGTON PARK	D	leased buildings	n/a	rental

A=in INRMP, actively managed	*Plan
B=in INRMP, little/no active management	1=PAX, WOLF
C=hybrids (some NR oversight)	2=BIR
D=not in INRMP (e.g., insufficient NRs)	3=SOL

Table III-C-2. Geologic Formation of Southern Maryland.

System	Series	Group	Formation	Width (feet)	Physical Character	Water-bearing properties
Quaternary	Recent and Pleistocene	-	Low-land deposits	0-150	Sand, gravel, sandy clay, and clay	Yields limited quantities of water to dug wells. North of Baltimore City yields a few hundred gallons a minute as a source of ground water in Southern Maryland.
Quaternary and Tertiary	Pleistocene and Pliocene	-	Upland deposits	0-55	Irregularly stratified cobbles, gravel, sand, and clay lenses.	Yields moderate quantities of ground water to dug or bored wells. Source of numerous rural water supplies.
Tertiary	Miocene	Chesapeake	St. Mary's	0-50	Sand, clayey sand, and blue clay; fossiliferous	Yields limited supplies of water to dug wells In Calvert and St. Mary's Counties. Not an important aquifer.
Tertiary	Miocene	Chesapeake	Choptank	20-105	Fine sand, sandy clay, and sand with fossiliferous layers.	Yields small supplies of water to a few dug wells near outcrop area. Not an important aquifer.
Tertiary	Miocene	Chesapeake	Calvert	20-180	Sandy clay and fine sand, fossiliferous; diatomaceous earth	Yields small quantities of water to dug or bored wells in outcrop area. A few drilled wells may tap basal sand.
Tertiary	Miocene	Pamunkey	Nanjemoy	40-240	Glauconitic sand with clayey layers. Basal part is red or gray clay.	An important aquifer in Calvert and St. Mary's Counties. Yields from individual

Table III-C-2. Geologic Formation of Southern Maryland.

System	Series	Group	Formation	Width (feet)	Physical Character	Water-bearing properties
						wells reported up to 60 gallons/minute.
Tertiary	Miocene	Pamunkey	Aquia	30-203	Glauconitic, greenish to brown sand with indurated or "rock" layers in middle and basal parts.	An important aquifer in Calvert, Charles, and St. Mary's Counties. Yields up to 300 gallons a minute reported from individual wells.
Tertiary	Paleocene	Pamunkey	Brightseat	0-40	Gray to dark-gray micaceous silty and sandy clay.	Not known to be an aquifer in Southern Maryland.
Cretaceous	Upper Cretaceous	-	Monmouth and Matawan	20-135	Sandy clay and sand, dark gray to black, with some glauconite. Basal part is lighter in color and less glauconitic.	Not a major aquifer in Southern Maryland, but yields up to 50 gallons a minute have been reported from individual drilled wells.
Cretaceous	Upper Cretaceous	-	Magothy	0-140	Light gray to white sand and fine gravel with interbedded clay layers; contains pyrite and lignite.	An important aquifer in Prince George's and Anne Arundel Counties. A few wells reportedly yield 1,000 gallons/minute, but average yields are considerably less.

Table III-C-2. Geologic Formation of Southern Maryland.

System	Series	Group	Formation	Width (feet)	Physical Character	Water-bearing properties
Cretaceous	Upper Cretaceous	-	Raritan	100+	Interbedded sand and clay with ironstone nodules; locally contains indurated layers.	Utilized by drilled and dug wells chiefly in Anne Arundel County. Yields up to a few hundred gallons/'minute reported.
Cretaceous	Upper Cretaceous	Potomac	Patapsco	100-650	Interbedded sand, clay, and sandy clay; color variegated but chiefly hues of red and yellow.	An important aquifer in Prince Georges and Anne Arundel Counties. Large diameter drilled walls yield up to 1,000 gallons/minute.
Cretaceous	Upper Cretaceous	Potomac	Arundel clay	25-200	Red, brown, and gray clay; in places contains ironstone nodules and plant remains.	Not generally a water- bearing formation in Southern Maryland.
Cretaceous	Lower Cretaceous	-	Patuxent	100-450+	Chiefly gray and yellow sand with interbedded clay; kaolinized feldspar and lignite common. Locally clay layers predominate.	Utilized by wells in parts of Prince Georges and Anne Arundel Counties, yields up to 540 gallons/minute. Aquifer largely undeveloped in Southern Maryland is present.

Table III-C-2. Geologic Formation of Southern Maryland.

System	Series	Group	Formation	Width (feet)	Physical Character	Water-bearing properties
Pre-Cambrian	-	-	-	Unknown	Chiefly gneiss, granite, gabbro, metagabbro, quartz, diorite, and granitized schist.	Yields moderate supplies of ground water, generally now more than 50 gallons/ minute per well. Some wells are unproductive.

(Adopted from Otton, 1955)

Table III-C-3. Abundant (A) and Common (C) Species Found on the Station during General Site Overview and Different Habitat Types.		
SCIENTIFIC NAME	COMMON NAME	RELATIVE RANKING
Wetland Forests		
Acer rubrum	Red Maple	A
Alnus spp.	Alder	A
Amelanchier spp.	Serviceberry	C
Aralia spinosa	Devil's Walkingstick	C
Athyrium filix-femina	Lady Fern	C
Boehmeria cylindrica	Smallspike False Nettle	A
Botrychium spp.	Grapefern	C
Calamagrostis spp.	Reedgrass	C
Campsis radicans	Trumpet Creeper	C
Carpinus caroliniana	American Hornbeam	A
Chasmanthium spp.	Woodoats (Spikegrass)	C
Chionanthus virginicus	White Fringetree	C
Clethra alnifolia	Coastal Sweet Pepperbush	A
Diospyros virginiana	Persimmon	C
Fraxinus spp.	Ash	C
Gaylussacia spp.	Huckleberry	C
Ilex opaca	American Holly	A
Ilex verticillata	Winterberry	C
Impatiens capensis	Jewelweed	C
Juncus effusus	Common Rush (Soft Rush)	C
Juncus tenuis	Poverty Rush (Slender Rush)	C
Leersia virginia	Whitegrass	C
Eubotrys racemosa	Swamp Doghobble (Fetterbush)	C
Lindera benzoin	Northern Spicebush	A
Liquidambar styraciflua	Sweetgum	A
Lonicera japonica	Japanese Honeysuckle	C
Magnolia virginiana	Sweetbay Magnolia	C
Nyssa spp.	Tupelo	A
Onoclea sensibilis	Sensitive Fern	A
Osmunda cinnamomea	Cinnamon Fern	A
Osmuda regalis	Royal Fern	A
Panicum spp.	Panicgrass	C
Pinus taeda	Loblolly Pine	C
Platanus occidentalis	American Sycamore	C
Quercus palustris	Pin Oak	C
Quercos phellos	Willow Oak	C
Ranunculus spp.	Buttercup	C
Saururus cernuus	Lizard's Tail	C
Smilax rotundifolia	Roundleaf Greenbrier (Common Greenbrier)	C
Thelypteris noveboracensis	New York Fern	C

Table III-C-3. Abundant (A) and Common (C) Species Found on the Station during General Site Overview and Different Habitat Types.		
SCIENTIFIC NAME	COMMON NAME	RELATIVE RANKING
Thelypteris palustris	Eastern Marsh Fern	C
Toxicodendron radicans	Poison Ivy	C
Vaccinium spp.	Blueberry	A
Viburnum dentatum	Southern Arrowwood	A
Viburnum lentago	Nannyberry	C
Viburnum nudum	Possumhaw Viburnum	C
Viola spp.	Violet	C
Woodwardia spp.	Chainfern	C
Upland Forests		
Acer rubrum	Red Maple	C
Amelanchier spp.	Serviceberry	C
Aralia spinosa	Devil's Walkingstick	A
Botrychium spp.	Grapefern	C
Campsis radicans	Trumpet Creeper	A
Carya spp.	Hickory	A
Celtis occidentalis	Hackberry	C
Cercis canadensis	Eastern Redbud	C
Cornus florida	Flowering Dogwood	A
Diospyros virginiana	Persimmon	C
Elaeagnus umbellata	Autumn Olive	C
Euonymus spp.	Burningbush	C
Fagus grandifolia	American Beech	C
Ilex opaca	American Holly	A
Juglans nigra	Black Walnut	C
Juniperus virginiana	Eastern Red Cedar	C
Kalmia latifolia	Mountain Laurel	C
Liquidambar styraciflua	Sweetgum	A
Liriodendron tulipifera	Tulip Poplar (Yellow-poplar)	C
Lonicera japonica	Japanese Honeysuckle	C
Lonicera tatarica	Tatarian Honeysuckle	C
Lycopodium spp.	Clubmoss	A
Mitchella repens	Partridgeberry	C
Morus spp.	Mulberry	C
Parthenocissus quinquefolia	Virginia Creeper	C
Pinus taeda	Loblolly Pine	A
Pinus virginiana	Virginia Pine	C
Polystichum acrostichoides	Christmas Fern	C
Prunus serotina	Black Cherry	C
Pyrola spp.	Wintergreen	C
Quercus alba	White Oak	A
Quercus coccinea	Scarlet Oak	C
Quercus falcata	Southern Red Oak	C

Table III-C-3. Abundant (A) and Common (C) Species Found on the Station during General Site Overview and Different Habitat Types.		
SCIENTIFIC NAME	COMMON NAME	RELATIVE RANKING
Quercus montana	Chestnut Oak	A
Quercus rubra	Northern Red Oak	C
Quercus stellata	Post Oak	C
Quercus velutina	Black Oak	C
Robinia pseudoacacia	Black Locust	C
Rosa multiflora	Multiflora Rose	C
Rubus spp.	Blackberries	C
Sassafras albidum	Sassafras	C
Maianthemum spp.	False lily of the valley (False solomon's seal)	C
Smilax spp.	Greenbriar	C
Tipularia discolor	Crippled Cranefly (Cranefly Orchid)	C
Toxicodendron radicans	Poison Ivy	C
Vaccinium corymbosum	Highbush Blueberry	C
Vaccinium stamineum	Deerberry	C
Viburnum prunifolium	Blackhaw	C
Vitis labrusca	Fox Grape	C
Agricultural Fields		
Ambrosia artemisiifolia	Radweed	A
Setaria faberi	Japanese Bristlegrass	A
Stellaria media	Chickweed	C
Open Fields/Mowed Areas		
Allium canadense	Meadow Garlic (Meadow Onion)	A
Allium vineale	Wild Garlic (Field Garlic)	A
Andropogon virginicus	Broomsedge Bluestem (Broom sedge)	A
Bromus spp.	Bromes	C
Cirsium spp.	Thistle	C
Festuca spp.	Fescues	C
Hieracium spp.	Hawkweed	C
Limosella spp.	Mudwort	C
Lolium perenne	Perennial Ryegrass	A
Muhlenbergia schreberi	Nimblewill	C
Tidal Marshes		
Baccharis halimifolia	Eastern Baccharis (Groundsel Tree)	C
Ceramium spp.	Banded seaweeds	C
Cladophora spp.	Green-tufted seaweeds	C
Distichlis spicata	Saltgrass	C
Ectocarpus spp.	Brown fuzz seaweeds	C
Enteromorpha spp.	Hollow-tubed seaweeds	C

Table III-C-3. Abundant (A) and Common (C) Species Found on the Station during General Site Overview and Different Habitat Types.		
SCIENTIFIC NAME	COMMON NAME	RELATIVE RANKING
Hibiscus moscheutos	Crimsoneyed Rosemallow (Marsh Hibiscus)	C
Iva frutescens	Jesuit's Bark (Marsh Elder)	C
Juncus roemerianus	Needlegrass Rush	A
Phragmites australis	Common Reed (Reed Grass)	A
Ruppia maritima	Widgeongrass	A
Salicornia spp.	Glassworts	C
Schoenoplectus americanus	American Threesquare	C
Spartina alterniflora	Smooth Cordgrass (Saltmarsh Cordgrass)	A
Spartina cynosuroides	Big Cordgrass	C
Spartina patens	Saltmeadow Cordgrass (Cordgrass or Saltmeadow Hay)	C
Typha angustifolia	Narrowleaf Cattail	A
Ulva lactuca	Sea Lettuce	C
Zannichellia palustris	Horned Pondweed	A
Zostera marina	Eelgrass (Seawrack)	C
Nontidal Marshes		
Acorus calamus	Sweetflag	C
Alnus serrulata	Hazel Alder (Common Alder)	C
Baccharis halimifolia	Eastern Baccharis (Groundsel Tree)	C
Carex spp.	Sedges	A
Cephalanthus occidentalis	Buttonbush	C
Ceratophyllum demersum	Coontail	C
Clethra alnifolia	Coastal Sweet Pepperbush	A
Elodea canadensis	Waterweed	C
Hibiscus moscheutos	Crimsoneyed Rosemallow (Marsh Hibiscus)	C
Impatiens capensis	Jewelweed	A
Juncus effusus	Common Rush (Soft Rush)	A
Lemna spp.	Duckweed	C
Myriophyllum spicatum	Eurasian Watermilfoil	C
Najas guadalupensis	Southern Waternymph (Bushy Pondweed)	C
Nuphar lutea	Yellow Pond Lily	C
Panicum spp.	Panicgrass	C
Peltandra virginica	Green Arrow Arum	C
Phragmites australis	Common Reed (Reed Grass)	C
Plantago lanceolata	Narrowleaf Plantain	C
Poa pratensis	Kentucky Bluegrass	C
Pontederia cordata	Pickerelweed	C

Table III-C-3. Abundant (A) and Common (C) Species Found on the Station during General Site Overview and Different Habitat Types.		
SCIENTIFIC NAME	COMMON NAME	RELATIVE RANKING
Potamogeton perfoliatus	Claspingleaf Pondweed (Redhead Grass)	C
Potentilla simplex	Common (Old Field) Cinquefoil	C
Rosa palustris	Swamp Rose	C
Salix nigra	Black Willow	C
Sambucus nigra canadensis	American Elderberry	C
Saururus cernuus	Lizard's Tail	C
Stellaria media	Chickweed	C
Stuckenia pectinatus	Sago Pondweed	C
Typha latifolia	Broadleaf Cattail	A
Taraxacum officinale	Common Dandelion	C
Vallisneria americana	American Eelgrass (Wild or Water Celery)	C
Zizania aquatica	Wild Rice	C
Scrub/Shrub Areas		
Acer rubrum	Red Maple	A
Allium canadense	Meadow Garlic (Meadow Onion)	C
Andropogon virginicus	Broomsedge Bluestem (Broom sedge)	A
Apocynum cannabinum	Indian Hemp (Dogbane)	A
Campsis radicans	Trumpet Creeper	A
Diospyros virginiana	Persimmon	C
Elaeagnus umbellata	Autumn Olive	A
Juniperus virginiana	Eastern Red Cedar	A
Lespedeza spp.	Bushclover	C
Liquidambar styraciflua	Sweetgum	A
Liriodendron tulipifera	Tulip Poplar (Yellow-poplar)	C
Lonicera japonica	Japanese Honeysuckle	C
Lonicera tatarica	Tatarian Honeysuckle	C
Morus nigra	Black Mulberry	C
Myrica pensylvanica	Northern bayberry	C
Panicum virgatum	Switchgrass	C
Pinus taeda	Loblolly Pine	C
Pinus virginiana	Virginia Pine	C
Prunus serotina	Black Cherry	A
Quercus alba	White Oak	C
Quercus falcata	Southern Red Oak	C
Quercus velutina	Black Oak	C
Rhus copallinum	Winged Sumac	C
Robinia pseudoacacia	Black Locust	C
Rosa multiflora	Multiflora Rose	C
Rubus spp.	Blackberries	C

Table III-C-3. Abundant (A) and Common (C) Species Found on the Station during General Site Overview and Different Habitat Types.		
SCIENTIFIC NAME	COMMON NAME	RELATIVE RANKING
Sassafras albidum	Sassafras	C
Smilax rotundifolia	Roundleaf Greenbriar	C
Solidago spp.	Goldenrods	A
Toxicodendron radicans	Poison Ivy	C
Vitis labrusca	Fox Grape	C

Table III-C-4. State-Rare, Threatened or Endangered Plant Species Known to Occur on PAX					
Common Name	**Scientific Name**	**Global Rank**	**State Rank**	**State Status**	**Habitat Descriptions**
Giant Cane	*Arundinaria gigantea (tecta)*	G5	S2	None	Abandoned rifle range
Twining Screwstem	*Bartonia paniculata*	G5	S3	None	Sandy woodland seep
Shortbeak Sedge	*Carex brevior*	G5	SNA	None	Dry, mowed field
Lined Sedge	*Carex striatula*	G5	S3	None	Wet woods
American Chestnut	*Castanea dentata*	G3	S2S3	None	Dry sandy woods
Bigseed Alfalfa Dodder	*Cuscuta indecora*	G5	S2?	None	On *Solidago* and *Iva* in marsh
Manyflower Flatsedge (Umbrella-sedge)	*Cyperus lancastriensis*	G5	S2S3	None	Dry edge of mowed field
Needleleaf Rosette Grass (Needle Witchgrass)	*Dichanthelium aciculare*	G5	S2?	None	Utility right-of-way
Roughish Witchgrass	*Dichanthelium leucothrix*	G4?Q	SU	None	
Bald Spikerush	*Eleocharis erythropoda*	G5	SU	None	
Twisted Spikerush	*Eleocharis tortilis*	G5	S3	None	Woodland seeps
Devil's-Grandmother (Tobaccoweed)	*Elephantopus tomentosus*	G5	S1S2	E, PT	Mowed lawn beneath trees and mowed utility rights-of-way
Claspingleaf St. John's-wort	*Hypericum gymnanthum*	G4	S3	None	
Beach Pinweed	*Lechea maritima*	G5	S3	None	Beaches and sand spoil piles
Bearded Sprangletop (Saltpond Grass)	*Leptochloa fusca* spp. *fascicularis*	G5T5	SU	None	Riverside marsh
Tall (Downy) Bushclover	*Lespedeza stuevei*	G4?	S3	None	
Sandplain Flax	*Linum intercursum*	G4	S2	T	Mowed, dry sandy and clayey powerline right-of-way
Whorled Water-milfoil	*Myriophyllum verticillatum*	G5	S1	None	Managed pond edge
Seabeach Knotweed	*Polygonum glaucum*	G3	S1	E	Beach at drift line
Clustered Beakrush	*Rhynchospora glomerata*	G5	S3	None	

Table III-C-4. State-Rare, Threatened or Endangered Plant Species Known to Occur on PAX					
Common Name	**Scientific Name**	**Global Rank**	**State Rank**	**State Status**	**Habitat Descriptions**
Branched Bur-reed	*Sparganium androcladum*	G4G5	SU	None	Muddy edge of pond
Swamp Wedgescale	*Sphenopholis pensylvanica*	G4	S2	T	Stream floodplain with open canopy and fresh marsh associated with pond

As of February 2023. Explanation of ranking and status codes in Annex III-D.

The following species have been removed from the State list of rare, threatened or endangered species:

Engelmann's Spikerush (*Eleocharis engelmann*)
Whiteroot Rush (*Juncus brachycarpus*)
Guadeloupe Cucumber (*Melothria pendula*)
Fewflowered Nutrush (*Scleria pauciflora*)

Table III-C-5. State-Rare, Threatened or Endangered Plant Species Known to Occur on WOLF				
Common Name	**Scientific Name**	**Global Rank**	**State Rank**	**State Status**
Whorled Milkweed	*Asclepias verticillata*	G5	S2	None
Shortbeak Sedge	*Carex brevior*	G5	SNA	None
American Chestnut	*Castanea dentata*	G3	S2S3	None
Downy Milkpea	*Galactia volubilis*	G5	S3	None
Claspingleaf St. John's-wort	*Hypericum gymnanthum*	G4	S3	None
Angularfruit Milkvine	*Matelea gonocarpus (Gonolobus suberosus)*	G5	S2	None
Seabeach Knotweed	*Polygonum glaucum*	G3	S1	E
Clustered Beakrush	*Rhynchospora glomerata*	G5	S3	None
Bent-awn Plumegrass	*Saccharum contortum*	G5	S3S4	None

As of February 2023. Explanation of ranking and status codes in Annex III-D.

The following species have been removed from the State list of rare, threatened or endangered species:

Whiteroot Rush (*Juncus brachycarpus*)

Guadeloupe Cucumber (*Melothria pendula*)

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Birds							
Pied-billed Grebe *Podilymbus podiceps*	Known	Known	~Possible	G5	S2S3B	-	-
Brown Pelican *Pelecanus occidentalis*	Known	Known	No	G4	S1B	-	-
American Bittern *Botaurus lentiginosus*	Known	Probable	Probable	G5	S1B	-	T
Black-crowned Night Heron *Nycticorax nycticorax*	Known	Probable	Probable	G5	S3B, S2N	-	-
Yellow-crowned Night-Heron *Nyctanassa violacea*	Known	Probable	Yes	G5	S3B	-	-
Tricolored Heron *Egretta tricolor*	Known	Probable	~Unlikely	G5	S3B	-	-
Little Blue Heron *Egretta caerulea*	Known	Probable	~Unlikely	G5	S3B	-	-
Snowy Egret *Egretta thula*	Known	Known	Probable	G5	S3B	-	-
Great Egret *Casmerodius albus*	Known	Known	Probable	G5	S3S4B	-	-
Glossy Ibis *Plegadis falcinellus*	Known	Probable	Probable	G5	S3B	-	-
Gadwall *Mareca strepera*	Known	Known	No	G5	S2B	-	-
Blue-winged Teal *Spatula discors*	Known	Known	No	G5	S1B	-	-
Common Merganser *Mergus merganser*	Known	Known	No	G5	S2B	-	-

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Hooded Merganser *Lophodytes cucullatus*	Known	Known	No	G5	S3B	-	-
King Rail *Rallus elegans*	Known	Possible	Unlikely	G5	S2B	-	-
Sora *Porzana carolina*	Known	Known	No	G5	S2B	-	-
Common Gallinule *Gallinula galeata*	Known	Possible	Yes	G5	S2S3B	-	I
American Coot *Fulica americana*	Known	Probable	No	G5	S1B	-	-
American Oystercatcher *Haematopus palliatus*	Known	Unlikely	No	G5	S3B	-	-
Piping Plover *Charadrius melodus*	Known	Known	No	G3	S1B	LT	E
Spotted Sandpiper *Actitis macularius*	Known	Known	No	G5	S3S4B	-	-
Rufa Red Knot *Calidris canutus rufa*	Known	Unlikely	No	G4T2	S1M	T	T
Upland Sandpiper *Bartramia longicauda*	Known	Known	No	G5	S1B	-	E
Laughing Gull *Leucophaeus atricilla*	Known	Known	~Unlikely	G5	S1B	-	-
Common Tern *Sterna hirundo*	Known	Possible	Possible	G5	S1B	-	E
Least Tern *Sternula antillarum*	Known	Probable	Yes	G4	S2B	-	T

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Sandwich Tern *Thalasseus sandvicensis*	Known	Unlikely	Possible	G5	S1B	-	-
Forester's Tern *Sterna forsteri*	Known	Known	Possible	G5	S2B	-	I
Royal Tern *Thalasseus maximus*	Known	Known	Yes	G5	S1B	-	E
Black Skimmer *Rynchops niger*	Known	Possible	No	G5	S1B	-	E
Bald Eagle *Haliaeetus leucocephalus*	Known	Known	Yes	G5	S3S4	-	-
Northern Harrier *Circus hudsonius*	Known	Known	Yes	G5	S2B	-	I
Sharp-shinned Hawk *Accipiter striatus*	Known	Known	No	G5	S2S3B	-	-
Northern Goshawk *Accipiter gentilis*	Known	Possible	No	G5	S1B	-	E
American Peregrine Falcon *Falco peregrinus anatum*	Known	Known	Yes	G4T4	S2B	-	I
Barn Owl *Tyto alba*	Known	Known	Yes	G5	S2B	-	I
Short-eared Owl *Asio flammeus*	Known	Known	No	G5	S1B	-	E
Long-eared Owl *Asio otus*	Known	Probable	No	G5	S1B	-	-
Northern Saw-whet Owl *Aegolius acadicus*	Known	Probable	No	G5	S1B	-	-

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Eastern Whip-poor-will *Antrostomus vociferous*	Known	Probable	Yes	G5	S3S4B	-	-
Common Nighthawk *Chordeiles minor*	Known	Known	Yes	G5	S2S3B	-	-
Yellow-bellied Sapsucker *Sphyrapicus varius*	Known	Known	No	G5	S1B	-	-
Olive-sided Flycatcher *Contopus cooperi*	Known	Probable	No	G4	SHB	-	X
Least Flycatcher *Empidonax minimus*	Known	Probable	No	G5	S3S4B	-	-
Alder Flycatcher *Empidonax alnorum*	Known	Probable	No	G5	S2B	-	I
Bank Swallow *Riparia riparia*	Known	Known	Yes	G5	S3B	-	X
Red-breasted Nuthatch *Sitta canadensis*	Known	Known	No	G5	S3B	-	-
Winter Wren *Troglodytes hiemalis*	Known	Known	No	G5	S2B	-	-
Sedge Wren *Cistothorus platensis*	Known	Possible	~Possible	G5	S1B	-	E
Golden-crowned Kinglet *Regulus satrapa*	Known	Known	No	G5	S3B	-	-
Swainson's Thrush *Catharus ustulatus*	Known	Known	No	G5	SHB	-	X
Loggerhead Shrike *Lanius ludovicianus*	Known	Possible	No	G4	S1B	-	E

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Golden-winged Warbler *Vermivora chrysoptera*	Possible	Possible	No	G4	S2B	-	I
Nashville Warbler *Leiothlypis ruficapilla*	Known	Known	No	G5	S1B	-	T
Black-throated Blue Warbler *Setophaga caerulescens*	Known	Known	No	G5	S3S4B	-	-
Cerulean Warbler *Setophaga cerulea*	Known	Probable	No	G4	S3B	-	-
Blackburnian Warbler *Setophaga fusca*	Known	Probable	No	G5	S3B	-	-
Magnolia Warbler *Setophaga magnolia*	Known	Known	No	G5	S3S4B	-	-
Yellow-rumped Warbler *Setophaga coronate*	Known	Known	No	G5	S2B	-	-
Mourning Warbler *Geothlypis philadelphia*	Known	Probable	No	G5	S1B	-	E
Canada Warbler *Cardellina canadensis*	Known	Probable	No	G5	S3B	-	-
Northern Waterthrush *Parkesia noveboracensis*	Known	Probable	No	G5	S2B	-	I
Henslow's Sparrow *Centronyx henslowii*	Probable	Probable	~Unlikely	G4	S2B	-	I
Saltmarsh Sparrow *Ammospiza caudacuta*	Known	Probable	Yes	G2	S2B, S1N	-	I
Lark Sparrow *Chondestes grammacus*	Known	Possible	No	G5	SXB	-	X

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Dark-eyed Junco *Junco hyemalis*	Known	Known	No	G5	S3B	-	-
Dickcissel *Spiza americana*	Known	Possible	Yes	G5	S3B	-	-
Bobolink *Dolichonyx oryzivorus*	Known	Known	No	G5	S3S4B	-	X
Pine Siskin *Spinus pinus*	Known	Known	No	G5	S2B	-	-
Purple Finch *Haemorhous purpureus*	Known	Probable	No	G5	S3B, S3N	-	-
Mammals							
Southeastern Shrew *Sorex longirostris*	Known	Possible	?	G5	S3S4	-	-
Southeastern Starnose Mole *Condylura cristata parva*	Probable	Probable	?	G5T4	SU		-
Eastern Red Bat *Lasiurus borealis*	Known	Known	Yes	G3G4	S3S4	-	-
Hoary Bat *Lasiurus cinereus*	Known	Known	Possible	G3G4	S3S4	-	-
Silver-haired Bat *Lasionycteris noctivagans*	Known	Known	Possible	G3G4	SU	-	-
Indiana Bat *Myotis sodalis*	Known	Known	No	G2	S1	E	E
Little Brown Bat *Myotis lucifugus*	Known	Known	Possible	G3	S1	UR	-
Tricolored Bat *Perimyotis subflavus*	Known	Known	Possible	G3G4	S1	PE	-

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Humpback Whale *Megaptera novaeangliae*	Probable	Unlikely	No	G4	S1S2	LE	E
Northern Atlantic Right Whale *Eubalaena glacialis*	Probable	Unlikely	No	G1	S1	LE	E
Reptiles							
Atlantic Loggerhead Turtle *Caretta caretta*	Known (dead)	Known (dead)	No	G3	S1B	LT	T
Atlantic Ridley/Kemp's Ridley *Lepidochelys kempii*	Known (dead)	Possible	No	G1	S1N	LE	E
Spotted Turtle *Clemmys guttata*	Known	Known	?	G5	S3S4	UR	-
Eastern Spiny Softshell *Apalone s. spinifera*	Known	Unlikely	^No	G5	S1	-	I
Six-lined Racerunner *Aspidoscelis sexlineata*	Known	Known	?	G5	S3	-	-
Red Cornsnake *Pantherophis guttatus*	Known	Known	Yes	G5	S2	-	-
Amphibians							
Eastern Narrow-mouth Toad *Gastrophryne carolinensis*	Known	Known	Yes	G5	S2S3	-	E
Insects							
LEPIDOPTERA							
Frosted Elfin *Callophrys irus*	Known	Possible	?	G2G3	S1	-	E
Monarch *Danaus plexippus*	Known	Probable	?	G4	-	C1	-

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
ODONATA							
Gray Petaltail *Tachopteryx thoreyi*	Known	Possible	?	G4	S3	-	-
Harlequin Darner *Gomphaeschna furcillata*	Known	Possible	?	G5	S3S4	-	-
Cyrano Darner *Nasiaeschna pentacantha*	Known	Possible	?	G5	S3S4	-	-
Arrowhead Spiketail *Cordulegaster obliqua*	Known	Possible	?	G4	S2	-	-
Four-spotted Pennant *Brachymesia gravida*	Known	Possible	?	G5	S3S4	-	-
Banded Pennant *Celithemis fasciata*	Known	Probable	?	G5	S3	-	-
Golden-winged Skimmer *Libellula auripennis*	Known	Probable	?	G5	S3	-	-
Bar-winged Skimmer *Libellula axilena*	Known	Possible	?	G5	S3	-	-
Yellow-sided Skimmer *Libellula flavida*	Known	Possible	?	G5	S2S3	-	-
Eastern Red Damsel *Amphiagrion saucium*	Known	Possible	?	G5	S3S4	-	-
Slender Bluet *Enallagma traviatum*	Known	Possible	?	G5	S3	-	-
COLEOPTERA							
Northeastern Beach Tiger Beetle *Habroscelimorpha d. dorsalis*	Known	Unlikely	?	G3G4T2	S1	LT	E

Table III-C-6. Rare Animal Species with Known or Expected Occurrence at NAS							
SPECIES	**Probable or Known**		**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***	**NAS PAX**	**WOLF**		**Global Rank**	**State Rank**	**Federal Status**	**State Status**
One-spotted Tiger Beetle *Cylindera unipunctata*	Known	Possible	?	G4G5	S3	-	-
Fish							
Atlantic Sturgeon *Acipenser oxyrhynchus*	Known	Possible	?	G3	S1	LE	E
Hickory Shad *Alosa mediocris*	Known	Probable	?	G4	S3	-	-
Ironcolor Shiner *Notropis chalybaeus*	Known	Unlikely	?	G4	S1	-	E
Flier *Centrarchus macropterus*	Known	Unlikely	?	G5	S2S3	-	I

As of February 2023. Explanation of ranking and status codes in Annex III-D.

~ Last documented as breeding in St. Mary's County prior to 1977.

^ Occurs in extreme western Maryland, not in the coastal plain. Likely released.

The following species have been removed from the State list of rare, threatened or endangered species:

Hermit Thrush (*Catharus guttatus*)
Vesper Sparrow (*Pooecetes gramineus*)
Savannah Sparrow (*Passerculus sandwichensis*)
Broad-headed Skink (*Plestiodon laticeps*)
Eastern Ribbonsnake (*Thamnophis sauritus*)

Table III-C-7. Rare Animal Species with Possible Occurrence at NAS							
SPECIES	**Possible or Unlikely (NAS PAX)**	**Possible or Unlikely (WOLF)**	**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***				**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Birds							
Least Bittern *Ixobrychus exilis*	Possible	Possible	Yes	G4G5	S2S3B	-	I
Roseate Tern *Sterna dougallii*	Possible/ Unlikely	Unlikely	No	G4	SXB	LE	X
Gull-billed Tern *Gelochelidon nilotica*	Possible	Possible	Unlikely	G5	S1B	-	E
Swainson's Warbler *Limnothlypis swainsonii*	Possible	Possible	No	G4	S1B	-	E
Mammals							
Eastern Small-footed Bat *Myotis leibii*	Possible	Possible	No	G4	S1	-	E
Northern Long-eared Bat *Myotis septentrionalis*	Unlikely	Unlikely	?	G2G3	S1	LT, PE	T
Southern Bog Lemming *Synaptomys cooperi*	Possible	Possible	No	G5	S3	-	-
West Indian Manatee *Trichechus manatus*	Possible	Unlikely	No	G2G3	-	LT	-
Reptiles							
Atlantic Leatherback Turtle *Dermochelys coriacea*	Possible	Unlikely	No	G2	S1N	LE	E
Green Sea Turtle *Chelonia mydas*	Possible	Unlikely	No	G3	S1N	LT	T
Northern Mole Kingsnake *Lampropeltis rhombomaculata*	Possible	Probable	?	G5	S1	-	-

Table III-C-7. Rare Animal Species with Possible Occurrence at NAS							
SPECIES	**Possible or Unlikely (NAS PAX)**	**Possible or Unlikely (WOLF)**	**Breeding in St. Mary's County**	**Ranking and Status***			
Common Name / ***Scientific name***				**Global Rank**	**State Rank**	**Federal Status**	**State Status**
Amphibians							
Eastern Mud Salamander *Pseudotriton m. montanus*	Possible	Possible	?	G5T5	S2?	-	-
Fish							
Shortnose Sturgeon *Acipenser brevirostrum*	Possible	Possible	No	G3	S1	LE	E
Mud Sunfish *Acantharchus pomotis*	Possible	Possible	No	G4G5	S3	-	-
Glassy Darter *Etheostoma vitreum*	Possible	Possible	No	G4G5	S2	-	T
Swamp Darter *Etheostoma fusiforme*	Possible	Possible	No	G5	S3	-	-

As of February 2023. Explanation of ranking and status codes in Annex III-D.

ANNEX III-D

EXPLANATION OF GLOBAL AND STATE SPECIES RANKING

EXPLANATION OF GLOBAL AND STATE SPECIES RANKS

Originally developed and instituted by The Nature Conservancy, an international conservation organization, the global and state ranking system is used by all 50 state Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species as well as the status within portions of the species' range. The primary criterion used to define these ranks is the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state rank descriptions listed here are based on Maryland's List of Rare, Threatened, and Endangered Animals. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the state and regional levels.

Global Rank

G1 – Critically Imperiled. At very high risk of extinction or extirpation due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors. Typically occurring in five or fewer populations.

G2 – Imperiled. At high risk of extinction or extirpation due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. Typically occurring in six to 20 populations.

G3 – Vulnerable. At moderate risk of extinction or extirpation due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors. Typically occurring in 21-80 populations.

G4 – Apparently Secure. At fairly low risk of extinction or extirpation due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

G5 – Demonstrably Secure. At very low risk of extinction or extirpation due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

GH – Historical (Possibly Extirpated). Known only from historical records and some hope of rediscovery remains. There is some evidence that the species may no longer be present, but not enough to know this with certainty.

GU – Possibly in peril range-wide, but its status is uncertain; more information is needed.

GX – Presumed Extirpated. Species believed to be extirpated from the jurisdiction (i.e. global, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

G? – The species has not yet been ranked.

_Q – Questionable Taxonomy. Indicates that the taxon has a questionable, controversial, or uncertain taxonomic standing, e.g., treated by some authors as a species, whereas others treat it as a subspecies or not at all.

_T – Taxon Rank. Indicates that the infraspecific taxon (subspecies) is ranked independently from the typical species.

State Rank

S1 – Highly State Rare. At very high risk of extinction or extirpation in Maryland due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors. Typically occurring in five or fewer populations

S2 – State Rare. At high risk of extinction or extirpation in Maryland due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. Typically occurring in 6-20 populations.

S3 – Watch List in Maryland. At moderate risk of extinction or extirpation due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors. Typically occurring in 21-80 populations.

S3.1 – Vulnerable and Globally Rare in Maryland. Species is actively tracked by the Service because of the global significance of Maryland occurrences. Although not currently threatened or endangered, Maryland occurrences may be critical to the long-term security of the species.

S4 – Apparently Secure in Maryland. At fairly low risk of extinction or extirpation due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors..

S5 – Demonstrable Secure in Maryland. At very low risk of extinction or extirpation due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

SA – Accidental or a vagrant in Maryland.

SE – Established, but no native to Maryland; it may be native elsewhere in North America.

SH – Historical (Possibly Extirpated). Known in Maryland only from historical records and some hope of rediscovery remains. There is some evidence that the species may no longer be present, but not enough to know this with certainty.

SP – Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).

SR – Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).

SRF – Reported falsely (in error) from Maryland, and the error may persist in the literature.

SU – Status Uncertain in Maryland. A numerical rank cannot be established with confidence for reasons including lack of historical records, low survey effort, cryptic nature of the species, or concerns that the species may not be native to the state. Uncertainty spans a range of more than three ranks as defined above.

SX – Presumed Extirpated. Species believed to be extirpated from the jurisdiction (i.e. global, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SZ – The species would not substantially benefit from protection efforts at a given location in Maryland because of its transitory nature.

S? – The species has not yet been ranked.

S_? – A question mark after another rank indicates uncertainty regarding that rank.

_B – A qualifier at the end of a rank. This species is a migrant and the subrank refers only to the breeding status of the species in Maryland. This species may have a different rarity rank for non-breeding populations.

_N – A qualifier at the end of a rank. This species is a migrant and the subrank refers only to the non-breeding status of the species in Maryland. This species may have a different sub-rank for breeding populations.

UR – Under Review

Federal Status

This is the status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CRF 17.

LE – Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.

LT – Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

PE – Taxa proposed to be listed as endangered.

PT – Taxa proposed to be listed as threatened.

C1 – Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

State Status

This is the status of a species as determined by the Maryland Department of Natural Resources, in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

E – Endangered; a species whose continued existence as a viable component of the state's flora or fauna is determined to be in jeopardy.

I – In Need of Conservation; an animal species whose population is limited or declining in the state such that it may become threatened in the foreseeable future if current trends or conditions persist.

T – Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the state.

X – Endangered Extirpated; a species that was once a viable component of the flora or fauna of the state, but for which no naturally occurring populations are known to exist in the state.

* – A qualifier denoting the species is listed in a limited geographic area only.

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 4

Implementation

Table of Contents

IV IMPLEMENTATION

1.0 Introduction

This portion of the INRMP addresses how the Plan will be carried out as a means of supporting the military mission through effective land stewardship. To that end, general management recommendations (GMRs) and specific management recommendations (SMRs) are made throughout the chapter. They are identified parenthetically as such.

The U.S. Navy and the Naval Air Station Patuxent River Complex intend to implement recommendations in this INRMP within the framework of regulatory compliance, national U.S. Navy mission obligations, anti-terrorism and force protection limitations, and funding constraints. Funding for projects in this INRMP is subject to the availability of funds appropriated by Congress, and none of the proposed projects should be interpreted to require obligation or payment of funds in violation of any applicable federal law, including the Anti-Deficiency Act (31 USC § 1341, et seq.).

Once they are designed and written, plans must then be implemented if goals and objectives are to be transferred from paper to the resources to which they apply. The first step in executing the NAS INRMP is to submit project summaries and cost estimates through the Environmental Program Requirements (EPR) Web environmental budgeting program. This is done 3 to 4 years in advance of the fiscal year for which funding is being requested. The next step is to prepare an execution plan for each upcoming fiscal year. This is also completed in the EPR Web environmental budgeting program.

INRMPs are developed and executed by a multi-tier managerial approach with various levels of Naval operations oversight. The roles and responsibilities for Navy natural resources management are described in OPNAVINST 5090.1 (series) and in the Navy guidance for INRMP development and implementation. A summary of responsibilities for natural resources management at NAS follows.

The Chief of Naval Operations (CNO) Environmental Readiness Division (OPNAV N45) serves as the principal leader to provide policy, guidance, and resources for the development, revision, and implementation of INRMPs. OPNAV N45 also represents the Navy on issues and resolves high-level conflicts regarding development and implementation of INRMPs.

Commander, Navy Installations Command (CNIC) is the Echelon II command under OPNAV N45 responsible for Navy-wide shore installation management. CNIC has overall shore installation management responsibility and authority as the budget submitting office for installation support and is the Navy point of contact for installation policy and program execution oversight. CNIC must ensure the programming of resources necessary to maintain and implement INRMPs; participate in the development and revision of INRMPs; and provide oversight for all natural resources program elements.

The DoD Regional Environmental Coordinators (REC) support the DoD/Navy mission through coordination, communication, and facilitation of environmental issues and activities when these

activities affect two or more DoD installations within an US Environmental Protection Agency (USEPA) region. The Commander Navy Region Mid-Atlantic (CNRMA) is the DoD/Navy REC for military installations within Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and Washington, D.C.

Naval Facilities Engineering Systems Command Washington (NAVFAC Washington) is the regional facilities command and supports the mission of CNIC and NDW with technical authority, project management, and contracts management as requested. NAVFAC Washington, which is Echelon IV, also provides technical and fiscal oversight for natural resource projects, facilitates agency review and stakeholder agreement of INRMPs, and reviews and signs INRMPs to ensure technical sufficiency.

The Office of Management and Budget (OMB) and the USEPA require federal agencies to classify natural resources projects based in part on compliance requirements. DoDI 4715.03, Enclosure 4, provides detailed guidance on programming and budgeting natural resources projects.

To solicit project funding, natural resources budget exhibits are developed in EPR Web and routed electronically through several levels of approval. Budget execution plans are then established, with local prioritization performed by the Installation Environmental Program Manager (IEPM), and Regional prioritization done by the Environmental Review Board (ERB) – comprised of all IEPMs and assistant IEPMs within the Region. In both cases, projects are generally ranked as follows:

(1) Requirements to support essential elements of the military mission;

(2) Requirements to fix noncompliance;

(3) Requirements to address pending noncompliance; and

(4) Environmental investments.

Upon approval of a budget for a fiscal year, projects to be funded will be selected by priority. Projects that are designed to maximize the accomplishment of multiple objectives will be given the highest priority.

DoDINST 4715.03, Enclosure 4, provides detailed guidance on natural resources management and project prioritization. These requirements are summarized below with corresponding classification per DoDINST 4715.06, *Environmental Compliance in the United States*.

Recurring Natural Resources Conservation Management Requirements (Class 0):

- Includes activities needed to cover the recurring administrative, personnel, and other costs associated with managing the DoD Natural Resources Conservation Program in compliance with federal and state laws, regulations, EOs, DoD policies, or in direct support of the military mission.
- Priority should be given to requirements associated with facility and installation operation, including recurring costs related to manpower, training, supplies, hazardous waste disposal, recycling activities, permits, fees, testing and monitoring and/or sampling and

analysis, reporting and record keeping, maintenance of environmental conservation equipment, and compliance self-assessments.

Non-Recurring Natural Resources Management Requirements:

- Current Compliance (Class I). Includes projects and activities to support installations currently out of compliance; signed compliance agreement or consent order; meeting requirements based on applicable federal or state laws, regulations, standards, presidential EOs, or DoD policies; immediate and essential maintenance of operational integrity or mission sustainment; and projects or activities that will be out of compliance if not implemented in the current program year.
- Maintenance Requirements (Class II). Includes projects and activities needed to meet an established deadline beyond the current program year and maintain compliance.
- Enhancement Actions beyond Compliance (Class III). Includes those projects and activities that enhance conservation resources or the integrity of the installation mission, or are needed to address overall environmental goals and objectives, but are not specifically required by law, regulation or EO and not of an immediate nature.

An additional Navy funding classification consists of four Environmental Readiness Levels (ERLs), as follows.

Environmental Readiness Level 4:

- Supports all actions specifically required by law, regulation or EO (Class I and II requirements) just in time.
- Supports all Class 0 requirements related to a specific statute such as hazardous waste disposal, permits, fees, monitoring, sampling and analysis, reporting and record keeping.
- Supports recurring administrative, personnel and other costs associated with managing environmental programs that are necessary to meet applicable compliance requirements (Class 0).
- Supports DoD policy requirement to comply with overseas Final Governing Standards and Overseas Environmental Baseline Guidance Document.
- Supports minimum feasible Navy executive agent responsibilities formally designated by the Office of the Secretary of Defense (OSD), participation in OSD-sponsored inter-department and inter-agency efforts, and OSD-mandated regional coordination efforts.

Environmental Readiness Level 3:

- Supports all capabilities provided by ERL4.
- Supports existing level of Navy EA responsibilities, participation in OSD-sponsored inter-department and inter-agency efforts, and OSD-mandated regional coordination efforts.
- Supports proactive involvement in the legislative and regulatory process to identify and mitigate requirements that will impose excessive costs or restrictions on operations and training.

- Supports proactive initiatives critical to the protection of Navy operational readiness.

Environmental Readiness Level 2:

- Supports all capabilities provided under ERL3.
- Supports enhanced proactive initiatives critical to the protection of Navy operational readiness.
- Supports all Navy and DoD policy requirements.
- Supports investments in pollution reduction, compliance enhancement, energy conservation and cost reduction.

Environmental Readiness Level 1:

- Supports all capabilities provided under ERL2.
- Supports proactive actions required to ensure compliance with pending/strongly anticipated laws and regulations in a timely manner and/or to prevent adverse impact to Navy mission.
- Supports investments that demonstrate Navy environmental leadership and proactive environmental stewardship.

The Natural Resources Program functions and operations will not be conducted unless they comply with this INRMP. However, if a Base function is incompatible with any of the goals and/or objectives of this plan, the office of primary responsibility for the operation will be contacted and a solution sought. If the negative effects cannot be mitigated, a report will be developed and submitted to the Environmental Review Board (or other appropriate authoritative body) for a policy decision. If the decision changes any goals and/or objectives of the INRMP, a revision will be made to reflect the new management direction.

2.0 Integration and Planning

Planning, which starts with this document, is supported by an important tool – the Station's geographic information system (GIS), called the GeoReadiness Explorer (GRX). This computer-based system contains all geospatial natural and cultural resources information for the Complex. An overall objective of the INRMP is to promote GRX both as the clearinghouse for all NAS environmental information and as a central planning tool for land use/development and natural resources management decisions. To that end, both GRX and the INRMP should be used not only by natural resources management personnel but also by facility planners as a detailed supplement to the Installation master plan (GMR IV.1). To facilitate this, GRX has been incorporated (via links) with an electronic Station Public Works Department (PWD) Planning Checklist. The Checklist allows planners to view any existing or potential environmental constraints that are or may be associated with a project site or action. The Checklist integrates questions regarding environmental compliance with the geographical information that pertains to a given site. In order to maintain the efficiency of the Checklist, NR personnel should monitor applicable laws, regulations, Navy guidance, and best management practices, updating any questions regarding natural resources as needed (SMR IV.1). In addition, NR staff should review and update (as

needed) GIS data layers to provide accurate constraints information to project planners (Project IV.1).

It should be noted that operational projects/programs are generally not reviewed via the Planning Checklist unless they include some facilities component. The NAWCAD Ranges Sustainability Office (SO) provides environmental oversight in this arena; however SO does and should continue to consult with the PWD Conservation Branch when there is a potential for impacts to installation natural resources (GMR IV.2).

2.1 Approach

As discussed in the introductory chapter of this INRMP, the main goal in natural resources management is the promotion of balanced ecosystems. The sizes, locations and biodiversity of the three largest NAS properties can make it challenging to maintain ecosystem integrity. Any proposed attempt to manage for or against a single species must first be analyzed to determine its potential impact to the associated biological communities and the ecosystem as a whole.

To truly integrate natural resources management, an interdisciplinary team of ecologists and other scientists (from various federal and state agencies, as well as private individuals) was assembled to prepare and later update this Plan. This differs substantially from the usual method of farming out plans or sections of a plan to different resource management agencies, a process that almost inevitably leads to conflict over the recommendations and management prescriptions.

The overriding focus in the preparation of this Plan was to maintain or enhance critical ecosystem functions in natural areas by blending requirements of the military mission with the management needs of those areas.

2.2 Mission-Related Planning Constraints and Opportunities

The primary purpose of the Complex is to perform a military mission; the mission sometimes requires that natural areas be disturbed or destroyed as part of the development of necessary facilities. These constraints on preservation, protection, and enhancement of natural resources are overriding and cannot be compromised. However, as outlined in this Plan, there are also opportunities for restoration, enhancement, and preservation of natural resources associated with mission activities. These are the opportunities that must be realized to their fullest potential. For example, under the Air Installations Compatible Use Zones (AICUZ) Program, areas defined as Accident Potential Zones (APZ), or those areas determined to be incompatible with developed land uses (such as high-noise areas), could be maintained in or restored to some natural condition in accordance with this Plan.

The NAS Patuxent River Natural Resources Manager is primarily responsible for implementing this INRMP and coordinating with other personnel on the installation. Some of the implementation responsibilities include identifying personnel, internal or external to the installation, with expertise to perform the work; identifying the appropriate funding source to accomplish the projects; and ensuring installation personnel are familiar with the contents of this INRMP. The Natural Resources Manager is also responsible for ensuring this Plan is reviewed in coordination with the U.S. Fish and Wildlife Service (USFWS) and the Maryland Department of Natural Resources (MDNR).

The major concern with the restoration of natural ecosystems on any portion of the Complex involves the future development potential of these lands. If these areas are restored and become critical habitat for rare species or unique habitat types, and are managed as such, the future development potential of these areas may be severely limited. For this reason, it is extremely important that future development be anticipated and be consistent with the relevant natural resources management schemes. A careful integration of the NAS Master Plan with this INRMP is required to successfully manage and maintain natural resources while supporting development for the military mission. A fundamental goal of the Master Plan should be to preserve or enhance NAS natural resources to the maximum extent practicable (GMR IV.3).

It may also be possible to maintain some portion of a natural system in areas that are managed for other military uses. Examples of managing areas to benefit both priorities include using native species and local phenotypes for landscaping material, as well as preserving elements of the natural system that can be practicably maintained in association with development projects.

Conversely, there may be aspects of development and natural area preservation that require cost/benefit analysis to be consistent with the overall goal of the INRMP. For example, the substantial amount of mowed turf grass attracts numbers of resident Canada Geese to the airfield environment, which creates a serious BASH risk. In addition, it is evident through the analysis of current site conditions that there is an excessive amount of forest-edge vegetation resulting from the maintenance of fire breaks and utility corridors. This edge-type community, in turn, results in elevated deer populations that can become a threat to the safety of Complex personnel. The solution to this problem may involve assessing the risk due to forest fire versus that of injury, death, and/or property loss due to deer strikes.

2.3 Integration with Other Plans

As previously stated, to ensure support of the military mission and avoidance or minimization of conflicts, the INRMP must be integrated with other current and future plans, including the NAS Master Plan, NAS Integrated Cultural Resources Management Plan (ICRMP), Environmental Restoration plans, Range Management Plan, and major test plans (GMR IV.4/SMR IV.2).

This integration can be made simpler and smoother with the aid of automated data handling and decision-support tools like GRX. The GRX provides, among other things, the interface between the database and potential users as well as the means of integration with other plans. All planners and land managers should be trained in the use of GRX for the interpretation of natural and cultural resources opportunities and constraints (GMR IV.5/SMR IV.3).

Installation master plans propose specific land uses within both developed and undeveloped areas and guide future construction projects at an installation. NAS has updated its Installation Master Plan (completed in 2012), which addresses development at PAX and WOLF. An Installation Development Plan, which addresses PAX and WOLF, was finalized in 2018. In addition, CNIC has initiated Regional Installation Master Plans (RIMPs) to encompass all major installations within a given CNIC region. In the case of Naval District Washington (NDW), the RIMP (completed in 2010) includes the NAS Patuxent River Complex, the U.S Naval Academy, the Washington Navy Yard, the Naval Observatory, and Naval Support Facilities Indian Head and

Dahlgren. The NR Program manager should coordinate with the PWD Planning Branch to ensure that the INRMP is incorporated into current and future regional and installation-specific planning documents (GMR IV.6/SMR IV.4).

2.4 National Environmental Policy Act

The National Environmental Policy Act (NEPA) ensures that decision-makers take environmental impacts into account and that environmental damage is avoided or minimized. These goals are realized through the preparation of an Environmental Assessment (EA) and/or an Environmental Impact Statement (EIS) for all major government actions. The INRMP contains information vital to preparing an EA/EIS for any area of the Complex and should be used to the maximum extent possible when evaluating potential environmental impacts related to any and all of the natural resources in and around the Complex (GMR IV.7).

2.5 Environmental Restoration Program

The Navy's Environmental Restoration Program (ERP), which began as the Installation Restoration Program in 1980, was established to identify, assess, characterize, and clean up past hazardous waste disposal operations at Naval installations. As part of the NAS ERP, any plans to return an environmental restoration (ER) site to its natural condition should be designed consistent with the goals and objectives of the INRMP (GMR IV.8). These areas offer unique opportunities to steer plans toward restoration of critical ecosystem functions or other environmentally compatible goals. For example, areas surrounding the solid waste landfill (excluding the landfill proper) can eventually be restored to hardwood forest and added to the forest reserve area. The feasibility of establishing late successional vegetation on capped landfills should be investigated, possibly by establishing experimental plots (SMR IV.5).

2.6 Integration within Chapters of the INRP and Among Resource Programs

This document has been thoroughly reviewed and analyzed for consistency in regard to suggested future actions and management schemes. It contains a wealth of information and suggestions regarding future operations at the Complex as well as the relationship between these activities and the numerous natural resources on NAS. Inevitably, however, there will be conflicts between management schemes; in such instances, the needs of the military and/or Complex personnel must be weighed against the ultimate environmental impacts of the proposed action. It is these types of decisions that require a full integration of the various chapters of this plan. In effect, no decision regarding the management of an individual resource should be made without fully considering both the potential impacts to other resources and the possibility of additional consequences resulting from such a management decision (SMR IV.6).

As stated previously, this document is intended to develop recommendations that are not contradictory in their scope or effect. However, there are general recommendations that, if implemented, may seem to contradict the overall goal of this plan. In these instances, an assessment should be performed prior to execution of contradictory recommendations to determine whether or not the benefits of the project outweigh the fiscal losses or ecological impediments associated with that particular natural resource (GMR IV.9/SMR IV.7). For example, management of an area for deer hunting by creating edge-type vegetation communities may impact the contiguous nature

of the forest. In this case, the benefits associated with an increased deer population and successful hunting program would be weighed against the environmental impact of fragmenting the forest area and increasing the airfield safety risk.

Another prime example of this type of conflict is evident when comparing INRMP recommendations pertaining to outdoor recreation (specifically, horseback riding) with those for land management. The suggestion is made that the fire breaks within the wooded portions of PAX be utilized as horseback riding trails in order to take pressure off the hiking trails. However, the land and ecosystem management approaches taken in other chapters of the Plan suggest letting these areas re-vegetate in order to reduce mowing, increase contiguous forest, decrease deer populations, and increase overall biodiversity. The NR Program has already taken this measure to some degree, maintaining the fire breaks such that the edges have been permitted to grow in and the overall widths reduced. If the need for fire breaks in these areas is deemed more important than the other concerns, it would be appropriate to continue to maintain these areas and assess the possibility of using them for horseback riding.

3.0 Compatibility Analysis and Conflict Resolution

Clearly, there will be land uses or values that compete or conflict with one another. Therefore, it is essential to develop a system that can identify (and perhaps predict) areas in which conflicts do (or will) occur and provide a means to mitigate them.

Many past (and present) natural resources management programs either conflicted with, or possessed the potential to conflict with, the military mission. Successful implementation of a compatibility analysis and conflict resolution system will support the military mission by eliminating or minimizing potential problems such as wildlife/aircraft strikes, nuisance wildlife-based human health and morale problems, or inefficient and counter-productive land-use management practices.

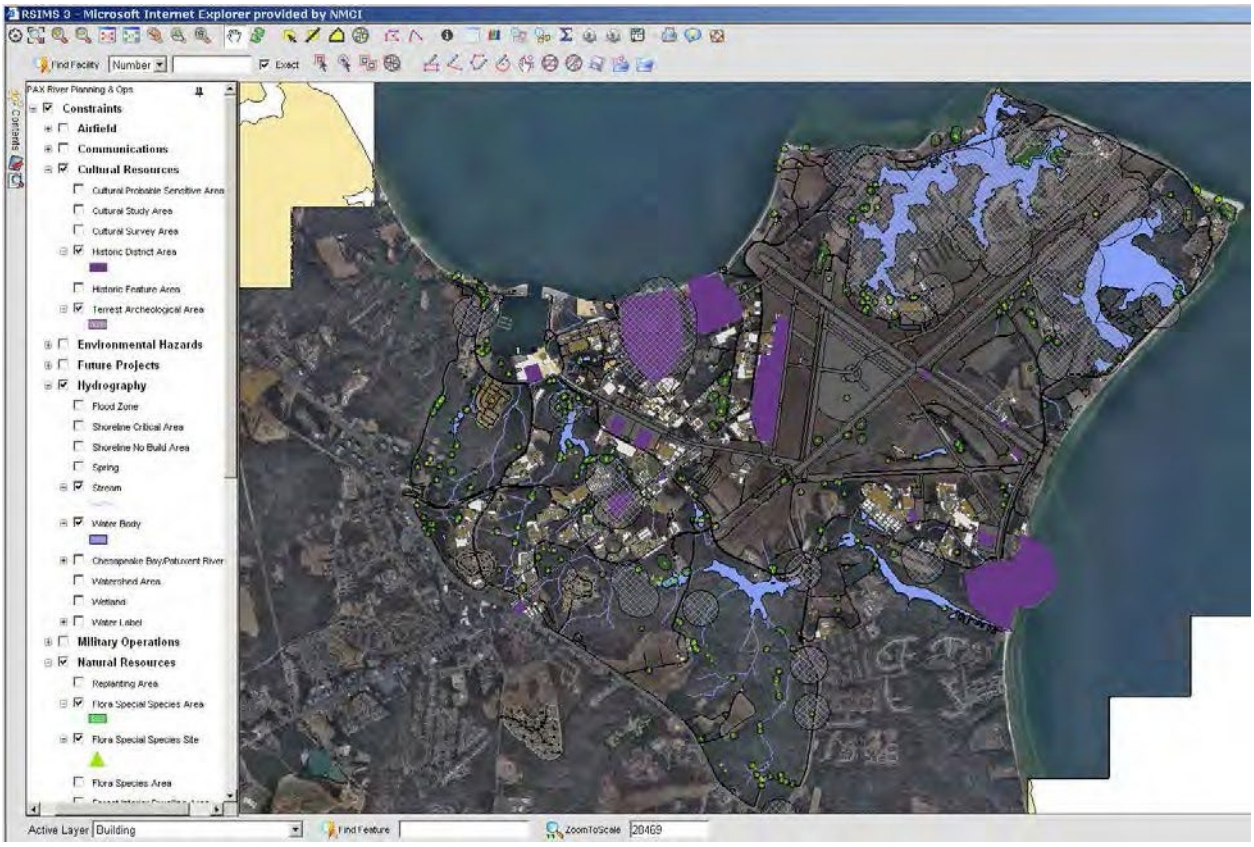
The approach recommended by this Plan involves the determination and designation of different use zones, along with the development of decision-making tools (e.g., checklists and matrices) that evaluate the compatibility of various uses with each other, as well as the appropriateness of certain management practices and prescriptions for each use zone. The process can be supported, and automated to a great extent, by the GIS. This approach also provides a means by which we can acknowledge the existence of special or unique resources and prioritize potential uses while providing for a wide array of multiple uses across the installation.

3.1 Management Areas

The first step in the application of this compatibility procedure is determining the actual or potential use or value of a particular parcel of land. It may have a deliberate active or passive use or even an intentional non-use - in which case it still possesses a certain value or serves a particular function. Each land use or land value is given a unique two-letter code. These codes are then distributed among three categories: Special Use Management Areas (SUMA), Multiple Use Management Areas (MUMA), and Military Use Areas (MUA).

3.1.1 Special Use Management Areas

SUMAs have been so designated because they have some overriding use or value that very clearly takes precedence over or even precludes, all other uses or values. These areas often have laws establishing their designation as "special," such as wetlands for water quality protection or National Register properties for historic preservation. They may carry severe land use restrictions (e.g., unremediated ER sites) or represent rare, unique, or declining ecosystems (e.g., large forest tracts serving as forest preserves or endangered species habitat). To date, eight SUMAs have been established, some of which already exist in GRX. Those remaining SUMAs should be identified, mapped, and entered into GRX (Project IV.2).



Using GIS to implement a compatibility analysis and conflict resolution system.

The eight SUMAs that have been defined for NAS are based on a use or uses that are seen as taking precedence over the general multiple use, sustained yield (MUSY), or multiple use, maximum yield (MUMY) philosophy. They are as follows:

FP: Forest Preserve

WQ: Water Quality Protection

ER: Environmental Restoration Site

TE: Threatened/Endangered Species

BS: BASH Reduction Zone

OR: Dedicated Outdoor Recreation Facility

HP: Historic Preservation

ID: Intensively Developed Areas

The FP category refers to large forested tracts of land such as those that are limited to safeguarding old growth and ecosystem integrity; intensive silviculture is not permitted there. The WQ areas seek to preserve wetlands, stream buffers, and steep slopes. The ER category segregates lands that have been subjected to hazardous substance contamination. The TE grouping identifies the habitats of both plants and animals that cannot thrive in the presence of some multiple uses. This category looks at state-listed species as well as those that are federally listed. The BS code identifies any area that is set aside to administer the Navy's programs to minimize the strike threat that exists when aircraft and animals (aerial and terrestrial) are operating in the same spaces. The OR category looks at permanent campgrounds, marinas, the golf course, and other recreational amenities that are not subject to change in the foreseeable future. Category HP pertains to the cultural resources that are or may be National Register-eligible properties. The final category, ID, includes permanent buildings and established roads or locations set aside for specific military or personnel usage.

3.1.2 Multiple Use Management Areas

All natural areas on Station not identified as SUMAs are to be designated as MUMAs. These areas can and should be managed for as many compatible uses as possible within the context of the INRMP goals and objectives (SMR IV.8). The following 24 multiple use codes have been created:

AO: Agriculture Outleasing

AP: Moderate to High Archaeological Potential

AS: Archaeological Site

BM: Motorized Boating

BN: Non-Motorized Boating

CA: Camping

CP: Commercial Production

FH: Fish Habitat

FI: Fishing, Shellfishing, Crabbing

FL: Floodplain Protection

HA: Archery Hunting

HE: Highly Erodible Soil

HF: Firearm Hunting

HK: Hiking

HR: Horseback Riding

NA: Noise Attenuation

PU: Prime & Unique Farmland Soil

SB: Sunbathing/Beach-combing

SP: Shoreline Protection

SS: Steep Slope

VB: Visual Barrier

WH: Wildlife Habitat

WQ: Water Quality

WW: Wildlife Watching/Study

3.1.3 Military Use Areas

Clearly, NAS is in place to fulfill its military mission. On land dedicated to mission-supporting activities, attempts are made to work in accord with natural resources considerations. Where a compromise cannot be achieved, the military use must take priority. It is therefore essential to have these lands well-delineated.

MUAs fall into eight categories, listed below. Geographically, most MUAs are within a single category, the intensely developed areas (ID). Some of the areas are already in GRX. All MUAs should be identified, mapped, and entered into GRX (Project IV.3). The eight MUA categories are as follows:

AF: Airfield (improved surfaces only)

AZ: Aircraft Accident Potential Zone

CZ: Airfield Clear Zone

MR: Military Research and Testing

MT: Military Training

PD: Potential Development

EH: Hazards of Electromagnetic Radiation (to personnel)

IO: Industrial/Operational/Housing Areas

3.2 Management Practices and Prescriptions

All of the commonly applied management practices and prescriptions (MPPs) in the INRMP have also been assigned a unique two-letter code. These MPPs can be joined together by resource category (i.e., forest management, land management, cultural resources management, etc.) as listed below.

Runway clearing project at Webster Outlying Field:
An Illustration of the Management Practices and Prescriptions (MPPs).

Outdoor Recreation	TM	Trail Maintenance
Forest Management	PB	Prescribed Burning
	VH	Salvage Harvest
	SH	Selective Harvest
	RH	Regeneration Harvest
	FC	Firewood Cutting
	PC	Pest Control
Land Management	PB	Prescribed Burning
	SA	Sludge Application
	HA	Herbicide Application
	SC	Soil Conditioning (lime/fertilizer)
	EP	Eradication of Exotic Plant Species
Cultural Resources Management	AI	Archaeological Investigation
	SS	Site Stabilization
	SI	Site Interpretation
Fisheries Management	FS	Fish Stocking
	PD	Pond Drawdown
	HT	Herbicide Treatment
	RH	Recreational Harvesting
	EF	Eradication of Exotic Fish Species
Wildlife Management	WP	Wildlife Planting
	WI	Waterfowl Impoundment
	PC	Predator Control
	RH	Recreational Harvesting
	SR	Species Reintroduction
	EA	Eradication of Exotic Animal Species
Military Mission Management	FC	Facility/Roadway Construction
	UI	Utility Line Installation
	UM	Utility Line Maintenance
	GM	Grass Mowing

3.3 Compatibility Matrices

While the INRMP adopts an ecosystem management approach, there is logic behind conducting multiple uses on many areas of the Complex. To ensure compatibility of uses between and within various use areas as well as the appropriateness of various management practices, the Plan contains several matrices that represent thousands of compatibility determinations. These matrices are the key to integration of natural resources use and management programs and to successful conflict avoidance or resolution.

There are four levels within the matrices that allow for quick and easy determination of whether or not activities and management practices can function harmoniously. These levels of compatibility are:

FC: Fully Compatible: The two objects of comparison do not conflict with one another in any way

##: Compatible with Restrictions (annotated): Compatible as long as certain procedures or rules are followed (These restrictions are annotated by code within each matrix; codes are then defined in the List of Annotations that follows Table IV-A-9 in Annex IV-A.)

XX: Incompatible: The two objects of comparison are not compatible under any circumstance (or are not applicable)

RS: Requires Study: Insufficient information to make the compatibility determination

3.3.1 Compatibility Summary

Nearly 2,400 compatibility determinations were made in the matrices that make up Tables IV-A-1 through IV-A-9 in Annex IV-A. Compatibility status and opportunities for each matrix are summarized below. It is clear from the results that numerous activities can often be fully compatible, or at least compatible with restrictions, on a given parcel of land.

- Table IV-A-1 in Annex IV-A compares SUMAs to SUMAs, reflecting a total of 28 compatibility determinations. Of these, 9 are fully compatible; 7 are incompatible or not applicable; 10 are compatible with restrictions; and 2 require further study.
- Table IV-A-2 in Annex IV-A compares SUMAs to MUAs. There are a total of 64 compatibility determinations. Of these, 17 are fully compatible; 20 are incompatible or not applicable; and 27 are compatible with restrictions. None are considered to require further study.
- Table IV-A-3 in Annex IV-A compares SUMAs to MUMAs. This matrix has 192 compatibility determinations. Of these, 60 are fully compatible; 39 are incompatible or not applicable; 83 are compatible with restrictions; and 10 require study.
- Table IV-A-4 in Annex IV-A compares MUMAs to MUMAs. There are a total of 276 compatibility determinations. Well over half (169) are fully compatible; 44 are incompatible or not applicable; 63 are compatible with restrictions; and none require study.
- Table IV-A-5 in Annex IV-A compares MUAs to MUMAs. There are a total of 192 compatibility determinations. Of these, 69 are fully compatible; 55 are incompatible or not applicable; 59 are compatible with restrictions; and 9 require study.
- Table IV-A-6 in Annex IV-A compares MPPs to SUMAs. This table has a total of 240 compatibility determinations. Of these, 95 are fully compatible; 57 are incompatible or not applicable; 70 are compatible with restrictions; and 18 require study.
- Table IV-A-7 in Annex IV-A compares MPPs to MUAs. In this case, there are also a total of 240 compatibility determinations. Here, however, 129 are fully compatible; 37 are incompatible or not applicable; 70 are compatible with restrictions; and only 4 require study.
- Table IV-A-8 in Annex IV-A compares MPPs to MUMAs. This matrix has a total of 720 compatibility determinations. Analysis here shows that 449 are fully compatible; 137 are incompatible or not applicable; 123 are compatible with restrictions; and 11 require study.

- Table IV-A-9 in Annex IV-A compares MPPs to MPPs. This matrix has a total of 435 compatibility determinations. Of these, well over three-quarters (365) are fully compatible; 57 are incompatible or not applicable; 3 are compatible with restrictions; and 8 require study.

3.3.2 Procedures for the Application of Use Zones and Compatibility Matrices

These matrices can be indispensable in the making of land-use decisions. Implementing an associated set of procedures constitutes a demonstration of the most rigorous application of GIS technology and highlights its true utility. It is the means by which we actually apply land-use rules to specific parcels of NAS property. A detailed accounting of the application procedures is provided in the summary on the next page.

3.3.3 Other Benefits of the System

Aside from the obvious benefits of conflict avoidance or resolution, the system described above produces other benefits. It reveals opportunities to enhance special resource areas, perhaps as mitigation in response to some proposed development activity.

For example, the loss of isolated patches of woodland habitat can be mitigated in the most meaningful manner by expanding the Forest Preserve SUMA. Project proponents could be responsible for the conversion of adjacent non-forested tracts to forest.

The Water Quality SUMA provides another example. It can easily be shown that minor watershed impacts from development or disturbance are optimally mitigated by the natural capacity of forest (or other native vegetation) to provide buffering capabilities. Rather than trying to improve downstream water quality with expensive stormwater management facilities, we can instead rely on natural upstream control of source pollutants.

All facility planners, operational planners, land managers, and NEPA coordinators should be trained in the use of these compatibility codes and matrices (GMR IV.10/SMR IV.9). This will put land use information at their fingertips, facilitate and streamline their planning processes by reducing environmental consultation time, and hopefully result in more environmentally sound projects and a reduction in the incidence of expensive and unproductive confrontations and delays.

Step-by-Step Summary of Procedures	
Step 1.	Identify SUMAs.
Step 2.	Map SUMAs in GRX.
Step 3.	Perform GIS overlay of all SUMA coverages to search for any areas of overlap and potential conflict between individual special uses.
Step 4.	Use Table IV-A-1 in Annex IV-A (SUMA vs. SUMA) to determine if there are any areas of actual conflict between special uses.
Step 5.	Alter uses, if possible, to mitigate any conflicts.
Step 6.	Map remaining natural areas in GRX as MUMAs.
Step 7.	Identify MUAs that are located outside the intensely developed SUMAs.
Step 8.	Map MUAs in GRX.
Step 9.	Perform GIS overlay of SUMA and MUA coverages to search for any areas of potential conflict between resource management goals and the military mission.
Step 10.	Use Table IV-A-2 in Annex IV-A (SUMA vs. MUA) to determine if there are any areas of actual conflict between resource management goals and the military mission.
Step 11.	Identify any mission conflicts and make recommendations to mitigate.
Step 12.	Use Table IV-A-3 in Annex VI-A (SUMA vs. MUMA) to determine what other Multiple Uses might be fully compatible with the primary Special Use.
Step 13.	Develop a GIS database for the SUMA coverage with fields for other compatible uses and compatibility codes.
Step 14.	Use Table IV-A-4 in Annex IV-A (MUMA vs. MUMA) to decide what uses are at least partially compatible with each other within the MUMAs. Select a combination of use types that optimizes overall use of each area.
Step 15.	Develop a GIS database for the MUMA coverage that contains fields for other compatible uses and the codes describing degree of compatibility.
Step 16.	Use Table IV-A-5 in Annex IV-A (MUA vs. MUMA) to evaluate each MUMA (with its unique set of uses/values) for potential conflicts with the military mission.
Step 17.	Develop a GIS database for the MUA coverage that contains fields for other compatible uses and the codes describing degree of compatibility.
Step 18.	Alter uses or combinations of uses to mitigate any conflicts.
Step 19.	Use Table IV-A-6 in Annex IV-A (MPP vs. SUMA) to determine what management prescriptions can and should be applied to each SUMA.
Step 20.	Use Table IV-A-7 in Annex IV-A (MPP vs. MUA) to determine what management prescriptions can and should be applied to each MUA.
Step 21.	Use Table IV-A-8 in Annex IV-A (MPP vs. MUMA) to determine what management prescriptions can and should be applied to each MUMA.
Step 22.	Use Table IV-A-9 in Annex IV-A (MPP vs. MPP) to determine if conflicts exist between different management prescriptions.
Step 23.	Alter uses or combinations of uses to mitigate any conflicts and produce the optimal set of MPPs for each area.
Step 24.	Modify GIS databases for SUMA, MUMA, and MUA coverages to include fields for the compatible MPPs selected for each area.

4.0 References

Department of Defense Instruction (DoDINST) 4715.06, *Environmental Compliance in the United States* May 4, 2015, Incorporating Change 2, August 31, 2018

Department of Defense Instruction (DoDINST) 4715.03, *Natural Resources Conservation Program,* March 18, 2011, Incorporating Change 2, August 31, 2018

ANNEX IV-A

TABLES

Table IV-A-1. Resource Uses/Values: Special Uses vs. Special Uses Compatibility Matrix.

SPECIAL USE MANAGEMENT AREA CODES								
Special Use Management Area Codes	**FP**	**WQ**	**ER**	**TE**	**BS**	**OR**	**HP**	**ID**
FP		FC	RS	FC	XX	FC	FC	XX
WQ			XX	FC	14	50	25	XX
ER				RS	FC	59	17	FC
TE					14	5	10	XX
BS						XX	FC	FC
OR							17	XX
HP								17
ID								

Table IV-A-2. Resource Uses/Values: Special Uses vs. Military Uses Compatibility Matrix.

MILITARY USE MANAGEMENT AREA CODES								
Special Use Management Area Codes	**AF**	**AZ**	**CZ**	**MR**	**MT**	**PD**	**EH**	**IO**
FP	XX	FC	XX	1	1	XX	FC	XX
WQ	XX	FC	3	3	3	XX	FC	XX
ER	FC	FC	FC	4	4	XX	FC	4
TE	XX	FC	5	XX	XX	XX	2	XX
BS	FC	FC	FC	FC	FC	46	FC	46
OR	XX	6	XX	7	7	29	XX	XX
HP	8	6	9	10	10	XX	47	10
ID	30	XX	30	11	11	FC	XX	FC

Table IV-A-3. Resource Uses/Values: Special Uses vs. Multiple Uses Compatibility Matrix.

MULTIPLE USE MANAGEMENT AREA CODES												
Special Use Management Area Codes	**CA**	**HK**	**HR**	**SB**	**FI**	**BM**	**BN**	**HF**	**HA**	**WW**	**VB**	**NA**
FP	48	1	1	XX	FC	XX	XX	1	1	FC	FC	FC
WQ	1	1	1	FC	1	20	FC	1	1	FC	FC	FC
ER	XX	RS	RS	XX	49	RS	RS	4	4	4	RS	RS
TE	XX	5	5	5	5	5	5	5	5	5	5	5
BS	XX	FC	FC	FC	XX	FC	FC	FC	FC	14	14	14
OR	FC	FC	FC	FC	FC	FC	FC	7	7	FC	FC	FC
HP	10	10	10	10	10	10	10	10	10	10	RS	RS
ID	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

Special Use Management Area Codes	**CP**	**WH**	**WQ**	**AO**	**FL**	**SS**	**HE**	**SP**	**AS**	**AP**	**FH**	**PU**
FP	XX	FC	FC	XX	FC	FC	FC	FC	1	1	FC	FC
WQ	XX	FC	FC	XX	FC	FC	FC	FC	1	1	FC	FC
ER	RS	RS	XX	XX	12	1	1	13	10	10	XX	XX
TE	5	FC	FC	XX	FC	FC	FC	5	5	5	FC	FC
BS	14	XX	14	14	FC	FC	FC	FC	FC	FC	FC	FC
OR	XX	2	FC	XX	FC	15	15	15	10	10	15	50
HP	10	10	10	10	10	10	10	10	10	10	10	FC
ID	XX	XX	XX	XX	12	15	15	15	XX	10	XX	XX

Table IV-A-4. Resource Uses/Values: Multiple Uses vs. Multiple Uses Compatibility Matrix.

MULTIPLE USE MANAGEMENT AREA CODES												
Multiple Use Management Area Codes	**CA**	**HK**	**HR**	**SB**	**FI**	**BM**	**BN**	**HF**	**HA**	**WW**	**VB**	**NA**
CA		FC	17	FC	FC	FC	FC	7	7	FC	FC	FC
HK			18	FC	FC	XX	XX	18	18	FC	FC	FC
HR				18	FC	XX	XX	18	18	FC	FC	FC
SB					FC	FC	FC	18	18	FC	FC	FC
FI						FC	FC	18	18	FC	FC	FC
BM							FC	18	XX	FC	XX	XX
BN								18	XX	FC	XX	XX
HF									FC	7,18	FC	FC
HA										7,18	FC	FC
WW											FC	FC
VB												FC
NA												
CP												
WH												
WQ												
AO												
FL												
SS												
HE												
SP												
AS												
AP												
FH												
PU												

Multiple Use Management Area Codes	CP	WH	WQ	AO	FL	SS	HE	SP	AS	AP	FH	PU
CA	XX	FC	FC	XX	FC	1	1	15	10	10	15	FC
HK	18	FC	FC	XX	FC	1	1	15	FC	FC	XX	FC
HR	18	FC	15	XX	FC	1	1	15	FC	FC	XX	FC
SB	18	FC	FC	XX	FC	XX	1	15	FC	FC	XX	FC
FI	XX	FC	FC	XX	FC	XX	1	15	FC	FC	FC	FC
BM	XX	19	20	XX	21	XX	XX	21	21	21	20	XX
BN	XX	FC	FC	XX	FC	XX	XX	FC	FC	FC	FC	XX
HF	FC	FC	FC	18	FC	FC	FC	FC	FC	FC	FC	FC
HA	FC	FC	FC	18	FC	FC	FC	FC	FC	FC	XX	FC
WW	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
VB	51	FC	FC	XX	FC	FC	FC	FC	FC	FC	FC	FC
NA	51	FC	FC	XX	FC	FC	FC	FC	FC	FC	FC	FC
CP		2	15	FC	12	15	15	15	10	10	XX	FC
WH			FC	XX	FC	FC	FC	FC	FC	FC	FC	FC
WQ				15	FC	FC	FC	FC	FC	FC	FC	FC
AO					12,15	XX	XX	XX	53	53	XX	FC
FL						FC	FC	FC	FC	FC	FC	FC
SS							FC	FC	FC	FC	XX	FC
HE								FC	FC	FC	XX	FC
SP									10	10	50	FC
AS										FC	FC	FC
AP											FC	FC
FH												XX
PU												

Table IV-A-5. Resource Uses/Values: Military Uses vs. Multiple Uses Compatibility Matrix.

MULTIPLE USE MANAGEMENT AREA CODES												
Military Use Management Area Codes	**CA**	**HK**	**HR**	**SB**	**FI**	**BM**	**BN**	**HF**	**HA**	**WW**	**VB**	**NA**
AF	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
AZ	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
CZ	XX	XX	XX	XX	XX	XX	XX	23	23	FC	XX	XX
MR	24	24	24	24	24	24	24	24	24	24	FC	FC
MT	24	24	24	24	24	24	24	24	24	24	FC	FC
PD	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
EH	XX	RS	RS	XX	XX	RS	RS	RS	RS	RS	FC	FC
IO	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

Military Use Management Area Codes	**CP**	**WH**	**WQ**	**AO**	**FL**	**SS**	**HE**	**SP**	**AS**	**AP**	**FH**	**PU**
AF	XX	XX	25	22	12	XX	XX	15	10	10	XX	FC
AZ	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
CZ	XX	XX	FC	22	FC	FC	FC	FC	FC	FC	FC	FC
MR	24	2	1	26	12	1	1	15	10	10	25	FC
MT	24	2	1	26	FC	1	1	FC	10	10	27	FC
PD	FC	28	28	28	28	XX	XX	XX	28	28	XX	28
EH	FC	FC	FC	RS	FC	FC	FC	FC	FC	FC	FC	FC
IO	XX	XX	XX	XX	XX	15	15	15	XX	RS	XX	XX

Table IV-A-6. Management Practices/Prescriptions vs. Special Uses Compatibility Matrix.

SPECIAL USE MANAGEMENT AREA CODES									
Management Practice		**FP**	**WQ**	**ER**	**TE**	**BS**	**OR**	**HP**	**ID**
Outdoor Recreation	**TM**	FC	FC	4	5	FC	FC	FC	FC
Forest Management	**PB**	XX	XX	RS	RS	14	53	54	XX
	VH	XX	15	4	XX	14	FC	10	FC
	SH	XX	16	4	XX	14	FC	10	FC
	RH	XX	XX	4	XX	14	XX	10	XX
	FC	XX	XX	4	XX	14	7	10	FC
	PC	55	29	FC	RS	FC	FC	FC	FC
Land Management	**PB**	XX	XX	RS	RS	14	53	54	XX
	SA	XX	XX	RS	XX	FC	FC	FC	FC
	HA	XX	29	RS	XX	FC	FC	FC	FC
	SC	XX	XX	RS	XX	FC	FC	FC	FC
	EP	29	29	FC	29	FC	FC	FC	FC
Cultural Resources Management	**AI**	30	15	RS	XX	FC	7	FC	31
	SS	FC	15	FC	XX	FC	7	FC	31
	SI	30	15	RS	XX	FC	7	FC	31
Fisheries Management	**FS**	XX	FC	XX	5	14	FC	FC	FC
	PD	XX	FC	RS	5	XX	FC	FC	FC
	HT	XX	29	RS	RS	FC	FC	FC	FC
	RH	XX	FC	49	5	FC	FC	FC	FC
	EF	29	29	29	FC	FC	FC	FC	FC
Wildlife Management	**WP**	XX	FC	XX	XX	XX	FC	10	33
	WI	XX	XX	XX	XX	XX	FC	RS	XX
	PC	XX	FC	FC	5	14	FC	FC	FC
	RH	FC	FC	RS	5	FC	7	FC	XX
	SR	FC	FC	XX	RS	XX	FC	FC	34
	EA	29	29	FC	5	FC	FC	FC	FC
Military Mission Management	**FC**	XX	28	RS	XX	FC	28	XX	FC
	UI	XX	28	RS	XX	FC	28	XX	FC
	UM	30	30	9	4	FC	FC	10	FC
	GM	XX	XX	FC	4	14	FC	FC	FC

Table IV-A-7. Management Practices/Prescriptions vs. Military Uses Compatibility Matrix.

MILITARY USE MANAGEMENT AREA CODES									
Management Practice		**AF**	**AZ**	**CZ**	**MR**	**MT**	**PD**	**EH**	**IO**
Outdoor Recreation	**TM**	XX	FC	XX	40	40	FC	RS	FC
Forest Management	**PB**	XX	37	XX	41	41	FC	FC	XX
	VH	XX	FC	XX	40	40	FC	42	FC
	SH	XX	FC	XX	40	40	FC	42	FC
	RH	XX	FC	XX	40	40	FC	42	XX
	FC	XX	FC	XX	40	40	FC	42	FC
	PC	XX	FC	XX	FC	FC	FC	FC	FC
Land Management	**PB**	56	37	37	41	41	FC	FC	XX
	SA	FC	FC	FC	41	40	FC	FC	FC
	HA	FC	FC	FC	FC	FC	FC	FC	FC
	SC	FC	FC	FC	FC	FC	FC	FC	FC
	EP	FC	FC	FC	FC	FC	FC	FC	FC
Cultural Resources Management	**AI**	10	FC	39	19	19	FC	42	FC
	SS	10	FC	39	19	19	FC	42	FC
	SI	10	FC	39	19	19	28	42	FC
Fisheries Management	**FS**	XX	FC	XX	FC	FC	FC	FC	FC
	PD	XX	FC	XX	FC	FC	FC	FC	FC
	HT	XX	FC	XX	FC	FC	FC	FC	FC
	RH	XX	FC	XX	40	40	FC	RS	FC
	EF	XX	FC	XX	FC	FC	FC	FC	FC
Wildlife Management	**WP**	XX	FC	XX	FC	FC	FC	FC	33
	WI	XX	FC	XX	FC	FC	XX	FC	XX
	PC	23	FC	FC	40	40	FC	FC	FC
	RH	XX	FC	37	40	40	FC	RS	XX
	SR	XX	FC	XX	FC	FC	FC	FC	34
	EA	23	FC	FC	40	40	FC	FC	FC
Military Mission Management	**FC**	35	38	39	40	40	FC	RS	FC
	UI	36	FC	36	40	40	FC	42	FC
	UM	37	FC	14	FC	FC	FC	42	FC
	GM	14	14	14	FC	FC	FC	42	FC

Table IV-A-8. Management Practices/Prescriptions vs. Multiple Uses Compatibility Matrix.

MILITARY USE MANAGEMENT AREA CODES													
Management Practice		**CA**	**HK**	**HR**	**SB**	**FI**	**BM**	**BN**	**HF**	**HA**	**WW**	**VB**	**NA**
Outdoor Recreation	**TM**	FC	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC
Forest Management	**PB**	53	40	40	40	40	XX	XX	40	40	40	FC	FC
	VH	FC	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC
	SH	XX	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC
	RH	XX	FC	FC	FC	FC	XX	XX	FC	FC	FC	XX	XX
	FC	XX	FC	FC	FC	FC	XX	XX	FC	FC	FC	XX	XX
	PC	40	40	40	40	40	XX	XX	40	40	40	FC	FC
Land Management	**PB**	53	40	40	40	40	XX	XX	40	40	40	FC	FC
	SA	XX	XX	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC
	HA	40	40	40	40	40	XX	XX	40	40	40	FC	FC
	SC	FC	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC
	EP	FC	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC
Cultural Resources Management	**AI**	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SS	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SI	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Fisheries Management	**FS**	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	PD	FC	FC	FC	FC	40	7	7	FC	FC	FC	FC	FC
	HT	40	FC	FC	FC	40	FC	FC	40	40	40	FC	FC
	RH	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	EF	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Wildlife Management	**WP**	FC	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC
	WI	XX	FC	XX	FC	FC	7	FC	FC	FC	FC	XX	XX
	PC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	RH	7	18	18	18	18	18	18	FC	FC	18	FC	FC
	SR	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	EA	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Military Mission Management	**FC**	XX	XX	XX	FC	XX	XX	XX	XX	XX	XX	XX	XX
	UI	7	RS	RS	XX	XX	XX	XX	XX	XX	FC	XX	XX
	UM	FC	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC
	GM	FC	FC	FC	FC	FC	XX	XX	FC	FC	FC	FC	FC

Management Practice		CP	WH	WQ	AO	FL	SS	HE	SP	AS	AP	FH	PU
Outdoor Recreation	**TM**	FC	FC	1	XX	12	1	1	FC	10	10	XX	FC
Forest Management	**PB**	FC	FC	FC	XX	FC	43	43	FC	54	54	XX	FC
	VH	FC	FC	FC	XX	XX	XX	XX	XX	10	10	XX	FC
	SH	FC	FC	FC	XX	FC	FC	FC	FC	10	10	XX	FC
	RH	FC	FC	XX	XX	FC	XX	XX	XX	10	10	XX	FC
	FC	FC	FC	3	XX	FC	FC	FC	FC	10	10	XX	FC
	PC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	XX	FC
Land Management	**PB**	FC	FC	FC	40	FC	43	43	FC	54	54	XX	FC
	SA	FC	FC	XX	FC	15	43	43	XX	FC	FC	XX	FC
	HA	FC	FC	57	FC	FC	15	15	XX	FC	FC	XX	FC
	SC	FC	FC	XX	FC	XX	FC	FC	XX	FC	FC	XX	FC
	EP	FC	5	15	FC	FC	15	15	XX	FC	FC	XX	FC
Cultural Resources Management	**AI**	FC	FC	15	19	12	15	15	15	FC	FC	RS	FC
	SS	FC	FC	15	19	12	15	15	15	FC	FC	RS	FC
	SI	FC	FC	15	19	12	15	15	15	FC	FC	RS	FC
Fisheries Management	**FS**	XX	FC	FC	XX	FC	XX	XX	FC	FC	FC	FC	FC
	PD	XX	FC	FC	XX	FC	XX	XX	FC	FC	FC	FC	FC
	HT	XX	FC	FC	XX	FC	XX	XX	FC	FC	FC	FC	FC
	RH	XX	FC	FC	XX	FC	XX	XX	FC	FC	FC	FC	FC
	EF	XX	FC	FC	XX	FC	XX	XX	FC	FC	FC	FC	FC
Wildlife Management	**WP**	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	WI	XX	FC	XX	XX	FC	XX	XX	FC	10	10	FC	FC
	PC	FC	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	RH	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SR	FC	FC	FC	RS	FC	FC	FC	FC	FC	FC	FC	FC
	EA	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Military Mission Management	**FC**	XX	XX	XX	XX	XX	15	15	15	RS	RS	XX	XX
	UI	XX	RS	XX	58	FC	15	15	15	RS	RS	XX	16
	UM	FC	FC	15	FC	FC	15	15	15	10	10	XX	FC
	GM	FC	FC	FC	FC	FC	15	15	15	10	10	XX	FC

Table IV-A-9. Management Practices/Prescriptions: Practice vs. Practice Compatibility Matrix.

MANAGEMENT PRACTICE AREA CODES																
Management Practice		**TM**	**PB**	**VH**	**SH**	**RH**	**FC**	**PC**	**PB**	**SA**	**HA**	**SC**	**EP**	**AI**	**SS**	**SI**
Outdoor Recreation	**TM**		FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	10	10	10
Forest Management	**PB**			FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	VH				FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SH					FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	RH						FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	FC							FC	FC	FC	FC	FC	FC	FC	FC	FC
	PC								FC	FC	FC	FC	FC	FC	FC	FC
Land Management	**PB**									FC	FC	FC	FC	FC	FC	FC
	SA										FC	FC	FC	FC	FC	FC
	HA											FC	FC	FC	FC	FC
	SC												FC	FC	FC	FC
	EP													FC	FC	FC
Cultural Resources Management	**AI**														FC	FC
	SS															FC
	SI															
Fisheries Management	**FS**															
	PD															
	HT															
	RH															
	EF															
Wildlife Management	**WP**															
	WI															
	PC															
	RH															
	SR															
	EA															
Military Mission Management	**FC**															
	UI															
	UM															
	GM															

Management Practice		FS	PD	HT	RH	EF	WP	WI	PC	RH	SR	EA	FC	UI	UM	GM
Outdoor Recreation	**TM**	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Forest Management	**PB**	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	VH	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SH	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	RH	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	FC	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	PC	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Land Management	**PB**	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SA	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	HA	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SC	XX	XX	XX	XX	XX	FC	FC	FC	FC	FC	FC	XX	FC	FC	FC
	EP	FC	FC	FC	XX	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Cultural Resources Management	**AI**	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SS	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	SI	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	RS	RS	FC	FC
Fisheries Management	**FS**		FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	RS	RS	FC	FC
	PD			FC	FC	FC	FC	FC	FC	FC	FC	FC	RS	RS	FC	FC
	HT				FC	FC	FC	FC	FC	FC	FC	FC	XX	XX	FC	FC
	RH					FC	FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
	EF						FC	FC	FC	FC	FC	FC	FC	FC	FC	FC
Wildlife Management	**WP**							FC	FC	FC	FC	FC	FC	FC	FC	FC
	WI								FC	FC	FC	FC	FC	FC	FC	FC
	PC									FC	FC	FC	XX	XX	FC	FC
	RH										FC	FC	XX	FC	FC	FC
	SR											FC	FC	FC	FC	FC
	EA												XX	RS	FC	FC
Military Mission Management	**FC**													RS	FC	FC
	UI														FC	FC
	UM															FC
	GM															

List of Annotations
(Applicable to Tables IV-A-1 through IV-A-9)

1. Compatible if no disturbance occurs to vegetation or soil.
2. Compatible if activity does not adversely affect vegetation and wildlife.
3. Compatible if secondary vegetation growth is allowed to establish and soils are not disturbed.
4. Compatible if personnel are insulated from contamination and if activity does not exacerbate contamination problem.
5. Compatible if species of concern does not interfere or interact with activity and activity does not adversely affect species -- concern is species-specific.
6. Compatible if structures are not permanently occupied and large congregations of people are not present.
7. Compatible if activities are temporary or seasonal and do not occur while organized recreation takes place.
8. Compatible if airfield does not require site disturbance and site investigation can be conducted around airfield operation.
9. Compatible if above-ground structures do not hinder clearance.
10. Compatible if soils, vegetation and historical structures are not disturbed.
11. Compatible if activities are temporary and/or similar to existing activities.
12. Compatible if activities do not result in a reduction of floodplain storage, with necessary permits.
13. Compatible if activities do not exacerbate contamination problem.
14. Compatible if precautions are taken to ensure activity will not increase threat of strike hazard.
15. Compatible if strict adherence to soil erosion control measures is upheld.
16. Compatible if soils are not destroyed or irreversibly converted.
17. Compatible if activities are confined to specific areas.
18. Compatible if participants are aware of other use.
19. Compatible if sensitive areas are off-limits to activity.
20. Compatible if fueling takes place on land and no discharges to water are allowed.

21. Compatible if no wake zones are created in sensitive areas.

22. Compatible if wildlife-proof crops are planted.

23. Compatible if activity is used as special wildlife control measure under strict supervision to avoid interference with airfield operations.

24. Compatible if research/training is temporary and does not actively interfere with activity.

25. Compatible if structural control is used to protect water quality.

26. Compatible if activity occurs after harvest and before planting.

27. Compatible if heavy vehicle traffic is kept out of open water and fringe marshes.

28. Compatible if loss or reduction of activity/resource is acceptable when development occurs.

29. Compatible if selective eradication techniques (including the use of chemicals) are employed.

30. Compatible if minimal disturbance to vegetation, soils and water areas is accomplished.

31. Compatible if safeguards are taken to protect human health and safety and real estate.

32. Compatible if catch-and-release is practiced -- areas of contaminated waters should warn anglers not to ingest fish products.

33. Compatible if plantings will not attract nuisance or pest species.

34. Compatible if species will not become a nuisance or pest.

35. Compatible if required for airfield operations.

36. Compatible if underground and conducted in a manner not to conflict with airfield operations.

37. Compatible if activity is conducted in a manner not to conflict with airfield operations.

38. Compatible if no permanent occupation structures are constructed.

39. Compatible if activity does not obstruct clearance.

40. Compatible if activities are not occurring at the same time.

41. Compatible if sensitive equipment will not be harmed.

42. Compatible if safe exposure limits of workers are known and strictly enforced.

43. Compatible if areas are patrolled for erosion problems and are remediated.

44. Compatible if development enhances recreational opportunities.

45. Compatible if development is related to airfield operations.

46. Compatible if operations do not produce or harbor large concentrations of birds.

47. Compatible if site investigations can occur during periods of non- transmission.

48. Backcountry (limited), low-impact primitive camping only.

49. Catch-and-release only or strict consumption limits.

50. Compatible if activity will not degrade water quality.

51. Compatible if only selective harvesting is permitted.

52. Compatible in areas of previous agricultural use.

53. May be useful for controlling ticks in leaf litter.

54. May be used in some cases to clear underbrush and facilitate study.

55. Compatible for control of exotic, non-native pest species.

56. Fully compatible, with proper smoke management.

57. Use only herbicides labeled for aquatic use or use in/around waterways.

58. Compatible if installed either overhead or a minimum of 3 to 4 feet underground.

59. Compatible subject to requirements and/or restrictions of human health risk assessment.

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 5

Land Management

Table of Contents

V LAND MANAGEMENT

1.0 Introduction

Land management is an encompassing term that can apply to all management activities that involve the physical alteration or maintenance of lands. Activities such as pond-stocking and silvicultural harvests could possibly come under this title. However, in order to discriminate the function of these activities, management of most programs is classified by the natural resource involved. Those program areas that primarily involve the land itself or soil and other mining resources will be covered in this chapter. Programs such as soil conservation, erosion control, agriculture, mining, grounds maintenance, wetlands protection, land use coordination, and land reclamation are included. When the resource title becomes "man," the associated resource activities are also classified under "Land Management." Hence, land management herein also pertains to those activities that support the facilities of the human (military) resource within the Complex.

1.1 Purpose

The purpose of proper land management is to maintain facility grounds to provide for the conservation and rehabilitation of natural resources and simultaneously, preserving the integrity of the military mission while protecting real estate, human health, and environmental quality. Land management involves coordination and integration of potentially conflicting land uses and other resource management activities. Because land management deals with the entire land base of NAS, it is from this perspective that all other management goals, objectives, and activities must be compared and contrasted. Hence, integration of the natural resources management plan starts here.

1.2 Scope

Land management activities are limited to PAX, WOLF, Grayson property, Pine Hill Run property, Glenn Forest housing area, the theodolite stations along the Chesapeake Bay shore from Cedar Point to Point Lookout, and Bishops Head on Maryland’s Eastern Shore.

2.0 Applicable Laws, Regulations, and Policies

2.1 Federal Laws and DoD/DoN Instructions

Several Federal, state, and local statutes address land management activities. These regulations include a variety of focal areas within land management including pests, soils, and water resources. The applicable regulations are summarized below.

2.1.1 Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended, 7 USC 121 and 136 et seq., 15 USC 1261 et seq., 21 USC 321 et seq.

The application of this act provides the principal means for preventing environmental pollution due to the use of pesticides. Pollution prevention is accomplished through product registration and applicator certification. The registration of all pesticide products by EPA results in instructions on each container for use, storage, and disposal. This act was amended in 1972 by the Federal Environmental Pesticide Control Act.

2.1.2 Federal Noxious Weed Control Act, as amended, 7 USC 2801 et seq.

Establishes regulation, control and eradication of noxious weeds, and authorizes agents to control noxious weeds at landowner expense.

2.1.3 Farmland Protection Policy Act of 1981, 7 USC 4201 et seq.

Requires consideration of protection for those areas having prime (nationally important) or unique (state-important) farmland soils. The purpose is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses.

2.1.4 Soil Conservation Act, 16 USC 590(a) et seq.

This act provides for the application of soil conservation practices on federal lands.

2.1.5 Soil and Water Resources Conservation Act of 1977, 16 USC 2001 et seq.

This act establishes a program for conservation of soil and water resources by state and federal agencies. It calls for investigation and analysis of the feasibility of collecting organic waste materials (e.g., digested sewage sludge) and applying these materials to the land to improve soil tilth and fertility.

2.1.6 Rivers and Harbors Act, 33 USC 401 et seq.

This act requires consultation and permitting from the U.S. Army Corps of Engineers (USACE) for any construction activities in navigable waterways of the United States.

2.1.7 Marine Resources and Engineering Development Act of 1966, as amended, 33 USC 1101 et seq.

This act establishes a national policy for the management, beneficial use, protection, and development of the land and water resources of the coastal zones.

2.1.8 Federal Water Pollution Control Act [Clean Water Act (CWA)], as amended, 33 USC 1251 et seq.

This act is the major federal legislation that regulates activities involving the Nation's water resources. Section 319 requires federal agency consistency with state non-point source pollution abatement programs. Section 401 requires state-administered water quality certification for projects that affect water quality, including wetland disturbance. Section 404 regulates discharges in navigable waters and wetlands and is administered through the USACE. The Navy is to comply with the national goal of no net loss of wetlands, and is to avoid loss of size, function, and value of wetlands.

2.1.9 Comprehensive Environmental Response, Cleanup, and Liability Act of 1980 (CERCLA), 42 USC 9601 et seq.

Natural resources trustees evaluate proposed remedial actions for impact to natural and cultural resources, prepare ecological risk assessments, and serve as members of Restoration Advisory Boards (RABs).

2.1.10 Coastal Zone Management Act of 1972 (CZMA), 16 USC 1451 et seq.

This act requires that, to the extent practicable, federal actions affecting any land/water use, or coastal zone natural resource, be implemented consistent with the enforceable policies of an approved state management program. The Act authorizes states to administer approved coastal

nonpoint pollution programs. Maryland has developed and implemented a federally approved Coastal Zone Management Plan (CZMP) based on existing state laws and regulations, particularly the Maryland Tidal Wetlands Law (Wetlands and Riparian Rights) and the Maryland Critical Areas Program. Federal consistency determinations in Maryland are reviewed by the Wetlands and Waterways Program of the Maryland Department of the Environment (MDE).

This act was amended through both the Coastal Zone Reauthorization Amendments of 1990 as well as the Coastal Zone Protection Act of 1996.

2.1.11 Energy Independence and Security Act (EISA) of 2007, 42 USC 17001 et seq.

Section 438 directs federal agencies to design facilities larger than 5,000 square feet as to maintain to the maximum extent technically feasible the site's hydrology with regards to temperature, rate, volume and duration of flow.

2.1.12 Department of the Navy Low Impact Development Policy for Stormwater Management, dated November 16, 2007

This memorandum from Assistant Secretary of the Navy establishes policy in regards to Low Impact Development (LID) for Department of the Navy (DoN) installations. The policy establishes a goal of no net increase in stormwater volume, sediment, or nutrient loading. Additionally it mandates the consideration of LID in the design of all projects that have a stormwater management element, implementation of LID where possible on all FY11 projects and beyond, a waiver process where LID is not appropriate, and an annual reporting process that summarizes how LID was implemented on all projects.

2.2 State and Local Governments

As a general rule, the Federal Government is protected from regulation by state governments through the principle of sovereign immunity. Sovereign immunity exists with respect to all state laws unless, and until, the Federal Government has affirmatively waived it. However, it is the policy of the United States Navy and this installation to abide by the spirit and intent (if not to the letter) of state and local laws to the greatest extent practicable.

2.2.1 Non-tidal Wetlands Protection Act, Annotated Code of Maryland, Title 8, Subtitle 18, Sec. 8-1201 et seq.

This act is administered by the Maryland Department of Natural Resources. It requires a co-permit process with the USACE for wetland and wetland buffer disturbances.

2.2.2 Chesapeake Bay Critical Area Law, Annotated Code of Maryland, Title 8, Subtitle 18, Sec. 8-1801 et seq., as amended

This comprehensive law regulates all non-federal lands under the tidal influence of the Chesapeake Bay and its tributaries up to the head of tide, as well as wetlands connected to these waters. It also regulates land uses within a 1,000-foot boundary inland from that line. The Critical Area Law is included within Maryland's Coastal Zone Management Program.

2.2.3 Erosion and Sediment Control, Annotated Code of Maryland, Title 26, Subtitle 17, Chapter 01

This regulation requires an approved erosion and sediment control plan for projects which require land clearing, grading, or earth disturbance greater than 5,000 square feet or 100 cubic yards.

2.2.4 Stormwater Management, Annotated Code of Maryland, Title 26, Subtitle 17, Chapter 02

The primary goals of the state and local stormwater management programs are:

1. To maintain after development, as much as possible, the predevelopment runoff characteristics.
2. To reduce stream channel erosion, pollution, siltation and sedimentation, and local flooding by implementing environmental site design (ESD) to the maximum extent practicable.
3. To use appropriate structural best management practices only when necessary.

This regulation requires an approved stormwater management plan prior to the issuance of a building and/or grading permit for any project which will create more than 5,000 square feet of impervious surface, or 5,000 square feet or 100 cubic yards of disturbed area. The NAS Patuxent River Complex must also comply with EISA Section 438 which states that projects that meet the threshold for the stormwater management plan have to design the project so there is no net increase of stormwater runoff. Projects also have to comply with the NAVFAC LID Policy, which requires projects that are of certain funding thresholds to use LID in their design to the maximum extent practicable, regardless of the area of disturbance.

3.0 Key Issues and Concerns

There are a number of key issues and concerns surrounding the operations of a land management program. These include recommended land uses, agricultural outleasing, marginal land reclamation, soil stabilization and erosion control, stormwater management, landscaping and grounds maintenance, and wetland protection.

4.0 Program Goals and Objectives

The goals of land management at PAX and WOLF are as follows:

A. The grounds of the Complex are effectively and economically maintained for the conservation and rehabilitation of natural resources in an environmentally safe and sensitive manner that compliments the military mission while protecting real estate and human health.
B. Multiple land uses are compatible to the greatest extent practicable.
C. Applied land management practices are consistent with the ecosystem management approach.
D. Station lands are available for productive non-military uses.

In order to meet these goals, the following objectives are established (note that each is followed by the letter designation of the goal or goals supported):

1. Management practices are designed to require minimum resources for optimal results. (A)

2. Best management practices are incorporated into the land management program. (A and C)
3. The Station will have no net loss of wetlands. (A and C)
4. A viable agricultural outlease program is maintained on the Complex. (A and D)
5. All human-altered barren/marginal lands are reclaimed. (A)
6. Station surface water quality is improved. (A and C)
7. Grounds maintenance costs are reduced through the application of innovative management techniques. (A)
8. Station personnel and visitors find the site aesthetically pleasing. (A)
9. Grounds are maintained in a manner that reduces the risk of aircraft wildlife strikes. (A and D)
10. Station shorelines are stable. (A and C)
11. Engage with other programs to stay aware of activities that may impact lands or land uses. (A)
12. Topsoil losses are minimized. (A)
13. Station land use incompatibilities are decreased on an annual basis. (B)
14. Natural areas with a high degree of ecosystem integrity receive priority protection from development over those areas with less integrity. (C)
15. Availability of significant mineral resources is maintained. (D)

Each objective listed above can be attained through the use of recommendations that appear throughout the chapter. The number of the objective(s) supported by each recommendation is parenthetically recorded after that recommendation. General management recommendations (GMRs) and specific management recommendations (SMRs), supporting no particular objective and/or requiring no funding, also occur throughout the chapter. These are identified parenthetically as such.

5.0 Existing Land Use/Land Cover

Existing land use/land cover was analyzed for this document. October 1991 false color infrared aerial photographs were used to create a new land use/cover map for PAX, Pine Hill Run, and the Glenn Forest housing area. March 1990 true color aerial photographs were used to create a new land use/cover map for WOLF. Suitable aerial photography and base maps were not available for the remote theodolite stations. The land use/cover classification system used was derived from "A Land Use and Land Cover Classification System for Use with Remote Sensor Data," US Geological Survey Professional Paper 964, 1976, E. Anderson. The Anderson system, as it is called, uses a four digit classification code that reflects four levels of detail: Levels I, II, III, and IV. Level I (represented by the first digit) is the most general classification of the code, whereas Level IV (represented by the fourth digit) is the most specific classification of the code. For example, code 1443 means the following: 1000 (Level I) is Urban or Built-up Land; 1400 (Level II) is Transportation, Communication, and Utilities; 1440 (Level III) is Airports; and 1443 (Level IV) is Airport Runway and Tarmac. The entire land use database is currently available in the Station’s geographic information system (GIS), called the GeoReadiness Explorer (GRX).

5.1 Existing Land Use/Land Cover – PAX

Tables V-1 and V-2 provide land use information recorded on PAX during this investigation for Levels I and II, respectively. More detailed Level III and IV classifications for non-urban codes are available in Table V-C-1 in Annex V-C. Refer to Annex V-D for a key containing a detailed explanation of the land use/land cover classifications.

The largest land cover type encountered on PAX is urban land (3,474 acres) followed by forestland (2,489 acres). Together, they represent close to 79% of PAX land area. The remaining lands include agriculture, open water, wetlands, and barren lands. Distribution of these land cover types is displayed in Map V-1 in Annex VB.

Table V-1. Level I Land Use/Land Cover for PAX

Land Use Code[1]	Description	Total Acreage	% Land Use
1000	Urban	3,474.26	45.9
2000	Agricultural	673.57	8.9
4000	Forestland	2,489.44	32.9
5000	Open Water	420.55	5.6
6000	Wetlands	343.63	4.5
7000	Barren Land	175.42	2.3
Total	-	7,575.87	100.0

[1]NAS does not hold any level 3000 lands (Rangeland).

5.2 Existing Land Use/Land Cover –WOLF

Tables V-3 and V-4 provide land use information recorded for WOLF during this investigation for Levels I and II, respectively. Some polygons within the land use GIS did not have land use codes assigned during this INRMP update and were grouped based on the description of the polygon. More detailed Level III and IV classifications for non-urban codes are available in Table V-C-2 in Annex V-C.

The largest land cover type encountered on WOLF is urban land followed by wetlands. Together, they represent close to 85% of WOLF land area. The remaining lands include forestland, agriculture, and open water. Distribution of these land cover types is displayed in Map V-2 in Annex V-B.

5.3 Developed Grounds

Developed or improved grounds include residential, commercial, industrial, transportation/communications/utilities, recreational, and construction sites. This land use type equals 3,027 acres, or 40% of the total area at PAX (Map V-3 in Annex V-B).

Total developed grounds on WOLF equal 219 acres, or 25% of the property (Map V-4 in Annex V-B).

Table V-2. Level II Land Use/Land Cover for PAX

Land Use Code[1]	Description	Total Acreage	% Land Use
1100	Residential	334.74	4.42
1200	Commercial	555.03	7.33
1300	Industrial	166.14	2.19
1400	Transportation/Communication/Utilities	1,635.45	21.59
1700	Other Urban	447.40	5.91
1800	Recreational	335.49	4.43
2100	Cropland/Pastureland	664.61	8.77
2200	Orchards/Vineyards/Nurseries	8.96	0.12
4100	Deciduous Forest	829.06	10.94
4200	Coniferous Forest	183.41	2.42
4300	Mixed Forest	770.95	10.18
4400	Brush/Shrubland	706.02	9.32
5100	Streams	2.41	0.03
5300	Artificial Lakes & Reservoirs	51.86	0.68
5400	Bays/Estuaries/Other Tidal Waters	366.28	4.83
6100	Coastal Wetlands	64.24	0.85
6200	Interior Wetlands	279.38	3.69
7100	Barren Land	33.95	0.45
7400	Altered Lands	51.29	0.68
7500	Transitional Areas	90.19	1.19
Total	-	7,575.87	100

[1]PAX does not hold any level 1500 (Industrial/Commercial Complexes), 1600 (Mixed Urban/Build-up), 2300 (Confined Feeding Operations), 3000 (Rangeland), 5200 (Lakes), 7200 (Bare Exposed Rock), or 7300 (Extractive Mining) lands.

5.4 Maintained Grounds

Maintained grounds include agricultural lands, altered lands, mowed airfield areas, airfield old field, road shoulders, and other lands that require regular or periodic maintenance. Total maintained and finely groomed grounds on PAX equals approximately 783 acres, or 10% of the Station area (Map V-3 in Annex V-B).

Total maintained grounds on WOLF equal 291 acres, or 34% of the property (Map V-4 in Annex V-B).

5.5 Natural Areas

Undeveloped, natural lands include forested lands, wetlands, waterways, and beaches. At PAX, these areas equal 3,254 acres, or 43% of PAX grounds (Map V-3 in Annex V-B).

Natural lands at WOLF equal 233 acres, or 27% of the property (Map V-4 in Annex V-B).

6.0 Land Use Suitability and Limitations

Land development at NAS is likely to continue in the future, beyond the pulse of development which occurred as a result of base realignment and closure (BRAC) and relocated operations here from other installations. In light of the development goals and the ability of the land to support those goals, land development must be carried out. A thorough assessment of the environmental and regulatory restrictions and limitations must be completed for each land development project. Therefore, the beginning of the development planning stage is the critical point where all limitations and suitability must be established.

Table V-3. Level I Land Use/Land Cover for WOLF

Land Use Code[1,2]	Description	Total Acreage	% Land Use
1000	Urban	510.10	59.04
2000	Agricultural	120.54	13.95
4000	Forestland	13.72	1.59
5000	Open Water	0.98	0.11
6000	Wetlands	218.66	25.31
Total	-	864	100.0

[1]WOLF does not hold any level 3000 lands (Rangeland) or 7000 lands (Barren).
[2]Land Use Codes had not been assigned to all polygons at WOLF during this INRMP Update.

6.1 Recommendations

The following recommendations are presented to ensure that land-use suitability decisions are carried out consistent with the INRMP.

- The NR Program should be informed of proposed projects at the earliest planning stage so that it may be an integral part of the decision-making process (Obj. 1-4, 6-11, 13 and 15) (GMR V.1).
- Continue use of the NEPA-required Environmental Assessment (EA) and Environmental Impact Statement (EIS) development process as an aid for review of major projects (Obj. 1-4, 6-11, 13 and 15) (GMR V.2/SMR V.1).
- The Installation should comply with applicable measures of the State of Maryland Critical Area Law, Non-Point Source Pollution Control Plan, and other NOAA-approved State Coastal Zone program features in all activities (e.g., land management projects and construction), as required by the CZMA (Obj. 2) (GMR V.3/SMR V.2).
- To ensure that all resource issues are addressed, GRX must be queried for environmental information in the area of interest (Obj. 1-4, 6-11, 13 and 15) (GMR V.4).

- Development should be focused on the improved grounds and military use areas where intensive development already exists (Obj. 1-4, 6-11, 13 and 15) (GMR V.5).
- Reconstruction, renovation, and rehabilitation of obsolete facilities should be opted for over new construction when feasible (Obj. 1-4, 6-11, 13 and 15) (GMR V.6).
- New land development should focus on improved grounds that are adjacent to other developed areas; semi-improved grounds are the next land types to review (Obj. 1-4, 6-11, 13 and 15) (GMR V.7).
- Natural or unimproved areas should be the last lands reviewed for development (Obj. 1-4, 6-11, 13 and 15) (GMR V.8).
- Development in core forest areas should be discouraged to the maximum extent possible without compromising the military mission (Obj. 14) (SMR V.3).
- All natural areas of the Complex should be categorized into Special Use Management Areas (SUMAs) and Multiple Use Management Areas (MUMAs) as a means of greatly enhancing the land use management and development decision process concerning natural areas. (Obj. 13 and 14) (Project V.1). Areas would be selected as SUMAs when they have some overriding use or value that clearly takes precedence over all other uses and values. All other natural areas on Station would be designated as MUMAs. MUMAs would function for as many compatible uses as possible within the context of the INRMP goals and objectives.
- Compatibility matrices (Annex IV-A) should be used to determine which of a variety of land uses and management practices/prescriptions are appropriate (Obj. 13) (GMR V.9/SMR V.4).
- A separate coverage of SUMA and MUMA zones should be created and applied through use of GRX (Obj. 13) (Project V.2). Assessment of this land scheme as a first-cut development review effort may streamline the review process. The formation of these management areas is further discussed in Chapter 4 of this document.

Table V-4. Level II Land Use/Land Cover for WOLF

Land Use Code[1]	Description	Total Acreage	% Land Use
1200	Commercial	8.99	1.04%
1300	Industrial	10.39	1.20%
1400	Transportation/Communication/Utilities	403.28	46.68%
1700	Other Urban	83.58	9.67%
1800	Recreational	3.86	0.45%
2100	Cropland/Pastureland	120.54	13.95%
4100	Deciduous Forest	2.58	0.30%
4200	Coniferous Forest	3.38	0.39%
4300	Mixed Forest	5.07	0.59%
4400	Brush/Shrubland	2.70	0.31%
5300	Artificial Lakes & Reservoirs	0.98	0.11%
6100	Coastal Wetlands	13.63	1.6%
6200	Interior Wetlands	205.03	23.73%
Total	-	864	100.00%

[1]WOLF does not hold any level 1100 (Residential), 1500 (Industrial/Commercial Complexes), 1600 (Mixed Urban/Build-up), 2100 (Cropland/Pastureland), 2200 (Orchards/Vineyards/Nurseries), 2300 (Confined Feeding Operations), 2400 (Other Agriculture – Horse Farms), 3000 (Rangeland), 5100 (Stream/Canals), 5200 (Lakes), 5400 (Bays/Estuaries/Other Tidal Waters), 7100 (Barren Land), 7200 (Bare Exposed Rock), 7300 (Extractive Mining), 7400 (Altered Lands), or 7500 (Transitional Lands) lands.

7.0 Management History

Land use management at PAX and WOLF has improved substantially over the years as higher regard has been paid to the environment and as the recognition that these lands are held in the public trust has developed. While improvements are possible, large areas of significant neglect are not apparent. A visit to the Station reveals well-kept grounds and an attention to aesthetics.

As with other management programs, land management is now being viewed as an integral portion of the entire resource management objective; some of the older practices are no longer considered viable. For instance, the use of used motor oil to remove weed growth around signposts and curbs was once viewed as an acceptable and economical method of weed control. In light of water quality goals and other environmental considerations, this method has been replaced with mechanical removal and the use of EPA-approved herbicides. This example points to the necessity of reviewing old practices and their continuance in the context of an environmentally sensitive natural resources management plan.

7.1 Historical Development – PAX

Before the Station was developed in 1942, Cedar Point (as it was known) was primarily an agricultural landscape. Figure V-1 in Annex V-A shows an aerial photograph of the base just prior

to its development. The area around the airfield and much of the developed areas surrounding Cedar Point Road were all under agricultural land use. The lands along the southern and western border of the Station (adjacent to Rt. 235/Three Notch Road) held forestland. Many tidal creeks ran to the Patuxent River along the northern border of the Station.

Development of the airfield and the other facilities converted most of the farm fields at Cedar Point. Three seaplane basins and portions of the airfield severely altered at least two tidal creeks along the Chesapeake Bay and six others along the Patuxent River. Some of the remaining portions of these creeks are now freshwater and nontidal. Others are no more than tidal ditches and some do not exist at all. In addition, there was an unknown quantity of wetlands and other sensitive environments lost during the Station's construction. Maps III-5a through III-5i in Annex III-B show the 1945 proposed PAX construction plan overlays superimposed on pre-development topography. Today, many of the land transformations that were carried out at that time would be either disallowed or completed with compensations to the environment.

7.2 Historical Development – WOLF

Prior to the purchase of approximately 850 acres of land by the US government for the purpose of developing an outlying field for PAX, the site now known as WOLF had served as the grounds for a religious community of Jesuits. Figure V-2 in Annex V-A shows a 1938 aerial photograph of the parcel. A majority of the area was under agricultural use. The lands in the southern portion of the property were forested, and many tidal creeks scalloped the parcel boundaries to the north and west.

Construction of the airfield required many areas to be altered or filled, thus resulting in a loss of agricultural areas, forests, wetlands, and some tidal creeks as well as other sensitive environments.

8.0 Proposed Land Uses and Management Measures

8.1 Recommended Land Uses

As mentioned above, the land use demands of NAS will continue in the future. The undeveloped portions of the properties will be under increased development pressure as time goes on. One objective of the Natural Resources Manager should be to help direct development toward the less environmentally sensitive areas. The physical land requirement parameters for the new development must be established. Then, the most acceptable areas for development, from an environmental standpoint, must be established. By over-laying the two parameters, preferably in the GIS, suitable development areas can be identified (see Section 5.1, herein, for more details). Additionally, the compatibility matrices discussed in Chapter 4 of this document will also be a useful tool for planners as they search for suitable development areas.

8.2 Agriculture Outleasing

The Agriculture Outleasing Program allows private farmers to use Navy lands for farm production. There are 385 acres and 129 acres of property currently leased for this purpose on PAX and WOLF, respectively. Table V-5 provides more detailed information concerning the agricultural outlease parcels. Analysis of additional acreage for potential inclusion in the agricultural outlease program showed that these lands were not suitable.

Those areas at PAX and WOLF that are actively used for agriculture purposes, as well as those with potential to be used for this purpose are shown in Maps III-21 and III-22 in Annex III-B, respectively.

Agricultural leases run for a period of one year (with a non-competitive renewal option for four [and occasionally nine] additional years) with payments or in-kind services values currently averaging about $34 per acre/year. The lessees must abide by contract terms and the Agricultural Outlease Plan. This plan contains specifications for crop types, pesticides, fertilizers, tillage, erosion control, etc.; in part, to keep the program compatible with BASH and Deer/Aircraft Strike Hazards (DASH) prescriptions that link wildlife behavior to airfield vegetation types and heights. The plan also contains a Soil and Water Conservation Plan as certified by the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and follows the recommendations of the Chesapeake Bay Critical Area Law. There are no mechanisms in place to compensate farmers for crop damage due to activities at NAS; however, the NR manager works with the farmer to minimize impacts as much as possible (such as through project footprint reduction or timing projects to occur outside of the growing season).

Agricultural lands at NAS

The program provides a valuable and necessary benefit to the military by substantially reducing areas of required turf grass in military use zones, while providing an income vehicle through leasing. For example, lands surrounding the airfield would normally be placed under turf because of airfield clear zone requirements related to a high aircraft accident potential rating. Maintenance of those fields would come at a high cost to the Navy. The Navy has allowed controlled agricultural use of some of these lands, thereby avoiding the expense of turf maintenance and creating income

or in-lieu ground maintenance through leasing. Similarly, lands surrounding the weapons storage magazines that normally require turf grasslands to act as fire breaks and security zones are leased for agricultural use under CNO Exemption No. NAS PAXRIV E1-81. Table V-5 displays relative acreages of mowed and farmed lands at PAX and WOLF.

Farm fields along the airfield often use bird-resistant sorghum to discourage avian visitation of these areas. Other fields produce Corn, Soybeans, Winter Wheat (*Triticum* spp.), Barley (*Hordeum* spp.), and Sorghum (*Sorghum* spp.). No-till or minimum tillage practices are implemented where possible.

8.2.1 Recommendations

- Continue use of the Soil Conservation Plan contained within the Agricultural Outlease Plan, employing current BMPs on farmland at all times (Obj. 2, 4, 6, 7 and 9) (Project V.3).
- Update the Agricultural Outlease periodically (Obj. 4) (Project V.4).
- Expand the Agricultural Outlease Program. To identify candidate parcels for this potential growth, a comprehensive land review should be conducted through the GIS (Obj. 4) (SMR V.5). Areas that could be converted from costly turf grounds in military use zones would be prime candidates.
- Consider and evaluate the feasibility of both hay and nursery outleases supplemental to the agricultural outlease (Obj. 7) (SMR V.6).
- Continue use of the Soil and Water Conservation Plan, revised as recommended by climate change adaptation strategies (Obj. 2, 6, 7 and 12) (SMR V.7).
- Renew CNO Exemption No. NAS PAXRIV E1-81 when necessary to continue the agricultural outlease program around the weapons storage facility (Obj. 4) (GMR V.10/SMR V.8).
- Preserve hedgerows in agricultural parcels, where necessary and permissible, to prevent soil losses from wind erosion and reduce attractiveness to Canada Geese by shrinking parcel size. These hedgerows are present around many of the agricultural fields at PAX and should be maintained in the future (Obj. 4, 9 and 12) (GMR V.11/SMR V.9).
- Control invasive plant species. As necessary, focus limited funding and in-house treatment on historically controlled sites that may become reinfested (Obj. 4) (Project V.5). There are some invasive plant species that are of concern (e.g., Kudzu, Mile-a-minute Weed, Johnson Grass [*Sorghum halepense*], Shattercane [*Sorghum bicolor*], and Canadian Thistle [*Cirsium arvense*]) and in need of control in order to maintain viable agricultural fields. One of these, Kudzu, was planted to control erosion on several sites in the 1960's and once threatened areas of forest and shrub lands with its rapid and uncontrolled expansion. While the species coverage has been significantly reduced, historic Kudzu sites should be monitored annually for any reoccurrence.

Invasive plant species: Mile-a-minute (*Polygonum perfoliatum*)

8.3 Marginal Land Reclamation

8.3.1 Marginal Land Reclamation – PAX

There are currently 15 Environmental Restoration (ER) sites, formerly known as Installation Restoration (IR) sites, at PAX (Map V-5 in Annex V-B). These sites are contaminated with various hazardous substances and are monitored by an ER program coordinator, also located within the Environmental Planning and Conservation Branch (CN) of the PWD Environmental Division. Investigations and cleanup plans have been initiated at some of these sites. There are approximately 130 groundwater monitoring wells associated with the ER sites which allow groundwater sampling for the purposes of contamination testing. Most of these are sampled only as requested; however, the wells at Fishing Point landfill are sampled every 15 months landfill, Site 31 is sampled quarterly, and Sites 11 and 39 are sampled semi-annually. The Oil Control Program sites are now all closed; as a result, 10 monitoring wells formerly associated with this program became part of the ER Program.

Other CN staff act in advisory roles in the management of these facilities and occasionally offer remediation support for ground surface reconditioning. Cleanup plans frequently must address the impact to sensitive resources at or adjacent to ER sites, such as rare species, wetlands, or archaeological sites. Cleanup actions can impact these resources (and vice versa), thus necessitating review and input from natural and cultural resources specialists. Currently, the Conservation Director serves on the Environmental Restoration Site Remedial Advisory Board (RAB).

Past NR Program remedial involvement has centered on the use of sewage sludge application and erosion control protection. For example, the NR Program applied sewage sludge to the marginal lands of the "Boneyard" Site. Marginal lands are those that have lost their organic layer, such as gravel/borrow pits, old landfills, dredge disposal areas, and mineral soils lacking organic material. The Boneyard, a waste storage area, had contaminated the soils to the point where vegetation would not grow. Application of sewage sludge conditioned the soil to accept turf seed and establish

a vegetative cover. It also improved the microbial digestion of oils in the soil and improved the buffering capacity of the soil, thereby rendering some contaminants immobile and establishing a partial remediation of the site. The NR Program was also involved in a project at the Fishing Point Landfill, an old abandoned landfill along the Patuxent River shoreline. This landfill was eroding and posed a threat of releasing its contents into the estuary. Through a cooperative agreement with the University of Maryland's Coastal Research Lab, the NR Program produced a design for an environmentally friendly and maintenance-free erosion control system. By reestablishing grades, installing offshore breakwaters, and importing clean beach sand, PAX was able to remedy this problem with the landfill. Surface reclamation was then accomplished with low maintenance, wildlife-friendly native warm-season grasses (NWSG).

8.3.2 Recommendations

- When appropriate, NR staff will assist the ER Program's Remedial Project Manager in identifying potential impacts to natural resources caused by the release of hazardous substances, pollutants and contaminants from ER sites into the environment (Obj. 11) (SMR V.10).

  NAS recognizes the possibility for release of these contaminants. The DoN ER Program is responsible for identifying CERCLA releases, considering risks and assessing impacts to human health and the environment (including impacts to endangered species, migratory birds and biotic communities). In addition, the ER Program is charged with developing and selecting response actions when it is likely that a release could result in an unacceptable risk to human health and the environment.

- Continue NR Program involvement in the ER Program by maintaining a seat on the RAB and reviewing all monitoring/cleanup plans (Obj. 11) (GMR V.12/SMR V.11).

- Identify altered marginal/barren land sites and develop plans to reclaim them (Obj. 5) (SMR V.12).

- Consider increased usage of digested sewage sludge on marginal lands, including ER sites where appropriate, for land reclamation (Obj. 5) (GMR V.13/SMR V.13).

- Maintain the use of NWSG in lieu of tall fescue for revegetation of the closed/capped landfill at Fishing Point (Obj. 7) (GMR V.14/SMR V.14).

8.3.3 Marginal Land Reclamation – WOLF

Although the two former ER sites at WOLF are now closed, there is a munitions response site located in the wooded area between the airfield and Finger Pond (Map V-6 in Annex V-B). The site (UXO-01) is the location of a former bombing range. It is inspected annually following approval by the Naval Ordnance Safety and Security Activity to enter.

8.4 Groundwater Protection

Drinking water at NAS is pumped from the Piney Point/Nanjemoy, Aquia, and Patapsco aquifers – groundwater sources below St. Mary's County. The Compliance Branch of the PWD Environmental Division is responsible for both groundwater monitoring and protection of

groundwater wells located on the Installation. All groundwater wells are monitored regularly, according to state and federal safe drinking water sampling analysis standards and requirements.

Wellhead Protection is a program designed to protect public drinking water supplies by managing the land surface around a well where activities might affect the quality of water. The Safe Drinking Water Act Amendments of 1986 established a program, administered by the EPA, to encourage states to develop Wellhead Protection Programs. Recognizing the fact that fertilization of agricultural outlease parcels and existence of ER sites could lead to contamination of groundwater sources, the Compliance Branch has completed a Source Water Assessment and developed a Wellhead Protection Plan. The plan delineates the groundwater wellhead protection areas at PAX, develops an inventory of potential contamination areas, and describes management practices to prevent contamination of the wellhead protection areas. Source Water Assessments and Wellhead Protection Plans should be updated and reviewed as necessary (Obj. 2).

8.5 Soil Stabilization and Erosion Control

There are two basic areas of erosion control and soil stabilization that are of concern at NAS: shoreline erosion and interior land erosion. The causes of erosion are wind and water, with water being the primary causal factor by a large margin. Water erosion of the shoreline is caused primarily by wave and current action and, to a lesser extent, overland flow of stormwater. Water erosion of the interior lands is caused by stormwater runoff and stream flow.

8.5.1 Shoreline Erosion

NAS, along with other Naval installations, was the subject of a shoreline erosion study prepared by the Baltimore District of the USACE in 1985. The study, which did not address the Station's tidal creeks, identified several areas of eroded shoreline along the Chesapeake Bay and the Patuxent River and offered methods of repairing the problem areas. In response to this study, new offshore breakwaters were placed at Fishing Point and riverward of the abandoned PAX landfill, in addition to some other minor repairs located elsewhere. Protection of the landfill is vital to the environmental health of the Patuxent River and Chesapeake Bay waters. The study concluded that there are no significant problems on the Bay or Patuxent River shoreline at PAX or WOLF and that current protection practices are adequate. Maps V-7 and V-8 in Annex V-B display the existing shoreline protection measures that are in place at PAX and WOLF, respectively.

An EA for improvements along the installation coast included the use of living shorelines, where appropriate, in addition to revetments, breakwaters, and sills. A follow-on EA and stabilization plan for the PAX creek shorelines was completed in 2017 and should be implemented as funding permits.

8.5.1.1 Recommendations

- Continue monitoring of shoreline stability and condition of existing erosion control structures (Obj. 10) (GMR V.15/SMR V.15).
- Document erosion problems/events as they occur (Obj. 10) (GMR V.16/SMR V.16)
- In addition, conduct an erosion study on WOLF tidal creek shorelines (Obj. 10) (GMR V.17).

- In order to determine shoreline protection options for the northeastern portion of WOLF, conduct a bathometric survey of Moll's Cove (adjacent to WOLF) (Obj. 10) (GMR V.18).
- Implement shoreline protection measures for significant problem areas as they occur (Obj. 10) (Project V.6).
- Utilize the expertise and resources of partner agencies to conduct erosion studies and design solutions (Obj. 6, 10 and 12) (GMR V.19/SMR V.17).

8.5.2 Interior Land Erosion

The greatest potential for soil erosion occurs around stream systems and in locations where the landscape has steep slopes. These conditions are prevalent in the western portion of PAX. Although a 1989 study (NAS PAX, 1989) cited few stream erosion problems, field inspections of the stream corridors encountered in this area while conducting forestry studies disclosed some severe stormwater erosion gullies leading into the stream corridors. This has resulted in severe sedimentation of the stream channels and sloughing of the stream corridor slopes. Additional stream surveys were conducted from 2007 to 2008 at PAX which identified and mapped stream erosion, sedimentation, and blockage issues. Similar investigations should be conducted at WOLF.

8.5.2.1 Recommendations

- Conduct a specific survey of WOLF interior lands to identify all erosion problems. During the survey, recorded information on each problem should include location, scope of the erosion, severity of the problem, and cause of the erosion. The list of problem areas should then be prioritized for remediation using a three-tiered approach. Class I problems would include severe erosion areas that pose a hazardous condition to human health and welfare; Class II, severe erosion problems that do not pose an immediate hazard; and Class III, minor erosion problems. The results of the erosion survey should then be entered into GRX for subsequent use in planning remedial action on erosion areas (Obj. 12) (Project V.7).
- Design interior land erosion control projects. The appropriate remedial practices should be identified for each erosion problem area. The survey projects should generate a priority list for erosion control measure implementation (Obj. 12) (Project V.8).
- Implement interior land erosion control projects, such as removal of woody vegetation that could destabilize dams or shoreline structures. Prioritized items in the erosion control plan should be budgeted and programmed for implementation (Obj. 12) (Project V.9).

8.6 Stormwater Management

Proper stormwater management is important to the aquatic resources and water quality of ponds, streams, and tidal creeks at NAS as well as the open waters of the St. Mary's River, Patuxent River, and Chesapeake Bay. While there are numerous stormwater management facilities at both PAX and WOLF, most of the infrastructure at both installations was constructed before such facilities were required or deemed necessary.

In accordance with MDE guidelines the existing stormwater pollution prevention plan (SWPPP) for PAX and WOLF was updated in 2020. Another individual SWPPP for NRC SOL was updated

in 2018. There was an Illicit Discharge Survey Update completed for PAX, WOLF, and NRC SOL in 2020. As required by law, these documents shall be amended whenever there is a change in industrial operations which may cause the discharge of significant quantities of pollutants.

Example of erosion at PAX; Stormwater management will help remedy similar future impacts.

The Maryland Water Quality Inventory (1989-1991) found that the St. Mary's River and St. Inigoes Creek, which border WOLF, contain elevated levels of bacteria and nutrients, primarily from agricultural runoff. High suspended sediment levels, too, may result from agricultural practices, urban runoff, construction, erosion, and forestry operations. A strategy to maintain and improve the water quality of the waterways off of WOLF should include the prevention of polluted and surface runoff. At PAX, many ponds receive runoff and also serve as stormwater management features. The dam at Holton Pond was replaced in 2017 which helps support the capture of nutrients that would otherwise flow into Pine Hill Run and then the Bay.

LID is a set of approaches and practices that are designed to retain or reduce runoff of stormwater and pollutants from developed sites through infiltration, evapotranspiration, and reuse of rainwater. Rather than collecting runoff in piped or channelized networks and controlling the flow downstream in a larger stormwater management facility, LID incorporates a set of overall site design strategies and small decentralized control techniques (such as bioretention areas, permeable pavers, rain gardens and green roofs) to reduce overall stormwater discharge rates. The Assistant Secretary of the Navy (Installations and Environment) signed a memorandum in November 2007 requiring the Navy to incorporate LID into all major renovation and construction projects on installations. The State of Maryland has also established guidelines to reduce adverse impacts associated with increased stormwater runoff, which can be found in "Maryland Stormwater Management Guidelines for State and Federal Projects." The goal is to manage stormwater by using environmental site design (ESD) to the maximum extent practicable to reduce stream channel erosion, pollution, siltation, sedimentation, and local flooding. ESD as described in the Maryland guidance is very similar, if not synonymous, to LID practices.

The Chesapeake Bay Total Maximum Daily Load (TMDL) passed by Environmental Protection Agency (EPA) in December 2010 is essentially a "Pollution Diet" for the Chesapeake Bay. Each state along the Chesapeake Bay has been assigned their portion of the nitrogen and phosphorus load to help meet that goal. MDE has required all counties in Maryland to come up with two-year milestones to show their plan and progress in meeting the TMDL. All milestones specific to the NAS Patuxent River Complex (including WOLF and NRC SOL) will be made available for review before inclusion with the county plans.

8.6.1 Recommendations

- Update the regional stormwater plan at PAX and WOLF regularly (Obj. 6 and 7) (GMR V.20). Development pressures at the Complex may continue in the foreseeable future, exacerbating stormwater impacts to the environment and the need for appropriate stormwater management.

- Promote the use of stormwater management design criteria which adhere to Low Impact Development BMPs and produce biological benefits; however, any stormwater design that would result in open, standing water cannot be permitted on or near airfields (due to BASH concerns) (Obj. 3, 6 and 8) (GMR V.21).

- Implement sound stormwater management practices on both new construction and existing sites (Obj. 6) (GMR V.22). Improper or inadequate stormwater treatment is one of the greatest impacts to surface water quality and the degradation of aquatic habitats on the Installation. As part of the implementation of stormwater BMPs, NAS may initiate a program of stormwater treatment retrofits for all facilities whose construction pre-dates stormwater management requirements/regulations.

- Examine the use of fertilizers and pesticides in both agricultural and grounds maintenance practices, especially at WOLF, and reduce application as needed to maintain or improve water quality (Obj. 2 and 6) (GMR V.23/SMR V.18).

- Employ BMPs throughout the Complex, but especially at WOLF, to avoid facility contribution to water quality degradation (Obj. 2, 6 and 12) (GMR V.24).

8.7 Landscaping/Grounds Maintenance Specifications

The Federal government retains a great deal of real estate, much of which requires some form of grounds maintenance. Thus, the administration is presented with the unique opportunity to take the lead in the area of landscaping by developing practical and cost-effective methods to preserve and protect these lands. In April of 1994, the President issued the Memorandum for the Heads of Executive Departments and Agencies, Subject: Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds (Annex V-E). This document requires federal agencies to employ landscaping technologies and practices that serve to conserve water and prevent pollution.

A great deal of time, effort, and money are expended each year to maintain the Complex grounds. This work is conducted through a grounds maintenance contract that is awarded through competitive bidding. The contract covers landscaping and grounds maintenance including

planting, seeding, mowing, pruning, trimming, clipping, chemical application, erosion control, and maintenance of the machines and tools of operation.

There are 1,456 and 294 acres of mowed and otherwise maintained lands on PAX and WOLF, respectively (Maps V-3 and V-4 in Annex V-B and Table V-5, above). Therefore, it is prudent to review the grounds maintenance specifications employed and the possibility of reducing the amount of area requiring intensive maintenance.

8.7.1 Mowing Reduction

In the past, many large tracts of previously mowed turf grass were planted with trees, shrubs or other wildlife cover to reduce the area of mowed grounds. Areas that are now under lawn should be re-evaluated for another reduced mowing schedule. The immediate areas around buildings and other facilities need to remain well groomed in order to meet anti-terrorism/force-protection clearance requirements, generally vegetation under eight inches within the structure clear zone (Unified Facilities Criteria 4-010-01, Change 2). However, the Station maintains many frequently mowed areas that could have their mowing frequency reduced. Many times, mowing only twice a year will maintain an herbaceous edge and prevent secondary growth (growth of woody vegetation). Grounds maintenance maps (Annex-B, maps V-3 and V-4) show the different categories of vegetation management. This secondary growth can be destructive to pavement and, therefore, must be controlled. One of the drawbacks to mowing reduction is the probable increase in the tick (Ixodoidea family) population, and thus the occurrence of Lyme disease (*Borrelia burgdorferi*). Therefore, mowing reduction should not be utilized without appropriate pest control measures in areas that are heavily utilized by personnel.

8.7.2 Review of Planting and Maintenance Specifications

Planting and maintenance specifications were developed for PAX in 1983 and included in a Grounds Conservation Plan (NAVFACENGCOM, 1983). These "Management Practices" are a series of standard operating procedures (SOPs) for mowing, planting, seeding, fertilizing, pruning, and erosion control methods to be used on Complex properties. These specifications are held by the NR Program and should be reviewed and revised if necessary (GMR V.25).

Additional planting and maintenance information can be found in the Installation Appearance Plan for the NAS Complex. This document provides landscape guidance for programmers and planners.

8.7.3 Recommendations

- Reduce mowing frequency around remote roads (Obj. 7) (GMR V.26). There are some remaining road edges in remote areas around the Base that are frequently mowed at a width exceeding 12 feet. Mowing of these areas can be reduced in scope and frequency. Frequently mow the strip directly adjacent to the road edge in a path no wider than that made by the mower in one pass. The remainder of the shoulder should be allowed to transition into successional forest. If a forest edge is not acceptable, the remainder of the shoulder should only be mowed at a frequency selected to support site specific conservation and rehabilitation. This will promote wildflower growth in the "rough" shoulder, thereby increasing biodiversity (especially pollinators) and animal cover.

- Promote scrub/shrub communities in utility rights-of-way (ROWs) (Obj. 7) (GMR V.27/SMR V.19). While some of the utility ROWs that occur at PAX maintain a turf cover, others (such as those leased by the local electric company) are now maintained as scrub/shrub and infrequently mowed. Through the use of selective herbicide treatments, a low-growing scrub/shrub habitat can be established to benefit wildlife and other biota. In addition, maintenance costs will be reduced.
- Continue mowing reduction efforts by converting turf to other vegetative cover that requires reduced or no maintenance, or agricultural lands that maintain a positive funding flow (Obj. 7) (GMR V.28/SMR V.20).
- Review grounds landscaping plans for appropriateness of plant materials, methods and locations. Use regionally native plants. Encourage the use of low-maintenance/low-input landscaping techniques to reduce both water consumption for irrigation and the necessity for intensive chemical applications. The NR Program suggests consulting the US Fish and Wildlife Service document entitled "Conservation Landscaping for Federal Facilities: Guide to Beneficial Landscaping in the Chesapeake Bay Watershed," for environmentally and wildlife-beneficial planting designs (Obj. 1, 7, 8 and 11) (SMR V.21).
- Review grounds maintenance contract for consistency with INRMP objectives (Obj. 9, 11 and 13) (SMR V.22).
- Consult a Natural Resources Specialist for planting and maintenance specifications (Obj. 9, 11 and 13) (GMR V.29)
- Continue employing best management practices in landscaping and grounds maintenance activities (Obj. 1, 2, 7 and 8) (GMR V.30).

8.8 Pest Management

As directed by DODINST 4715.03 (Natural Resources Conservation Program), this INRMP includes management recommendations for biosecurity; specifically, preventing introduction or spread of invasive/noxious species and stray or feral animals that have the potential to impact natural resources.

Most pest control work is conducted through a pest management contract administered by PWD. Pest control activities are carried out by selected private contractors. Pest control activities involving vertebrate wildlife species are discussed in Wildlife Management (Chapter 8). NR staff continues to carry out BASH mitigation, some groundhog control on cultural resources sites and active agriculture outlease lands, and invasive plant treatment (in-house and contracted).

8.8.1 Integrated Pest Management

An Integrated Pest Management Plan (IPMP) was adopted for PAX and WOLF in 1994 and most recently revised in November 2016. The IPMP is a comprehensive document that captures all the pest management and pesticide-related activities conducted at NAS. It provides the regulatory framework in which the NAS pest management program operates while providing comprehensive information to installation staff and internal and external compliance auditors. The objective of the

plan is to provide guidance for the maintenance of an effective pest management program on lands occupied by NAS. The plan incorporates an Integrated Pest Management (IPM) approach that focuses on safe, environmentally sound, and cost-effective control of pests. IPM is a comprehensive approach to pest management or prevention that considers various chemical, physical, and biological suppression techniques, the habits of the pest, and the environment. IPM programs emphasize preventive pest control measures in lieu of corrective measures wherever cost effective. An example of the pests that IPM handles includes all small rodent pest control.

IPM is based on the principle that control is only required if a population will surpass an economic or aesthetic injury threshold. Therefore, the presence of a pest does not warrant immediate control efforts unless:

(1) The pest population will cause economic loss.

(2) The pest population will endanger health and/or welfare and/or impact Navy morale.

(3) The pest population will become so numerous that they can no longer be tolerated.

8.8.1.1 Recommendations

- Review IPMP updates as a means to strive for continued and improved application of IPM methodologies (Obj. 2, 6 and 7) (SMR V.23).
- Review the pest control contract to determine consistency with the objectives of the INRMP and ensure that pest control is conducted with minimal impact to aquatic environments (Obj. 2, 6 and 7) (SMR V.24).
- Review pest control activities proposed by the agricultural lessee for consistency with all applicable laws, regulations, and INRMP objectives (Obj. 2, 6 and 7) (SMR V.25).
- Ensure that NR Program pesticide and herbicide use is captured in the NAVFAC Online Pesticide Reporting System (Obj. 2) (SMR V.26).

8.9 Urban Forestry

The purpose of the Urban Forestry Program is to ensure that the addition and care of landscape trees on all NAX properties are properly executed. While most landscape management actions at the Station are performed by the grounds maintenance contractor, NR personnel serve as advisors with respect to trimming, removal and selection of replacements. In addition, NR staff review proposed development projects to confirm the use of regionally native species in both general landscape and stormwater management features.

PAX has received two different awards for its excellent urban/community forestry program. It was the first Naval installation (and third Defense installation) in the US to win the National Arbor Day Foundation's "Tree City USA" award. PAX has won the award each year since 1988, as well as the prestigious "Growth Award" in most years since 1994.

PAX has also won Maryland DNR's "PLANT (People Loving and Nurturing Trees) Community Award," each year since 1994, as well as their "Green" award in many subsequent years. These awards are an excellent way to develop personnel awareness and community support.

- PAX should maintain the standards necessary to qualify for, and submit nominations for, the "Tree City USA" and "PLANT Community" awards each year. In addition, an effort should be made to include WOLF in these accomplishments (Obj. 8) (SMR V. 27).

PAX personnel help to plant a tree
during a National Arbor Day Foundation

An Urban Forestry Plan was completed for PAX in 1994 (NAS PAX, 1994). The purpose of the document is to guide the maintenance and utilization of the urban forest resource within PAX. The primary goal of the plan is to locate and remedy hazardous conditions, develop guidelines for efficient maintenance, improve forest composition, develop an urban forest database, and incorporate this information into GRX.

The plan lists management prescriptions for 5,964 trees (106 different species) that occurred in the urban landscape of PAX at that time. Eighty-five percent of the urban trees are listed in fair to good condition, while only eight percent are listed as over-mature or in the "dead" age class. No major disease or pest problems were identified in the plan, although Dutch Elm Disease (DED) continues to take its toll on the Station's native elms. Continue to replace lost American Elms with the disease-resistant *Zelkova serrate*, which closely resembles our elms in growth form (Obj. 8) (SMR V.28). Also, continue monitoring programs for other exotic tree pests, such as Emerald Ash Borer (*Agrilus planipennis*), Asian Long-horned Beetle (*Anoplophora glabripennis*), and Spotted Lanternfly (*Lycorma delicatula*) (Obj. 2) (SMR V.29). The urban tree program is further discussed in Forest Management (Chapter 6).

Urban Forestry: One of the many examples of urban tree communities managed at PAX.

8.9.1 Recommendations

- Conservation staff should continue to encourage implementation of the Urban Forestry Plan (Obj. 2 and 8) (Project V.10).
- The NR Program should re-inventory PAX (last performed in 1994) and develop a revised Urban Forestry Plan with updated data (Obj. 2 and 8) (Project V.11).
- The NR Program should inventory and develop an Urban Forestry Program for WOLF and include in future INRMPs (Obj. 2 and 8) (Project V.12).
- Updates should be made the Urban Forestry Program and future INRMPs should include an Urban Forestry Program (Obj. 2 and 8) (SMR V.30).

8.10 Wetlands Protection

Wetland protection is vital to the ecological integrity of the aquatic resources on and adjacent to PAX and WOLF. Chesapeake Bay waters have been heavily impacted over the decades through intensive farming, sedimentation, and loss of wetlands. In addition, climate change and predicted sea-level rise may result in loss of many wetlands to inundation. Wetlands play a vital role in cleansing runoff of dissolved and particulate pollutants before they reach open waters such as the Bay. Destruction of wetlands through agriculture and urbanization has resulted in free passage of these pollutants to the Bay. Strict regulations are in place regarding the disturbance of wetlands. In some instances, wetlands disturbance is only allowed if losses are compensated through mitigation. The NR Program should be the lead group in overseeing all wetland protection measures (GMR V.31).

8.10.1 Federal Wetlands Policy

The Federal government's wetlands policy maintains five principles. They are as follows:

(1) Support the interim goal of no overall net loss of the Nation's remaining wetlands, and the long-term goal of increasing the quality and quantity of the Nation's wetland resource base.

(2) Regulatory programs must be efficient, fair, flexible, and predictable; must be administered in a manner that avoids unnecessary impacts upon private property and the regulated public; and must minimize those effects that cannot be avoided, while providing effective protection for wetlands. Duplication among regulatory agencies must be avoided and the public must have a clear understanding of regulatory requirements and various agency roles.

(3) Non-regulatory programs (such as advanced planning; wetlands restoration, inventory, and research; and public/private cooperative efforts) must be encouraged in order to reduce the Federal government's reliance upon regulatory programs as the primary means to protect wetland resources and to accomplish long-term wetland gains.

(4) The Federal government should expand partnerships with state, tribal, and local governments, the private sector, and individual citizens, and should approach wetlands protection and restoration in an ecosystem/watershed context.

(5) Federal wetlands policy should be based upon the best scientific information available.

While there are many initiatives set forth to satisfy the above goals, it is noted that the Administration also promotes the use of mitigation banking and planning for such, and was successful in changing Section 404 of the Clean Water Act through legislation to officially sanction this form of mitigation as official policy. Agency (U.S. EPA and USACE) implementation of this policy occurred on April 10, 2008, and it became effective on July 10, 2008.

8.10.2 Wetland Delineation

The first line of wetland protection is identification and documentation of the wetland resources at PAX and WOLF. The Station GIS wetlands coverage, originally based on National Wetlands Inventory maps produced by the Department of the Interior, has been updated using aerial photography and some field reconnaissance (Maps III-9and III-11 in Annex III-B). Additionally, mapping of the limits of navigability and headwaters delineations of streams at both PAX and WOLF have been captured in GRX. This information will aid the base planners in their cursory search for areas most suitable for development.

While this information is useful in the initial stages of development planning, a Jurisdictional Determination (JD) from the USACE should be obtained to confirm legal boundaries prior to any disruptive activities around wetlands as required by federal statutes and regulations.

8.10.3 Wetland Regulations

The USACE regulates the discharge of dredged and fill materials in all US waters, including wetlands. Any NAS discharge into Waters of the United States requires a permit from the Baltimore District of the USACE. In addition, per Section 401 of the CWA, DNR provides Certification and MDE oversees impacts to state waters and isolated wetlands in Maryland under Section 404. USACE maintains a cooperative permit process with MDE under Section 10 Rivers and Harbors Act and Section 404 activities. The nature of regulated activities is broadly interpreted and may include filling, grading, clearing, grubbing, excavation, driving piles, etc. It should be

considered that, with a few exceptions, any activity within a jurisdictional wetland area requires a joint permit from the USACE and MDE.

State Programmatic General Permits (SPGPs) are issued by the District Engineer for a general category of activities when the activities are similar in nature and cause minimal environmental impact (both individually and cumulatively), and regional permits reduce duplication of regulatory control by state and federal agencies. The most current version of the Maryland State Programmatic General Permit (MDSPGP) is MDSPGP-6. This permit is administered by the USACE and MDE and will expire on September 30, 2026. Nationwide Permits (NWPs) authorize a category of activities throughout the entire nation, and are valid only if the national and regional conditions applicable to the permits are met. If not, then a regional, general or individual permit will be required. Because MDSPGP-6 is designed to continue to authorize certain activities previously covered by the NWP program and institute a streamlined Corps regulatory process that has been integrated with state processes, the Corps of Engineers has suspended many of the NWPs which are applicable to activities qualifying for MDSPGP-6 authorization. Suspension of various NWPs will avoid confusion over SPGP use and eliminate redundancy since state and federal regulatory programs are administered jointly in these states. If the SPGPs become void, enjoined, revoked, or removed from effect for any reason, the Corps will consider reissuance of some or all of the suspended NWPs.

In addition to the USACE, DNR issues Water Quality Certificates under Section 401 of the Clean Water Act. Water quality certification is required for most wetland disturbances.

Wetlands at PAX

Wetland regulations and policies are constantly evolving and changing. Reauthorization of the Clean Water Act may lead to dramatic changes in wetland definitions, delineation methodologies, and/or regulations. The EPA expects to propose a new CWA Section 401 Certification rule in 2022, until then the EPA will return to the 1971 CWA 401 Certification rules.

8.10.4 Wetland Disturbances

While wetland protection is essential, avoidance of wetland impacts is sometimes not feasible. In order to fulfill a "no overall net loss" policy, wetland mitigation must be carried out as appropriate

to compensate for losses. Historically, this has been accomplished through individual project planning at a very high cost. Wetland mitigation refers to the restoration, creation, enhancement, and, in certain defined circumstances, reservation of wetlands expressly for the purpose of providing compensatory mitigation in advance of discharges into wetlands authorized under the Section 404 regulatory program. The Federal Mitigation Rule was adopted April 10, 2008, by the USACE and the EPA (33 CFR part 332 and 40 CFR part 230) and refers to the compensatory mitigation required for unavoidable impacts to the Water of the U.S., including wetlands, and their functions, as a result of activities authorized under Section 404 of the CWA. This rule specifies a federal permitting preference for mitigation bank options over permittee-responsible mitigation for the following reasons:

- Banking allows immediate compensation for wetland disturbance.
- Because mitigation banks are typically large, they have the potential for creating a more stable wetland ecosystem than a series of smaller mitigation sites. In addition, the unit area price for creating larger banks is usually lower than that for smaller individual sites.
- Banking can relieve the sometimes burdensome responsibility that mitigation issues can impose upon individual project planning.
- Locally, the construction of mitigation wetlands in the vicinity of the airfield could attract birds and other wildlife and increase aviation safety risks.

8.10.5 Recommendations

- The NR Program should continue to make wetland protection a priority at NAS (Obj. 3 and 6) (GMR V.32/SMR V.31). Utilization of the Public Works Department (PWD) Planning Checklist and GRX in determining potential wetland impacts of developments and other activities will help avoid unnecessary and accidental wetland disturbances.
- The NR Program should seek new ways of updating mapped wetland resource data in GRX. Field determination information concerning wetland boundaries across the Complex should be used in conjunction with GPS data collection to improve the GIS coverage (Obj. 3) (SMR V.32).
- Develop a mitigation banking strategy for the Station which emphasizes offsite mitigation preferences due to BASH concerns (Obj. 3) (SMR V.33). The Complex is likely to experience continued development pressures. The NR Program will focus on off-site compensation (working with the NAWCAD Ranges Sustainability Office and Readiness and Environmental Protection Initiative [REPI]) in lieu of any preference for on-site mitigation bank development due to BASH concerns.
- Update base wide wetland delineation using current USACE protocol that was developed in 2010. Periodically update mapped wetlands resource data in GRX so project planners have more reliable constraint information when siting projects. In addition, conduct surveys on PAX property acquisitions (such as the Grayson property near WOLF) (Obj. 3) (Project V.13).

8.11 Pollinator Habitat Management

Pollination is an ecosystem service that is vital to installation landscapes and, subsequently, to carrying out the military mission. Many of the listed and at-risk species located on DoD lands are

either pollinators (e.g., bees, bats and butterflies) or flowering plants that require pollination. As pollinators decline in numbers, native landscapes could become barren or be overrun by invasive species. Declines in populations of listed or at-risk species (such as the Monarch Butterfly [*Danaus plexippus],* which is further discussed in Chapter 8) might result in access restrictions, which in turn could reduce the military's capacity to test and train. Diverse native plant communities, which may depend heavily on pollinators, are frequently more resilient to impacts from training and nearby development activities than poorer quality habitats – they resist erosion from terrestrial testing/training maneuvers and are more resilient to fire.

8.11.1 Recommendations

- Continue to support requests from recreational beekeepers for placement of managed hives throughout the installation (Obj. 2) (SMR V.34).
- Continue to recommend the use of native pollinator plants in stormwater management and general landscape design, to include reduced mowing areas (Obj. 2) (SMR V.35).

8.12 Encroachment Management

OPNAVINST 5090.1 (series) defines encroachment as "any non-Navy action planned or executed in the vicinity of a naval activity or operational area which inhibits, curtails, or possesses the potential to impede the performance of Navy activities." The NAS Encroachment Action Plan, developed and overseen by the Sustainability Office (SO), has identified six particular encroachment challenges as the top priorities with respect to encroachment planning at the Complex. They are:

- Urban development;
- Population growth trends;
- Airborne noise;
- Competition for air space, land and sea space;
- Frequency spectrum; and
- Interagency coordination.

In order to offset these challenges, the Navy may acquire property interests (and, possibly, the management responsibility for natural resources on these properties) through programs such as REPI.

As such, the NAS Conservation Branch Director should continue to work with SO in the identification of encroachment challenges, prevention and mitigation and ensure that any NR Program responsibilities accrued through REPI actions are addressed in the INRMP (SMR V.36).

8.13 Mineral Resources Accessibility

Mineral resources such as masonry (pure) sand, topsoil and construction-grade gravel have been found on or near NAS. As the Station continues to grow, it may prove profitable to guide development in such a way as to maintain availability of areas known to contain these resources. It is important, however, to note that mining at NAS will be done only as needed for local (Station) projects (e.g., excavating sand for purposes of beach restoration). There will be no commercial

mining operations or sales of mining materials. In addition, mined areas will be restored to pre-excavation land cover to the greatest extent practicable.

8.13.1 Recommendations

- Identify all significant mineral resource areas (Obj. 15) (SMR V.37).
- Consider the benefits of maintaining access to mineral areas when reviewing development plans (Obj. 15) (SMR V.38).

9.0 Coastal Zone

The Coastal Zone Management Act of 1972 (16 USC 1451 et seq), as amended through the Coastal Zone Reauthorization Amendments of 1990 and the Coastal Zone Protection Act of 1996, requires federal agencies to ensure development projects in the coastal zone are, to the maximum extent practicable, consistent with the enforceable policies of the approved State Coastal Zone Management Plans (CZMP). The Maryland CZMP is based on federal laws, such as Section 404 of the Clean Water Act of 1977, and incorporates a number of state laws and authorities including the Chesapeake Bay Critical Area Law and Program, the Tidal Wetlands Act of 1970, the Nontidal Wetlands Protection Act of 1989, state erosion and sediment control laws and the state Stormwater Management Act. Enforceable policies are given legal effect by state law and do not apply to federal lands, waters or agencies, or other areas or entities outside of a state's jurisdiction, unless authorized by federal law (CZMA does not confer such authority).

As a component of the Maryland CZMP, the Chesapeake Bay Critical Area Program implements comprehensive plans and policies to protect land and water resources in the Chesapeake Bay Critical Area. Land-use development standards and requirements established in the program are intended to foster more sensitive development activity for shoreline areas and minimize the adverse impacts of development and land-use activities on water quality and natural resources. The State Critical Area includes all non-federal land within 1000' of the Bay and its tidal tributaries.

While there is technically and legally no Critical Area on the NAS Complex, the spirit of the law is captured by designation of 1000-foot shoreline protection areas and 100-foot shoreline buffers. See Maps V-9 and V-10 in Annex V-B for an illustration of the shoreline protection zones for PAX and WOLF, respectively.

Any actions within these areas are reviewed for impacts to state coastal resources such as wetlands and tidal waters. In an effort to streamline these reviews, the DoD Regional Environmental Counsel worked with the state and applicable installations to complete a Memorandum of Understanding (MOU) between DoD and Maryland concerning CZMA requirements and implementation of enforceable policies of Maryland's CZMP. Additionally, lists of *de minimis* and environmentally beneficial activities were prepared; as agreed to by both parties, activities on these lists may generally be carried out without further CZMA review or consultation. The CZMA MOU was signed by DoD and state representatives in May of 2013.

9.1 Recommendations

- Adhere to the CZMA consistency requirements as identified in the CZMA MOU (Obj. 2 and 6) (SMR V.39).
- Continue to incorporate, as appropriate, land-use guidelines as set forth in the Chesapeake Bay Critical Area Law into the land management program (Obj. 2 and 6) (SMR V.40). The NR Program should seek compliance with all enforceable policies of this law to the maximum extent practicable, while fulfilling the military mission. This is already being accomplished in the Agricultural Outlease Program by certification of the Soil and Water Conservation Plan.
- As necessary and appropriate, carry out special resource management projects within or adjacent to the Coastal Zone in order to mitigate negative impacts to these sensitive resources (Obj. 2 and 6) (SMR V.41).

10.0 References

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Unified Facilities Criteria (UFC), 2022. UFC 4-010-01: DoD Minimum Antiterrorism Standards for Buildings. Change 2, 30 July 2022.

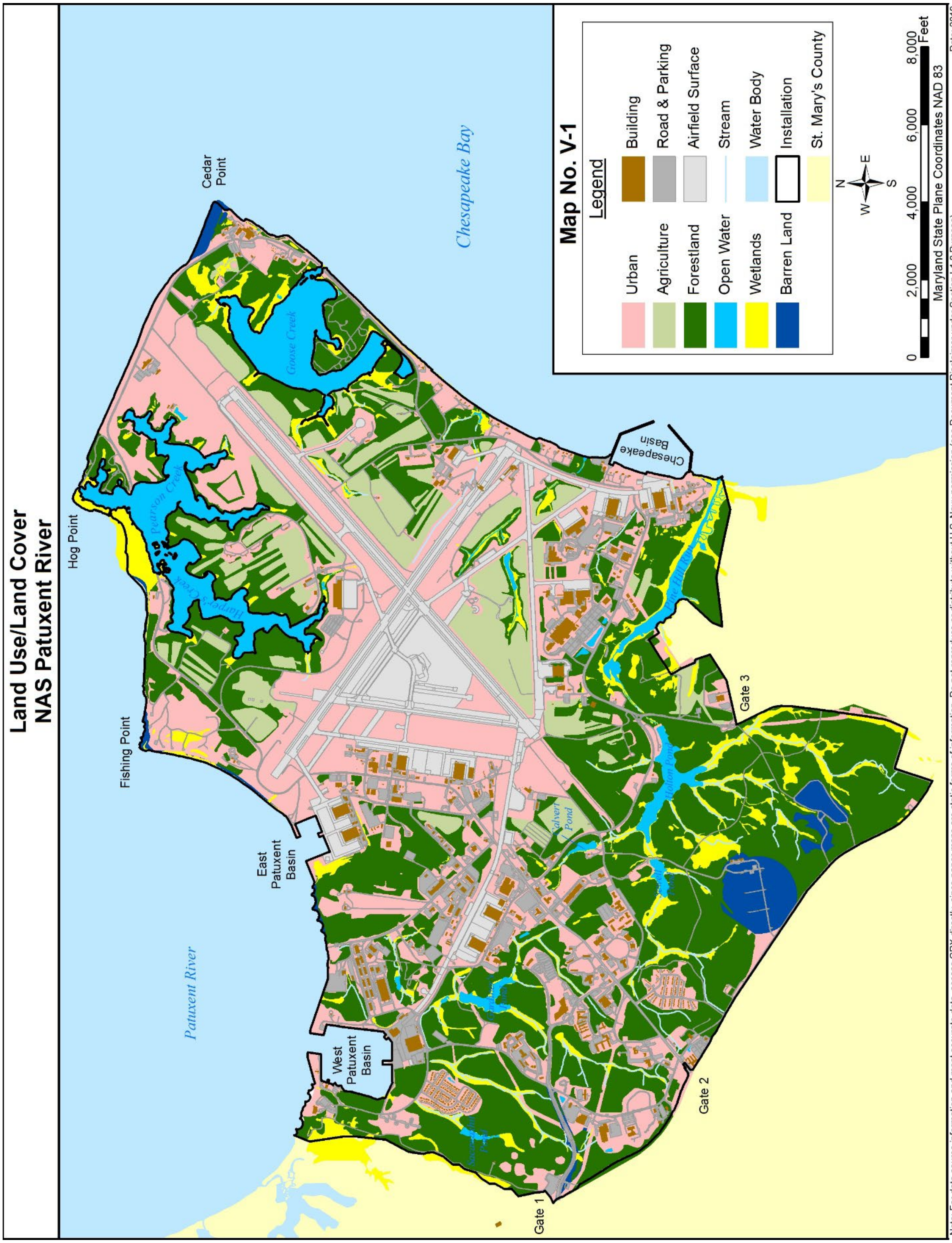
ANNEX V-A

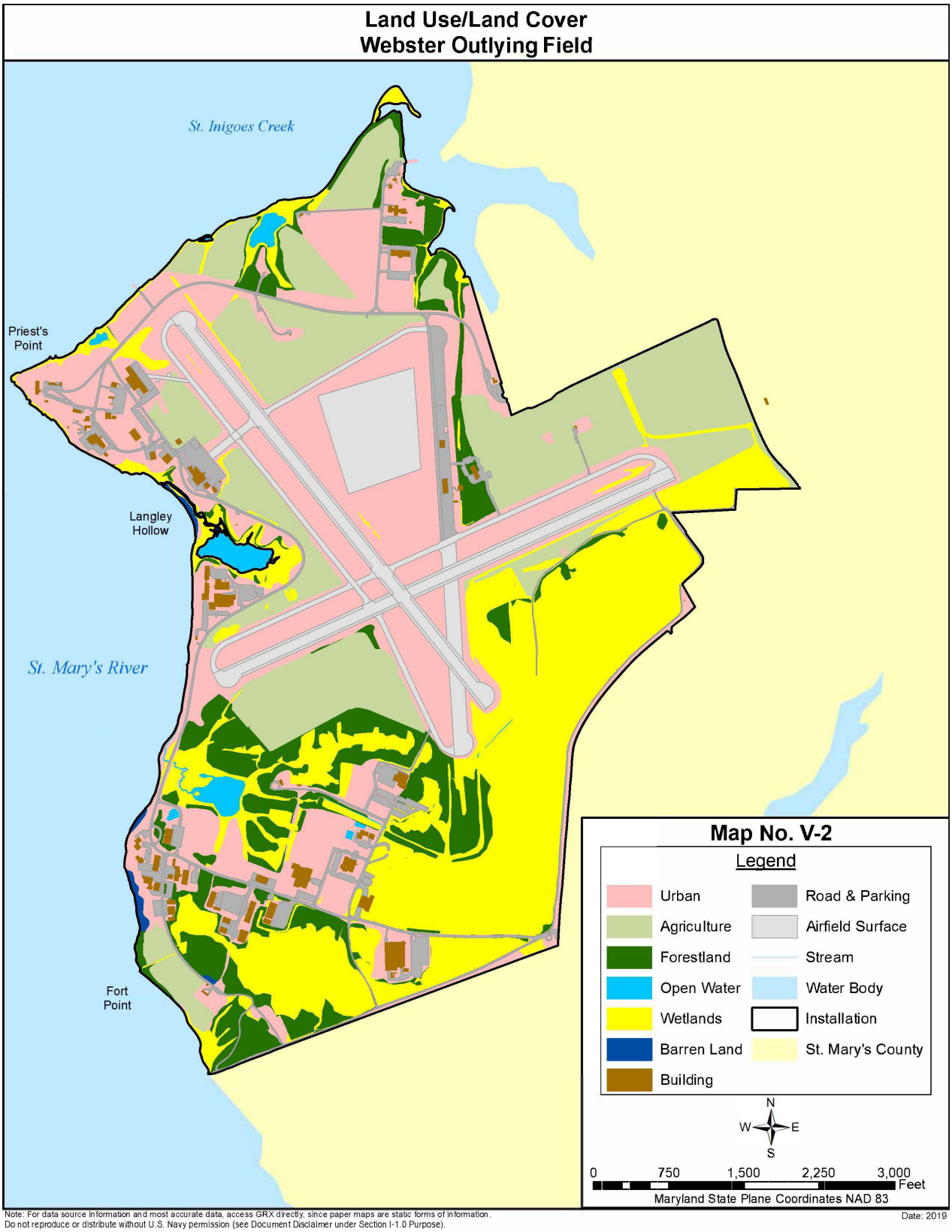
FIGURES

Figure V-1. NAS Patuxent River property prior to construction (1938).

ANNEX V-B

MAPS


Land Use/Land Cover
NAS Patuxent River
Map No. V-1
Legend
Urban
Agriculture
Forestland
Open Water
Wetlands
Barren Land
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper Creek
Calvert Pond
Gate 1
Gate 2
Gate 3


Land Use/Land Cover
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. V-2
Legend
Urban
Agriculture
Forestland
Open Water
Wetlands
Barren Land
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
750
1,500
2,250
3,000
Feet
Maryland State Plane Coordinates NAD 83
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.
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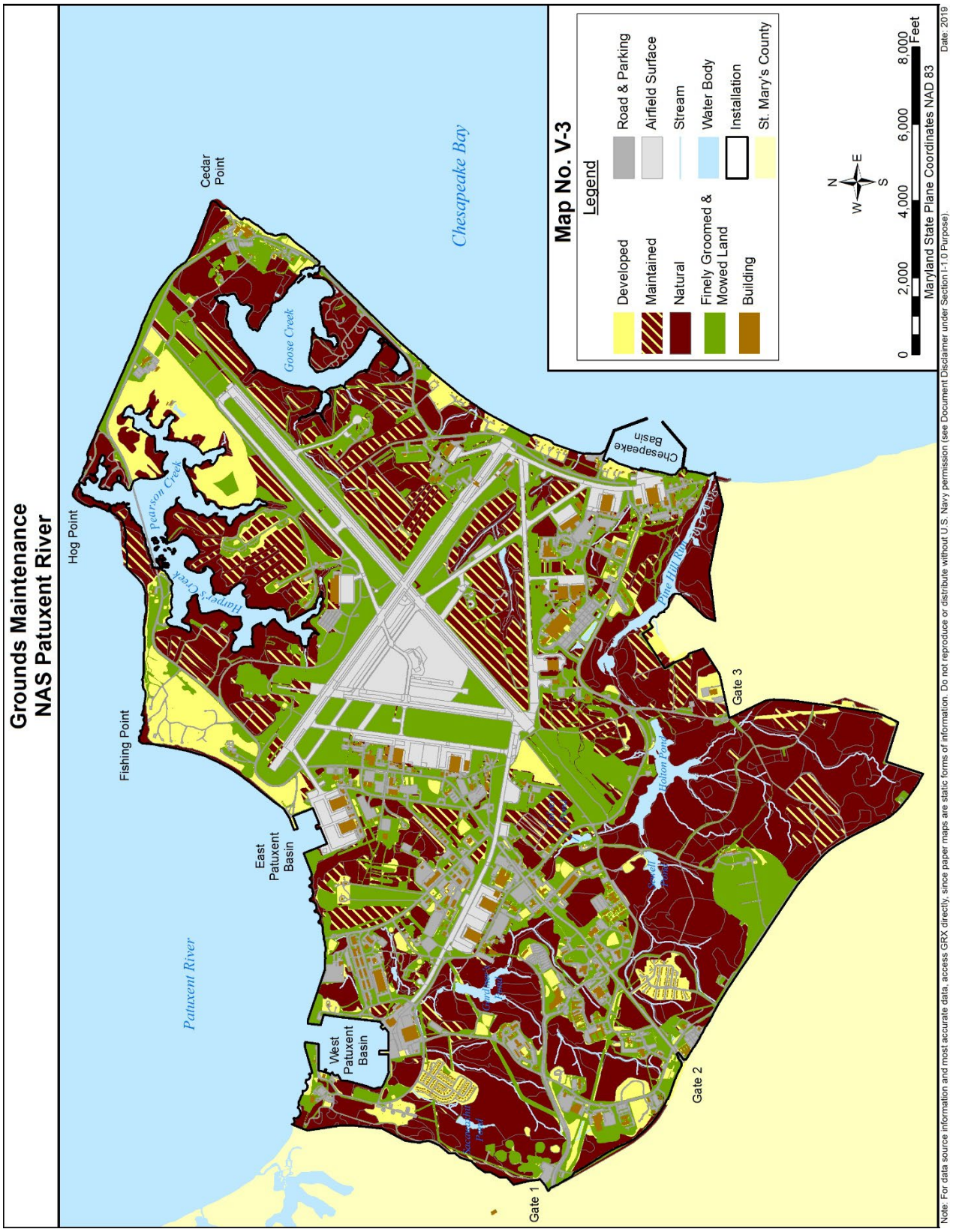
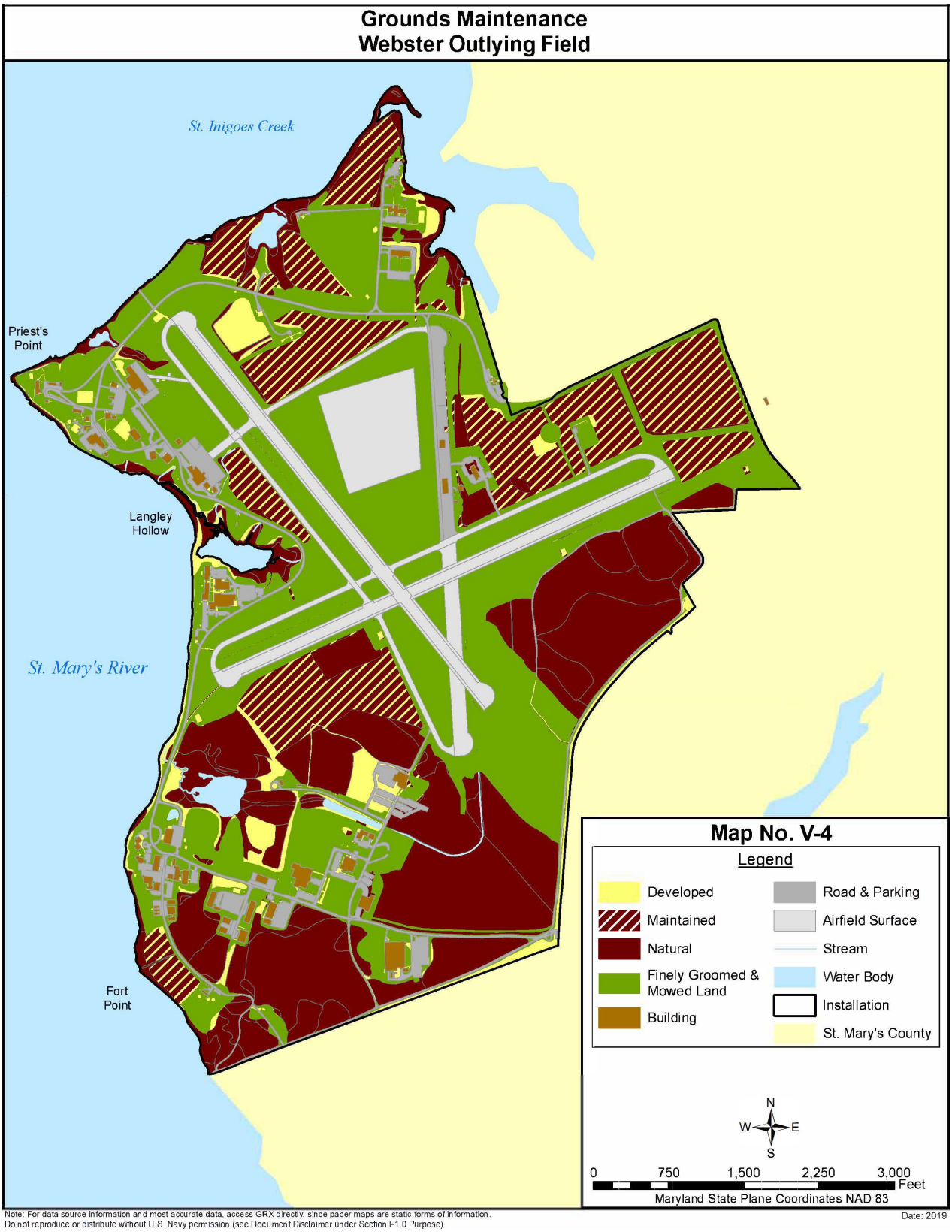
Date: 2019


Grounds Maintenance
NAS Patuxent River
Map No. V-3
Legend
Developed
Maintained
Natural
Finely Groomed & Mowed Land
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Pearson Creek
Harper's Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Trolon Pond
Gate 1
Gate 2
Gate 3
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).



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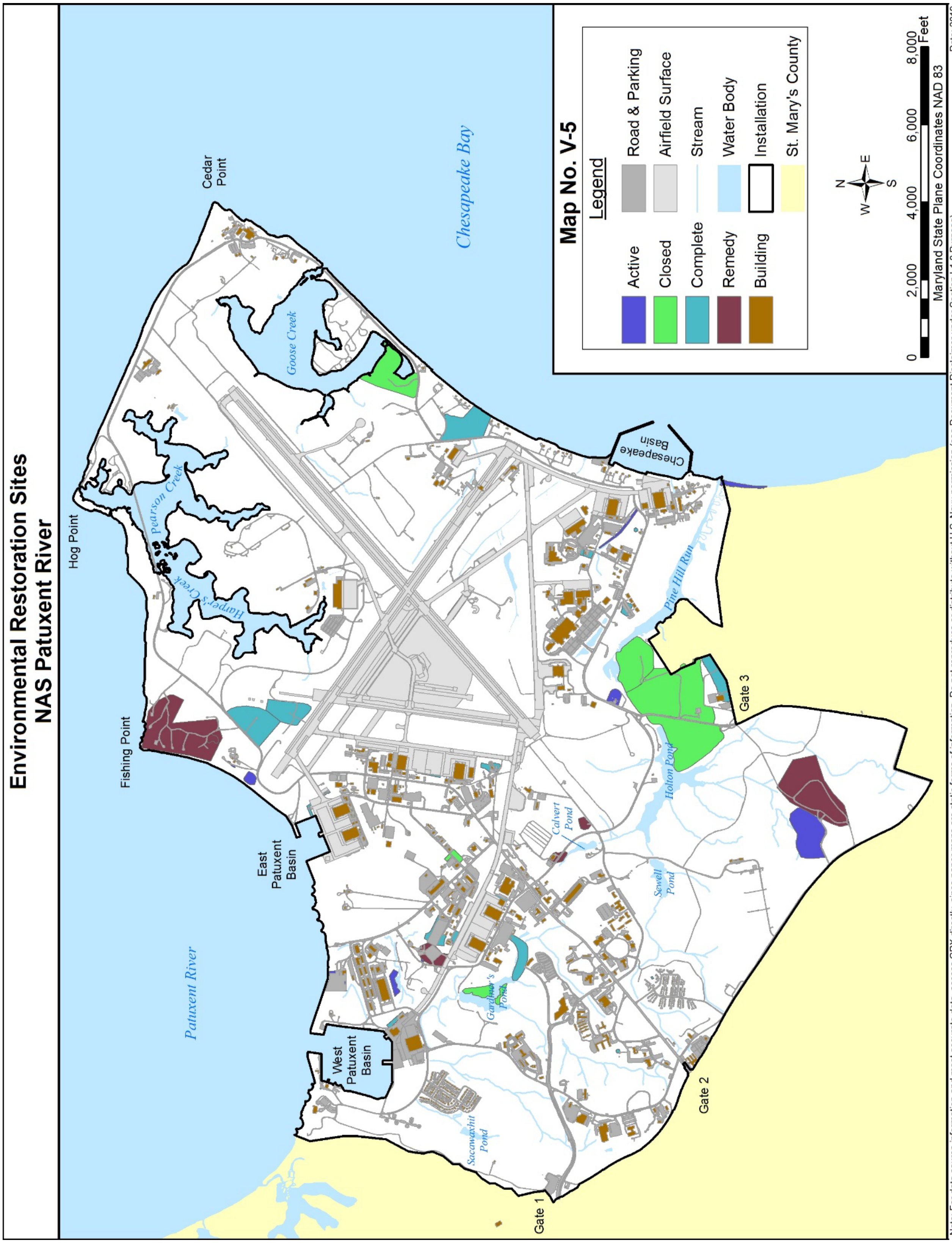
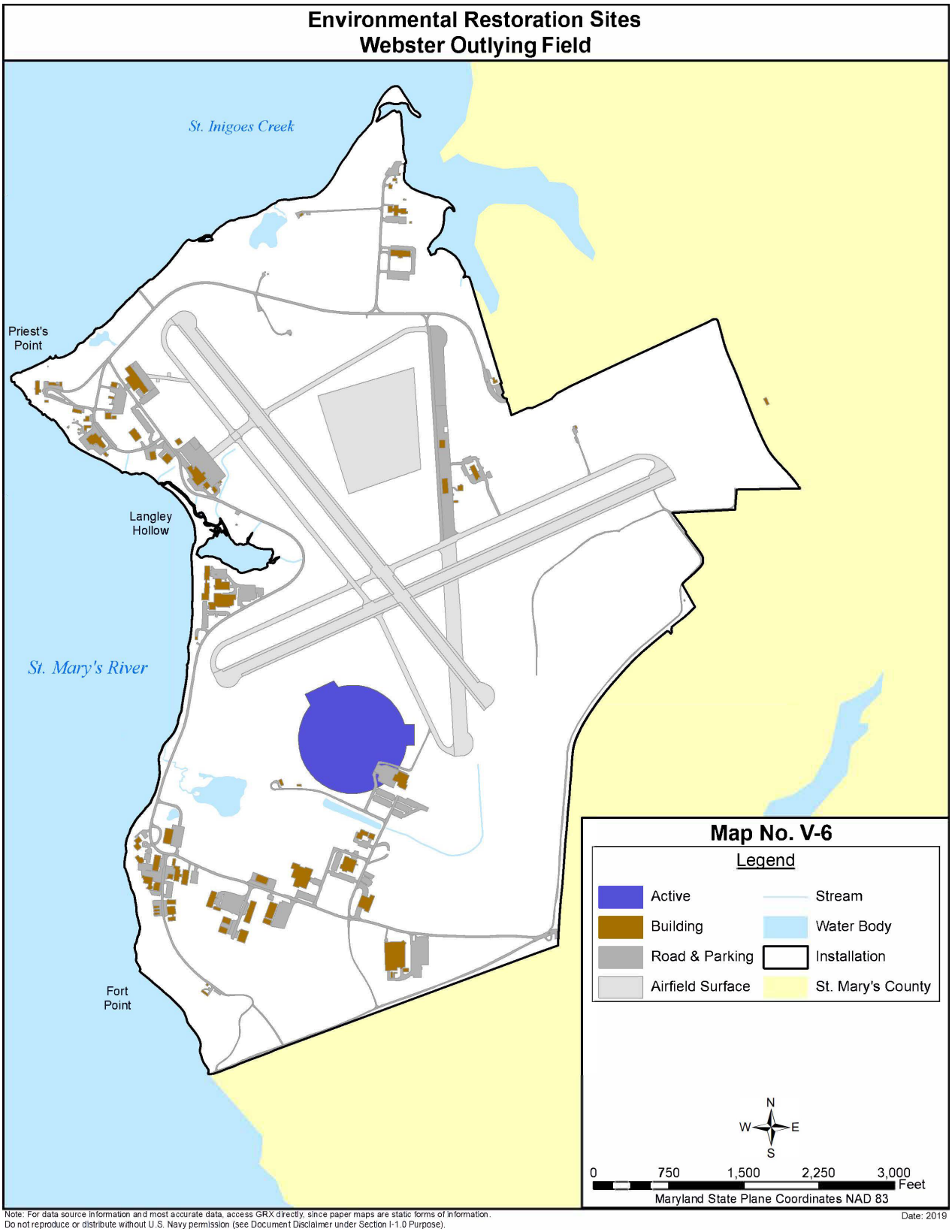

Environmental Restoration Sites
NAS Patuxent River
Map No. V-5
Legend
Active
Closed
Complete
Remedy
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Chesapeake Bay
Patuxent River
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Holton Pond
Calvert Pond
Sewell Pond
Gardiner's Pond
Sacawaxhit Pond
Gate 1
Gate 2
Gate 3


Environmental Restoration Sites
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. V-6
Legend
Active
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
750
1,500
2,250
3,000
Feet
Maryland State Plane Coordinates NAD 83
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.
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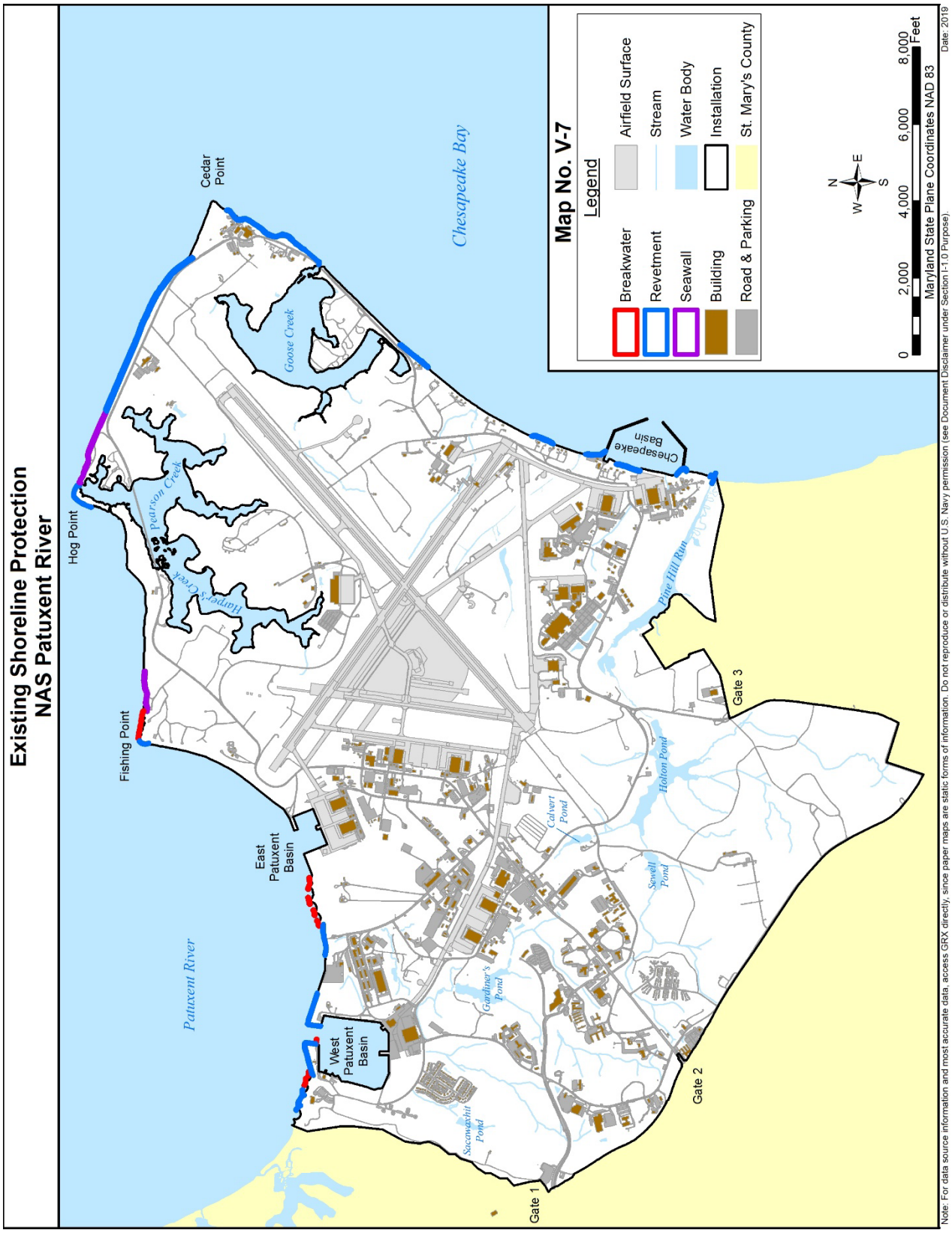
Date: 2019



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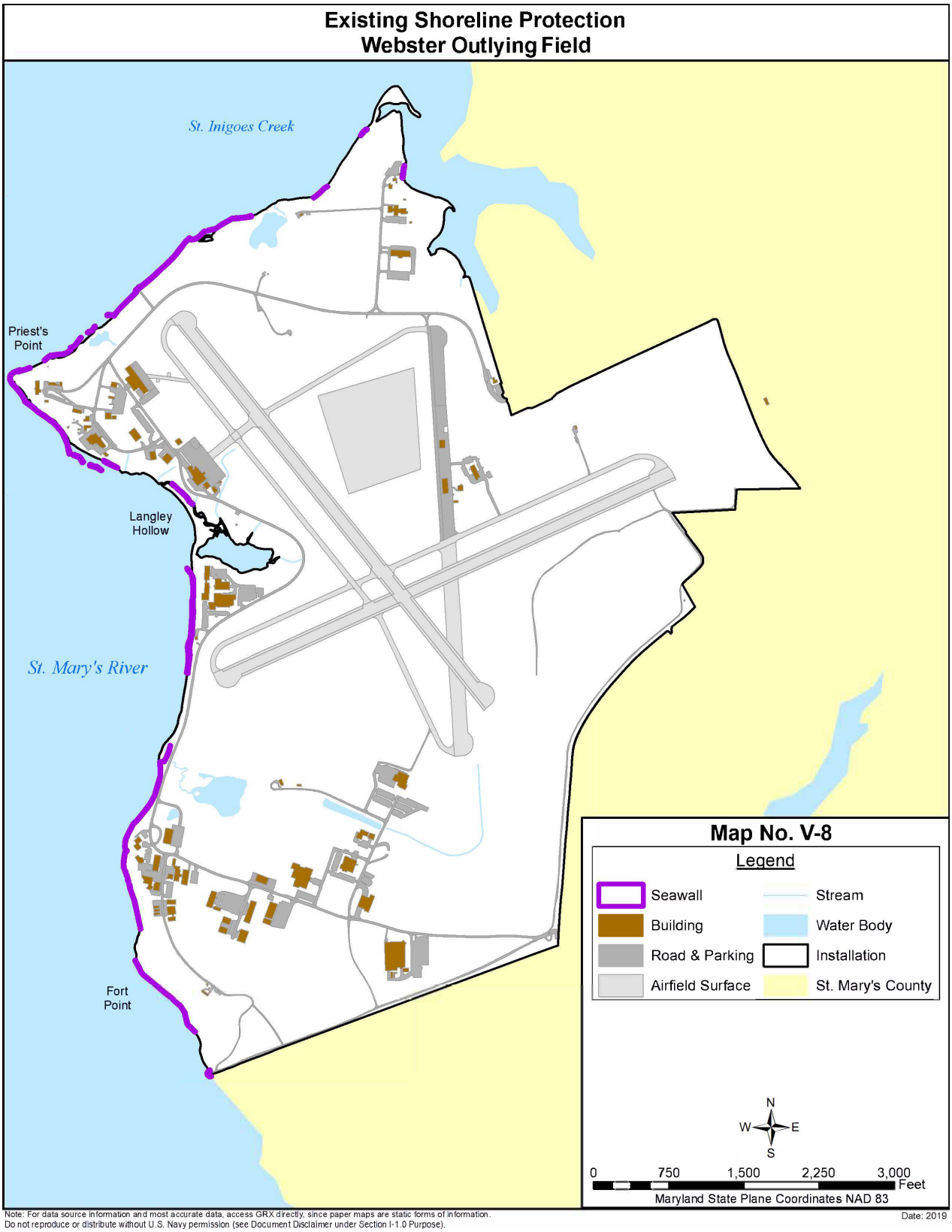

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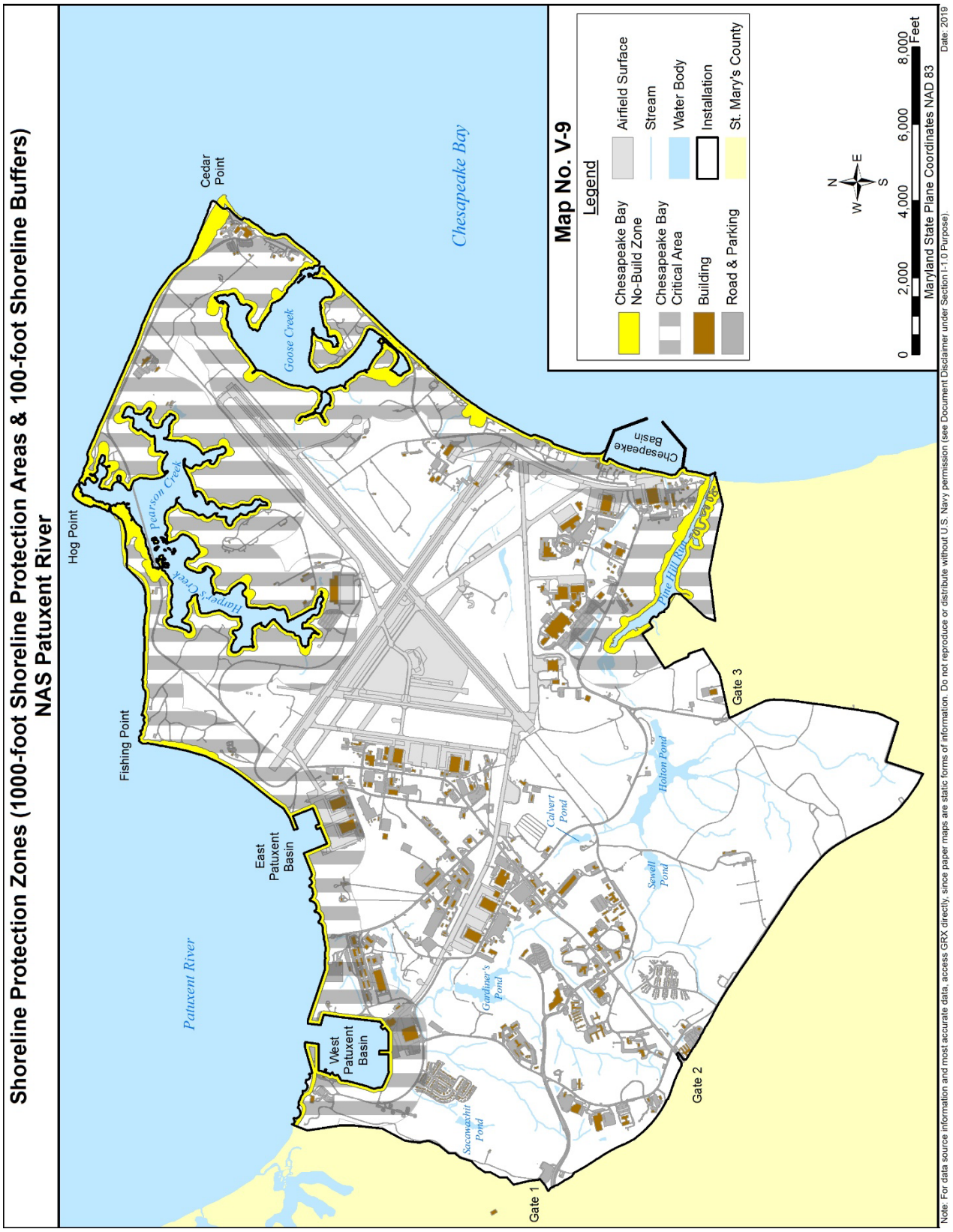
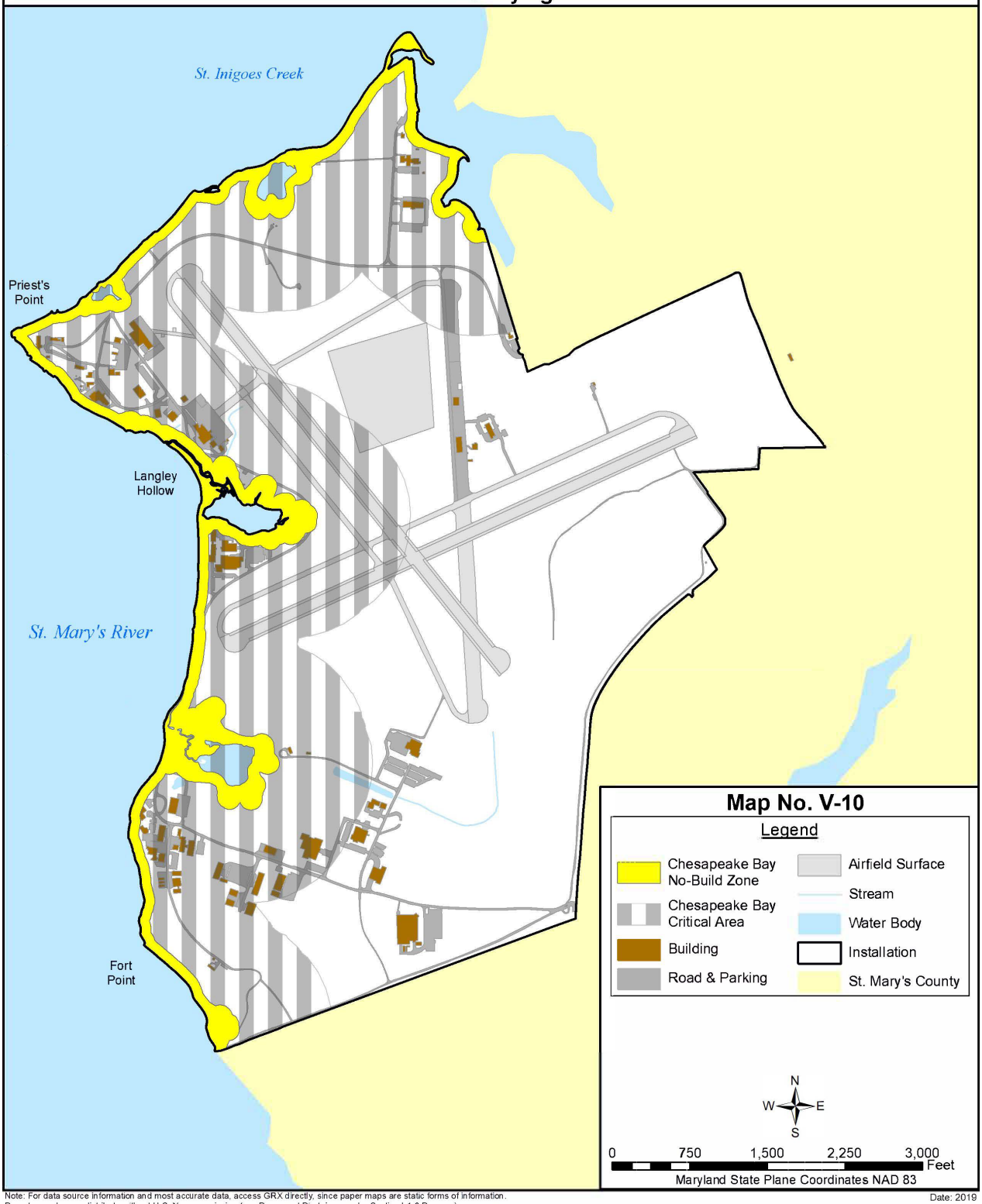

Shoreline Protection Zones (1000-foot Shoreline Protection Areas & 100-foot Shoreline Buffers)
NAS Patuxent River
Map No. V-9
Legend
Chesapeake Bay No-Build Zone
Chesapeake Bay Critical Area
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
Goose Creek
Harper Creek
Pearson Creek
Pine Hill Run
Chesapeake Basin
East Patuxent Basin
West Patuxent Basin
Gate 1
Gate 2
Gate 3
Gardiner's Pond
Calvert Pond
Holton Pond
Sewell Pond
Saccomacchi Pond

Shoreline Protection Zones (1000-foot Shoreline Protection Areas & 100-foot Shoreline Buffers)
Webster Outlying Field



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Date: 2019

ANNEX V-C

TABLES

Table V-C-1. Level III & IV Land Use/Land Cover for PAX			
LAND USE CODE	**DESCRIPTION**	**TOTAL ACREAGE**	**% LAND USE**
Agriculture			
2100	Cropland and Pastureland	26.51	0.35%
2110	Harvested Cropland	438.21	5.78%
2120	Pastureland	20.56	0.27%
2130	Inactive Cropland	179.33	2.37%
2230	Nurseries	9.0	0.12%
Forest			
4100	Deciduous Woods	0.23	0.003%
4110	Deciduous, 10-50% Crown Closure	441.91	5.83%
4120	Deciduous, >50% Crown Closure	386.92	5.11%
4210	Coniferous, 10-50% Crown Closure	47.93	0.63%
4220	Coniferous, >50% Crown Closure	79.86	1.05%
4230	Coniferous Plantation	55.62	0.73%
4310	Coniferous/Deciduous	257.56	3.40%
4320	Deciduous/Coniferous	513.39	6.78%
Shrub/Scrub			
4410	Old Field (<25% Brush Cover)	154.60	2.04%
4420	Deciduous Brush/Shrubland	168.32	2.22%
4430	Coniferous Brush/Shurbland	104.89	1.38%
4440	Mixed Deciduous/Coniferous Brush/Shrubland	278.21	3.67%
Water			
5110	Streams	2.41	0.03%
5310	Artificial Lakes	51.86	0.68%
5410	Bays and Estuaries	366.06	4.83%
Wetlands			
6110	Saline Marshes	61.89	0.82%
6120	Freshwater Tidal Marsh	2.35	0.03%
6210	Deciduous Wooded Wetlands	89.38	1.18%
6215	Deciduous/Coniferous Wooded Wetlands	26.99	0.36%
6220	Coniferous Wooded Wetlands	33.35	0.44%
6230	Brush Dominate & Bog Wetlands	64.13	0.85%
6240	Non-Tidal Marshes	65.53	0.86%
Barren			
7110	Open Beach	22.42	0.30%
7130	Other Sandy Areas	11.53	0.15%
Altered Lands			
7410	Solid Waste Disposal Areas	34.35	0.45%
7420	Dredge Material Disposal Sites	16.94	0.22%
Transitional Lands			
7530	Commercial/Service Under Construction	2.77	0.04%
7550	Trans./Comm./Utilities Under Construction	87.42	1.15%

Table V-C-1. Level III & IV Land Use/Land Cover for WOLF			
LAND USE CODE	**DESCRIPTION**	**TOTAL ACREAGE**	**% LAND USE**
Agriculture			
2110	Harvested Cropland	120.54	13.95%
Forest			
4110	Deciduous, 10-50% Crown Closure	1.67	0.19%
4120	Deciduous, >50% Crown Closure	0.91	0.11%
4210	Coniferous, 10-50% Crown Closure	1.29	0.15%
4220	Coniferous, >50% Crown Closure	0.93	0.11%
4230	Coniferous Plantation	1.16	0.13%
4310	Coniferous/Deciduous	0.47	0.05%
4320	Deciduous/Coniferous	4.59	0.53%
Shrub/Scrub			
4410	Old Field (<25% Brush Cover)	1.55	0.18%
4430	Coniferous Brush/Shurbland	1.14	0.13%
Water			
5310	Artificial Lakes	0.98	0.11%
Wetlands			
6110	Saline Marshes	13.63	1.58%
6210	Deciduous Wooded Wetlands	16.95	1.96%
6215	Deciduous Wooded Wetlands	72.04	8.35%
6220	Coniferous Wooded Wetlands	32.61	3.77%
6230	Brush Dominate & Bog Wetlands	40.54	4.69%
6240	Non-Tidal Marshes	42.88	4.96%

ANNEX V-D

LAND USE/LAND COVER CLASSIFICATION SYSTEM

LAND USE/LAND COVER CLASSIFICATION SYSTEM

There is considerable diversity of opinion about what constitutes land use. One concept that has much merit is that land use refers to "man's activities on land which are directly related to the land" (Clawson and Stewart, 1965). Land cover, on the other hand, describes, "the vegetational and artificial constructions covering the land surface" (Burley, 1961).

Concepts concerning land use and land cover activity are closely related. For the purpose of this study, land use takes precedence over land cover when the activity can be recorded by means of remote sensing techniques. The land use codes described below exclude 1000-Urban and 3000-Rangeland.

2110 Harvested Cropland

This category contains agricultural areas that are managed for the production of harvested row or field crops. These include row crops (such as corn and soybeans) or field crops predominately used as forage (such as hay or alfalfa). Row crops are easily identified on imagery because of the striations and the regular patterns. However, there are problems distinguishing field crops (such as hay or winter wheat) from pastureland.

Pastureland can be distinguished because of its close association with farm structures such as barns or feeding stations. Also, pastureland usually has a slightly more mottled or uneven tone than the photographic signature of field crops. All croplands on Station are part of the Agricultural Outlease program.

2120 Pastureland

This category contains agricultural areas that are mapped as pasture areas for livestock grazing. These areas may be either permanent pastures or tillable cropland used as pasture at the time of photography. The identification problems using imagery alone are discussed in Section 2110. Identification of pastureland, field cropland, and inactive cropland may require field verification or other supplemental information. Pasture may be covered by some brush, but is included in 2120 if the predominant use is for pasture. The pastureland on PAX is associated with the recently closed stables and Riding Club.

2130 Inactive Cropland

This category contains agricultural areas that have no physical indication of present agricultural use. These areas include both abandoned cropland and fields left fallow or planted in soil-improving grasses and legumes. An indication of inactive cropland is the presence of any woody stems in the field. The area is placed in the Brushland category if the woody stems cover is abundant and the field appears to be abandoned rather than left fallow for soil improvement. An area is placed in Brushland as either Old Field (4410) or Brush/Shrubland (4430/4440), depending on the percentage of brush cover.

2230 Nurseries

This category is comprised of areas that are intensively managed for nurseries. Nurseries can be recognized as narrow fields with very regular and definite rows. The colors are usually darker in tones than other cropland. Different shades and tones are present in adjacent cropland. Different shades and tones are present in adjacent fields due to the different stages of seedlings or saplings planted. These shades and tones in the narrow fields present a different signature from other agricultural areas. The one nursery area on PAX is currently slated for partial development.

2430 Horse Farm

This category contains specialized farms for raising and training horses. This includes horse barns, corrals, and training race tracks. The oval training race tracks adjacent to the old horse stables are easily recognized on PAX aerial photography. Extensive acreage of pasture associated with the former horse farm is mapped as Pastureland (2120).

4110 Deciduous, 10-50% Crown Closure

This category contains deciduous forest stands that have crown closure greater than 10%, but less than 50%. Crown closure is made while viewing the area stereoscopically. The ocular judgment is a reliable estimate since the category levels for closure are relatively broad: 10-50% and > 50%. This procedure will also be followed to determine percent crown closure in the other categories.

4120 Deciduous, > 50% Crown Closure

This category contains deciduous stands with crown closures greater than 50%.

4210 Coniferous, 10-50% Crown Closure

This category contains natural coniferous stands with crown closure between 10% and 50%.

4220 Coniferous, > 50% Crown Closure

This category contains natural coniferous stands with crown closure greater than 50%.

4230 Plantation

This category contains conifer stands that have been artificially planted. These include stands planted for timber harvesting or aesthetics. Crown closure estimates will not be determined for plantations. Plantations appear as uniform blocks (usually rectangular) of conifers. Most of the tree plantations at PAX are Loblolly Pine.

4310 Mixed with Coniferous Prevalent (> 50% Coniferous)

This category contains stands of mixed coniferous and deciduous trees. The percentage of coniferous trees is higher than the deciduous (>50% of the stand), but the coniferous species do not dominate the stand (< 75%).

4320 Mixed with Deciduous Prevalent (> 50% Deciduous)

This category contains stands of mixed deciduous and coniferous trees. The percentage of deciduous trees is higher than the coniferous (> 50%), but the deciduous species do not dominate the stand (< 75%).

4410 Old Field (<25% Brush Covered)

This category includes open areas that have less than 25% brush cover. The predominant cover in these areas is grasses with many tree seedlings or saplings present. Old fields are distinguished from inactive farmland (2130) by the amount of brush cover. If a field contains few woody stems (<5%), it is placed in the inactive farmland category. An area is placed in the Old Field category if the amount of brush cover requires extensive brush removal before plowing.

4420 Deciduous Brush/Shrubland (>25% Brush Covered with Deciduous Species Predominant > 75%)

This category contains natural forested areas with deciduous species less than 20 feet in height. An area must have greater than 25% brush cover to be placed in this category. This category also contains inactive agricultural areas that have been grown over with brush.

There are photographic signature differences between brushland and the pole or saw-timber stage trees (Categories 4100, 4200, 4300). Besides the obvious height difference visible on stereo viewing, larger trees display much larger crown diameters than brushland areas.

4430 Coniferous Brush/Shrubland (>25% Brush Covered with Coniferous Species Predominant >75%).

This category contains natural forested areas with coniferous species less than 20 feet high.

4440 Mixed Deciduous/Coniferous Brush/Shrubland (>25% Brush Covered with a Mixture of Deciduous and Coniferous Species; <75% of One Type)

This category contains natural forested areas less than 20 feet in height with a mixture of coniferous and deciduous trees.

5110 Streams

This category includes streams that are no less than 80 feet wide. These features are easily recognized on aerial photography because of their meandering pattern and variable width due to natural fluvial processes. Short distances of water course constriction that fall under the minimum width standard may be included for the sake of continuity. The photographic characteristics of streams are much too numerous and obvious to list. In general, most of the streams at PAX are smaller than the mappable unit above. Therefore, stream definition in this coverage is underestimated.

5310 Artificial Lakes

Water bodies one acre or larger are included in this category. All lakes on PAX are artificial and are used for recreational purposes.

5410 Bays and Estuaries

Like all Level III features, this one also must be at least one acre. Bays and estuaries have many obvious characteristics that make identification simple. Most important is their close proximity to the open bay or river. Next the presence of beaches, shallow water, and marine vegetation assure the identification. In addition, the myriad of fishing and recreation characteristics confirms the identification.

6110 Saline Marshes

These are open, graminoid-dominated regions associated with waters with salinities >1 part per thousand (ppt). Saline marshes are generally dominated by two growth forms of *Spartina alterniflora* in regions with the highest salinities. Marshes having salinities less than 10 ppt are generally brackish and co-dominated by cordgrass, common reed, and sedges. The photographic signatures for these areas are smooth and low, and range in color from red to pinks on summer infrared photographs.

6120 Freshwater Tidal Marshes

These marshes are co-dominated by annual and perennial herbaceous vegetation on substrates associated with tidal waters with salinities less than one ppt. Freshwater marsh species are characterized by spatterdock, arrow arum, pickerelweed, wild rice and cattail. The photographic signatures for these areas are both smooth-and rough-textured with little elevation. The colors range from dark grey to pink on summer infrared photographs.

6210 Deciduous Wooded Wetlands

These wetlands are closed canopy swamps dominated by deciduous trees normally associated with watercourses, edges of marshes and isolated wetlands. The important canopy species include Red Maple, Black Gum, Black Willow, Sweetgum, and Eastern Sycamore. These species combine to form a series of mixed hardwood lowland habitats throughout the entire state. These species have photographic signatures that exhibit height, rough texture, and are dark blue-gray to dark gray or black on winter infrared, and gray to dark gray on panchromatic film.

6220 Coniferous Wooded Wetlands

These wetlands are closed canopy, dominated by coniferous tree species associated with watercourses, seeps, and low topographic land. These areas will support Loblolly Pine and Eastern Red Cedar. Other species include Red Maple and Black Gum. These species have photographic signatures that are varied in texture and are red to dark red on winter infrared film and dark gray to black on winter panchromatic film.

6230 Brush-Dominated and Bog Wetlands

These wetlands are dominated by woody species that are less than 20 feet tall. As there are no bogs on the Complex property, these wetlands are successional woodlands. Species composition is varied with many nuisance plants such as multiflora rose present. The brush-dominated wetlands have a similar signature to 6210 with more space and smaller stature. The color seen on winter

infrared photographs will be dark blue-gray to black and dark gray to black on the panchromatic films.

6240 Non-Tidal Marshes

These wetlands are dominated by various herbaceous species in a variety of hydrologic conditions. They can exist in isolated depressions, lake edges, abandoned farm fields, and in non-tidal stream systems. This cover type will have a photographic signature similar to 6120, varied texture, and light blue-gray or tan color on winter infrared and light gray on the panchromatic photograph.

7110 Open Beach

The open beach potentially includes the sandy area from mean low water of the foreshore to the berm crest of the back shore. It is characterized by sparse vegetative cover and an overwhelming abundance of sand. Other substances may be mixed in with the sand including pebble, rock, silts, shell, flotsam, etc. The signature on both panchromatic and infrared film is white.

7130 Other Sandy Areas

This classification is reserved for natural areas that appear sandy and for perturbed areas that have been kept in a sandy state for which no other known land use is evident.

7410 Solid Waste Disposal Areas

Junkyards, open dumps, landfills and incinerators fall under this land use heading. Only active landfills were evident on the Complex.

7420 Dredge Material Disposal Sites

Dredge material disposal sites are barren areas sometimes separated from other landforms by dikes. Inside the rectangular dike systems are fine sediments from aquatic sites. PAX has some older disposal sites near Pearson Creek and along the Patuxent River. These areas are Bay or River sediments that were probably placed over tidal marshes, but did not possess any dike structure. Rather, this sediment appears to have been piled freely by hydraulic dredging. The area is under a varied state of tree and shrub cover with much of the sediment still exposed. An area northeast of Runway 14 is currently used as a site for the disposal of dredge material. This area is diked and has an herbaceous ground cover.

7530 Commercial/Service under Construction

Graded land, unfinished buildings, and a lot of bare earth typify construction sites. The apparent layout of the construction site will dictate the eventual land use. At PAX, the commercial construction was typified by large, multiple-storied structures.

7550 Transportation/Commercial/Utilities under Construction

The only area delineated under this heading at PAX was the new north gate entrance and road. The road and gate were under construction at the time of the photographic analysis.

ANNEX V-E

MEMORANDUM ON ENVIRONMENTALLY AND ECONOMICALLY BENEFICIAL PRACTICES ON FEDERAL LANDSCAPED GROUNDS

Memorandum for the Heads of Executive Departments and Agencies

Subject: Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds

Dated: April 26, 1994

The Report of the National Performance Review contains recommendations for a series of environmental actions, including one to increase environmentally and economically beneficial landscaping practices at Federal facilities and federally funded projects. Environmentally beneficial landscaping entails utilizing techniques that complement and enhance the local environment and seek to minimize the adverse effects that the landscaping will have on it. In particular, this means using regionally native plants and employing landscaping practices and technologies that conserve water and prevent pollution.

These landscaping practices should benefit the environment, as well as generate long-term cost savings for the Federal Government. For example, the use of native plants not only protects our natural heritage and provides wildlife habitat, but also can reduce fertilizer, pesticide, and irrigation demands and their associated costs because native plants are suited to the local environment and climate.

Because the Federal Government owns and landscapes large areas of land, our stewardship presents a unique opportunity to provide leadership in this area and to develop practical and cost-effective methods to preserve and protect that which has been entrusted to us. Therefore, for Federal grounds, Federal projects, and federally funded projects, I direct that agencies shall, where cost-effective and to the extent practicable:

(a) use regionally native plants for landscaping;

(b) design, use, or promote construction practices that minimize adverse effects on the natural habitat;

(c) seek to prevent pollution by, among other things, reducing fertilizer and pesticide use, using integrated pest management techniques, recycling green waste, and minimizing runoff. Landscaping practices that reduce the use of toxic chemicals provide one approach for agencies to reach reduction goals established in Executive Order No. 12856 "Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements;"

(d) implement water-efficient practices, such as the use of mulches, efficient irrigation systems, audits to determine exact landscaping water-use needs, and recycled or reclaimed water and the selecting and siting of plants in a manner that conserves water and controls soil erosion. Landscaping practices, such as planting regionally native shade trees around buildings to reduce air conditioning demands, can also provide innovative measures to meet the energy consumption reduction goal established in Executive Order No. 12902, "Energy Efficiency and Water Conservation at Federal Facilities;" and

(e) create outdoor demonstrations incorporating native plants, as well as pollution prevention and water conservation techniques, to promote awareness of the environmental

and economic benefits of implementing this directive. Agencies are encouraged to develop other methods for sharing information on landscaping advances with interested nonfederal parties.

In order to assist agencies in implementing this directive the Federal Environmental Executive shall:

(a) establish an interagency working group to develop recommendations for guidance, including compliance with the requirements of the National Environmental Policy Act, 42 U.S.C.4321, 4331-4335, and 4341-4347, and training needs to implement this directive. The recommendations are to be developed by November 1994; and

(b) issue the guidance by April 1995. To the extent practicable, agencies shall incorporate this guidance into their landscaping programs and practices by February 1996.

In addition, the Federal Environmental Executive shall establish annual awards to recognize outstanding landscaping efforts of agencies and individual employees. Agencies are encouraged to recognize exceptional performance in the implementation of this directive through their awards programs.

Agencies shall advise the Federal Environmental Executive by April 1996 on their progress in implementing this directive.

To enhance landscaping options and awareness, the Department of Agriculture shall conduct research on the suitability, propagation, and use of native plants for landscaping. The Department shall make available to agencies and the public the results of this research.

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 6

Forest Management

Table of Contents

VI FOREST MANAGEMENT

1.0 Introduction

As a steward of public land containing significant forested ecosystems and potential timber resources, it is the responsibility of NAS to actively manage its forests for optimum conservation and utilization (and, where practicable, enhancement), while maintaining environmental conditions that are consistent with the military mission of the Station.

1.1 Purpose

Forested areas account for approximately 37% (2,346.32 acres) of the land cover at PAX and 25% (214.05 acres) at WOLF (Maps III-18 and III-19 in Annex III-B). These areas have the potential to provide carbon sequestration, commercial products, wildlife habitat, recreation, and other benefits such as noise attenuation and aesthetic value. These areas also have the potential to cause problems for the Complex operations by impairing airfield visibility and providing habitat for nuisance species. The management of these areas should be done in such a way as to maximize the usefulness of these areas while minimizing problems for the normal operations of the Installation.

1.2 Scope

During the discussion of different management schemes, various options will be given. These options may vary widely over time for different areas of the properties depending on the objectives and the current regulations, policies, and military missions. The best use for each forest area must also be determined before the appropriate management scheme can be formulated and implemented. This determination relies on a variety of factors, which are addressed in this chapter.

2.0 Applicable Laws, Regulations, and Policies

A series of federal, state, and local laws, regulations, and policies have the potential to impact activities within the forested areas of PAX and WOLF. These activities include harvesting, road construction, sediment and erosion control, clearing, and recreation. The more general, broad-based laws that apply to numerous program areas are described in the introductory chapter (Chapter 1) of this document. Laws that pertain particularly to forestry are described herein.

2.1 Federal Laws and DoD/DoN Instructions

2.1.1 Sale of Certain Interests in Land; Logs; 10 USC 2665

This title authorizes the sale of forest products and the reimbursement of the costs of managing forest resources for timber production.

2.1.2 Forest and Rangeland Renewable Resources Planning Act, 16 USC 1601 *et seq*.

This act requires an inventory of potential renewable resources and an evaluation of opportunities for improving their yield of goods and services. Agencies must provide an opportunity for public involvement and consultation with other agencies in establishing policies for multiple use and sustained yield.

2.1.3 DODINST 7310.5, Accounting for Production and Sale of Lumber and Timber Products

This instruction provides guidelines for the production and sale of forest products and reimbursement of the cost of forest management towards this goal.

2.1.4 NAVCOMPT Manual Vol. 3

This manual provides guidance on funding, accounting, and fiscal reporting procedures. Annual DON Forestry Program expenditures will normally not exceed annual income from the sale of forest products. Transfer of surplus funds by way of military departments is authorized to balance forestry income with expenses for each department.

2.1.5 NAVFAC P-68, Navy Contracting Manual

This manual outlines the procedures for handling service contracts for work such as reforestation, timber stand improvement, and fire prevention. Also included are procedures for advertising, bidding, and awarding contracts.

2.1.6 NAVFACINST 11015.2 (series)

This instruction establishes procedures for the administration and management of forest resources on all installations in the Naval District Washington for optimum protection, conservation, and utilization.

2.2 State and Local Governments

As a general rule, the Federal Government is protected from regulation by state governments through the principle of sovereign immunity. Sovereign immunity exists with respect to all state laws unless, and until, the Federal Government has affirmatively waived it. However, it is the policy of the United States Navy and this installation to abide by the spirit and intent (if not to the letter) of state and local laws to the greatest extent practicable.

2.2.1 Maryland Forest Conservation Program, Natural Resources Article 5-1601 to 5-1612

This forest conservation program applies to land clearing and development activities, requiring the preservation of a percentage of forest areas or afforestation up to a certain percentage, depending on zoning and development densities. While this article does not directly apply to federal lands, it is indirectly applied under the Coastal Zone Management Act as an enforceable policy of the Maryland Coastal Zone Management Program.

3.0 Key Issues and Concerns

The key issue in forest management at NAS is the potential conflict between ecosystem management for the purpose of achieving the biodiversity goal outlined in Section 4.0 of this chapter (and earlier in the INRMP) and the intent to maintain a profitable and successful commercial forest products program. The biodiversity goal requires that forests be managed as contiguous areas with an emphasis on climax species, while the commercial products objective requires fragmentation through harvesting with an emphasis on successional species.

These concerns should be addressed by selecting portions of the forests at PAX and managing them for biodiversity. These areas should be large patches of contiguous forest in which future development would be severely restricted or prohibited, thus allowing forest resources to reach the

climax stage. These areas should be treated as preserves for native species and would be periodically monitored and management needs assessed in order to achieve the stated goals. The most likely areas for such preserves are shown in Map VI-1 in Annex VI-A. There is no such recommendation for WOLF.

Other forest areas on NAS that have been fragmented by development should be managed primarily for the principle needs of the surrounding land uses. This management, in most cases, will be multiple use management with production of commercial forest products in areas where this use is compatible with other primary forest uses as described below. The biodiversity goal should still take precedence under the following conditions: wetland areas, floodplains, and current climax (or near climax) communities.

4.0 Program Goals and Objectives

The goals of forest management at PAX and WOLF are as follows:

A. The Station has healthy, biologically diverse forested ecosystems that will sustain native populations of flora and fauna.
B. Station forests support an optimal mix of multiple uses/values (both consumptive and non-consumptive) of the resources.
C. Station forests are maintained in a condition that minimizes threats to safety and human health.

Each of these specific goals defines a basic need demanded of the INRMP. In order to meet these goals, the following objectives are established (note that each is followed by the letter designation of the goal or goals supported):

1. The native-to-exotic plant species ratio is improved. (A)
2. Populations of area-sensitive or area-dependent forest species are maintained or increased. (A)
3. The vegetative composition of forest preserve areas represents mature eastern deciduous forests. (A)
4. Noteworthy trees (e.g., Champion Trees) are identified and protected. (A)
5. Supply of commercial forest products is maintained. (B)
6. The number of compatible uses in individual forested areas is increased. (B)
7. Residential and work areas near the airfield have noise levels no greater than 65 decibels. (B and C)
8. Information on forest resources is available to all personnel. (B and C)
9. Surface water quality on the Complex is improved. (B and C)
10. Safety for working personnel in forest areas is improved. (C)
11. Safety is improved for people engaged in concentrated recreation activities in forested areas. (C)

Each objective listed above can be attained through the use of recommendations that appear throughout the chapter. The number of the objective(s) supported by each recommendation is parenthetically recorded after that recommendation. General management recommendations

(GMRs) and specific management recommendations (SMRs), supporting no particular objective and/or requiring no funding, also occur throughout the chapter. These are identified parenthetically as such.

5.0 Description of Forest Resources

A forest is defined as a biological community dominated by trees and other woody plants. Several specific forest types are encountered on NAS and are divided according to a variety of characteristics such as size, species composition, canopy closure, and height. Detailed data from the field investigations can be found in the 1993 Naval Air Station Patuxent River Forest Study Data Compilation.

A detailed forest investigation was performed as a part of the studies needed to formulate the original INRMP (signed in 2002). The general methods utilized to complete this study are outlined in Annex VI-C. The forest type designation codes found in the text and tables of this chapter are defined in this annex as well. Table VI-B-1 in Annex VI-B ranks the plant species encountered during the forest study according to frequency of occurrence in each vegetative stratum. Additional studies performed in 1994 and 1996 are referenced later in this document and refer back to this description of general methods.

Utilizing the data provided in the "Forest Management Plan," prepared in 1981 by the Chesapeake Division of NAVFACENGCOM, as a guide, all of the forested areas on PAX and WOLF were sampled and characterized. In order to accomplish this task, a detailed sampling of approximately 1% of the forested areas on PAX and WOLF was performed, as well as a less detailed review of approximately 75% of the forested areas. These field studies were supplemented with the use of aerial photography to identify the limits of individual forest types.

5.1 General Forest Types

In the following sections, the forests on PAX and WOLF are presented in terms of their broad classifications or forest types (i.e., bottomland or upland, pine or hardwood). Some of the acreage values and coverage percentages will differ from those given in Chapter 3, which are derived from Anderson (1976). All maps referenced in Section 5.1 of this chapter subsections represent areas as defined during the 1994 and 1996 forest studies.

Section 5.2 of this chapter depicts, in more detail, the forest communities encountered on the Complex.

5.1.1 Upland Pine Forest

Pine forests are defined as areas dominated mainly by trees of the genus *Pinus*, consisting of needle-leaved evergreen species. The main pine species on NAS are Loblolly Pine (*Pinus taeda*) and Virginia Pine (*Pinus virginiana*). These species are found in almost pure stands, as well as in association with each other. Upland pine forest accounts for 778 acres (33%) of the forests encountered on PAX and 12 acres (6%) on WOLF (Maps VI-2 and VI-3 in Annex VI-A).

5.1.2 Bottomland Pine Forest

This forest type consists of needle-leaved evergreen species in areas where the water table is at a depth sufficient to influence the development of oxygen reducing conditions and create hydric soil

and hydrophytic vegetation characteristics. Loblolly Pine and associated hardwood species often dominate these areas. This forest type accounts for 27 acres (1%) of the forests encountered on PAX and 72 acres (34%) on WOLF (Maps VI-2 and VI-3 in Annex VI-A).

5.1.3 Upland Hardwood Forest

This forest type consists of hardwood tree species in areas where the water table is below a depth where hydric characteristics develop in the soils and plant community. These areas are dominated by Chestnut Oak (*Quercus montana*), White Oak (*Quercus alba*), Sweetgum (*Liquidambar styraciflua*), Yellow-poplar (*Liriodendron tulipifera*), hickory (*Carya* spp.), and other associated hardwood species. This forest type accounts for 863 acres (37%) of the forests encountered on PAX and 39 acres (18%) on WOLF (Maps VI-2 and VI-3 in Annex VI-A).

5.1.4 Bottomland Hardwood Forest

This forest type consists of hardwood tree species in wetland areas. These areas are dominated by Sweetgum, Red Maple (*Acer rubrum*), tupelo (*Nyssa* spp.), Hornbeam (*Carpinus carolinana*), Sycamore (*Platanus occidentalis*) and other associated hardwood species. Bottomland hardwood forest type accounts for 36 acres (2%) of the forests encountered on PAX and 63 acres (29%) on WOLF (Maps VI-2 and VI-3 in Annex VI-A).

5.1.5 Mixed Forest

Pine species also occur in combination with hardwood tree species to form mixed forest types. These areas are dominated by the two common pine species in association with Chestnut Oak, White Oak, Sweetgum, Yellow-poplar and other associated hardwood species. This mixed forest type accounts for 517 acres (22%) of the forests encountered on PAX and 40 acres (19%) on WOLF (Maps VI-2 and VI-3 in Annex VI-A).

5.2 Specific Forest Types and Communities

Species adapted to particular types of soils, moisture regimes, and climatic situations tend to grow in association with one another. This group of species is designated as a community. The forest communities found within each forest type are listed below. Detailed information relating to acreage, corresponding data points, and observation points can be found in Tables VI-B-2 and VI-B-3 in Annex VI-B for the pine forest communities; Tables VI-B-4 and VI-B-5 in Annex VI-B for the hardwood forest communities; and Tables VI-B-6 and VI-B-7 in Annex VI-B for the mixed forest communities of PAX and WOLF.

5.2.1 Pine Forest Communities

5.2.1.1 Loblolly Pine Dominated Forest

Loblolly Pine is a large, resinous tree with a rounded crown of spreading branches. This is the principal commercial pine species in the South, cultivated on plantations for pulpwood and lumber. Loblolly Pine habitat ranges from deep, poorly drained floodplains to well-drained slopes of rolling, hilly uplands. It tends to form pure stands, especially in abandoned agricultural areas. The definition of loblolly is “mud puddle,” which describes one habitat in which this tree is commonly found. Establishment of this species requires abundant sunlight, as it is very intolerant of shading. Loblolly is moderately tolerant of drought and flooding.

Most of the pure forest areas on NAS in which Loblolly Pine is the only dominant species are plantations consisting of young trees [average basal area per tree between 0.20 and 0.74 square feet (sf)] with deciduous, deciduous/coniferous or no dominant understory species. These areas comprise 72 acres on PAX and 37 acres on WOLF.

Also identified were areas of older trees (average basal area per tree between 0.75 and 1.24 sf) with deciduous and mixed deciduous/broadleaf evergreen understory. These areas comprise 38 acres on PAX and 3 acres on WOLF.

Additionally, areas were found where the trees had an average basal area per tree from 1.75 to 2.74 sf, with a deciduous understory, and >3.75, with a deciduous/broadleaf evergreen understory. These areas comprise 19 acres on PAX only.

5.2.1.2 Virginia Pine Dominated Forests

Virginia Pine is a small tree with a flat, scraggly crown. The wood is soft, brittle, coarse, and knotty. It is seldom cut for lumber, but is sometimes used for railroad ties or as pulpwood. This tree is commonly found in dry, rocky places with poor, sandy soils, and thrives on sterile or worn-out land. Virginia Pine is tolerant of drought but intolerant of flooding.

Most of the pure forest areas in which Virginia Pine is the only dominant species are previously cleared areas consisting of young trees (average basal area per tree between 0.20 and 0.74 sf) with coniferous, deciduous, broadleaf evergreen and/or no dominant understory species. These areas comprise 41 acres on PAX only.

As the pure Virginia Pine forest areas mature (average basal area >0.75 sf) they become dominated by larger and faster growing Loblolly Pines (see below), as well as oaks and Yellow-poplars (see Mixed Forest Communities, Section 5.2.3 of this chapter).

5.2.1.3 Mixed Loblolly and Virginia Pine Dominated Forests

These areas appear to be plantations with deciduous, broadleaf evergreen or no dominant understory, comprising 56 acres on PAX only. These areas are generally planted in Loblolly Pine, with Virginia Pine seedlings invading as pioneers

5.2.2 Hardwood Forest Communities

5.2.2.1 Red Oak Dominated Forests

Species in the red oak group of the Oak family (Fagaceae) indigenous to this geographical area are Black (*Quercus velutina*), Blackjack (*Q. marilandica*), Northern Red (*Q. rubra*), Pin (*Q. palustris*), Scarlet (*Q. coccinea*), Southern Red (*Q. falcata*), and Willow (*Q. phellos*) Oaks. With the exception of Blackjack Oak (a small tree), the local red oak species are medium- to large-sized trees with broad, round crowns in the open, and tall, straight trunks with narrow crowns in forested areas. Lumber from Black, Northern Red, Scarlet, and Southern Red Oaks is commonly used for furniture and construction. In addition, tannic acid, used for tanning leather, is derived from the barks of these trees. Lumber from Blackjack, Pin, and Willow Oaks is less desirable as a building material.

Most red oak species are commonly found on dry uplands and gravelly slopes and are moderately tolerant to drought, but not to flooding. Pin Oak and Willow Oak, however, are moderately tolerant of flooding and are commonly found in moist bottomlands and along streams.

Red oak varieties are dominant in several areas, ranging from small- to medium-sized trees (average basal area per tree from 0.25 to 1.74 sf), with deciduous, broadleaf evergreen, coniferous and/or no dominant understory species. These areas comprise 112 acres on PAX and a tenth-acre on WOLF.

Red oak varieties of all sizes (average basal area per tree from 0.20 to >3.75 sf) are frequently found among other dominant species such as Yellow-poplar, Sweetgum, and White Oaks; and occasionally among Red Maple and Black Cherry (*Prunus serotina*).

5.2.2.2 White Oak Dominated Forests

Varieties of the white oak group of the Oak family (Fagaceae) indigenous to this geographical area are Chestnut, Post (*Quercus stellata*), Swamp Chestnut (*Q. michauxii*), Swamp White (*Q. bicolor*) and White (*Q. alba*) Oaks. The local white oak species are typically medium- to large-sized trees with broad, round crowns in the open, and straight, tall trunks with narrow crowns in forested areas. Lumber from all white oak varieties is used for furniture, flooring, construction, and shipbuilding. Tannic acid is derived from the bark of the Chestnut Oak.

Chestnut, Post, and Eastern White Oaks are commonly found on dry uplands and gravelly to rocky slopes, and are moderately tolerant to drought but not to flooding. Swamp Chestnut and Swamp White Oaks, however, are moderately tolerant of flooding and are commonly found in moist bottomlands and along streams. They were not directly observed on the Complex but are relatively common in the Mid-Atlantic Coastal Plain area.

Several forested areas were observed to consist of white oak varieties, ranging from small- to large-sized trees (average basal area per tree from 0.20 to 3.74 sf) with deciduous, broadleaf evergreen, coniferous and/or no dominant understory species. These areas comprise 329 acres on PAX and 19 acres on WOLF.

White oak species tend to be more dominant than red oak species. In addition, they were frequently found in all sizes (average basal area per tree from 0.20 to 3.74 sf) among other dominant species such as Sweetgum and red oaks, and occasionally among species such as Yellow-poplar, Loblolly Pine, and Red Maple.

Some forested areas consist of a red oak-white oak co-domination, with trees ranging in size from small to very large (average basal area per tree from 0.20 to >3.75 sf). These areas comprise 115 acres on PAX only.

5.2.2.3 Yellow-poplar Dominated Forests

Yellow-poplar, also known as Tulip Poplar or Tuliptree, is a large tree with a straight, tall trunk and a shallow, broad, open crown. The habitat of the Yellow-poplar ranges from rich bottomlands to rocky slopes and from forests to old fields. The lumber is used for furniture, cabinetry and construction. Yellow-poplar is a common species in upland scrub-shrub and young wooded areas,

and is a fairly common tree throughout this area. Yellow-poplar is fast-growing, very tolerant of direct sunlight, and somewhat tolerant of drought and flooding.

The forested areas in which Yellow-poplar was identified as the only dominant species consist of small- to medium-sized trees (average basal area per tree from 0.20 to 1.74 sf) with deciduous and/or broadleaf evergreen dominant understory species. These areas comprise 52 acres on PAX only.

Yellow-poplar was occasionally observed in all sizes (average basal area per tree from 0.20 to 2.74 sf) among other dominant species such as Red Maple, Black Walnut (*Juglans nigra*), Sweetgum, Black Cherry, and Virginia Pine.

5.2.2.4 Red Maple and Sweetgum Dominated Forests

Red Maple has a short trunk and a narrow, dense crown in the open, whereas the trunk tends to be tall and straight in forested areas. Sweetgum has a straight trunk and a pyramidal crown in the open, and a small, high crown in forested areas. Both are medium- to large-sized trees, and are common throughout this area. The habitats of the Red Maple and Sweetgum are similar and range from wet bottomlands to dry uplands, although both are more commonly found in the wetter areas. Lumber from Red Maple and Sweetgum is used for furniture and crates. Both are common species in most scrub-shrub and wooded wetlands, and are dominant species in the regeneration process of old clearings and abandoned agricultural areas to scrub shrub, young wooded areas, and forest. Red Maple and Sweetgum are very tolerant of direct sunlight, shade, flooding, and drought.

Few forested areas were observed to have Red Maple as the only dominant tree species. These areas consist of small trees (average basal area per tree from 0.20 to 0.74 sf) with deciduous dominant understory species. They comprise 1 acre on PAX and 4 acres on WOLF.

Typically, Red Maple was observed as a co-dominant among other dominant species such as Sweetgum, Black Cherry, Black Locust (*Robinia pseudoacacia*), Yellow-poplar, Sycamore, Eastern White Oak, Virginia Pine, and Loblolly Pine. Several large Red Maple trees occur in the largest forested tract at the southern tip of PAX.

Several forested areas were observed to have Sweetgum as the only dominant species. These areas consist of small- to medium-sized trees (average basal area per tree from 0.20 to 1.24 sf) with deciduous and/or broadleaf evergreen dominant understory species. They comprise 64 acres on PAX and 0.4 acres on WOLF.

Sweetgum was occasionally observed as dominant small- to medium-sized trees (average basal area per tree from 0.20 to 1.74 sf) among other dominant species such as Sycamore, red oaks, White Oak, Yellow-poplar, Red Maple, Virginia Pine, and Loblolly Pine.

5.2.2.5 Other Hardwood Dominated Forests

Black Locust is a small- to medium-sized tree with an irregular, open crown. It is typically found in dry, rocky, or sterile soils. The lumber is used for posts and railroad ties. Black Locust is commonly found in older clearings and waste places, although it is occasionally observed in forested areas. It is tolerant of direct sunlight and drought, but intolerant of shade and flooding.

When cut or disturbed, Black Locust sprouts vigorously from the stump and roots, forming very dense coppice stands.

Black Locust was observed as the only dominant species in one wooded area on PAX. This area comprises 14 acres. Black Locust was also observed as a co-dominant with Black Cherry, comprising 16 acres on PAX and a quarter of an acre at WOLF. All areas consist of small trees (average basal area from 0.20 to 0.74 sf) with deciduous and/or coniferous dominant understory species.

Black Gum (*Nyssa sylvatica*), also called Black Tupelo or Tupelo Gum, is a small- to medium-sized tree with an irregular crown. Its habitat ranges from moist bottomlands to abandoned agricultural fields. Lumber from tupelo is used for furniture, crates, and railroad ties. Tupelo is occasionally found in old clearings or forested areas, but is more commonly found in wetter areas. It is tolerant of direct sunlight, shade, drought, and flooding.

Black Gum was observed in two wooded areas as the only dominant species. These areas consist of small trees (average basal area per tree from 0.20 to 0.74 sf) and a deciduous dominant understory species, and comprise 21 acres on PAX only.

5.2.3 Mixed Forest Communities

5.2.3.1 Pine-Oak Dominated Forests

Most of the mixed forest communities observed are comprised mainly of combinations of Loblolly Pine, Virginia Pine, red oak and/or Eastern White Oak, with Yellow-poplar and Sweetgum only occasionally included. Tree sizes in these mixed forest areas range from small to large (average basal area per tree from 0.20 to 2.74 sf) and the dominant understory consists of deciduous, broadleaf evergreen, and/or coniferous species. The pine-oak dominated forest areas comprise 82 acres on PAX and 32 acres on WOLF.

5.2.3.2 Pine-Sweetgum Dominated Forests

Virginia Pine-Sweetgum and Loblolly Pine-Virginia Pine-Sweetgum combinations are dominant in several areas. Tree sizes range from small to medium (average basal area per tree from 0.20 to 1.74 sf) and the dominant understory consists mainly of deciduous and/or broadleaf evergreen species. The lack of dominant coniferous understory species in most of the observed areas indicates that pines will probably not be the dominant species in these areas in the future. The pine-Sweetgum dominated forest areas comprise 9 acres on PAX only.

5.2.3.3 Loblolly Pine-Other Hardwood Dominated Forests

Loblolly Pine was observed as a co-dominant species in several forested areas with Red Maple, Black Tupelo, and/or Black Locust. In these areas, tree size ranges from small to large (average basal area per tree from 0.20 to 2.74 sf), and the dominant understory in most of the observed areas consists of deciduous species. The lack of dominant coniferous understory species in most of the observed areas indicates that Loblolly Pine will probably not be a dominant species in these areas in the future. These Loblolly Pine-other hardwood dominated areas comprise 123 acres on PAX only.

5.2.3.4 Virginia Pine-Other Hardwood Dominated Forests

Virginia Pine was observed as a co-dominant species in several forested areas with Yellow-poplar, Red Maple, Black Cherry, and Black Tupelo. Tree sizes are small (average basal area per tree from 0.20 to 1.24 sf) and the dominant understory in most observed areas consists of deciduous species. The lack of dominant coniferous understory species in most of the observed areas indicates that Virginia Pine will likely not be a dominant species in these areas in the future. These Virginia Pine-other hardwood dominated areas comprise 41 acres on PAX only.

5.3 Present Timber Volumes

Timber volumes presented in this section are original to the data found in the 2002 INRMP. Calculations using standard forest volume tables identified approximately 29,766,700 board feet of lumber within the forested areas of PAX. Much of the volume calculated includes areas that are recommended to remain natural or be managed in some other way that restricts large scale harvesting. The present timber volumes for the recommended harvest areas, totaling 6,694,006 board feet at PAX and 937,802 board feet at WOLF, can be found in Tables VI-B-8 and VI-B-9 in Annex VI-B. The locations of the recommended harvest areas for PAX and WOLF are displayed on Maps VI-4 and VI-5 in Annex VI-A.

This plan suggests that additional areas on PAX and WOLF be brought into timber production. Volume estimates for these areas are not included in the tables named above. Establishment of these new plantation areas would require conversion of mostly brush and scrubland, which could provide wood chip for commercial purposes if the market exists.

If the proposed plantations are brought into production sometime in years 1 to 5, they should yield approximately 25,000 to 100,000 board feet of poletimber per year available for harvest on a 50-year rotation schedule. In year 50, the existing plantations could be harvested.

This plan, as outlined below, should provide a minimum of 100,000 board feet of timber per year for the next 50 years, with the potential for maintaining this level of harvest far into the future. This excludes harvest on development sites and selective harvesting in other areas (as described below), which have the potential for increasing these harvest volumes even further.

5.4 Projected Growth

This measure is most relevant in areas that will be maintained strictly for commercial forest products production and areas that will be harvested as part of a sustained yield program. Generally, it can be assumed that growth rates between 40 and 120 cubic feet per acre can be expected, depending on site conditions. The actual growth rates of plantation species and selected species in other harvest areas should be monitored in order to determine the best management practices for each individual stand. General rotational guidelines are discussed in the following sections.

5.5 Forest Compartments

The forest compartments developed in the 1981 Forest Management Plan for PAX were slightly modified to conform to artificial divisions and were then re-utilized in this plan (Map VI-6 in

Annex VI-A). These compartments are an artificial organization for the purposes of orientation, administration, and silviculture operations.

There are no corresponding compartments defined for WOLF.

6.0 Management History

Forest management for ecosystem functions on the Complex has been minimal in the past. There has, however, been extensive forest management activity that is not related to ecosystem functions.

Loblolly Pine plantations have been planted and maintained in scattered areas throughout PAX. Those areas that are proposed to continue as plantations as well as those which are scheduled for harvest at PAX are shown in Map VI-4 in Annex VI-A.

In the past, forest management at the Complex has included harvesting and reforestation for commercial timber. Since 1995, the only harvesting conducted has been for construction projects and airfield clear zone maintenance. The only timber harvesting performed at WOLF since its inclusion into the Complex, other than for construction projects, occurred in 1995. Approximately nine acres were harvested when clearcutting was performed at the end of a runway for clear zone maintenance.

Prescribed burning was also undertaken at various times over the years. Prescribed burning is the skillful application of fire to defined areas of a forest, grassland or swamp, for a specific purpose, under exacting weather conditions, to achieve management objectives. The major objectives of prescribed burning are reduction of hazardous natural fuel accumulations, control of competing vegetation, wildlife habitat improvement, and preparation of sites for planting or seeding. It is also a tool for reducing insect and tick populations in concentrated recreational areas. Map VI-7 in Annex VI-A illustrates the areas where prescribed burning techniques were used in the past at PAX. This technique has been used only once at WOLF since incorporation into the Complex. In 1999, vegetation in the clear zones alongside and at the ends of the two inland runways was cut and burned.

Most of the timber harvesting has been in association with development projects and maintenance in some small-scale loblolly pine plantations. On rare occasions, singletree harvests have been conducted to meet a very specific produce need, such as a replacement ship mast. There has been little or no management of forests for the purpose of providing other critical ecosystem management functions, with the exception of food patch production, clearing of fire breaks and wildlife tree marking and preservation. Food patches and fire breaks are incompatible with the contiguous forest goal for the forest preserve area, and should only take place outside of this area (Obj. 3). Other functions that cause little or no tree canopy disruption, such as wildlife tree preservation and selective tree harvesting, are compatible with and can be encouraged in all forested areas (although most likely to occur in non-preserve areas). These activities, as well as wildlife tree marking and preservation, may only be continued outside of the preserve area, where appropriate.

In addition to timber harvesting, the firewood sales program also generates revenue for the DoD forestry account. Firewood cutting areas are usually associated with construction areas which may

require tree clearing in a small area or minor quantity. On occasion, forest stands that have sustained significant windthrow or ice damage may be sold for firewood.

7.0 Proposed Uses and Management Measures

The forest areas at NAS are utilized for a variety of purposes and some may also have the potential for other uses. Forest areas also provide numerous benefits that may or may not be realized to the fullest potential. Conversely, some forest areas may have the potential to cause harm and pose threats to human health and life, or at least provide minor inconveniences. As such, forest areas need to be managed on a stand-by-stand basis, with a variety of uses and activities in mind, and in such a way as to eliminate or reduce the negative consequences of the management scheme. To optimize forest management success, re-inventory NAS forest resources prior to every other INRMP update (Obj. 8) (Project VI.1).

Potential uses for the forest areas of PAX and WOLF include outdoor recreation, forest preserve, noise attenuation, air quality control, water quality control, fish and wildlife habitat, soil stabilization, commercial harvesting, noise abatement, and visual screening. Many of these are not exclusionary; however, management schemes for different uses may vary dramatically. It is important that uses for each particular area be identified and quantified, and that the management scheme is consistent with the most likely or most efficient use of the forested area. For example, a forest area that is acting as a visual screen and/or noise buffer should not be managed for commercial harvests since the primary use or benefit of the area will be lost upon harvesting.

In addition, the consequences of management schemes for particular areas must be carefully considered. For example, managing an area adjacent to roadways or runways as deer habitat may endanger Base personnel by increasing the risk of deer strikes.

7.1 Outdoor Recreation

Outdoor recreation is defined as voluntary, on-site activity, engaged in for pleasure, which is dependent upon the natural setting. This excludes organized sports but includes viewing of scenic resources.

There are two types of management associated with outdoor recreation. One is the direct management for outdoor recreation, including the construction of facilities, modification of settings, and regulation, direction, and education of visitors. The other is an indirect management that attempts to minimize the adverse effects of other management activities on recreation. Outdoor recreation management is discussed in greater detail in Chapter 10 of the INRMP. Maps VI-8 and VI-9 in Annex VI-A depict the forested outdoor recreation areas on PAX and WOLF, respectively.

7.1.1 Recommendations

In all but a few selected areas of PAX and WOLF, which are specifically designated and modified to be primarily used for outdoor recreation, indirect management would be preferred. Where there is no conflict with the intended primary use in these areas, various forms of outdoor recreation, such as nature appreciation and hunting, can be encouraged. To do so:

- Unique flora areas in various habitats that can enhance the observational (non-consumptive) uses of the forest resources should be identified (Obj. 6) (SMR VI.1).
- The NR Program should then create maps of these areas and make them available to the public (Obj. 6 and 8) (SMR VI.2).
- In addition, the NR Program should create and provide maps of forested areas open for consumptive uses (Obj. 8) (SMR VI.3)
- Station personnel may be allowed to collect reasonable quantities of fruits/seeds (e.g., berries, pine cones, acorns) and fallen foliage (e.g., pine needles and other leaves on the ground) from trees and plants for individual, personal (i.e., noncommercial) use only, so long as the health and/or quality of the host plant is not adversely affected (Obj. 6) (SMR VI.4).
- Any area-specific limitations (e.g., Wildlife Trees, wetland boundaries, etc.) to consumptive use should be physically displayed in the field through signage or easily interpreted maps (Obj. 6 and 8) (SMR VI.5).

There are also areas in which the primary management goal would be to eliminate human intrusion: sensitive habitat types; rare, threatened, or endangered species areas; and dangerous areas.

- Areas in which human intrusion should be eliminated or reduced should be mapped and this map should be updated periodically as further information becomes available (Obj. 6 and 8) (SMR VI.6)

7.2 Noise Attenuation

Vegetation can provide a barrier that changes the intensity and frequency of sound along its path between source and receiver. Two major components of the forest are important for sound attenuation: the ground surface and the vegetation. The softer the ground surface, the greater the attenuation. This type of attenuation is most effective on lower frequency sounds. Conversely, vegetation is more important for the attenuation of high frequency sounds. Broad-leaved vegetation (such as most deciduous species) is more effective than narrow-leaved vegetation (such as most coniferous species); however, conifers provide year-round benefits. Thus, the effects of a forested area with both deciduous and coniferous species, with a dense understory and abundant leaf litter, may provide significant benefits of sound attenuation. This effect is enhanced by the creation of other, more pleasant noises, such as rustling leaves, bird songs and other wildlife sounds that may mask some offensive noises.

Noise attenuation is particularly important in the areas surrounding runways, taxiways, and major roadways on NAS, especially where these areas are adjacent to or in close proximity to work or home environments. In these areas, the primary management goal should be noise attenuation. Noise contours for PAX and WOLF are shown in Maps VI-10 and VI-11, respectively, in Annex VI-A.

A noise attenuation study within forested areas was completed in 2012.

7.2.1 Recommendations

- A study on noise levels and the degree of attenuation should be performed in residential and work areas located near large noise-generating sources, such as dog pens, rifle ranges, and generators; based on the results of these studies, target specific forest areas for the primary use of noise attenuation, with possible secondary uses where applicable (Obj. 7) (SMR VI.7).

7.3 Air Quality Control

Vegetation can be used to abate air pollution effects and improve air quality. It can act as a filter and a reactive surface that traps air particulates, usually at the leaf surface. Vegetation can also be an important sink for many airborne pollutants, including nitrogen dioxide, sulfur dioxide, hydrogen fluoride, chlorine, ozone, nitric oxide, and carbon monoxide.

Carbon sequestration can occur in forests on a number of levels. Trees can take in substantial amounts of carbon through their stems - as much as 60 metric tons per acre of forest. In addition, leaves, needles, branches, and underbrush can amass another 10 metric tons of carbon per acre. Forest soils can store more carbon than soils of any other non-forest, vegetated ecosystem.

Coniferous species with an extensive branching structure provide particulate removal year round, while deciduous species with a high tolerance for urban environments are better suited to gaseous pollutant removal. For general air quality benefits, large multilayered forest areas are most effective. However, a dense edge with overlapping vegetation may force polluted air masses up and over the forested area.

7.3.1 Recommendations

Management of forest areas for air pollution control should be a primary concern in areas where airborne pollutants may pose a threat to human health. The Air Quality Program manager should assess these areas by conducting an air-sampling program throughout NAS, particularly in residential, work, and outdoor recreation environments. If potential problem areas are identified, the source or sources of the pollution should be determined and minimized as practicable. Additionally, forest areas between the source and the problem area should be managed with a primary purpose of air quality control.

- Air pollution control should be considered a secondary benefit in areas managed for other uses (Obj. 10 and 11) (GMR VI.1).

7.4 Visual Screening

Forest vegetation can also be used to screen undesirable or objectionable views. This type of screening also becomes a benefit in that it is visually appealing. In addition, visual screening may involve the reduction of sun glare and headlight glare at night and, as a secondary benefit, act as a crash barrier in areas where accidents are frequent.

Management of forest areas for screening involves maintaining a multi-layered forested area with a good mix of deciduous and coniferous species. This is consistent with management for the other uses listed above. Management for this use should also include the maintenance of species that are

visually appealing. For crash barriers, small, resilient, dense vegetation should be encouraged as edge species along roadways and at intersections where accidents are likely to occur.

7.4.1 Recommendations

- The amount and quality of visual screening provided by particular forest resources should be assessed. The potential impact to this function should be considered in any plans to modify currently existing forest areas (Obj. 6) (SMR VI.8).

7.5 Watershed/Wetland Protection

The role of forests in protecting and enhancing clean water supplies cannot be overstated, and the increased demand for clean water has placed additional pressures on forest managers. Each watershed and sub-watershed on the Complex should be considered as its own system when determining how forests will be managed to protect and enhance water quality. A watershed is defined as an area through which precipitation is redistributed into components of the hydrological cycle, such as infiltration, stream flow, evapotranspiration and evaporation. Each watershed possesses its own unique physical, chemical, and biological properties that determine how water will react within that system.

Forest areas influence the hydrological cycle in many complex ways. For example, infiltration rates are dependent mainly on soil pore spaces, which are influenced by soil texture and structure, soil moisture, organisms, and organic matter. All of these properties are directly influenced by land cover. For example, roots create large pore spaces and trees produce large roots that eventually decay to form larger pores. Forest cover attracts burrowing animals that create additional large pore spaces. Organic matter generated over time influences soil texture and structure.

Dense forest areas also intercept large amounts of precipitation in the canopy and transfer it back to the atmosphere through evaporation. Plants, especially trees, store enormous quantities of water in their tissues. They remove surface and shallow groundwater and transfer it back to the atmosphere through evapotranspiration. Dense forest areas also slow the rate of evaporation from surface soils through shading and accumulation of organic matter.

Probably more important than any other function, forests protect downstream areas from sediment accumulation by limiting erosion. This is accomplished by the extensive root network that binds the soils, and the accumulation of organic matter that absorbs and slows stormwater runoff. As stated earlier, this is a particularly important function of forested wetland areas.

7.5.1 Recommendations

- Each watershed area should be analyzed with respect to its hydrological functioning and needs, as well as the water quality needs of downstream areas. Forests within these watersheds should then be managed to provide the functions required based on these studies, when those functions are determined to be of primary importance. When not of primary importance, these functions should still be considered when implementing any other type of management scheme for a particular forest area (Obj. 9) (SMR VI.9).

- To the maximum extent practicable, silvicultural guidelines and BMPs as set forth in the Chesapeake Bay Critical Area law and regulations, as well as those contained in MDNR's

Soil Erosion and Sediment Control Guidelines for Forest Harvest Operations in Maryland, should be incorporated (Obj. 5 and 9) (SMR VI.10).

- Specific guidelines and recommendations that should be mandatory in any silvicultural operation on the Complex include the following:

    a) Water Quality Protection Zones should be maintained landward of any permanent or temporary water body, watercourse or wetland border (Obj. 9) (SMR VI.11). The width of these zones will vary with slopes, soil types, and vegetative cover. Maps VI-12 and VI-13 in Annex VI-A depict the forestlands within 300 feet of streams and open water areas on PAX and WOLF, respectively. The minimum width of forest adjacent to streams should be 50 feet for water quality protection; however, in order to provide a passageway for riparian wildlife, approximately 300 feet of forest adjacent to the stream is necessary. These requirements may need to be adjusted to compensate for steep slopes or erosion prone soils. Prohibited activities include clearcutting, construction of access roads, mechanical planting, fertilizer application, and prescribed burning.

    b) All stream crossings should be through closed culverts or over bridges. The decision to use a culvert or a bridge should be made on a case-by-case basis, based on the particular physical characteristics of the applicable stream. New crossings (as needed) should be constructed at narrow places in the channel and/or the narrowest point on the associated wetland area, and should not impede the flood stage of the steam (Obj. 9) (GMR VI.2).

    c) Trees susceptible to windthrow should be periodically removed from Water Quality Protection Zones (Obj. 9) (SMR VI.12).

7.6 Fish and Wildlife Habitat

Second only to water quality and watershed protection, fish and wildlife habitat is probably the most important function of forest resources. Forested areas provide those things necessary for completion of at least one portion of the life cycle of most of the species found in the area. These needs may be food, shelter, nesting or breeding sites, wintering habitat, escape from predators, and/or clean water. Many species rely on forest areas for all of the above reasons, and many others for at least one or some of them. However, not all species rely on the same types of forests, and some species may rely on different forest types for different portions of their life cycle. For this reason, management goals must be carefully considered and management must be geared toward the species of interest.

The most important management prescription proposed for wildlife habitat concerns is the designation of the forest preserve areas discussed earlier. These preserve areas will benefit many rare, threatened, and endangered species that are known to and/or have the potential to inhabit the region. The most important indicator of the success of the forest management prescription for the maintenance and restoration of critical ecosystem functions is the monitoring of Forest Interior Dwelling Species (FIDS). These species are considered "area sensitive" species and require some critical mass of contiguous forest type in order to survive. The monitoring of populations of these

species is crucial in determining the success of the forest preserve. Current FIDS bird species habitat at PAX is shown in Map VI-14 in Annex VI-A. Roughly 43 forested acres in the southeast portion of WOLF have the potential to provide FIDS bird species habitat, but only in conjunction with forest stands outside of the Installation.

In most cases, management for another use is consistent with providing some fish and wildlife habitat values. However, these secondary uses must be carefully considered to avoid potential problems. For example, management of an area as a crash barrier along a roadway should not include the encouragement of plant species that may attract deer. This would result in increased probability of deer strikes.

There are also areas in which management for fish and wildlife habitat values should be the primary management concern. This would include areas that are known to contain rare, threatened, or endangered species; hunting and trapping areas; and fishing areas; as well as areas that have the potential to provide biodiversity functions through the maintenance of native habitat types.

7.6.1 Recommendations

- Continue to protect large, contiguous forest blocks at PAX to preserve and maintain the critical ecosystem functions (Obj. 1, 2 and 8) (SMR VI.13).
- Continually monitor for the health of FIDS populations (Obj. 1) (Project VI.2).
- Any areas of forested or scrub/shrub land scheduled for construction should be logged or cleared during the winter months to lessen impact to bats and nesting migratory birds. Commercial timber harvests should also be conducted during the winter months, when possible (Obj. 1) (GMR VI.3).

7.7 Potential for Commercial Forest Products

The potential for commercial forest products such as poletimber, sawtimber, pulpwood, and firewood is an added economic benefit afforded by the forested areas on NAS.

Some portions of PAX and WOLF may be managed for the harvesting of commercial forest products. However, this type of management must be carefully implemented in order to avoid the loss of the beneficial functions listed above, especially in areas where these functions are of primary importance.

Some isolated patches of forest around the airfield are better managed as monotypic stands of pine without understory, as this stand type is unattractive to wildlife (specifically deer and many avian species, which pose a threat to aircraft). Although there is no requirement to harvest timber, such activity does support the military objective, as tall, mature trees around the airfield may become an air safety concern. In addition, timber harvesting generates revenue for other natural resources projects (e.g., revenue from plantations can be used to plant trees in those breaks that exist in the contiguous forest).

Two types of management are available for the production of commercial forest products, each having its own benefits and drawbacks. The first, most common type of commercial forestry is a specialized type of agriculture in which a specific species of tree is planted, grown, and harvested.

This is termed silviculture or typical commercial forestry. The second type of forestry is termed sustainable forestry. This method maintains and sustains the biological diversity and ecological productivity of the forest resources.

7.7.1 Silviculture

Typical commercial forestry practices, as defined in this plan, relate to the growth and harvest of trees strictly for the purpose of obtaining an economic benefit.

7.7.1.1 Recommendations

- Silvicultural practices should be implemented if there are areas identified on NAS that will be used primarily for commercial forest products production (Obj. 3) (Project VI.3). These would be designed and operated as any agricultural operation under a management scheme that best supports the desired end product. Areas that may be identified for such operations include disturbed land in which development is not planned in the near future, unproductive agricultural lands, and some recreational areas. The sites selected should be suitable for timber production and of sufficient size to produce a profitable crop. In addition, sites should be close to roadways capable of supporting the vehicles necessary to grow and harvest timber products, and in areas that do not require the forest functions described above as a primary consideration. Commercial harvesting of forested areas should also be a primary concern when a forested area is cleared for some other purpose, such as development.

- Ensure that all merchantable timber that is cut on NAS is disposed of properly, with appropriate disbursement to the Navy Forestry Account. This includes clearing for construction, airfield safety, or any other purpose (Obj. 3) (GMR VI.4/SMR VI.14).

- Continue to prohibit the wasteful practice of on-site burning of merchantable timber as construction clearing debris (Obj. 3) (GMR VI.5/SMR VI.15).

7.7.2 Sustainable Forestry

Sustainable forestry, as defined by this plan, refers to the harvesting of economically viable forest products in areas that are managed for some other purpose and where the harvest has no detrimental impact on other forest functions.

7.7.2.1 Recommendations

- Apply selective silvicultural practices in areas outside of commercial products areas, but within forested areas being managed for a different primary function (Obj. 6) (Project VI.4). This type of management should only be implemented in areas where there is a commercial benefit and little detriment to the other primary management goals for each particular area.

7.8 Military Uses and Restrictions

Military uses and restrictions are the primary motivation in any management scheme at NAS. Improved lands or lands that are planned for development should not be considered as potential production areas for commercial forest products. Semi-improved areas, such as areas surrounding the airfield, equipment storage areas, and other modified areas that are capable of being brought

into forest production should be assessed. Semi-improved areas would include areas that are currently mowed or rough-mowed (as in around structures) that could potentially produce forest products without causing problems for the current military land use.

These restrictions include the maintenance of lines-of-sight between the tower and airfield; height restrictions surrounding the airfield; non-interference with antennas, radars or cameras; and the maintenance of BASH and DASH goals and objectives.

7.9 Proposed Management and Conservation Measures

This plan outlines proposed management and conservation measures that take into consideration the critical ecosystem functions described above. This plan also considers the constraints imposed by military uses and the potential for threats to human health and welfare. Additionally, climate change adaptation strategies have been taken into account.

7.9.1 General Forest Management

Forest areas, including the forest preserve, should be managed such that they provide for multiple uses and their functions are maximized. Specific management schemes are outlined for a variety of areas on PAX and WOLF. Management prescriptions for other forested areas will need to be developed on a case-by-case basis as additional information is collected. Overall recommendations for general forest management are as follows:

- Fire breaks and other small openings that are not needed should be filled in, thereby increasing forest block sizes and reducing internal forest barriers and sources or fragmentation (Obj. 2) (SMR VI.16).
- Surveys for Gypsy Moth should be conducted annually. Other forest pests, such as Emerald Ash Borer, Asian Longhorn Beetle, and Spotted Lanternfly, should be monitored and control methods should be implemented, as needed. Survey activities should be coordinated and survey data shared with the US Forest Service and Maryland DNR Forestry Service (Obj. 1 and 5) (SMR VI.17).

7.9.1.1 Prescribed Burning and Wildland Fires

Prescribed burning is a valuable practice for managing both forests and wildlife. Controlled use of fire can decrease risk of forest or wildland fires by reducing or eliminating the fuel (fallen/dead trees, shrubs, etc.) that would be used by a natural fire. Burns are implemented at NAS as an inexpensive and effective grounds maintenance tool for the purpose of reducing understory.

- Prescribed burning should be implemented as needed, as a means for understory removal in campgrounds and plantations, as well as for wildlife habitat improvement. Coordinate with the Station fire department and state forestry personnel, and adhere to the guidelines of the Station's prescribed burning instruction when conducting prescribed burns (Obj. 5 and 6) (Project VI.5).

The DoD wildland fire management policy dictates that installations having unimproved lands that may pose a wildfire hazard, and/or which utilize prescribed burning for land management, must develop and implement a Wildland Fire Management Plan (WFMP). NAS developed Wildland

Fire Management Plan - Naval Air Station Patuxent River Complex, Patuxent River, Maryland (final August 2010) to include a prescribed burning plan (Obj. 10).

7.9.1.2 Management in Plantation Areas

The management scheme for plantation areas pertains to the proposed plantations listed below, as well as the one existing plantation to remain. These are the areas that will require the most intensive management. Management in other forest areas will be based on the proposed use and function of the forest in accordance with best management practices.

The plantations will be managed to increase growth and minimize competition from other tree species. All understory growth should be removed periodically in order to maintain open conditions under the main forest canopy. This management technique will not only decrease competition and increase growth rates, but will also discourage animal use in these areas. The minimized use by animals in the area surrounding the airfield will diminish the possibility of wildlife strikes.

7.9.1.2.1 New Plantation Areas

Any new plantations established at NAS should be managed in a manner which makes them profitable, meaning large, contiguous tracts of plantation in order to minimize management and harvest costs. These areas should also be selected to be consistent with the purposes of other management areas on PAX. (Obj. 6) (Project VI.6)

Several existing forested areas at WOLF (Map VI-5 in Annex VI-A) are comprised predominantly of Loblolly Pine, with lesser quantities of Sweetgum, Red Maple, and representatives of the White Oak group. If any of these areas are harvested commercially, they would be good candidates for reforestation as Loblolly Pine plantations and should be evaluated as such (Obj. 6).

7.9.1.2.2 Existing Plantation Areas

There are no existing defined plantations at PAX. The previous plantation area at PAX incorporating forest polygons A77, E71, and E87 has been harvested and converted to turf grass as a project under the previous INRMP. The trees were encroaching on the Runway 14 clear zone. The previous plantation area at PAX incorporating forest polygon 210 (bordered by Millstone and Cedar Point Roads and Taxiway Alpha) was also harvested and converted to turf grass. The trees were blocking the line of sight between the air traffic control tower and the helicopter pad at Taxiway Alpha West.

There are no existing defined plantations at WOLF.

7.9.1.3 Management in the Preserve Area

No formal management is required for or suggested in the proposed forest preserve areas. These areas should be treated as natural communities in which human impacts are avoided or substantially minimized. Periodic monitoring for forest health, composition, and species usage should be undertaken in order to assess the success of this project.

7.9.1.4 Management in Other Areas

Other specialized areas on PAX and WOLF should be considered for management under this plan. These include areas/sites for Champion or Specimen Tree searches, firewood cutting, and urban forestry.

7.9.1.4.1 Specimen Trees

Fred W. Besley, Maryland's first state forester, can be credited as the father of the National Big Tree Champion contest. The first statewide Maryland Big Tree Champion contest was held in 1925 to recognize large, distinguished trees of individual species. American Forests magazine started the National Big Tree Program in 1940; today, there are 861 species and varieties eligible for the National Register of Big Trees.

Candidates for Specimen Trees are awarded points based on circumference, height, and average crown spread, and then ranked accordingly by species. Trees with the highest number of points are denoted as champions either in a particular county, state or nationally.

Several Maryland State Specimen Trees are found on PAX. A Chestnut Oak which once ranked 3rd in the state has died, but has been replaced by a new specimen which now ranks as the St. Mary's County champion and 10th in the state with 269.0 points. A specimen Osage Orange (*Maclura pomifera*) which previously ranked 4th in the state was re-measured in 2012. It was subsequently reduced in ranking and has since been removed from the list.

In January 2012, two Sweetbay Magnolias (*Magnolia virginiana*) were re-measured, one of which was the former county champ. While in the area, a new tree was discovered which outscored the other two and became not only the county co-champ, but also the largest wild-grown tree in the state with a score of 103.0 points. Two cultivated specimens in Maryland are larger.

Also in January of 2012, two new Specimen Trees were discovered at the Mattapany Estate, producing two new county champions - an American Basswood (*Tilia americana*) at 241.0 points and a Pignut Hickory (*Carya glabra*) at 182.0 points. As of 2022, the basswood is still on the list (but is no longer county champion) while the pignut is no longer listed. Several other specimens have been discovered, but not yet officially measured, and will surely produce additional county champions.

- Specimen Trees should be continually monitored for health and treated in accordance with the standards established for urban trees (Obj. 4) (SMR VI.18).
- Forest stands should be assessed for additional potential state Specimen Trees at PAX (Obj. 4) (SMR VI.19).
- A survey should be conducted to determine the presence or absence of state Specimen Trees at WOLF (Obj. 4) (Project VI.7).
- Potentially qualifying trees should be cataloged and monitored accordingly, and those worthy of nomination should be actively sought out for inclusion in the Champion Tree program (Obj. 4) (SMR VI.20).

7.9.1.4.2 Firewood Cutting

Several areas on PAX have been proposed for firewood harvesting.

- Firewood cutting areas should be harvested selectively, with first priority on dead, dying, or diseased trees (Obj. 6, 10 and 11) (SMR VI.21).
- Harvesting should also proceed with the intent of minimizing disturbances in any one particular area, with trees marked for removal being spread throughout the stands (Obj. 6, 10 and 11) (SMR VI.22).
- As appropriate and practicable, these areas should then be allowed to regenerate naturally (Obj. 6, 10 and 11) (SMR VI.23).
- Firewood cutting areas should be identified at WOLF (Obj. 6) (SMR VI.24).

Firewood movement is viewed as a key pathway for the spread of forest pests, such as Emerald Ash Borer (*Agrilus planipennis*) and Asian Longhorned Beetle (*Anoplophora glabripennis*). Since firewood cutting may contribute to the introduction, continued existence, or spread of invasive species known to occur in the area or actions that may promote the introduction, growth, or expansion of the range of such species, it is assumed that EO 13112 and EO 13751 would apply.

- Efforts should be made to follow the BMPs of the National Firewood Task Force Recommendations dated March 2010 (Obj. 4) (SMR VI.25).
- Additionally, Station policy amendments should be drafted which prohibit the bringing of firewood onto the installation, particularly in light of the Animal and Plant Health Inspection Services (APHIS) firewood quarantine in many area counties, including St. Mary's County (Obj. 2) (SMR VI.26).

7.9.1.4.3 Urban Forestry

Urban forest areas consist of tree clusters and individual trees associated with developed portions of PAX and WOLF (Maps VI-15 and VI-16 in Annex VI-A).

- These areas should be managed in conjunction with the general management practices outlined in the Land Management chapter (Chapter 5) of this plan and the specific management recommendations contained in the Urban Forest Management Plan for the Naval Air Station Patuxent River Maryland, dated June 1994 (GMR VI.6/SMR VI.27).
- Additionally, the Installation Appearance Plan should be reviewed for consistency with both documents (Obj. 1) (GMR VI.7/SMR VI.28).

The PAX urban forestry program has garnered several notable awards, including the National Arbor Day Foundation's "Tree City USA" award and "Growth Award," as well as MDNR's "PLANT Community Award" and "Green" award.

7.9.2 Specific Forest Management

7.9.2.1 Clearcutting

Clearcutting involves the removal of an entire stand of trees in one cutting. In this method, virtually all woody vegetation is removed from the site, which is then replanted or allowed to revegetate naturally, if an adjacent seed source is available. Clearcutting at NAS is only acceptable in the cases and conditions outlined in the next several sections.

7.9.2.1.1 Forested Areas Proposed for Development

When a forested area is proposed for development, clearcutting is an acceptable method for removing timber from the site. Clearcutting should include the same proper sediment and erosion control methods that are required as part of the land development plans for the parcel. This type of land clearing shall involve only those areas needed to successfully complete the land development activity.

Efforts should be made to preserve woody species for landscape elements as a part of the land development plans where appropriate and practicable (Obj. 5 and 6) (GMR VI.8/SMR VI.29).

7.9.2.1.2 Conversion of Interior Pine Forests and Existing Plantations

A choice is available when converting interior pine forest areas to hardwoods as part of the forest preserve plan.

- These areas could be initially clearcut, or allowed to remain uncut to eventually be replaced by hardwood species through natural succession (Obj. 5) (SMR VI.30). If clearcut, these areas should be either replanted with hardwood species or allowed to revegetate naturally.

Interior pine forest areas at PAX and WOLF that are to be cut have been identified (Tables VI-B-8 and VI-B-9 in Annex VI-B). The cutting of these areas should not be delayed too far into the future.

- Any interior pine forests that appear profitable should be cut as soon as possible to allow for uninterrupted development of the contiguous forest in the preserve area. Any areas remaining uncut after forty years should be considered off-limits and no further clearcutting will be permitted in these areas (Obj. 5) (SMR VI.31).

7.9.2.1.3 Lines of Sight, Runway Approaches

Clearcutting of forest areas may be necessary for establishing lines of sight for aviators or controllers if flight safety is compromised, or to bring the airfield into compliance with existing clear zone and transition area height maximums. Additionally, if new approach patterns are utilized, it may be necessary to clear-cut certain forested areas.

7.9.2.1.4 Commercial Harvesting in Designated Plantation Areas

Although clearcutting is not the preferred method of harvest in many cases, this method is acceptable in plantation areas managed strictly for the commercial production of lumber, especially with even-aged pine stands.

- Plantations should be run as an agricultural operation in defined areas where the production of timber is cost effective (Obj. 5) (SMR VI.32).

- In order to remain cost effective, the appropriate harvest method (either clearcutting or selective harvesting) should be utilized to maximize profits from these areas, depending on supply and demand for different tree sizes in the future (Obj. 5) (SMR VI.33).

7.9.2.2 Selective Harvesting

Selective harvesting is defined as the cutting of individual trees for a specific purpose. This may entail the harvesting of any tree over a certain size in plantations, or harvesting trees of a particular size and species in a natural stand. This type of cutting has much less impact than clearcutting and is more imitative of natural disturbances. It is the preferred method of harvest in most cases, aside from those described above. The proposed selective timber harvest areas for PAX and WOLF are shown in Maps VI-4 and VI-5 in Annex VI-A.

The NR Program has already identified those forest areas of greatest ecological integrity and has severely limited commercial forestry (if any) in those areas to extractions which mimic natural disturbance (i.e., single tree selections). Examples of these individual tree harvests include specific trees needed for replica historic vessels used for local community educational outreach – 85-foot pine needed for a skipjack mast and large diameter oaks needed for ribs on the Dove.

7.9.2.2.1 Selective Harvesting in Plantations

This method is best utilized to thin out pulpwood and small poletimber and allow remaining trees to grow to a desired timber size faster. This may involve several selective harvests over a period of years as the trees in the stand increase in size (Tables VI-B-8 and VI-B-9 in Annex VI-B).

Utilization of this method depends on the demand and marketability of various lumber sizes at the time that trees are ready for harvest. For example, if pulpwood and poletimber are in demand, it may be more profitable to harvest the entire stand when the appropriate size is reached rather than cultivating sawtimber size trees.

- Pines in plantation areas should be selectively harvested (thinned) throughout the stand over a fifty-year period, with a suggested harvest of one-fifth of the stems every ten years. This will effectively aid in maintaining the areas. Reforestation in these areas should be consistent with the anticipated ultimate forest function for each individual stand (Obj. 5) (SMR VI.34).

7.9.2.2.2 Selective Harvesting for Specialty Products

Local markets exist for specialty products such as high quality poles/piles, fence posts, and fishing net stakes.

- Specialty products should be identified in appropriate areas and marketed aggressively to produce the greatest potential revenue (Obj. 5) (SMR VI.35).

7.9.2.2.3 Selective Harvesting for Firewood

The proposed firewood harvest areas for PAX and WOLF are listed in Tables VI-B-8 and VI-B-9 in Annex VI-B, respectively. Areas of proposed development may also be used as firewood cutting areas to alleviate pressure from the areas listed below. This will require advance notice of development areas which must be accessible with a suitable supply of hardwoods.

7.9.2.2.4 Selective Harvesting in Forest Preserve Areas

- Limited selective harvesting will be allowable within the forest preserve area as long as the following conditions are met (Obj. 3 and 5) (SMR VI.36):

  a. a designated tree species and size are needed and not available anywhere else on PAX or WOLF;

  b. the tree can be harvested with minimal disturbance to the surrounding area, including canopy closure;

  c. the tree to be harvested is not so important for wildlife that the harvest would detrimentally impact the habitat of a particular species in the area;

  d. the tree is not providing water quality benefits through stabilization of an erosion-prone area; and

  e. trees to be harvested are not adjacent to each other or other recent harvests so that a clearing would be produced within the preserve area.

7.9.2.2.5 Selective Harvesting in Other Forest Areas

Selective harvesting in other forest areas on PAX and WOLF is an acceptable practice for obtaining commercially viable trees, as well as for removing dead or dying trees, or trees that are susceptible to windthrow. This harvesting should also be done in such a way that critical forest functions are not negatively impacted in any particular stand.

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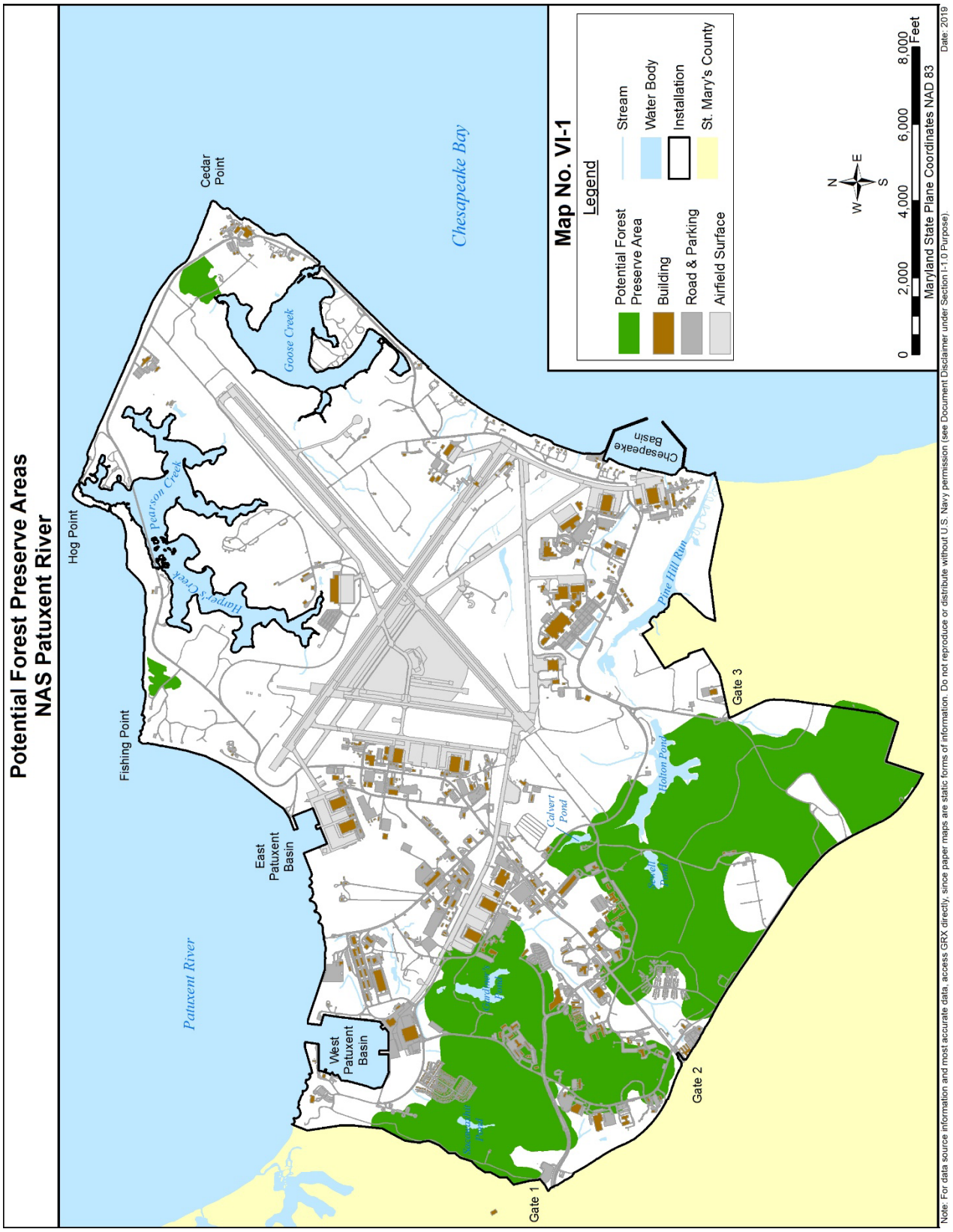
ANNEX VI-A

MAPS


Potential Forest Preserve Areas
NAS Patuxent River
Map No. VI-1
Legend
Potential Forest Preserve Area
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Pearson Creek
Harper Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Calvert Pond
Holton Pond
Gate 1
Gate 2
Gate 3
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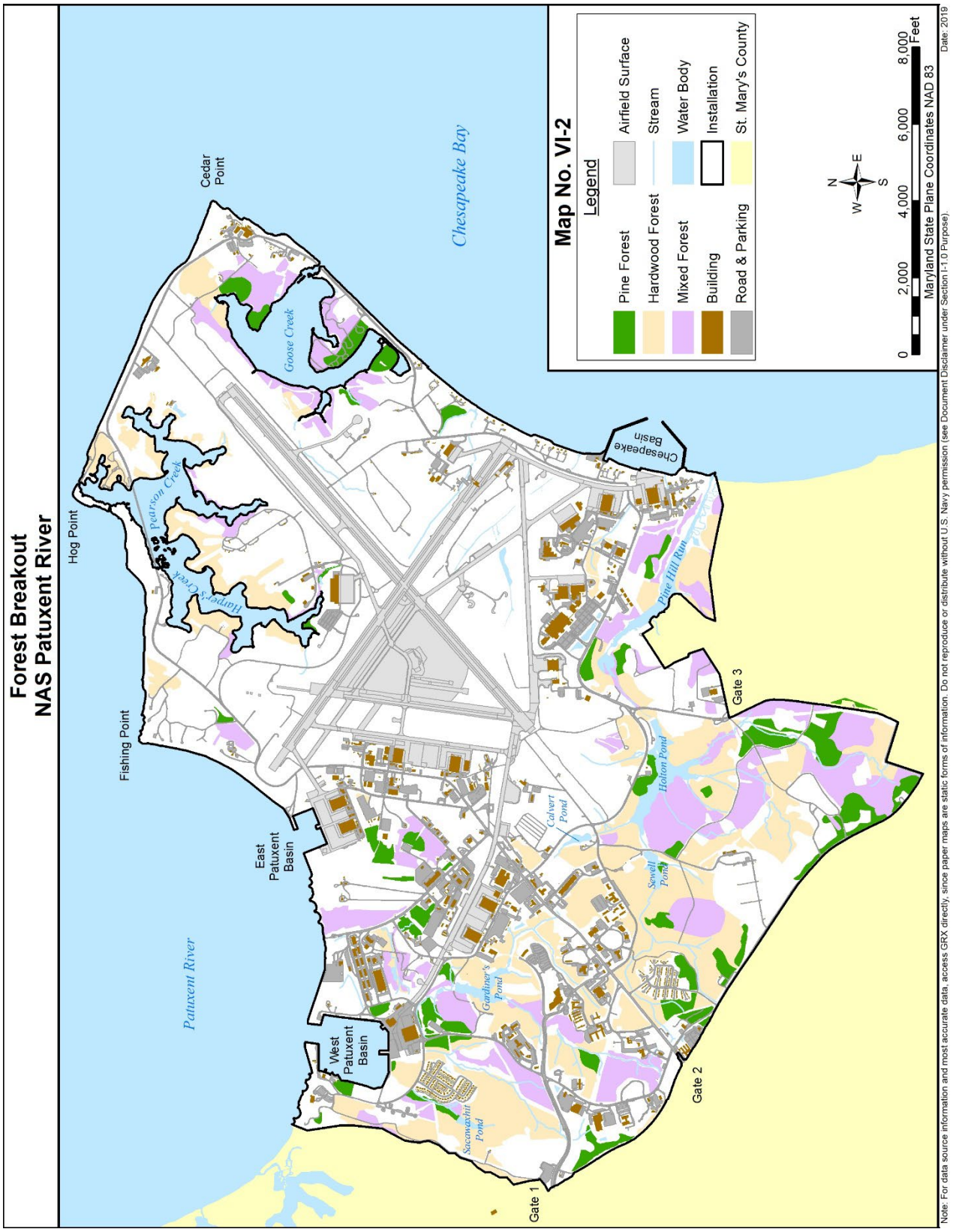
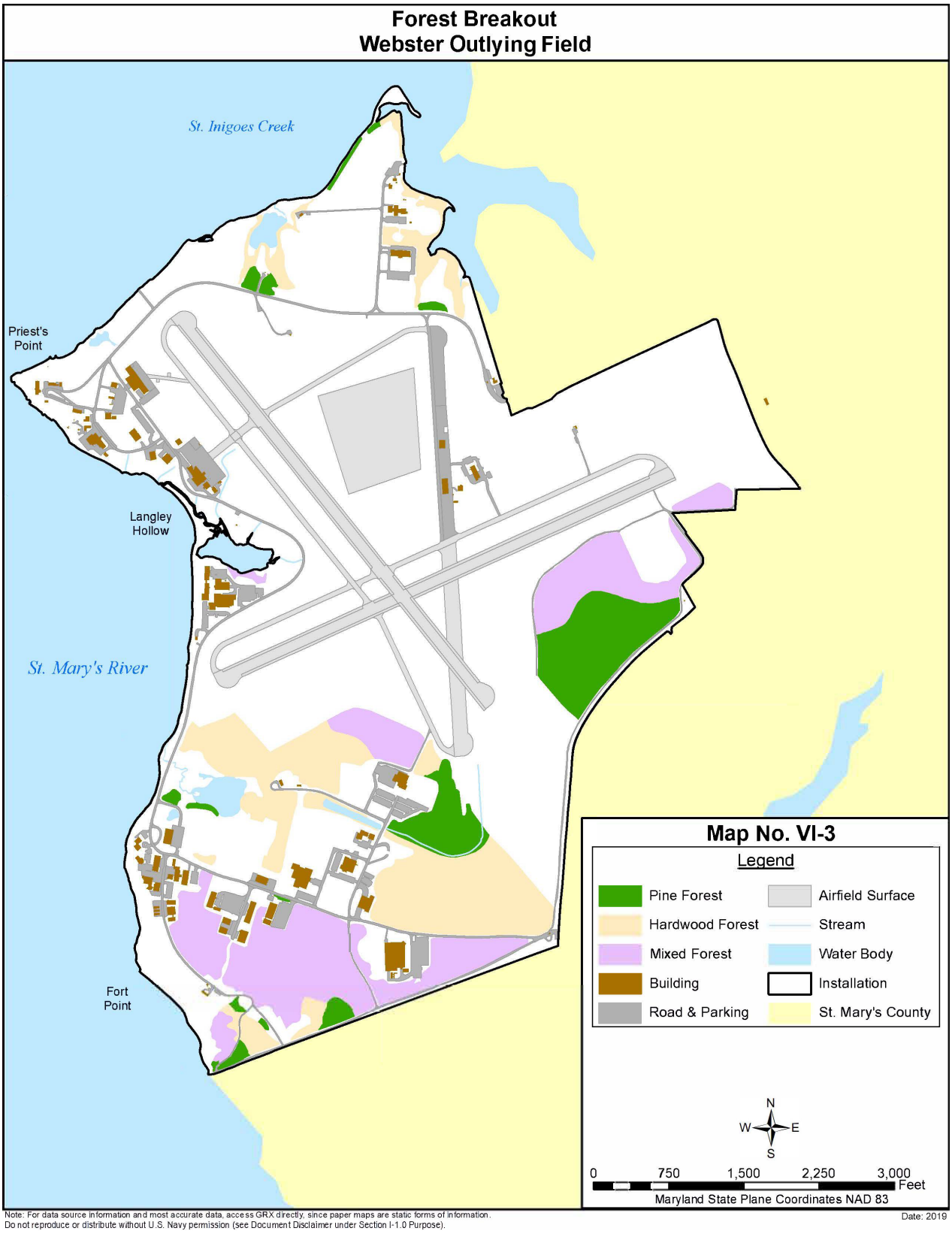

Forest Breakout
NAS Patuxent River
Map No. VI-2
Legend
Pine Forest
Hardwood Forest
Mixed Forest
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
Pearson Creek
Harper's Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Calvert Pond
Holton Pond
Sewell Pond
Gardiner's Pond
Sacowachmi Pond
Gate 1
Gate 2
Gate 3



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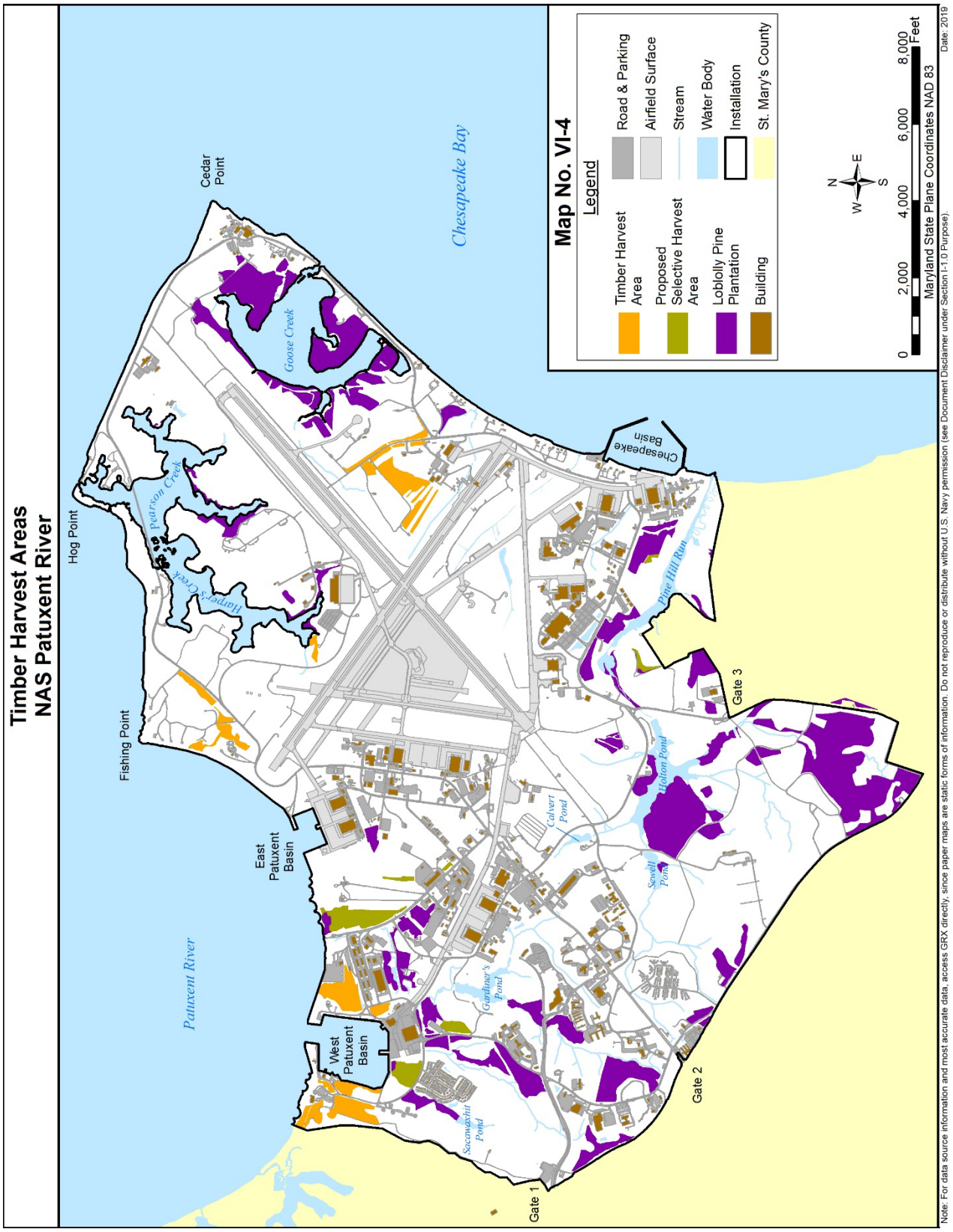

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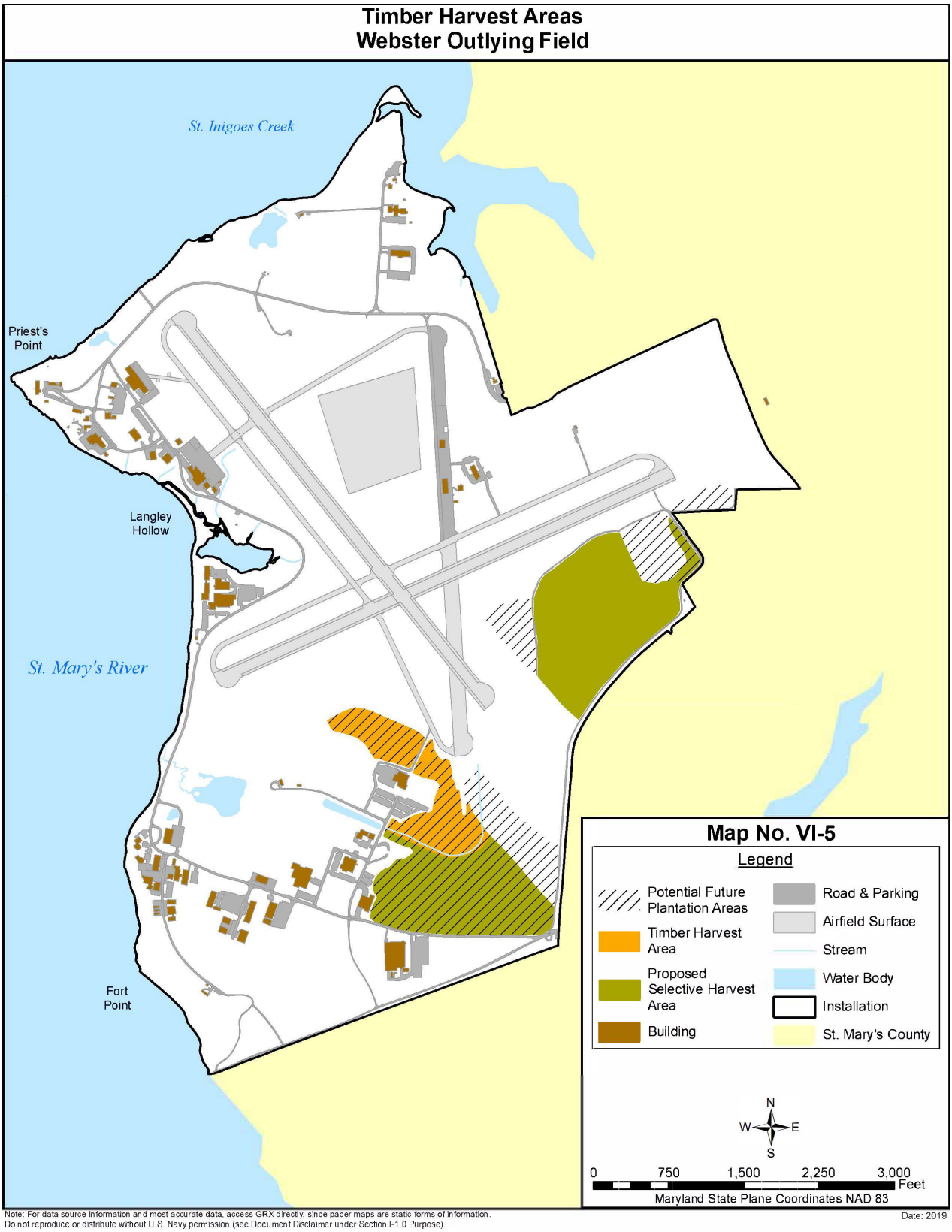

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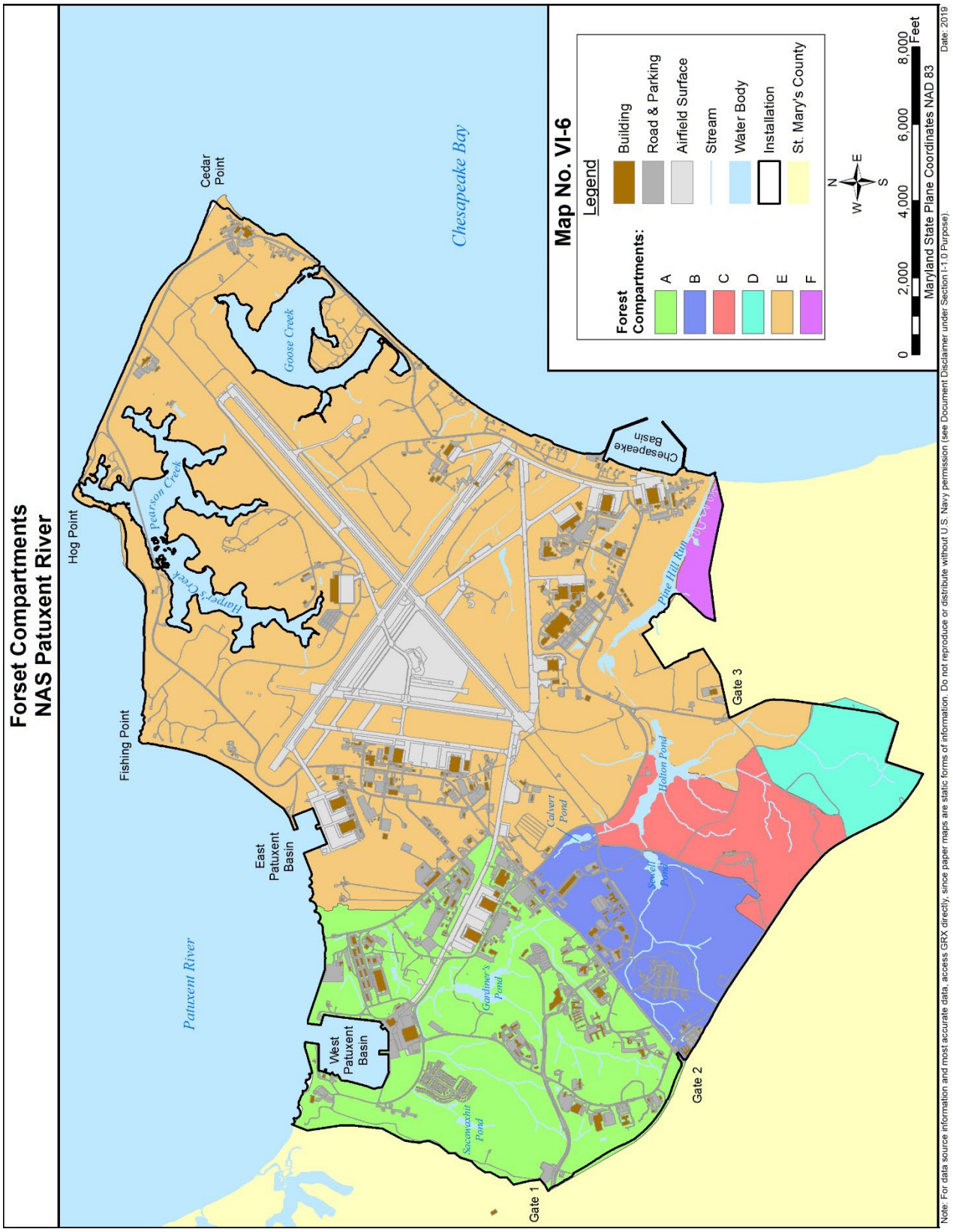
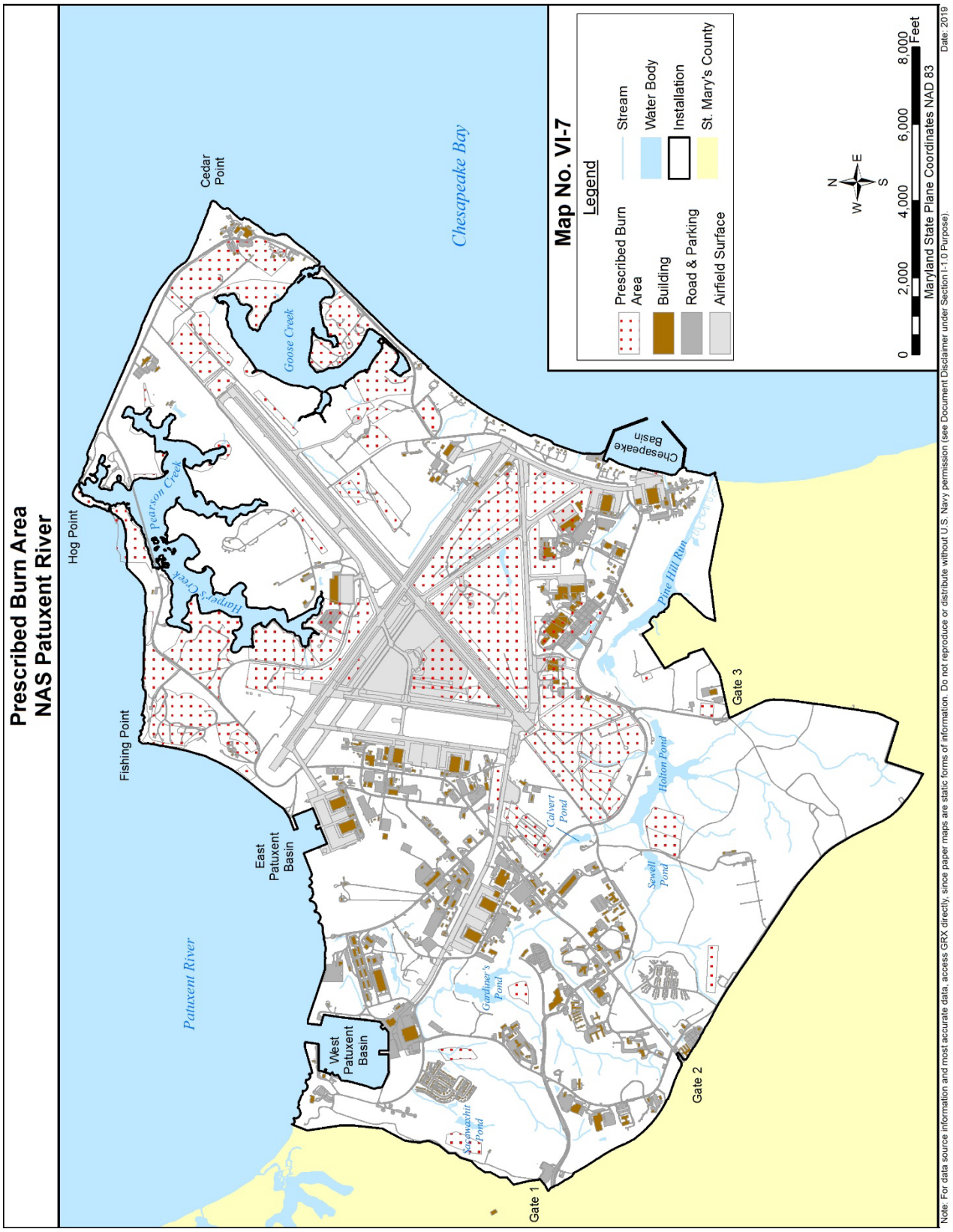
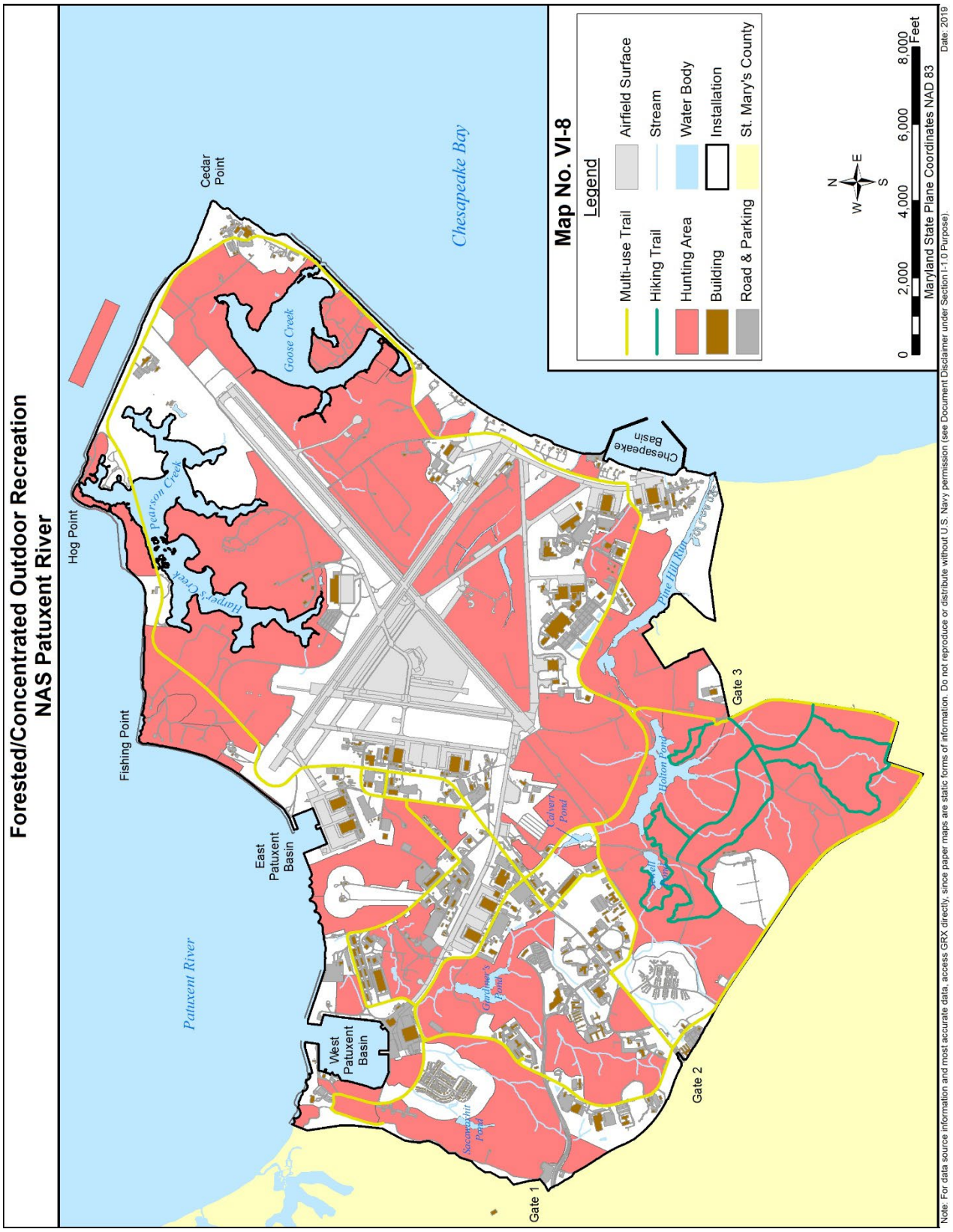

Forset Compartments
NAS Patuxent River
Map No. VI-6
Legend
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
Forest Compartments:
A
B
C
D
E
F
N
W
E
S
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
Pearson Creek
Harper's Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
Cove Creek
East Patuxent Basin
West Patuxent Basin
Calvert Pond
Holton Pond
Jewell Pond
Gardiner's Pond
Saccawaxhit Pond
Gate 1
Gate 2
Gate 3


Prescribed Burn Area
NAS Patuxent River
Map No. VI-7
Legend
Prescribed Burn Area
Stream
Water Body
Building
Installation
Road & Parking
Airfield Surface
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Pearson Creek
Harper Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Calvert Pond
Holton Pond
Sewell Pond
Gardiner's Pond
Gate 1
Gate 2
Gate 3


Forested/Concentrated Outdoor Recreation
NAS Patuxent River
Map No. VI-8
Legend
Multi-use Trail
Hiking Trail
Hunting Area
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
Goose Creek
Pearson Creek
Harper's Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Gate 1
Gate 2
Gate 3
Calvert Pond
Holton Pond
Gardiner's Pond
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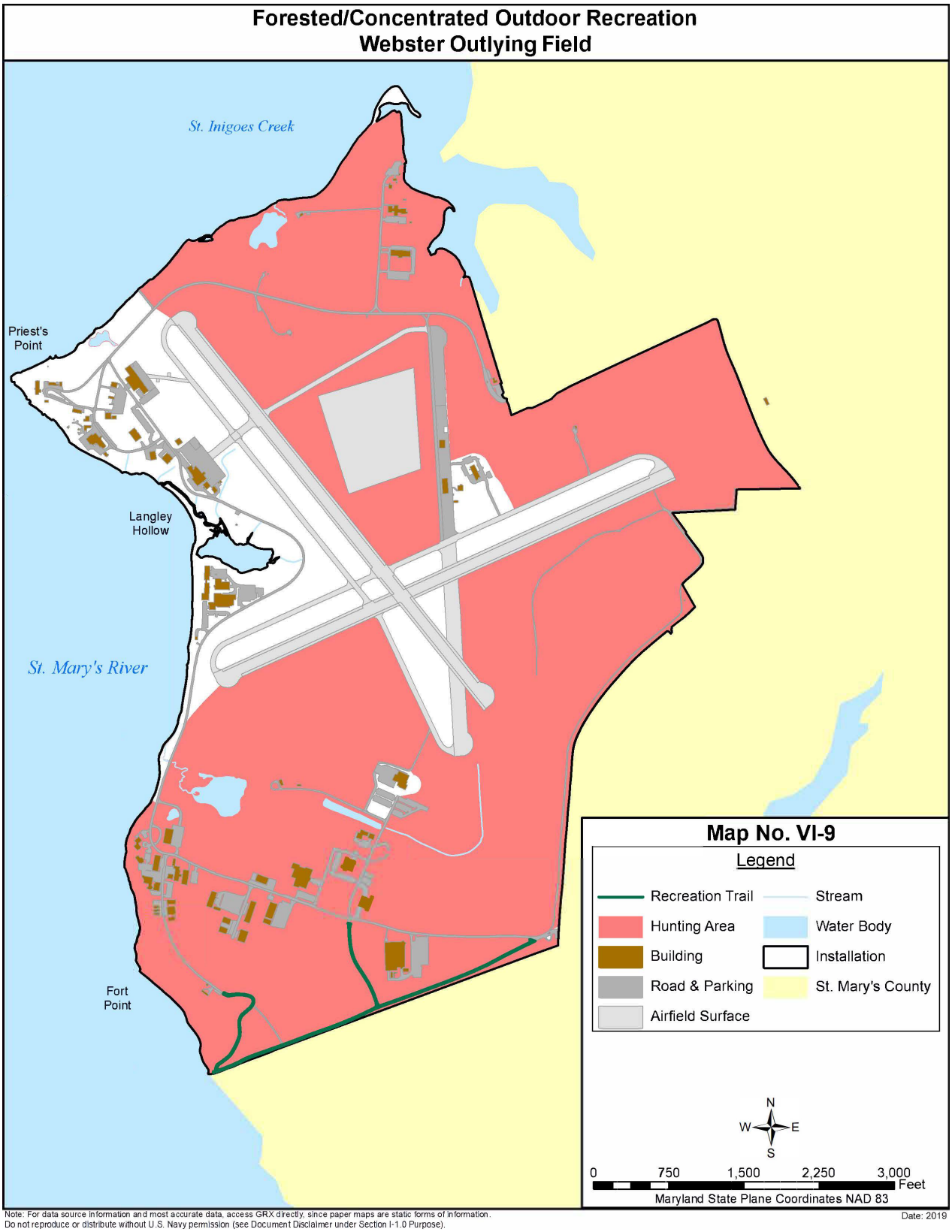

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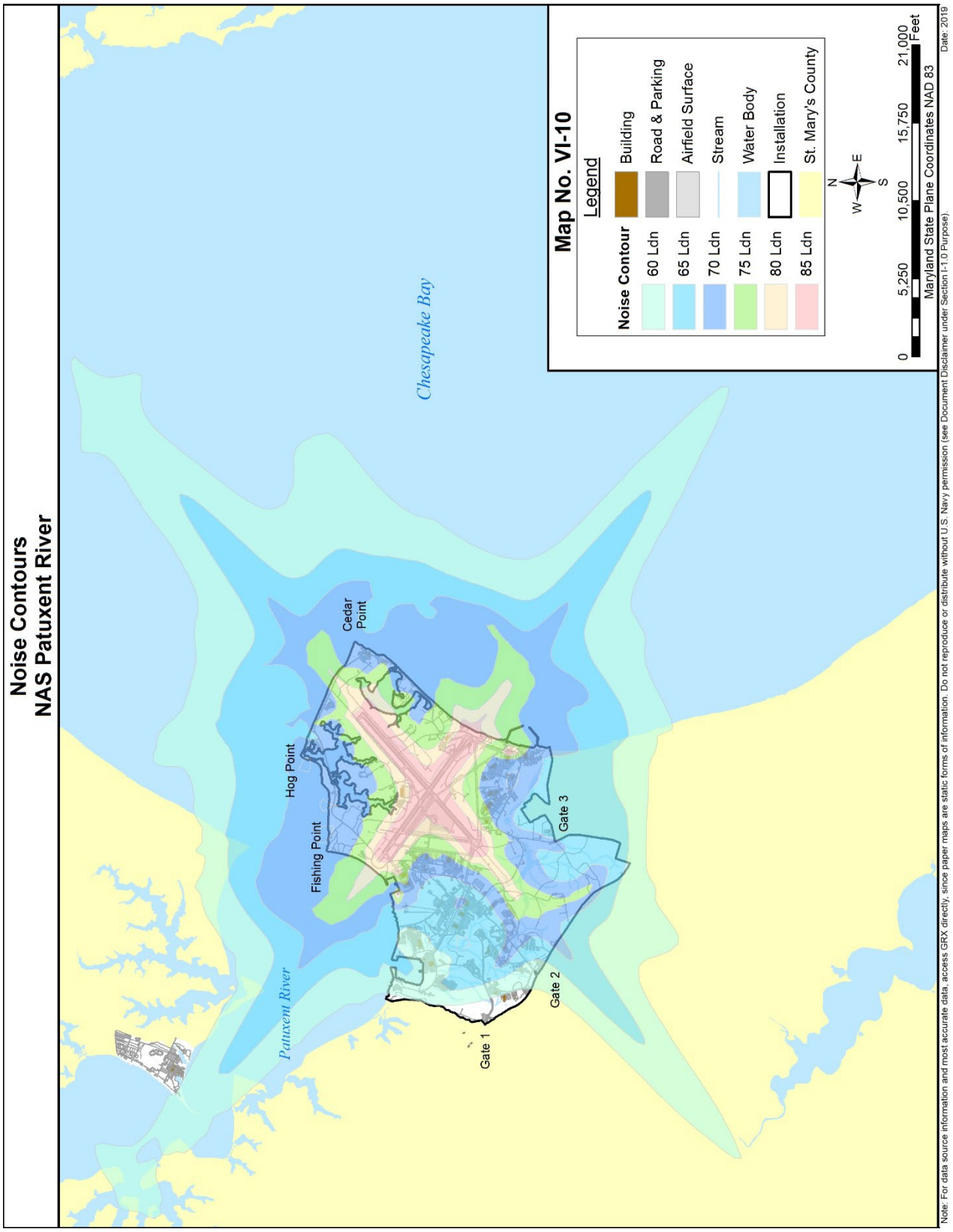
Noise Contours
NAS Patuxent River
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Gate 1
Gate 2
Gate 3
Map No. VI-10
Legend
Noise Contour
60 Ldn
65 Ldn
70 Ldn
75 Ldn
80 Ldn
85 Ldn
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
S
E
W
0
5,250
10,500
15,750
21,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
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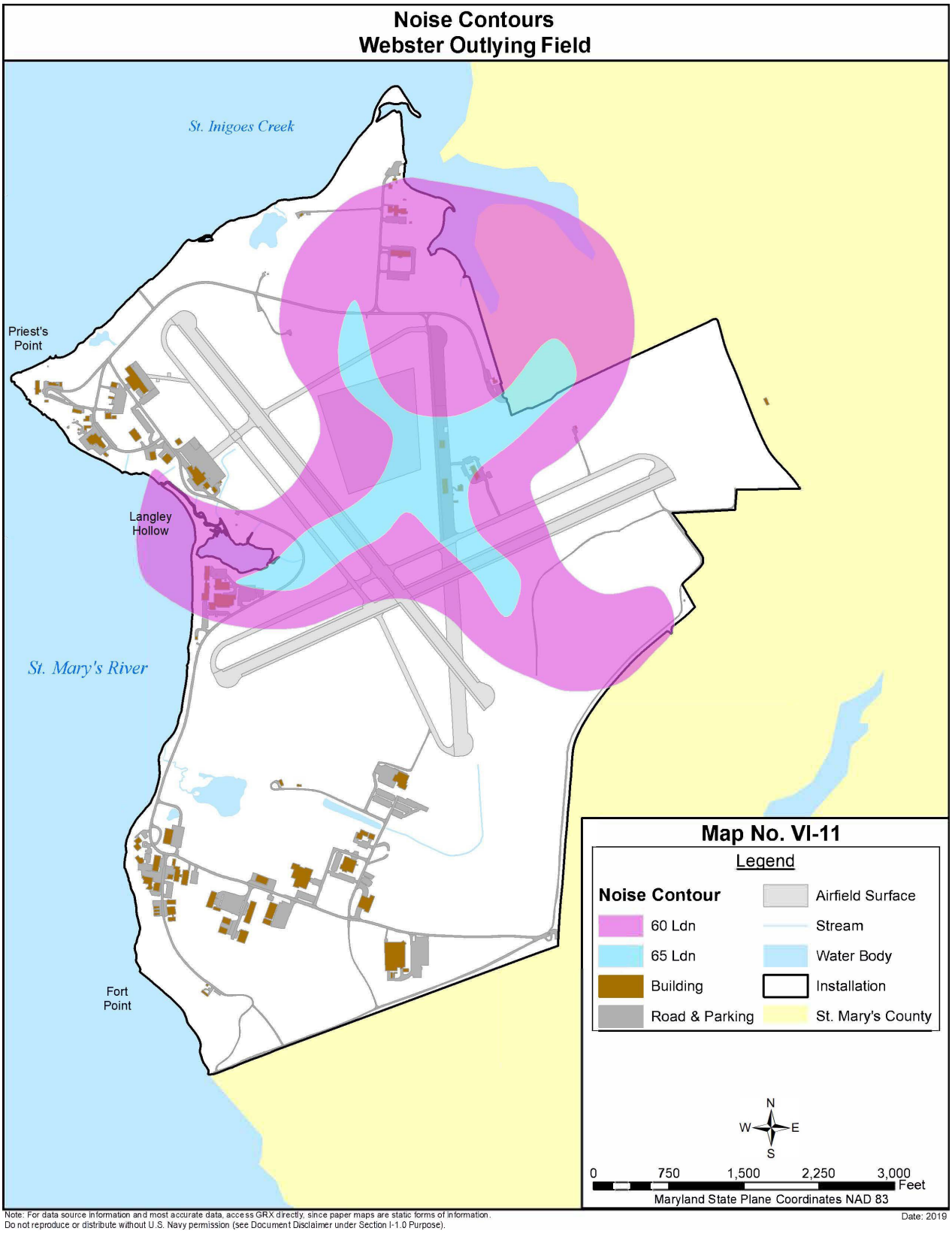

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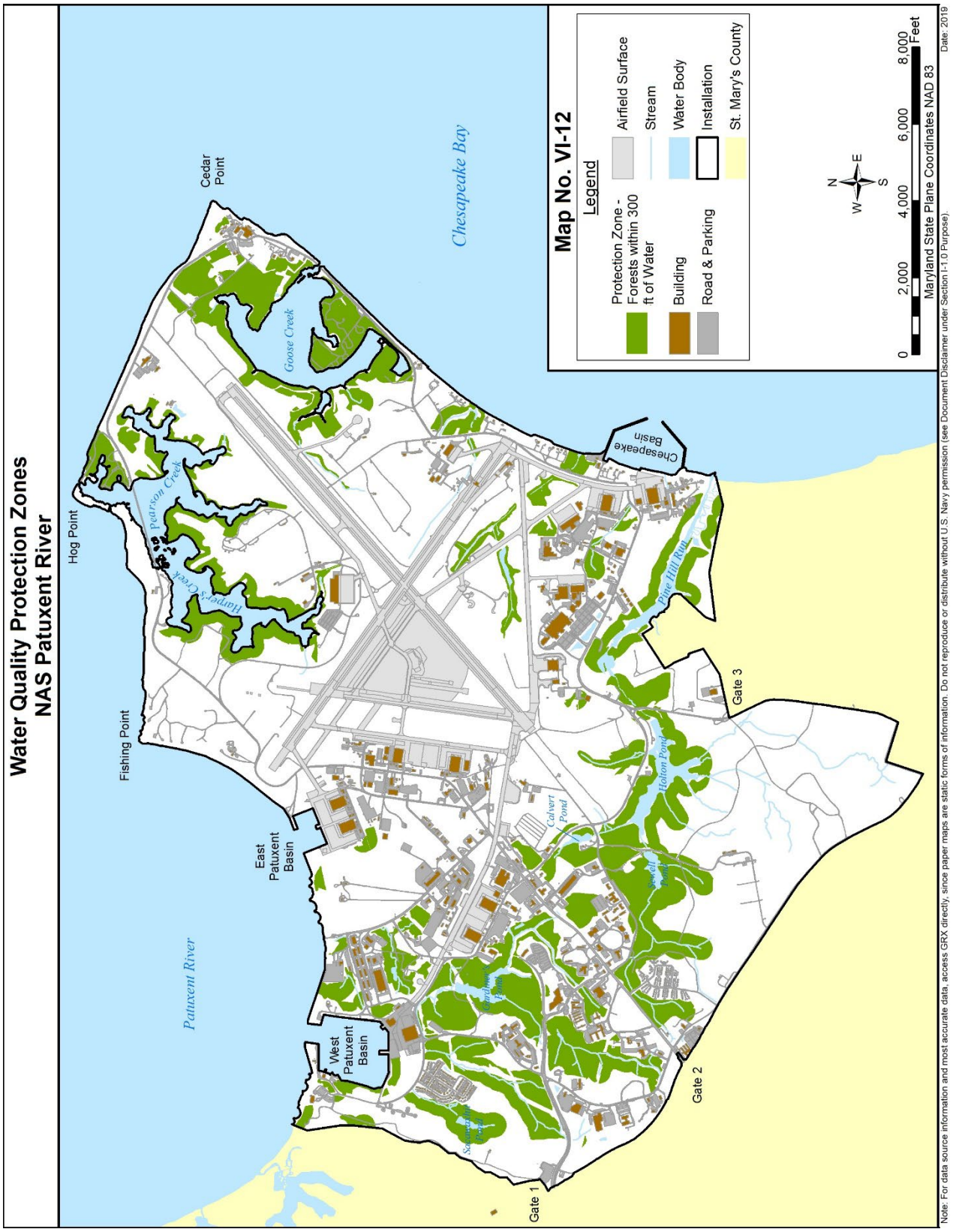
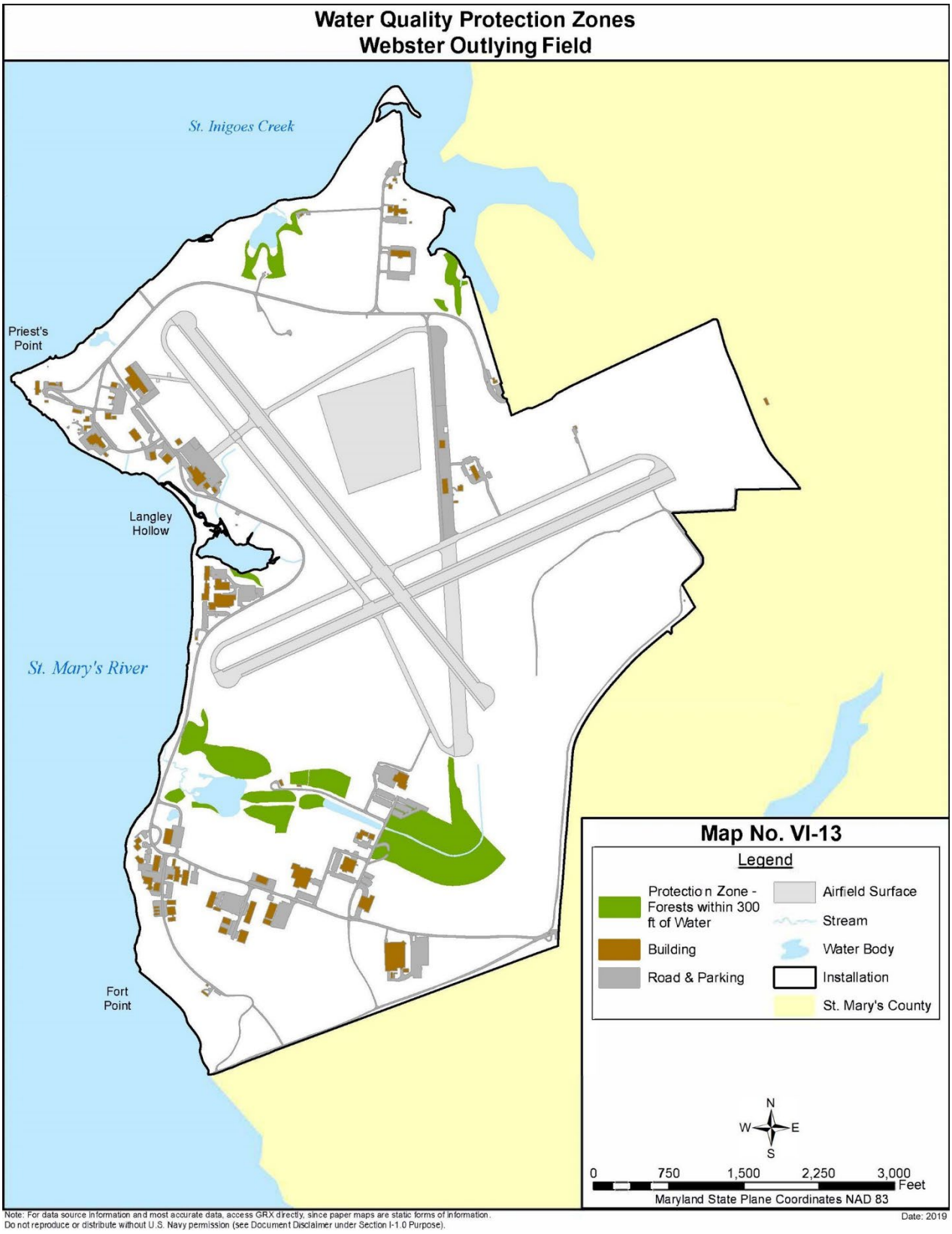
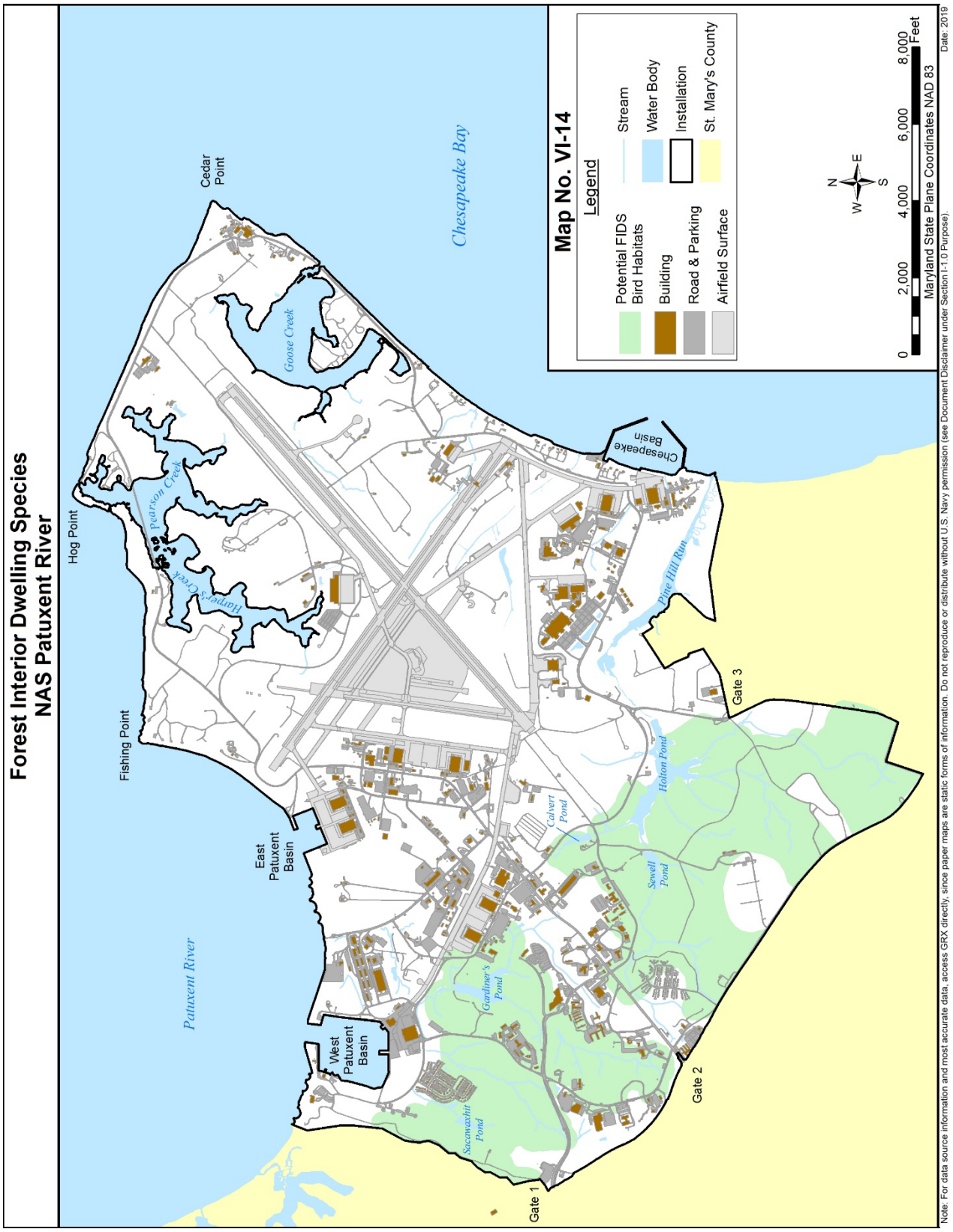
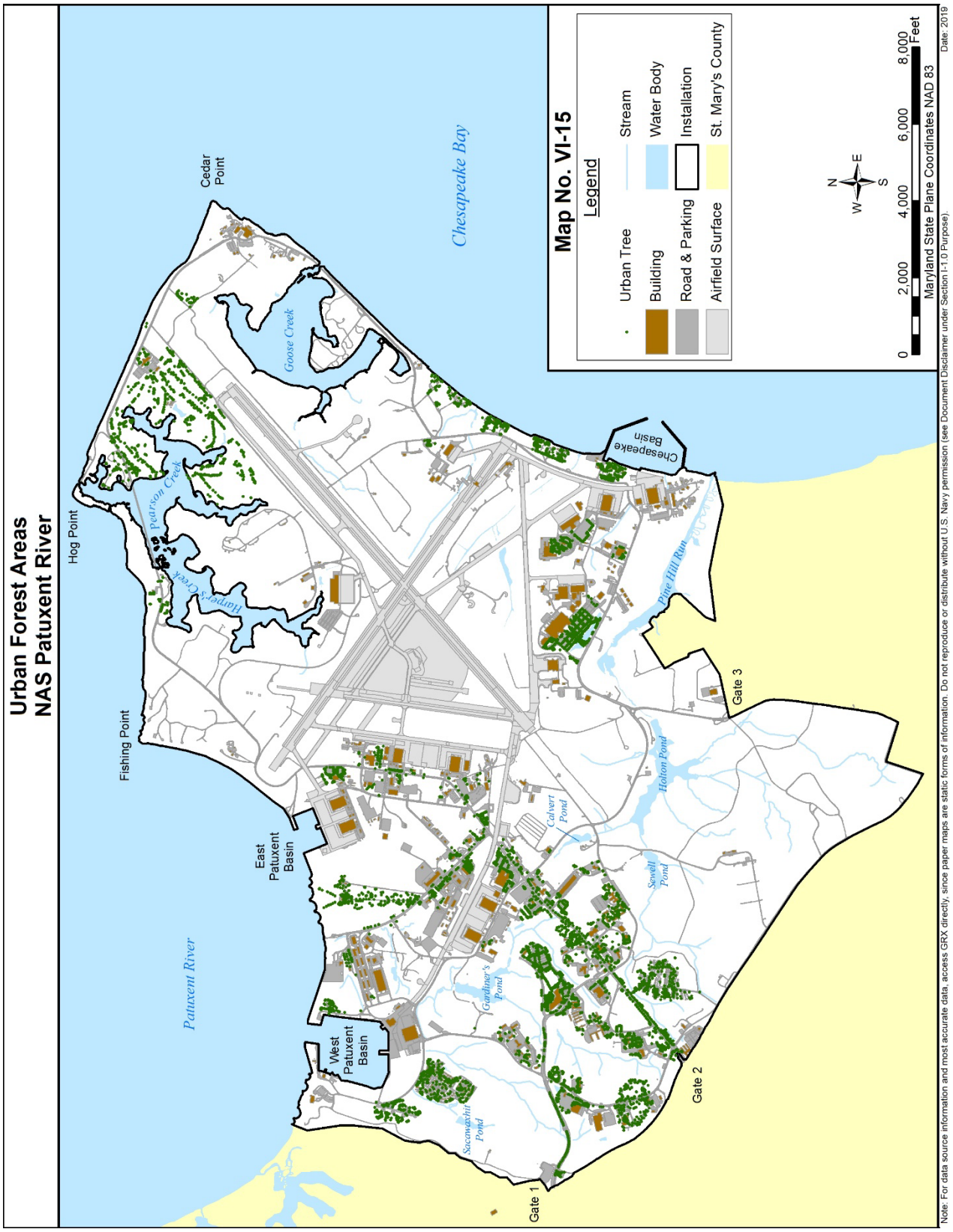

Water Quality Protection Zones
NAS Patuxent River
Map No. VI-12
Legend
Protection Zone - Forests within 300 ft of Water
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Pearson Creek
Harpers Creek
Goose Creek
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Pine Hill Run
Holton Pond
Calvert Pond
Gate 1
Gate 2
Gate 3



Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.


Forest Interior Dwelling Species
NAS Patuxent River
Map No. VI-14
Legend
Potential FIDS Bird Habitats
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
Pearson Creek
Harper's Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
East Patuxent Basin
West Patuxent Basin
Calvert Pond
Holton Pond
Sewell Pond
Gardiner's Pond
Saccawaxhi Pond
Gate 1
Gate 2
Gate 3
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).


Urban Forest Areas
NAS Patuxent River
Map No. VI-15
Legend
Urban Tree
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
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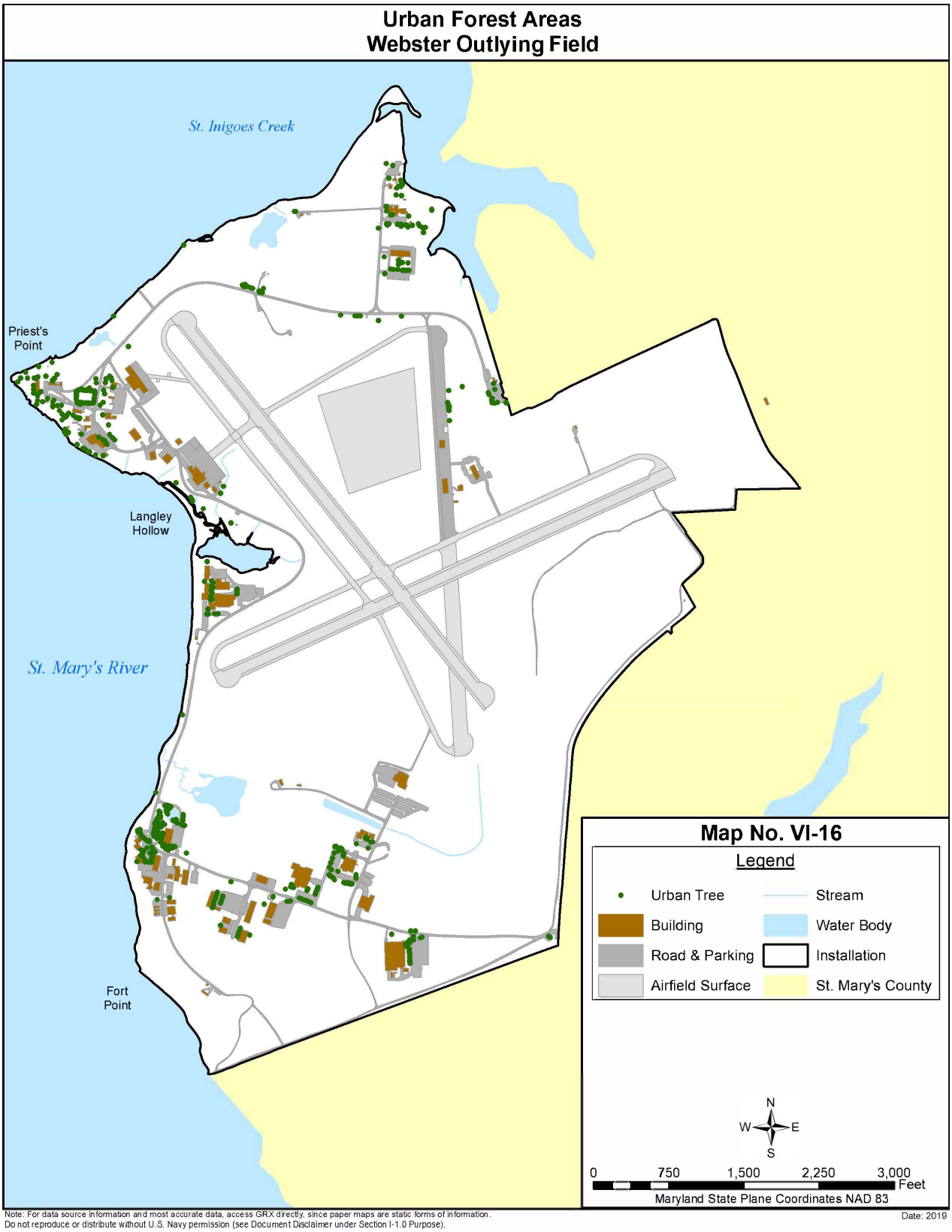
Gardiner's Pond
Secomarchi Pond
Gate 1
Gate 2
Gate 3



Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.

ANNEX VI-B

TABLES

Table VI-B-2. Pine Forest Communities at Pax

AAM Designation	Data Points (Observation Points)	Acreage
A1CIO	B12	9.65
A1C1X	B9	3.84
A1C1Y	D3	5.91
A1G1X	E9	36.24
A1J1X	A8	20.06
A1O	A4, A39, A50, and from aerial photography	10.03
A1X	A9, C2, E5, E82, and from aerial photography	66.77
A1Z	A19 and from aerial photography	4.96
C1G1X	From aerial photography and field reconnaissance	7.76
C1O	A13, C7, E10, E87, E98, and from aerial photography	21.02
C1X	B8, B14	19.71
C1XZ	E77	4.38
C1Y	From aerial photography and field reconnaissance	3.51
E2H1G1XY	E54	2.52
X	From aerial photography and field reconnaissance	121.57
XYZ	E42	6.46
XZ	E70	199.47
Z	A3, C12, C19, D8, E12, and from aerial photography	84.48
Tabular data comes from the 1993-1996 studies mentioned on p. VI-4		

Table VI-B-3. Pine Forest Communities at WOLF

AAM Designation	Data Points (Observation Points)	Acreage
A1E1X	From aerial photography and field reconnaissance	0.63
A1H1X	From aerial photography and field reconnaissance	1.53
A1O	From aerial photography and field reconnaissance	0.50
A1X	From aerial photography and field reconnaissance	23.88
A1XZ	From aerial photography and field reconnaissance	10.27
A2C1XZ	From aerial photography and field reconnaissance	0.46
A2H1X	From aerial photography and field reconnaissance	1.95
A2X	From aerial photography and field reconnaissance	2.56
H1J1D1X	From aerial photography and field reconnaissance	6.92
Z	From aerial photography and field reconnaissance	24.52
Tabular data comes from the 1993-1996 studies mentioned on p. VI-4		

Table VI-B-4. Hardwood Forest Communities at PAX

AAM Designation	Data Points (Observation Points)	Acreage
A1D1E1XY	from aerial photography and field reconnaissance	5.92
A1G1M1X	E55 and aerial photography	9.37
A1X	from aerial photography and field reconnaissance	42.89
A2H1X	E8 and aerial photography	5.49
C1G1X	D2 and aerial photography	7.76
D1H1J1XY	E61	2.94
D1X	E30	15.41
D1XY	P2	10.24
D2E2XY	E45	8.53
D2E2Y	A38	6.54
D2F2XYZ	E31	2.02
D2X	D9	16.63
D3E2X	E22	0.53
D3E3O	from aerial photography and field reconnaissance	2.08
D3E4Y	P4	22.11
D3X	E3, E10	1.84
D3XY	A21, E28, and aerial photography	52.79
D4E1XY	A25	14.68
D2E4X	E95	7.55
D4F1Y	A37	10.35
D5E5YZ	E11	3.13
D6E5XY	A17	14.89
E1D1XY	A49	12.61
E1D2H2X	B4	2.77
E1F1H1XY	from aerial photography and field reconnaissance	7.15
E1F1X	B3	19.49
E1F1XY	B8	7.2

AAM Designation	Data Points (Observation Points)	Acreage
E1F1Y	B1, C8	10.22
E1H1O	B14	1.27
E1O	A28	4.01
E1XY	A26, A41, A44, B13, B16, E17, E25	81.37
E2F2H2XY	from aerial photography and field reconnaissance	2.43
E2F3XY	B6B	3.27
E2G1J1X	from aerial photography and field reconnaissance	3.03
E2X	B16	2.43
E2XY	A14, A21, D1, D6, E13, and aerial photography	80.79
E2Y	A21, E31, and aerial photography	76.51
E3H1XZ	A6	8.49
E3X	C18	34.86
E3XY	A33, B2	26.02
E4X	B1	11.7
E4XY	from aerial photography and field reconnaissance	2.76
E5D4X	E26 and aerial photography	14.78
E5XY	C3	6.22
E1F1H1XY	B2	11.7
F1G1H1XY	E37	6.53
F1G1X	E7 and aerial photography	9.06
F1L1X	E10	1.56
F1XY	A29	2.88
F1Y	A25 and aerial photography	7.67
F2L1O	A2	8.22
F2X	B7B	27.4
F2XY	A40	1.70
F3H1O	A28	4.2
F3X	B10 and aerial photography	7.29

AAM Designation	Data Points (Observation Points)	Acreage
F4E3XY	A27	7.28
F6J1XY	E10	1.59
G1A1X	from aerial photography and field reconnaissance	0.79
G1H1N1X	E23	1.96
G1J1K1XZ	E47	1.39
G1M1X	from aerial photography and field reconnaissance	1.72
G1X	C1	1.45
H1N1X	A26	3.76
H1X	P3	2.11
H1XY	C7, E20	41.90
H2D1XY	E1	5.47
H2G2XY	from aerial photography and field reconnaissance	2.48
H2X	B6A	5.77
H2XY	A10, C16	7.23
H2Y	A15 and aerial photography	6.07
J1K1X	E6, E13, E71	0.72
K1XZ	E23	9.72
M1X	B7A	20.67
O	A17, E32	46.88
WX	A37	1.23
X	A11, A16, A20, A31, A34, E3, E4, E10, E11, E19, E24, and aerial photography	121.57
XY	from aerial photography and field reconnaissance	14.69
XZ	A21, A33, B7, E10, E69, E78	199.47
Z	E10	81.48
Tabular data comes from the 1993-1996 studies mentioned on p. VI-4		

Table VI-B-5. Hardwood Forest Communities at WOLF

AAM Designation	Data Points (Observation Points)	Acreage
A1D1X	from aerial photography and field reconnaissance	14.92
A1E2XYZ	from aerial photography and field reconnaissance	6.46
A1EWXYZ	from aerial photography and field reconnaissance	2.25
A1H1XZ	from aerial photography and field reconnaissance	2.40
A4H1G1ZX	from aerial photography and field reconnaissance	7.07
D1H1X	from aerial photography and field reconnaissance	0.26
E2A1XZ	from aerial photography and field reconnaissance	1.28
E30	from aerial photography and field reconnaissance	1.08
G1H1O	from aerial photography and field reconnaissance	3.63
G1H1X	from aerial photography and field reconnaissance	1.86
G1H1Y	from aerial photography and field reconnaissance	0.68
G2H1X	from aerial photography and field reconnaissance	9.33
H1G1O	from aerial photography and field reconnaissance	8.82
HIX	from aerial photography and field reconnaissance	0.37
X	from aerial photography and field reconnaissance	1.13
Tabular data comes from the 1993-1996 studies mentioned on p. VI-4		

Table VI-B-6. Mixed Forest Communities at PAX

AAM Designation	Data Points (Observation Points)	Acreage
A1C1E1Y	A5, D4	6.15
A1C1H1XY	E48	4.32
A1D1E1XY	from aerial photography and field reconnaissance	5.92
A1E1X	E59	1.91
A1E1Y	C11	4.38
A1G1H1YZ	E34	2.26
A1G1X	E2, E10, E16, E64	36.24
A1H1X	E14	1.93
A1H1XY	from aerial photography and field reconnaissance	18.57
A1H1XZ	A5	2.45
A1J1XZ	A35, E84	11.27
A1X	A38, B9	42.89
A1XZ	E81	1.32
A2C2E2X	from aerial photography and field reconnaissance	24.55
A2C2X	D7	13.07
A2D1E2XY	A42	7.26
A2D2F2XY	from aerial photography and field reconnaissance	12.29
A2D2X	E35	24.07
A2H2XY	A2 and aerial photography	35.07
A2H3X	E35	8.51
A2J1K1X	A39	8.17
A2X	E39 and aerial photography	29.30
A2XY	A45	9.86
A3C2X	D4A and aerial photography	23.58
A3E4XY	C17 and aerial photography	5.05
A3J3X	E36	13.37

AAM Designation	Data Points (Observation Points)	Acreage
A3K1G1X	A31 and aerial photography	20.72
A4E4XY	D4B and aerial photography	57.72
A4G1X	C5	48.20
A4X	E37	12.00
A6XY	C4	6.71
C1D1Y	E9, E25, P5	18.76
C1D3E3H1X	E96, E97 and aerial photography	7.75
C1E1XY	A30, C2	6.41
C1F1H1XYZ	A24 and aerial photography	4.7
C1F1X	B15	17.28
C1F2X	B18	10.61
C1H1XY	A7	2.67
C1H1Y	A14	2.1
C1J1XZ	E78	17.53
C1M1Y	P1	2.67
C1XY	A34, E18	17.74
C2E1X	E24 and aerial photography	10.05
C4E2XY	C11	23.98
D1XY	E32	10.24
D2YZ	E60	6.39
E1D1XY	A47	12.61
E2C1Y	A12 and aerial photography	21.02
E2XY	E11	80.79
E2Y	A12	76.51
F1G1XY	C3 and aerial photography	4.31
F1X	A10	5.27
H1XY	E33	41.90
J1C1X	A1	4.86

AAM Designation	Data Points (Observation Points)	Acreage
XZ	from aerial photography and field reconnaissance	199.47
ZX	from aerial photography and field reconnaissance	14.24
Tabular data comes from the 1993-1996 studies mentioned on p. VI-4.		

Table VI-B-7. Mixed Forest Communities at WOLF

AAM Designation	Data Points (Observation Points)	Acreage
A2E1X	from aerial photography and field reconnaissance	5.61
A2E2XYZ	from aerial photography and field reconnaissance	1.29
A2X	from aerial photography and field reconnaissance	2.56
D1X	from aerial photography and field reconnaissance	0.17
D4A1X	from aerial photography and field reconnaissance	4.75
D5G1X	from aerial photography and field reconnaissance	1.23
E1A1XY	from aerial photography and field reconnaissance	21.22
E1Y	from aerial photography and field reconnaissance	18.06
E2A1XYZ	from aerial photography and field reconnaissance	0.29
E4G1	from aerial photography and field reconnaissance	11.83
G1J1X	from aerial photography and field reconnaissance	3.29
G1X	from aerial photography and field reconnaissance	3.50
H1J1D1X	from aerial photography and field reconnaissance	6.92
K1J1X	from aerial photography and field reconnaissance	0.58
XZ	from aerial photography and field reconnaissance	1.16
ZX	from aerial photography and field reconnaissance	1.12
Tabular data comes from the 1993-1996 studies mentioned on p. VI-4		

Table VI-B-8. Timber Volumes in Recommended Harvest Areas at PAX

POLYGON #	ACREAGE	TBF^	PROPOSED USE
Forest Areas to be Clear Cut			
A77	0.94	95,800	Manage as Plantation
A85	16.08	0	Manage as Plantation
A95	1.49	8,500	Manage as Plantation
A97	1.01	0	Manage as Plantation
A100	8.61	0	Manage as Plantation
A109a	3.25	0	Manage as Plantation
A109b	4.19	0	Manage as Plantation
A111	3.66	30,300	Manage as Plantation
A112	0.31	0	Manage as Plantation
A114	0.57	3,300	Manage as Plantation
A125	1.74	0	Manage as Plantation
A127*	2.9	0	Manage as Plantation
A196	16.02	5,100	Manage as Preserve
A398	6.84	408,400	Manage as Preserve
A439	13.88	365,600	Manage as Preserve
A443	8.17	363,000	Manage as Preserve
A446	6.71	135,800	Manage as Preserve
C422	48.2	365,600	Manage as Preserve
C471a	5.59	162,400	Manage as Preserve
C471b	3.92	162,400	Manage as Preserve
D358	38.79	237,900	Manage as Preserve
D468	18.01	1,180,600	Manage as Preserve
D499	18.92	366,800	Manage as Preserve
D502a	2.34	569,500	Manage as Preserve
D502b	7.37	569,500	Manage as Preserve
E8*	4.92	129,500	Manage as Plantation

POLYGON #	ACREAGE	TBF^	PROPOSED USE
E12*	1.69	29,900	Manage as Plantation
E25	4.8	0	Manage as Plantation
E38	5.29	8,072	Manage as Plantation
E43	2.79	85,100	Manage as Plantation
E93	2.32	0	Manage as Plantation
E122a	0.96	0	Manage as Plantation
E122b	2.21	0	Manage as Plantation
E122c	2.46	0	Manage as Plantation
E122d	2.31	0	Manage as Plantation
E138a	0.6	0	Manage as Plantation
E138b	1.49	0	Manage as Plantation
E399	14.23	0	Manage as Plantation
E403	1.35	0	Manage as Plantation
E404	2.4	0	Manage as Plantation
E405	2.19	0	Manage as Plantation
Forest Areas to be Selection Cut			
A141	8.48	26,900	Visual Screen and Noise Attenuation
A160	4.31	134,200	Firewood Cutting Area
A187	5.21	104,400	Manage as Preserve
A199	4.29	1,117,500	Manage as Preserve
A210	17.87	43,534	Visual Screen and Noise Attenuation
A449	6.22	25,400	Visual Screen and Noise Attenuation
C287a	0.71	159,000	Firewood Cutting Area
C287b	2.8	159,000	Firewood Cutting Area
C355a	16.25	13,900	Water Quality and Forest Preserve
C355b	2.19	13,900	Water Quality and Forest Preserve
E27	1.64	458,400	Firewood Cutting Area
E157	0.66	17,600	Visual Screen and Noise Attenuation
E202	2.3	20,000	Visual Screen and Noise Attenuation

POLYGON #	ACREAGE	TBF^	PROPOSED USE
E303	0.98	13,300	Water Quality
*Portions of polygon. ^TBF = Total board feet Tabular data comes from the 1993-1996 studies mentioned on p. VI-4			

Table VI-B-8. Timber Volumes in Recommended Harvest Areas at WOLF

POLYGON #	ACREAGE	TBF^	PROPOSED USE
Forest Areas to be Clear Cut			
W28	7.07	0	Manage as Plantation
W29	-	-	-
W30	0.26	0	Manage as Plantation
W31	1.11	0	Manage as Plantation
W32	11.85	0	Manage as Plantation
W61	-	-	-
Forest Areas to be Selection Cut			
W11	14.92	0	Manage as Preserve
W13	1.53	0	Manage as Preserve
W14	21.42	0	Manage as Preserve
W34	15.4	0	Harvest Only
W35	18.08	0	Harvest Only
*Portions of polygon. ^TBF = Total board feet Tabular data comes from the 1993-1996 studies mentioned on p. VI-4			

ANNEX VI-C

FOREST INVESTIGATION METHODOLOGY

METHODOLOGY FOR FOREST STUDY INVESTIGATIONS

The following methodology was utilized to sample and characterize the forest areas on the Complex:

1.0 AERIAL PHOTOGRAPHIC ANALYSIS:

As described in Chapter 5, the following Land Cover Type Mapping was undertaken to characterize the Forest Type Land Use Polygons into more specific designations as follows:

ANDERSON CLASSIFICATION SCHEME:

4000 FORESTLAND

- 4100 - Deciduous Woods
  - 4110 - Deciduous, 10-50% Crown Closure
  - 4120 - Deciduous, > 50% Crown Closure
- 4200 - Coniferous Woods
  - 4210 - Coniferous, 10-50% Crown Closure
  - 4220 - Coniferous, > 50% Crown Closure
  - 4230 - Plantation
- 4300 - Mixed Deciduous / Coniferous Woods
  - 4310 - Coniferous / Deciduous Woods
  - 4320 - Deciduous / Coniferous Woods
- 4400 - Brush Land / Shrub Land
  - 4410 - Old Field (< 25% Brush Cover)
  - 4420 - Deciduous Brush / Shrubland (> 25% Brush Cover with Deciduous Species Predominant > 75%)
  - 4430 - Coniferous Brush / Shrubland (> 25% Brush Cover with Coniferous Species Predominant > 75%)
  - 4440 - Mixed Deciduous / Coniferous Brush / Shrubland (>25% Brush Covered with a Mixture of Deciduous and Coniferous Species; < 75% of One Type)

6000 WETLANDS

- 6200 - Interior Wetlands
  - 6210 - Deciduous Wooded Wetlands
  - 6220 - Coniferous Wooded Wetlands
  - 6230 - Brush Dominated and Bog Wetlands
  - 6240 - Nontidal Marshes

2.0 FOREST DATA POINTS:

1. One-tenth acre sampling points were set in representative areas of Forest Stands in each Forest Compartment according to the following criteria:

   A. Approximately one-fourth of all stands less than five acres in size were sampled. These stands were chosen randomly.

B. All other stands were sampled by at least one (1) sample point with an additional sample point added for areas over forty (40) acres and two additional sample points added for areas over fifty (50) acres. (*This criteria, along with field modifications, resulted in 107 data points for PAX or one point per every 18 acres of forest area.*)

C. After the land use study was completed, additional areas were identified for further characterization. These areas were reinvestigated through the use of "observation points" which were used to compare the forest type in these areas to the more specific data compiled in the forest plot sampling above.

2. Data points were sampled for the following data:

A. Vegetation species for: herbaceous, shrub, sapling, and tree strata
B. Relative undergrowth coverage
C. Diameters of individual trees of all species
D. Average tree heights
E. Number of snags
F. Number of fallen logs
G. Percent canopy closure
H. Relative health of stand

3.0 FOREST OBSERVATION POINTS:

Additionally, the majority of the forest areas on the Complex were reviewed in a more cursory manner. At these observation points, the following data was collected:

A. Approximate areal coverage of coniferous trees and deciduous trees
B. Dominant tree species
C. Associated tree species
D. Dominant understory species
E. Approximate average diameter at breast height (DBH) of dominant tree species
F. Average tree height
G. Approximate canopy closure percentage
H. Understory density
I. Presence or absence of wetlands
J. General quality and health of the stand

The forest data points were used as primary data while the observation points were used as secondary data. The observation points were used to relate the stand to a similar stand in which detailed data was collected. All of this was accomplished through the development of a forest cover type classification scheme as described below.

4.0 ARSENAULT, ATTARDI & McCULLEY, INC., FOREST TYPE DESIGNATION SCHEME:

Forest types were classified based on the observation points and data points using the following description codes:

Dominant Species Suffix

A - Loblolly Pine
B - Pitch Pine
C - Virginia Pine
D - Red Oaks (Black, Scarlet, Willow, Pin, Blackjack, Northern Red and/or Southern Red)
E - White Oaks (Post, Chestnut, White, Swamp White, and/or Swamp Chestnut)
F - Yellow-poplar
G - Red Maple
H - Sweetgum
J - Black Cherry
K - Black Locust
L - Walnut
M -Tupelo
N - Sycamore
P - Cedar

Dominant Understory Suffix

W - Cacti
X - Deciduous
Y - Broadleaf Evergreen
Z - Coniferous
O - Sparse or No Dominants

Dominant Species Average Basal Area (in Square Feet) Suffix

1 - 0.20 to 0.74
2 - 0.75 to 1.24
3 - 1.25 to 1.74
4 - 1.75 to 2.74
5 - 2.75 to 3.74
6 - 3.75 +

For example: A mixed deciduous and coniferous forest dominated by red oak (average basal area 1.20) and Loblolly Pine (average basal area 0.67) with a holly-dominated understory would be: 4320/D2A1Y.

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 7

Fisheries Management

Table of Contents

VII FISHERIES MANAGEMENT

1.0 Introduction

The purpose of the Fisheries Management Program at the NAS Patuxent River Complex (the Station) is to implement and apply concepts that focus on maintaining, protecting, and conserving the quality, quantity, and diversity of its fishery resource. As stewards of the waters entrusted to them, the Station fisheries program must reach a balance between maintaining the ecological integrity of those waters, and their fishery resources, while maintaining the military mission of the base. The Fisheries Management Program maintains this balance by implementing management and conservation measures developed through research and monitoring.

The Station also provides numerous recreational fishing opportunities at NAS Patuxent River (PAX), Webster Outlying Field (WOLF), and Naval Recreation Center Solomons (NRC SOL). This chapter presents the fisheries management plans for PAX and WOLF.

Freshwater fishing is authorized by NAS Patuxent River Instruction NASPAXRIVINST 11015.7 (series) in five of PAX's six freshwater ponds (Gardiner's, Sewall, Holton, Calvert, and Sacawaxhit - formerly known as Ponds #1, #2, #3, #4, and #5, respectively, as discussed in Chapter III) and both of WOLF's freshwater ponds (Fishing and Finger Ponds). Richneck Pond (formerly known as Pond #6) is currently used strictly as a brood pond, and fishing is not allowed there. Opportunities for saltwater fishing, shellfishing, and crabbing exist at PAX in Goose Creek, Harper's Creek, Pearson Creek, and Pine Hill Run, as well as approximately six miles of shoreline on the Chesapeake Bay and Patuxent River. A fishing pier is located on the Chesapeake Bay near the mouth of Goose Creek. Boat fishing from beyond 75 yards offshore is not restricted by PAX; it is, however, regulated by the State of Maryland. Saltwater fishing opportunities at WOLF include Molls Cove, St. Inigoes Creek and St. Mary's River. Crabbing is allowed in the tidal water bodies of WOLF (Chapel Cove, Priest's Inlet, Langley Hollow, and Fort Point Cove). Recreational fishing areas for PAX and WOLF are shown in Maps VII-1 and VII-2 in Annex VII-A, respectively, as identified in Instruction 11015.7 mapping dated March 2, 2007.

1.1 Purpose

Fisheries management on a United States military base focuses on reaching a balance between responding to the military mission of the base and maintaining a quality fisheries resource. The Station has the additional responsibility of ensuring optimum utilization of those waters while maintaining their ecological integrity. The fisheries management chapter of the INRMP focuses on the strategy of applying these concepts to the principles of multiple use and sustained yield.

1.2 Scope

This chapter of the INRMP addresses fisheries management at PAX and WOLF by highlighting the pertinent laws, regulations, and policies; delineating the goals and objectives of the fisheries management program; and describing the existing resources and how they came to their current stages. Subsequent sections propose management and conservation measures for the future as well as the attendant research and monitoring involved to implement those recommendations.

2.0 Applicable Laws, Regulations, and Policies

Several federal, state, and local statutes address fisheries management and harvesting activities. Many of these regulations are designed to control commercial and recreational harvests, thereby managing populations and protecting fisheries from excessive exploitation. The appropriate federal and state regulations are discussed below.

2.1 Federal Laws and DoD/DoN Instructions

There are a number of federal laws that impact fisheries management. Broad-based laws, such as the National Environmental Policy Act and the Coastal Zone Management Act, have been addressed in the introductory chapter of the INRMP. Discussion in this chapter is limited to the laws most directly associated with fisheries management and fishing activities at PAX and WOLF.

Fishing at PAX and WOLF is regulated through base command regulations as well as a fee/permit system that is administered by the CN. All fishing activities require both a valid state license and a NAS fishing permit. NAS fishing permits are valid at PAX, WOLF, and NRC SOL. A NRC SOL fishing permit is only valid at NRC SOL, and is not reciprocal at other facilities. Some forms of recreational crabbing require a state license, while all crabbing on NAS property requires a base permit.

PAX, WOLF, and NRC SOL permits were historically sold at the Morale, Welfare and Recreation (MWR) and Command Duty Office (CDO) buildings. Later, they were available at electronic, web-enabled sales kiosks located at each of the installations. Currently, these permits may only be obtained at the NAS website for hunting and fishing information and permit sales (https://naspaxriver.recaccess.com/). Recreational users may also access applicable installation instructions and maps at the website.

All authorized persons[1] (including guests) 12 years old and older must obtain a Station fishing permit to fish in tidal saltwater (including crabbing) or freshwater at PAX and WOLF. Permits must be in possession while fishing. Persons (including guests) between the age of 12 and 15 (inclusive) will be issued a free permit. Children under 12 years of age do not require saltwater or freshwater permits for any type of fishery resource activity. Current fee schedules for authorized persons over 15 are posted on the NAS hunting and fishing website and are included in the respective instructions. Licenses and base fishing permits are valid for a calendar year.

Under a reciprocal agreement between Maryland, Virginia, and the Potomac River Fisheries Commission, the following licenses are acceptable for saltwater fishing in Maryland tidal waters: Maryland State Recreational License, Virginia State Recreational Tidal Fishing License, or Potomac River Fisheries Commission Recreational Fishing License.

Specific license and fishing permit requirements for PAX and WOLF are detailed in Table VII-1.

[1] The term 'authorized person' is defined in the base regulations, Instruction 11015.7 (NASPAXRIVINST 11015.7, Section 4(b)).

2.1.1 Fish and Wildlife Coordination Act, as amended; Public Law 85-624, 16 USC 661 *et seq.*

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for USFWS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It also requires federal agencies involved with water resource development projects to first consult with the USFWS and state fish and wildlife agencies regarding the impacts on fish and wildlife resources, and provide mitigation measures for impacts. The FWCA provides assistance to federal and state agencies for protecting and increasing the supply of game and fur-bearing animals, as well as to study the effects of pollution on wildlife. The Act authorizes the preparation of plans to protect wildlife resources, including wildlife surveys on public lands, and directs the USFWS to use water resources for fish culture stations and fish migration areas, as well as migratory bird resting and nesting areas, and requires consultation between federal agencies and the USFWS prior to the construction of any new dams.

Amendments (later codified as Section 10) require consultation with the USFWS and the fish and wildlife agencies of states where any body of water is controlled or modified by any federal agency, in order to prevent loss and damage of wildlife resources. Other amendments added provisions to require equal consideration and coordination of wildlife conservation with other water resources development programs, and authorized the Secretary of Interior to establish and maintain public fishing areas and to provide a mechanism to accept donations of lands and funds.

2.1.2 Sikes Act, as amended, Public Law 86-797, 16 USC 670(a) – (o).

The Sikes Act authorizes the Secretary of Defense to develop cooperative plans for conservation and rehabilitation programs on military reservations and to establish outdoor recreation facilities.

This act requires each military department to:

1. ensure that services are provided for management of fish and wildlife resources on each installation,
2. provide their personnel with professional training in fish and wildlife management, and
3. give priority to contracting work with federal and state agencies responsible for conservation or management of fish and wildlife.

The most important aspect of the Sikes Act is the requirement for preparation of a fish and wildlife management plan to be executed in accordance with a cooperative management agreement mutually decided upon by the Secretary of Defense, Secretary of the Interior, and the state agency designated by each host state[2]. Without the cooperative management agreement, neither fishing nor the collection of fees from permit issuance is legal. Once this INRMP is signed as final, this chapter of the INRMP will satisfy this requirement.

Section 670 requires the Secretary of the Interior and the Secretary of Agriculture, in cooperation with state agencies and in accordance with comprehensive plans, to plan, develop, maintain and coordinate programs for conservation and rehabilitation of wildlife, fish and game under their jurisdiction. With approval, the Secretary of the Interior can also implement programs on Department of Energy or NASA lands. Programs shall include, but not be limited to, specific habitat improvement projects and related activities and adequate protection for species of fish, wildlife and plants considered threatened or endangered.

The Secretaries of the Interior and Agriculture are also directed to prescribe regulations, consistent with applicable comprehensive plans and cooperative agreements, to control and/or limit the public use of public land for hunting, trapping, or fishing which is the subject of any conservation and rehabilitation program implemented under the Sikes Act.

2.1.3 Fish Conservation Act; Public Law 89-04, 16 USC 757

The Act was adopted to conserve, develop, and enhance the fish resources of the U.S. that are subject to depletion from water resources development and other causes, or with respect to which the U.S. has made conservation commitments by international agreements. This Act authorizes the Secretary of the Interior to enter into agreements with states and other non-federal interests to conserve, develop and enhance fish resources.

2.1.4 Magnuson-Stevens Fishery Conservation and Management Act, as amended; Public Law 94-265, 16 USC 1801-1882

This Act requires that federal agencies consult with NOAA Fisheries on all real or proposed actions authorized, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). Per OPNAVINST 5090.1C (2011), temporary or minimal impacts are not considered to "adversely affect" EFH. "Temporary impacts" are those that are limited in duration and that allow the particular environment to recover without measurable impact. "Minimal impacts" are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.

[2] The required plan is discussed in paragraph VII-7.1. In addition, there is:

1) A Memorandum of Understanding, dated 19 December 1990, between DoN and the National Fish and Wildlife Foundation (NFWF) wherein the Foundation agrees to assist DoN in carrying out conservation and enhancement of fish; and
2) The Chesapeake Bay Agreement, dated 20 April 1990, between DoD and the Environmental Protection Agency (EPA) that establishes a policy of coordination and cooperation consistent with the goals, objectives, and commitments of the 1987 Chesapeake Bay Agreement, which aimed at attaining and maintaining adequate water quality to support the living resources of the Chesapeake Bay. The Chesapeake Bay Agreement was updated and renewed in 2000. The Chesapeake Bay Watershed Agreement was signed in 2014 and amended in 2020.

NOAA Fisheries must, in turn, provide recommendations such as measures for impact avoidance, minimization, or mitigation to conserve EFH. Regulations for implementing EFH coordination and the consultation provisions of the Magnuson-Stevens Act are codified at 50 CFR 600.905 - 930.

In 2006, the Act was re-named the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (P.L. 109-479). This Act has seven stated purpose goals.

1. Take immediate action to conserve and manage the fishery resources found off the coasts of the United States, and the species and Continental Shelf fishery resources of the United States, by exercising (A) sovereign rights for the purposes of exploring, exploiting, conserving, and managing all fish within the exclusive economic zone established by Presidential Proclamation 5030, dated March 10, 1983; and (B) exclusive fishery management authority beyond the exclusive economic zone over such species and Continental Shelf fishery resources, and fishery resources in the special areas.
2. Support and encourage the implementation and enforcement of international fishery agreements for the conservation and management of highly migratory species, and encourage the negotiation and implementation of additional such agreements as necessary.
3. Promote domestic commercial and recreational fishing under sound conservation and management principles, including the promotion of catch and release programs in recreational fishing.
4. Provide for the preparation and implementation, in accordance with national standards, of fishery management plans which will achieve and maintain, on a continuing basis, the optimum yield from each fishery.
5. Establish Regional Fishery Management Councils to exercise sound judgment in the stewardship of fishery resources through the preparation, monitoring, and revision of such plans under circumstances (A) which will enable the states, the fishing industry, consumer and environmental organizations, and other interested persons to participate in, and advise on, the establishment and administration of such plans; and (B) which take into account the social and economic needs of the states.
6. Encourage the development by the United States fishing industry of fisheries which are currently underutilized or not utilized by United States fishermen, including bottom fish off Alaska, and to that end, to ensure that optimum yield determinations promote such development in a non-wasteful manner.
7. Promote the protection of essential fish habitat in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat.

In December 2008, the NOAA Fisheries Service announced a plan to create a national saltwater angler registry of all marine recreational fishermen in order to help the nation better protect our shared marine resources. The improved quality of recreational fishing data achieved through this

registry would help demonstrate the economic value of saltwater recreational fishing and provide a more complete picture of how recreational fishing is affecting fish stocks. This kind of information is essential to NOAA's goal to end overfishing as required under the Magnuson-Stevens Fishery Conservation and Management Act. With a few exceptions, all recreational anglers who fish in federal waters would be required to participate.

The registry is the product of a major recommendation to NOAA in a 2006 independent scientific review by the National Research Council of the National Academy of Sciences (NRC-NAS). NRC-NAS found that NOAA needed a comprehensive list of everyone who fishes recreationally in marine waters to improve surveys of saltwater anglers used to help manage and rebuild fish stocks. The NRC-NAS recommendation became law in 2007 with the reauthorization of the Magnuson-Stevens Act, the primary federal law that enables NOAA to manage ocean fish stocks. The final rule requires anglers and spearfishers who fish recreationally in federal ocean waters to be included in the national saltwater angler registry (although exempting anglers that were licensed in states such as Maryland that have a system to provide complete information on their saltwater anglers to the national registry). The final rule is posted on the Marine Recreational Information Program website: www.countmyfish.noaa.gov.

2.1.5 Fish and Wildlife Conservation Act; Public Law 96-366, 16 USC 2901 *et seq.*

This Act, more commonly known as the Nongame Act, encourages states to develop conservation plans for nongame fish and wildlife of ecological, educational, aesthetic, cultural, recreational, economic or scientific value. The states may be reimbursed for a percentage of the costs of developing, revising or implementing conservation plans approved by the Secretary of the Interior. Amendments adopted in 1988 and 1989 also direct the Secretary to undertake certain activities to research and conserve migratory nongame birds.

2.1.6 Recreational Fisheries, EO 12962

This Executive Order mandates that federal agencies, to the extent permitted by law and where practicable, improve the quality, function, and sustainable productivity and distribution of U.S. aquatic resources for increased recreational fishing opportunities. It was amended by Executive Order 13474 in 2008.

2.1.7 Chesapeake Bay Protection and Restoration, EO 13508

This Executive Order recognizes the Chesapeake Bay as a national treasure and calls on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed. Instructions related to fisheries management include the expansion of public access, implementation of monitoring and decision support for ecosystem management, and the protection and restoration of the living resources of the Chesapeake Bay.

2.1.8 DODDIR 4700.4, Natural Resources Management Program

This directive establishes an integrated program for multiple-use management of natural resources on property under DoD control. In terms of fish and wildlife management, it calls upon installations to: (1) conserve resources for the benefit of the public after proper safety and security measures have been taken; (2) protect threatened and endangered species (TES) and their habitats; and, (3) establish a permit structure in addition to that required by the state.

2.1.9 OPNAVINST 5090.1 (series), Environmental Readiness Program Manual

This instruction provides a manual that identifies key regulations and Navy policy concerning environmental and natural resources. In terms of fisheries, it requires that a fish and wildlife program be conducted under a cooperative fish and wildlife management plan in accordance with the Sikes Act and other pertinent regulations. It further directs that any associated fees be used for funding, supplementing or augmenting the funding of that program.

2.1.10 NAVFAC MO-100.3, Fish and Wildlife Management

This Manual of Operation provides tri-service (Army, Navy and Air Force) technical guidance in fish and wildlife management practices. It is comprehensive in approach and application.

2.1.11 NASPAXRIVINST 11015.7; Fishing, Shellfishing, and Crabbing Regulations

This instruction identifies (1) authorized fishing personnel and areas; (2) license and permit requirements; (3) regulations concerning creel, size limits, seasons, and harvesting tools; and (4) violation actions governing fishing, shellfishing, and crabbing on PAX, WOLF, and NRC SOL. This instruction is subject to yearly updates and should be consulted prior to participation in the fishing program. The latest update to this Instruction as applied to the Station is March 2, 2007.

Table VII-1. Fisheries Activity License and Permit Requirements (By Age Class)

Activity	12-15 Years[1] (inclusive)	16-65 Years	Older than 65 Years
Saltwater Fishing	Station permit (no charge)	CBFL[2,3] and Station permit	CSRFL[4] and Station permit
Freshwater Fishing	Station permit (no charge)	MFFL[5] and Station permit	CSRFL and Station permit
Crabbing[6]	Station permit (no charge)	Station permit	Station permit
Shellfishing[6]	Station permit (no charge)	Station permit	Station permit

[1]No saltwater or freshwater state license is required for children under 12
[2]Chesapeake Bay Sport Fishing License
[3]Commercial fishing licenses are acceptable in lieu of CBFLs
[4]Consolidated Senior Resident Sport Fishing License
[5]Maryland State Freshwater Sport Fishing License
[6]No state license is required for crabbing or shellfishing

2.1.11.1 Recreational Fishing Access Policy

The recreational fishing access policy is articulated in Instruction 11015.7, dated March 2, 2007. For PAX and WOLF, access to fishing in freshwater is restricted to:

1. Active duty military personnel with DD Form 2
2. Dependents of active duty military personnel with DD Form 1173
3. Retired military personnel with Form 2
4. Dependents of retired military personnel with DD Form 1173
5. Reservists with appropriate ID card with DD Form 2

6. Active federal civil service employees assigned to PAX or WOLF with NAS ID badge or USCSC Optional Form 55
7. Dependents of civilian personnel assigned to PAX, WOLF or with USCSC Optional Form 55 (sponsor must obtain permit)
8. Retired civil service personnel with valid Officer's Club or Civilian Recreation Association (CRA) ID badge
9. Long-term contractors with a Common Access Card (CAC) picture ID badge (may fish and/or crab only in tidal waters of the Station; due to limited fisheries resource, contractors may not fish in freshwater areas or harvest shellfish)
10. Dependents of long-term contractors authorized above may fish or crab only in tidal waters on the Station.
11. Maryland Department of Natural Resources (DNR) Police with DNR uniform or DNR badge and USFWS special agents with badge and credentials
12. On WOLF, all personnel with a valid NAS badge and NAS fishing permit are authorized to fish, shellfish and crab within WOLF.
13. Guest Policy. Active duty military, retired military, civil service employees of PAX or WOLF, or civil service employees that retired from either PAX or WOLF may sponsor a guest or guests. Persons authorized to fish at NRC SOL may sponsor a guest(s). A sponsor must accompany their guest(s) at all times and shall assume responsibility for their actions. Guests may not shellfish. Daily guest permits are valid for 24 hours from the time of purchase. Guests between the ages of 12 and 15 (inclusive) must also obtain a fishing permit, which will be issued free of charge. Multiple fishing days may be specified on a single daily guest permit; however, the guest will pay the daily fee for each date specified. A guest may not purchase more than five (5) seven-day guest permits or fifteen (15) daily permits in a single fishing season.
14. Scouts. Members of official scout units (including leaders) when registered through the NAS Scouting Liaison Officer, may fish or crab without station permits during the duration of their official stay (not to exceed one week). This privilege extends only to Gardiner's Pond (#1), Sewell Pond (#2) and all tidal waters. All state licensing requirements still apply.
15. Exceptions. Exceptions to the limitations described above will be handled on a case-by-case-basis. Requests shall be submitted in writing to the Commanding Officer via the Conservation Branch Director.

2.2 State and Local Governments

Fishing (saltwater and freshwater), crabbing, and shellfishing on the Station are controlled by the Commanding Officer in accordance with all federal and state of Maryland laws and regulations, and by NASPAXRIV Instruction 11015.7. Table VII-1 outlines the license and permit requirements for these activities.

2.3 Other Guidance and Agreements

2.3.1 Cooperative Agreement for Professional and Technical Assistance in Conducting Biological Surveys on Military Lands

The Department of Interior (DoI) put forth a National Biological Survey (NBS) initiative to inventory the national biological resources and establish associated information and activity arms. To facilitate the accomplishment of that effort on military lands, a Memorandum of Agreement has been proposed between DoD and DoI whereby the two departments will work together to conduct a survey. DoI will further provide consultation on methods and protocols for surveying biological resources and maintaining data for long-term management of those resources. To date, no official NBS survey has been performed at PAX or WOLF.

2.3.2 Essential Fish Habitat Consultation Guidance from the Office of Habitat Conservation, NOAA Fisheries

This document, issued in November 1999, describes procedures by which NMFS (now NOAA Fisheries) and other federal agencies can address the essential fish habitat (EFH) coordination/consultation requirements established by the Magnuson-Stevens Fishery Conservation and Management Act and the Department of Commerce's EFH consultation regulations. The guidance facilitates the use of existing environmental review procedures as the primary mechanism for EFH consultations, streamlines the consultative requirements for activities minimally affecting EFH, and establishes a consistent, efficient approach to conducting programmatic and individual consultations.

3.0 Issues and Concerns

The Chesapeake Bay as a whole suffers from overfishing, habitat alteration, and pollution. In addition, climate change analysis predicts the eventual loss of species such as Eelgrass and Soft Shell Clams, as well as harsh summer conditions for Striped Bass and other Bay fish. While not as sharply impacted, its estuaries under Station stewardship do need management to restore, enhance, and then maintain the aquatic environment. This will involve Station participation in scientific and technical meetings, as well as working with other jurisdictions to determine and police licensure, creel limits, size limits, and seasons. It is also necessary to be part of the effort to set specific objectives for water quality and habitat requirements and assist in the implementation of determined best management practices (BMPs).

For the other waters on Station, the issues are actually very similar, but the smaller scale and reduced need for interaction with external agencies makes the execution of BMPs less complicated. Pond pollution issues, for example, may only involve balancing the need for pesticides and aquatic vegetation control with maintaining the diversity of fish species. In both cases, however, the central concerns are to avoid degradation of the existing ecosystem, work toward improving the environment, create an atmosphere that encourages stable biodiversity, and promote harvesting practices that minimize waste while maximizing biological (and possibly economical) return from the resources.

4.0 Program Goals and Objectives

The historic role of fisheries management has been to limit the impact of consumptive use on an aquatic environment so that it is able to sustain life and maintain a natural population capacity on an ongoing basis. The Station has expanded that function to include the following long-term goals for PAX and WOLF:

A. The Station's aquatic ecosystems remain healthy;

B. The Station's aquatic resources support an optimal mix of multiple users and uses; and

C. The Station promotes and maintains partnerships with other groups and agencies involved in fisheries management.

In order to meet these goals, the following objectives are established. Each enumerated objective is followed parenthetically by the applicable supporting objective (by corresponding letters):

1. Standards of environmental quality and habitat protection are applied in a manner consistent with the principles of ecosystem management. (A)

2. Quality recreational fishing opportunities are optimized, compatible with other programs. (B)

3. All aquatic threatened and endangered species present on or near PAX and WOLF are protected. (A)

4. Altered or degraded aquatic ecosystems at PAX and WOLF are restored. (A)

5. State and federal agencies and non-governmental organizations are assisted by the Station through collection and sharing of data and participation in interagency cooperative efforts. (A and C)

6. Knowledge of non-game aquatic species at PAX and WOLF, such as non-sport fish and invertebrates, is improved. (A)

7. Plan for the expansion of public access by identifying new opportunities as well as related safety and national security issues. (B)

It is the Station's intention to implement these objectives in harmony with the state and local host community in a manner that promotes benefit to the resource now and in the future. All objectives should take into consideration the mandates of both EO 13474 and EO 13508.

Each objective listed above can be attained through the use of recommendations that appear throughout the INRMP. The number of the objective(s) supported by each recommendation is parenthetically recorded after that recommendation. General management recommendations (GMRs) and specific management recommendations (SMRs), supporting no particular objective and/or requiring no funding, also occur throughout Chapter 7 and elsewhere in the INRMP. These are identified parenthetically as such.

5.0 Habitat Description

PAX is situated on a peninsula at the mouth of the Patuxent River. Of PAX's 6,781 acres, 977 acres are open water or wetland (Map III-9 in Annex III-B). This acreage is comprised of six freshwater ponds (52 acres); several perennial and intermittent streams; four estuaries (352 acres); two seaplane basins (East and West Patuxent Basins) totaling 83 acres; a partially enclosed sea-wall (Chesapeake Basin) at 48 acres; and numerous saline, freshwater tidal, and nontidal marshes, in addition to forested and scrub/shrub wetlands (totaling 422 acres of marshes/wetlands). There are also six miles of coastal shoreline that are open to fishing.

PAX shares boundaries with two significant aquatic resources – the Chesapeake Bay and the Patuxent River. The Chesapeake Bay, with its associated salt marshes, is the largest estuary in North America and one of the most productive in the world. Its bounty of finfish, shellfish, crabs, and waterfowl is world-renowned. The Patuxent River is one of the rivers initially designated as part of the Maryland State Wild and Scenic Rivers Program. In addition, while no Maryland river is on the National Wild and Scenic Rivers System, Patuxent River is listed in the Nationwide Rivers Inventory as having the significant resource values required for potential inclusion.

There are currently no known federal- or state-listed threatened or endangered fish species on Station property. The Shortnose Sturgeon (*Acipenser brevirostrum*), which has a federal status of endangered and is included on the current Maryland endangered species list, is capable of sustaining populations in the Patuxent River and the Chesapeake. A dead specimen of Atlantic Sturgeon (*Acipenser oxyrhyncus*) has been collected on the beach near Fishing Point (Rambo, 1994). In 2012, NOAA Fisheries issued a final determination to list the Chesapeake Bay Distinct Population Segment (which includes NAS properties) of Atlantic Sturgeon as an endangered species under ESA. In addition, it has a global heritage ranking of G3 (very rare and local throughout its range), and a state heritage rank of S1 (critically imperiled in Maryland because of extreme rarity, with five or fewer occurrences).

Fishing Information Board found throughout NAS PAX. Photograph by Jacqueline Smith.

WOLF is situated on a peninsula at the mouth of the St. Mary's River, which is a tributary of the Potomac River. As with the Patuxent River, the Potomac is a nationally recognized waterway, having been selected as an American Heritage River in the summer of 1998.

Approximately 126 acres of WOLF's total 859 acres are open water or wetland (Map III-11 in Annex III-B). This acreage is comprised of two freshwater ponds (1 acre), several intermittent streams, and four estuaries (10 acres), as well as marshes/wetlands (115 acres that include saline, freshwater tidal, and nontidal marshes; and forested and scrub/shrub wetlands). There are also approximately three miles of coastal shoreline that are open to saltwater fishing.

5.1 Freshwater Ponds

There are six man-made, freshwater ponds located at PAX ranging in size from 1 to 33 acres. Two of these, Gardiner's and Sacawaxhit Ponds, are remnants of a large tidal creek that was dredged and filled for construction of the West Patuxent Basin. In addition to providing valuable wildlife habitat, the man-made ponds provide additional functionality such as stormwater runoff collection and water storage for firefighting.

Over the years, fisheries management of the Station's freshwater ponds has focused primarily on maintaining a self-sustaining sport fishery; specifically, maintaining Largemouth Bass (*Micropterus salmoides*) and Bluegill (*Lepomis macrochirus*) populations. In addition, the Natural Resources (NR) Program has periodically stocked Station ponds with Channel Catfish (*Ictalurus punctatus*) and other game species (NAS, 1990). Stocking practices and other pond management techniques used throughout Station history are further discussed in Section 7.1 of this chapter.

Proper habitat management and enforcement of creel limits eliminates the need for restocking of bass, sunfish, and catfish as these breed naturally in freshwater ponds at NAS, usually providing adequate fishing stock. Periodic monitoring of fish populations through seining or electrofishing can identify "holes" in age classes of these species due to spawning failure in certain years or excessive age-specific mortality. If severe enough, these age-class gaps can be filled with supplemental stockings as necessary (Obj. 2) (GMR VII.1). A copy of the PAX Freshwater Fish Sampling Plan is included as Annex VII-C.

Golden Shiners (*Notemigonus crysoleucas*) have been inadvertently introduced in several ponds (most notably Gardiner's, and Sewall Ponds) by fishermen illegally using them as live baitfish, despite NAS regulations prohibiting their use. Live bait shiners occasionally escape from the hook and survive, while some fishermen undoubtedly release live, unused shiners into the ponds. When the population of shiners reaches an excessive level, their numbers will probably have to be controlled, similarly to crappie. In the interest of simplicity and balance, the NAS freshwater recreational fishery should feature only Largemouth Bass, sunfish, and catfish (Obj. 1) (GMR VII.2).

NR staff periodically lowers the water level of freshwater ponds to reduce the amount of noxious weeds such as Eurasian Watermilfoil (*Myriophyllum spicatum*) and Spatterdock (*Nuphar lutea*) (NAS, 1990). Winter drawdowns expose the roots of these noxious weeds to freezing temperatures and kill them without the risks associated with aquatic herbicide treatments.

During the summer of 2009, Holton Pond was dewatered so that contaminated sediments could be removed from the bottom of the pond in several locations. At that time, Maryland Department of the Environment (MDE) conducted an inspection of the dam and discovered severe piping around the outfall of the dam. Subsequent analysis of soil samples taken from the core of the earthen dam

also revealed the core to be saturated (a condition which could lead to a failure of the dam). These two issues led MDE to declare the dam unsafe and issue a letter to the Installation preventing the pond from being re-built until the dam was replaced.

A cut-through was placed in the Holton Pond dam, allowing water to flow out and prevent any ponding behind the dam. This left only a small channel that flowed through the former 33-acre pond, while the remainder of the bottom of the pond grew up with a lush variety of rushes, sedges and shrubs. During the dewatering process, over 400 fish, mostly Largemouth Bass, were captured and relocated to other ponds on Station. However, a large number of fish were trapped in small shallow pools and quickly succumbed to a lack of oxygen and were preyed upon by Osprey and other raptors.

A new dam was constructed in 2017 and the water level returned to normal. As there is natural reproduction taking place in the pond, no supplemental stocking has been conducted.

Table VII-B-1 in Annex VII-B lists the fish species that have been documented for each Station pond. As mentioned earlier, Richneck Pond is strictly a brood and irrigation pond and fishing is prohibited there.

There are two freshwater ponds at WOLF, totaling 1.2 acres. Largemouth Bass and Bluegill, both stocked in the 1980s, are the only known species in the two ponds.

5.2 Streams

Several streams are located within the Station's boundary. As shown in Maps III-9 and III-11 in Annex III-B, most are associated with one of the aforementioned ponds or estuaries, and several contain beaver ponds.

Stream surveys were officially conducted in 2007 and 2008 at PAX to determine flow regime, but not biota. However, they are known to support fish, including some species that migrate upstream from estuaries to spawn (Beaven, 1994). American Eels (*Anguilla rostrata*), Eastern Mudminnows (*Umbra pygmaea*), Pirate Perch (*Aphredoderus sayanus*), suckers, killifishes, bullheads and sunfish can be found in some of these streams.

Although there are likely no perennial streams originating from WOLF, streams that are believed to be intermittent are associated with the creek areas and the freshwater ponds. These streams have not been officially surveyed to determine flow regime or biota.

The 2007-2008 stream surveys conducted at PAX identified and mapped the occurrence and location of in-stream blockages to fish passage, stream erosion, and sedimentation. Stream surveys were conducted in 2012 at both PAX and WOLF and all natural blockages were removed. However, stream surveys should be repeated for both properties every 5 to 7 years so that any subsequent natural blockages can be addressed (Obj. 1 and 4) (Project VII.1). The North Atlantic Aquatic Connectivity Collaborative has developed protocols to assess both tidal and nontidal stream crossings. This protocol is used across the North Atlantic region.

5.3 Estuaries

The major estuaries within PAX comprise over 352 acres of surface water. A survey performed in 1984 found over a dozen fish species within Harper's and Pearson Creeks, and earlier studies also reported oysters, clams, and crabs in Pearson, Harper's, and Goose Creeks. Catfish, Bluegill, and Largemouth Bass are found in the upper reach of tidal Pine Hill Run, while Common Carp (*Cyprinus carpio*), White Perch (*Morone americana*), and other fish associated with tidal creeks are found in the lower reach.

White Perch. Photo by Ben Springer

The estuaries within WOLF, associated with the St. Mary's River and St. Inigoes Creek, comprise 10 acres of surface water.

A study was performed in September 2013 to determine the species that inhabit these estuaries. A continuation of the 2007 and 2013 surveys was conducted in 2019 (Table VII-2); the 29 fish species that were documented are captured in the Biodiversity Database in Appendix C.

Table VII-2. Fish Species Documented at PAX and WOLF

Common Name	Scientific Name
Alewife	*Alosa pseudoharengus*
American Eel	*Anguilla rostrata*
Atlantic Croaker	*Micropogonias undulatus*
Atlantic Menhaden	*Brevoortia tyrannus*
Atlantic Needlefish	*Strongylura marina*
Atlantic Silverside	*Menidia menidia*
Atlantic Spadefish	*Chaetodipterus faber*
Banded Killifish	*Fundulus diaphanus*
Bay Anchovy	*Anchoa mitchilli*
Black Drum	*Pogonias cromis*

Common Name	Scientific Name
Bluefish	*Pomatomus saltatrix*
Eastern Mosquitofish	*Gambusia holbrooki*
Fourspine Stickleback	*Apeltes quadracus*
Green Goby	*Microgobius thalassinus*
Hickory Shad	*Alosa mediocris*
Hogchoker	*Trinectes maculatus*
Mummichog	*Fundulus heteroclitus*
Naked Goby	*Gobiesoma bosci*
Northern Pipefish	*Syngnathus fuscus*
Northern Snakehead	*Channa argus*
Sheepshead Minnow	*Cyprinodon variegatus*
Skilletfish	*Gobiesox strumosus*
Spot	*Leiostomus xanthurus*
Spotted Seatrout	*Cynoscion nebulosus*
Striped Bass	*Morone saxatilis*
Striped Blenny	*Chasmodes bosquianus*
Striped Killifish	*Fundulus majalis*
Summer Flounder	*Paralichthys dentatus*
White Perch	*Morone americana*

5.4 Major Water Bodies Adjacent to NAS

The Patuxent River, which forms the northern coastline of PAX, flows 110 miles to its confluence with the Chesapeake Bay at Solomon's Island. South of the Patuxent River is the Potomac River, from which the St. Mary's River stems to form the western border of WOLF. Bordering on the eastern side of PAX, the Bay drains a 64,000 square mile basin that contains 48 major rivers, including the Patuxent, Potomac, and St. Mary's Rivers. It ranges from totally freshwater to ocean-level saltwater. The waters of both PAX and WOLF fall in the moderate salinity range (10-18 parts per thousand [ppt]).

This salinity variability permits the Patuxent and St. Mary's Rivers and the Chesapeake Bay to have an abundance and diversity of aquatic plants and marine life. These aquatic plants are discussed in Chapter III of this INRMP; the Biodiversity Database for NAS Patuxent River Complex (Appendix C) lists the commonly encountered species of fish and marine invertebrates as a function of the salinity zones in which they are found in the Chesapeake Bay. Sections 5.4.1 and 5.4.2 of this chapter focus on the fish and shellfish populations at PAX and WOLF.

5.4.1 Fish and Shellfish

The fishes of the Station vary from the small killifish (family Cyprinodontidae) seen along the Bay's shallow shores to the occasional Bull Shark (*Carcharhinus leucas*) (Lippson and Lippson, 1984). With 9 commonly encountered species of shrimp, 23 species of crabs, and 2 crayfish, the Chesapeake Bay has a diverse assemblage of decapods (order Decapoda). Market shrimps also occasionally occur in the Bay. The Pink (*Farfantepenaeus duorarum*), White (*Litopenaeus setiferus*), and Brown shrimps (*F. aztecus*) are periodically harvested, but are not found in

quantities adequate for a sustainable commercial fishery. Other shrimp, including Sand Shrimp (*Crangon septemspinosa*) and grass shrimp (*Palaemonetes* spp.) are widespread, lifelong inhabitants of the estuary. The Blue Crab (*Callinectes sapidus*) is well known for its lump meat. Data on Blue Crab landings are available on the web site of the Maryland Department of Natural Resources[3]. Historically, statewide annual landings have fluctuated from a little above 10 million pounds to just under 60 million pounds. The most recent available data (2014) show a total of just over 25.8 million pounds, including about 24.8 million pounds for the Chesapeake Bay, a decline from the 2008-2012 (just under 45.5 million pounds average).

Four commercially valuable mollusks occur in the Chesapeake Bay. These are the Blue Mussel (*Mytilus edulis*), Soft-shelled Clam (*Mya arenaria*), Hard Clam (*Mercenaria mercenaria*), and Eastern Oyster (*Crassostrea virginica*). The Blue Mussel is generally found only at the mouth of the Bay. The Soft-Shelled clam is widely distributed throughout the Bay and its tributaries because it can tolerate low to very high salinity, various types of sediments, and depths (intertidal and subtidal) to 20 feet. The Hard Clam is found only in areas of high salinity (18-30 ppt) - generally the lower third of the Bay. The harvests of both clams can reach thousands of bushels annually.

The American Oyster is the best known mollusk in the Bay. This oyster grows in clusters, forming dense oyster bars. Oyster bars cover extensive bottom areas throughout the mid- and lower Chesapeake Bay and create a special habitat that supports many other organisms. Because of the Bay's freezing winter temperatures, the American Oyster is subtidal, growing best in waters 8 to 25 feet deep. The most viable and productive oyster bars are in the mid-Bay region, where the salinity is low enough to reduce the oyster's saltwater predators and high enough that the oysters are not vulnerable to the detrimental effects of freshwater exposure.

The Burrowing Crayfish (*Lacunicambarus diogenes*) and Coastal Plain River Crayfish (*Faxonius limosus*) are commonly found in the upper Bay and its tributaries. These species are of no commercial value, but serve as important sources of food for many Bay fauna.

5.4.2 Sport and Commercial Fishing

Two popular sport fishes, the Atlantic Croaker (*Micropogonias undulatus*) and the Spot (*Leiostomus xanthurus*), are relatively abundant in the shallows of the mid- and lower Bay. Throughout the warm months, Summer Flounder (*Paralichthys dentatus*) are caught in the shallow shore waters where the young migrate after the adults spawn in the Atlantic Ocean. Two seatrout - Weakfish (*Cynoscion regalis*) and Spotted Seatrout (*Cynoscion nebulosus*) - are also popular with sport fishermen. They feed on Atlantic Menhaden (*Brevoortia tyrannus*), anchovies and other small fish, and crabs. Seatrout enter the Bay in spring, move into mid-Bay waters, and spawn near the mouth of the Bay.

The sentimental favorite fish in the Chesapeake Bay area is the Striped Bass or Rockfish (*Morone saxatilis*). Harvested abundantly until the 1970s, the population of this species declined dramatically due, at least in part, to pollution, degradation or loss of habitat, and overfishing. Research has shown that in the larval stage, striped bass are highly susceptible to toxins such as

[3] *Maryland's State-wide Blue Crab Landings, https://eyesonthebay.dnr.maryland.gov/fish/mdcomfish/crab/MDComcrab.cfm*

arsenic, copper, cadmium, aluminum, and malathion. In addition, the chlorinating of the effluent from sewage plants and electric power stations adversely affects zooplankton, which is the major food source of Striped Bass hatchlings (USFWS, 1994). Following the implementation of a number of restrictions to counteract this decline, the species has enjoyed a strong recovery (CEC, 1991).

Blue Crab and American Oyster are important commercially, as is the Atlantic Menhaden. The population of this latter species fluctuates widely, with catches up to two billion pounds in one year in the western Atlantic Ocean and the Gulf of Mexico. Population numbers for the Bluefish (*Pomatomus saltatrix*), a sport and commercial fish that is a major predator of the Atlantic Menhaden, also fluctuates widely.

5.5 Status of Associated Species Growth

5.5.1 Submerged Aquatic Vegetation

Submerged Aquatic Vegetation (SAV) is the vascular plant life that lives and grows completely underwater or just up to the water surface. It is found in shallow areas where sufficient light for photosynthesis can penetrate the water. SAV plays an important role in the ecological functioning of the Chesapeake Bay, providing habitat and food for many Bay species, acting as a nursery for many fish and invertebrates, and serving as a nutrient buffer and sediment trap. It fosters the development of an aquatic environment that is low in suspended sediments, dissolved nutrients, and phytoplankton.

The Chesapeake Bay Executive Council reports a precipitous decline of Bay grasses. It is generally believed that this reduction is due to continuing degradation of water quality as a result of increased loading of nutrients (from municipal sewage discharge), fertilizers (associated with agricultural runoff), and shoreline erosion and sediment (associated with runoff and shoreline erosion). The Council has therefore developed and implemented a Submerged Aquatic Vegetation Policy for the Chesapeake Bay and Tidal Tributaries. This policy has been established to restore SAV to its historic levels.

SAV surveys of the three tidal creeks on PAX have been conducted intermittently since 1977. These studies have found Widgeon Grass (*Ruppia maritima*) and Horned Pondweed (*Zannichellia palustris*) in Harper's, Pearson, and Goose Creeks. Results of the more recent studies are entered into the Station GIS so that SAV beds can be geographically monitored.

The current SAV population is adequate and stable, or even growing (Maps VII-3 and VII-4). Modest fluctuations in quantities among the surveys are attributed to turbidity and time of year.

SAV surveys of the estuaries on WOLF have been conducted intermittently since 1995. A two-phase investigation was completed in 1996, when it was discovered that widgeon grass and horned pondweed appeared at different times. Due to the variation in emergence times of the two species found there, future surveys at both PAX and WOLF will also be conducted in two phases when possible.

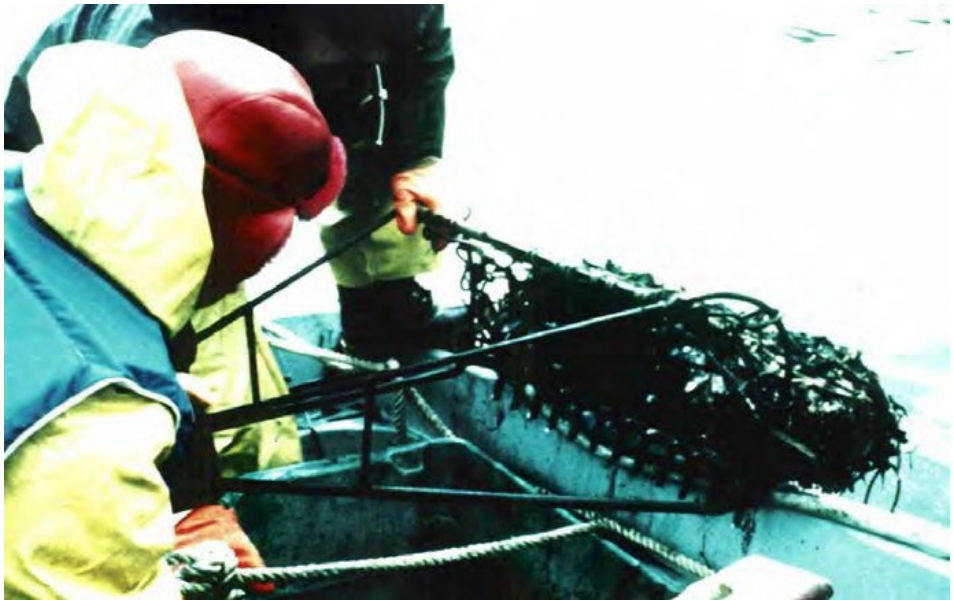
A 1981 fisheries study (FMP, 1981) of the Station reported an overabundance of submerged and emergent vegetation in its manmade freshwater ponds. Although not identified in the study by

species, it is assumed that this refers to aquatic weeds such as Eurasian Watermilfoil and Spatterdock, which are still very common in the ponds. The study further indicated that the shoreline vegetation had hampered fishermen's access to the ponds. It did not address vegetation as a food source or cover.

5.5.2 Oysters

The recent decline in water quality within the Chesapeake Bay has adversely affected the population of oysters, and their reefs, bars and beds present in the estuary. Water quality in the Bay has certainly been negatively impacted by many of the same factors responsible for declines in the oyster fishery. As filter feeders, oysters at historically high population levels were believed to be able to filter the entire volume of Bay water in only a few days. Land use changes and land practices that produce pollution as well as the pollutants themselves certainly have contributed to the overall decline in oyster populations in the Bay.

During the 2003-2005 period, the Maryland oyster harvest was severely impacted by two oyster protozoan parasitic diseases, MSX (*Haplosporidium nelsoni)* and Dermo or Perkinsosis (*Perkinsus marinus*). However, Maryland's oyster harvest rebounded in 2006, with total harvest over 133,000 bushels (as of March 2006), which is a significant increase from the 2003 harvest (55,840 bushels). In 2019-2020, over 270,000 bushels were harvested[4].



Oyster dredging – formerly a bountiful harvest, oyster populations declined in the past few decades but numbers are improving throughout the Chesapeake Bay watershed.

6.0 Existing Resource Uses

Resource usage is often assessed from the perspective of consumptive and non-consumptive purposes. Consumptive fishing, shellfishing, and crabbing deals with the extraction of the resources for personal recreation or sustenance as well as commercial harvesting within fishery

[4] Maryland oyster harvest data at:
https://dnr.maryland.gov/fisheries/Documents/2020_OysterStockAssessmentUpdate.pdf

management guidelines and/or regulations. Non-consumptive fishing, shellfishing, and crabbing is a less definitive or direct use of the resources that can be either a positive or a negative activity, with the latter frequently resulting in degradation to or loss of a species in the area under study.

6.1 Consumptive Use

6.1.1 Finfish

MDNR monitors some commercial and recreational fishery-dependent catches. For example, data was collected pertaining to the limited reopening of the Chesapeake rockfish fishery following the growth of the Chesapeake Bay Striped Bass spawning population and improvements in the species' reproductive success from 1987 to 1989. This effort indicated that the 1990-1991 commercial seasons yielded nearly 125,000 pounds from the Chesapeake Bay; the recreational harvest was over 380,000 pounds (CEC, 1991).

Although there is no current local harvest information categorized to the Station level, Station records do reflect that in the past decade, 1,995-3,160 fishing permits have been issued annually (3,160 in 2019). Recent data in terms of days/hours of use or size of catch is not available[5].

6.1.2 Shellfish

Over the years, the number of PAX shellfishing permits issued ranged from 0 to 82 each year (0 in 1998). Actual data in terms of days of use or size of catch is only available for oystering, although clamming is also popular. PAX conducted informal telephone surveys of oysterers from the 1983-84 season through the 1989-90 season. The total harvests varied from less than 50 bushels a year to over 200, with individual harvests averaging from less than two to somewhat more than three bushels. During the seven years records were maintained by PAX, 147 individuals were surveyed, 252 permits were issued, and more than 700 bushels were harvested. In the years since 1990, no survey has been taken due to the known meagerness of the oyster population (i.e., less than ten bushels harvested). No comparable studies have been performed for WOLF.

Recreational shellfishing at the Station is currently not permitted. Maryland Department of the Environment (MDE) has determined that the water quality in the tidal creeks of the Station are not within the standards set in the National Shellfish Sanitation Program (NSSP) for fecal coliforms and therefore has closed the waters to the harvesting of all shellfish. However, MDE cannot identify the source of the fecal coliforms and the test currently does not distinguish fecal coliforms as either human or wildlife. The shorelines of the tidal creeks have forested buffers, and there has been no land application of digested sewer sludge on the farm fields at PAX since 2003. No commercial harvesting of wild shellfish is allowed on the Station.

6.1.3 Crabs

Crabbing is popular throughout the Station, but no data is maintained to indicate catch sizes or number of days spent engaged in this activity.

[5] A 1969 report (DFS, 1969) shows 9,186 man days of fishing at the Station; a 1977 report (EPR, 1977) indicated that, "During recent years the ponds have been used for approximately 3,500 fishing trips…"

6.2 Non-consumptive Use

Some of the environmentally acceptable non-consumptive activities associated with PAX fisheries include scientific sampling; diving that may be done on the Patuxent River, Chesapeake Bay, St. Inigoes Creek, or St. Mary's River; and "catch and release" fishing as might be done with Largemouth Bass in PAX ponds. To date, there has been no monitoring of these activities. Less sound non-consumptive activities tend to be associated with an individual's going beyond legally established limitations, such as in excessive or improper catch-and-release fishing (which becomes consumptive and disrupts normal population and growth patterns).

Blue Crab (*Callinectes sapidus*). Photo by Jackie Smith.

7.0 Fisheries Management

The purpose of fisheries management is to view aquatic habitats in terms of existing resources and usage against a backdrop of key issues and concerns. This then becomes the basis for establishing strategies that will facilitate meeting ecosystem program goals/objectives in a manner that maximizes biological, economic, and social values. The following sections highlight the history of the fisheries management program at the Station, its interface with the Chesapeake Bay Program, and recommendations concerning the future direction of fisheries management.

7.1 History at PAX

Much of the original fresh, brackish, and estuarine areas at PAX have been filled in, dredged out, or generally reduced in size. Drainage patterns and access to the main bodies of water (the Patuxent River and the Chesapeake Bay) have completely changed (Goodwin, 1975). These modifications occurred in an atmosphere that addressed special concerns (such as mosquito control), rather than fisheries management, ecosystem, or regulatory compliance approaches.

Six small freshwater ponds were constructed at PAX from 1950 to 1975. The first five were developed to provide catch basins for surface runoff and recreational use. The sixth (Richneck Pond) was built to serve as the supply point for the golf course's irrigation system (NAS, 1972). USFWS biologists began providing fisheries management assistance to NAS in 1955. In 1964, the

Station, MDNR, and USFWS entered into an agreement known as the Cooperative Plan for Fish and Wildlife Management. This agreement has been revised (e.g., to ensure compliance with the 1973 Endangered Species Act) but remains in effect today with the same underlying principles. In terms of fisheries, this involves the USFWS furnishing advice/recommendations for improvement of sportfishing on the Station's waters, conducting surveys, and stocking gamefish as appropriate; the MDNR supplying technical assistance as necessary; and the Station providing labor, equipment, and materials for habitat improvement and protection. The agreement has been revised and incorporated as a part of this plan, and USFWS and MDNR signatures are being sought concurrent with approval of this plan.

Over the past 40 years, a number of other fishes have been stocked, including Largemouth Bass; several species of sunfish, including Bluegill, Pumpkinseed (*Lepomis gibbosus*), Redear Sunfish (*L. microlophus*), and Green Sunfish (*L. cyanellus*); several species of catfish, including Blue Catfish (*Ictalurus furcatus*), Channel Catfish (*I. punctatus*), White Catfish (*Ameiurus catus*), Brown Bullhead (*A. nebulosus*) and Black Bullhead (*A. melas*); Walleye (*Sander vitreus*); Black Crappie (*Pomoxis nigromaculatus*); and Golden Shiner (*Notemigonus crysoleucas*). Some fish have been stocked for mosquito control, such as Mosquito Fish (*Gambusia* species). Walleye stocked in Holton Pond in the 1950s and 1960s survived only a few years, as was expected. The Walleye is a fish adapted to the cool waters of deep northern lakes and rivers - not to the warm waters of small impoundments in the coastal plain of Maryland. In addition to stocking, several exotic species have shown up in the Station's waters. Most recently were catches by recreational fishermen of two Red-bellied Pacu (*Piaractus brachypomus*) – a piranha-like fish native to South America and a likely pet release.

The stocking effort has been largely successful, having overcome a number of obstacles, such as loss of fish as a result of oil and pesticide contamination. In addition to stocking, activities such as removal of dead fish, placement and removal of boards in water control structures for water level control, and shoreline/aquatic vegetation control have all been performed as warranted. A considerable anti-mosquito effort (using Dichlorodiphenyl-trichloroethane [DDT]) was undertaken in the late 1950s and early 1960s, and blasting was performed (using dynamite) to channelize streams and enhance drainage in 1967. Testing done in 1989 and 1990 found low levels of polychlorinated biphenyls (PCBs), as well as Dichlorodiphenyl-dichloroethane (DDD) and Dichlorodiphenyl-dichloroethylene (DDE) (by-products from the breakdown of DDT), in fish and sediments from Holton Pond. Further testing was performed in 1995 on fish from Holton Pond, as well as sediment and water from the other five ponds. Traces of DDD and DDE were found in both the fish and the Calvert Pond sediment, and low-level DDT was found in one sediment sample from Sacawaxhit Pond. In all instances, however, the Agency for Toxic Substances and Disease Registry determined that fish in all ponds were safe to eat if consumption was limited. These recommended consumption limits are included in the Station's Fishing Instruction, NASPAXRIVINST 11015.7 (Section 4. d. 1) dated March 2, 2007.

Stocking fish in the ponds at PAX.

Oyster population surveys have been conducted intermittently at PAX since at least 1959. In addition, cooperative agreements with MDNR foster meetings to monitor the status of the PAX shellfish population. As an outgrowth of these meetings, PAX started an Oyster Enhancement Program - by 1966 oyster shells were being placed in Harper's and Pearson Creeks to serve as cultch or spawning beds for other oysters. Three thousand bushels of shells were placed north of the bridge over Harper's and Pearson Creeks in 1987. In 2019, initial surveys were conducted to locate, survey, and evaluate suitable oyster habitat and historic oyster beds. The survey evaluated Pearson Creek, Harper's Creek, and Goose Creek. Also, as mentioned above, SAV surveys of the three tidal creeks on PAX have been conducted intermittently since 1977, and have been used as an indirect measure of water quality.

In the mid-1980s, a three-phased artificial fish reef was installed in the Bay waters near the Officers' Club. Created from fiberglass-reinforced plastic reef units, quarry rock piles, and concrete reef units, this reef spans roughly 1,500 yards. It was one of the first in a series of reefs constructed as part of the Maryland Recreational Fisheries Program to improve recreational fishing in state tidal waters.

The 1987 Chesapeake Bay Agreement committed Bay jurisdictions to the protection and management of natural resources of the Chesapeake Bay. As part of the agreement, a Fisheries Management Workgroup was formed under the aegis of the Chesapeake Bay Program's Living Resources Subcommittee. The Workgroup is composed of representatives of fisheries management agencies from Maryland, Pennsylvania, Virginia, the District of Columbia, and the federal government; the Potomac River Fisheries Commission; the Bay-area academic community; the fishing industry; conservation groups; and interested citizens. This assembly is responsible for developing fisheries management plans with a broad-based view, creating a forum to address problems unique to the Bay, and serving as the basis for implementing regulations. In July of 1994, this agreement was expanded to "managing the Chesapeake Bay watershed as a

cohesive ecosystem" (EPA, 1994). PAX had prepared a fisheries management plan in 1981, but its focus was on the ponds only. Since 1987, the Station has adhered to the Chesapeake Bay Agreement, principally in terms of data sharing and ensuring that their management approach fosters ecosystem management approaches and decisions. The Chesapeake Bay Agreement was renewed again in 2000. The Chesapeake Bay Watershed Agreement was signed in 2014 and amended in 2020. This document identifies goals, outcomes, and management strategies developed with wider stakeholder involvement to achieve watershed restoration.

In its letter to the Secretary of the Navy (Beattie, 1994), USFWS requested the Navy's participation in moving toward an ecosystem approach to fish and wildlife conservation. This approach seeks to conserve the Nation's biodiversity while providing fish- and wildlife-oriented recreation to the populace. The Station has continued its mission in concert with the USFWS under its strengthened dedication.

7.2 History at WOLF

There has been little documentation pertaining to fisheries management practices at WOLF prior to its annexation into the Station in 1995. It is known that WOLF's two small, manmade ponds (Finger and Fishing Ponds) have been maintained for surface water and preserved as surface water filtration, groundwater recharge, and wildlife/vegetative habitat as well as valuable habitat for finfish. In 1981, and again in 1985, each pond was stocked with Largemouth Bass and Bluegill. Both ponds have been open for fishing since 1990. The survival of stocked gamefish in WOLF ponds is unknown; as such, they should be sampled in order to determine species populations (Obj. 2).

In the past, the waters off of WOLF have been noteworthy as a nursery bed for shellfish. Disease and overharvesting as well as drought and pollution from developed areas north of St. Inigoes, have diminished the quality and quantity of these catches in recent years. The State of Maryland conducted a shellfish study of this area in conjunction with the Navy's installation of an artificial oyster reef off WOLF; however, study results were never received by the Station.

Due to elevated bacterial levels found in tidal waters of the St. Mary's River during the 1989-1991 Maryland Water Quality Inventory (further addressed in Chapter 5, Section 7.5), nearly six square miles of shellfish waters are classified as "conditionally approved" and may be closed if rain exceeds one inch in a 24-hour period. A strategy to maintain and improve the present water quality of both the St. Mary's River and St. Inigoes Creek should be developed (GMR VII.3), with the goal of prevention of any polluted runoff that would degrade these "conditionally approved" shellfish waters adjacent to WOLF (Obj. 1, 2 and 5). Any correspondingly negative impact on the quality of the St. Mary's River and St. Inigoes Creek would negatively affect the water quality of both the nearby Potomac River and the Chesapeake Bay.

7.3 Proposed Management and Conservation Measures

Each Naval installation having water areas suitable for fish habitat is responsible for implementing an active program for the conservation, enhancement, and management of fish, and for developing fish and wildlife chapters in its natural resources management plan. All management and

conservations measures should be in accordance with EO 12962 and EO 13508. The following recommendations can be made in an effort to be responsive to this requirement:

- Assess and evaluate the effectiveness of current aquatic resource management practices (Obj. 2-5) (SMR VII.1).
- Seek out new aquatic resource management practices and techniques, such as improving habitats in a manner that is endorsed by the American Fisheries Society, and apply those where appropriate (Obj. 2-5) (SMR VII.2).
- Continue fishing permit fees so that fishermen bear an appropriate proportion of the cost of providing recreational and conservation programs at NAS (Obj. 2) (SMR VII.3).
- Police licensure, creel limits, size limits, and seasons (Obj. 2) (GMR VII.4/SMR VII.4).
- Respect State of Maryland usage guidelines for fishing in order to maintain a quality recreational opportunity (Obj. 2) (SMR VII.5).
- Participate in scientific and technical meetings, working with other jurisdictions (Obj. 5) (SMR VII.6).

While these suggestions are appropriate, a fundamental component of an integrated management plan is to develop an approach to meeting the installation's goals and objectives through site-specific management and conservation measures. The following sections respond to that need.

7.3.1 Monitoring

Continued monitoring would have positive effects on natural resource management at the Station. To accomplish this:

- Continue to work with federal and state agencies to conform to coastal zone programs that monitor water quality and shoreline erosion (Obj. 1-5) (SMR VII.7).
- Revive user surveys of freshwater and saltwater fishermen, crabbers and oystermen in order to calculate user effort and quality of experience. Use survey information to help identify future demand, areas of use, and preferences for various fishing opportunities (Obj. 2) (Project VII.2).
- Continue the fishing surveys to also assist in identifying an acceptable recreational carrying capacity within the missions of NAS and the ecological parameters surrounding fish populations (Obj. 2) (SMR VII.8).
- Include fishing survey data pertaining to the usage rates of fishing piers in any upcoming Leisure Needs Assessments (Obj. 2) (Project VII.3).
- Collect data pertaining to days/hours of consumptive fish and crab resource use as well as catch size (harvest and landing-effort information, localized to the level of PAX or WOLF, is either limited or non-existent) (Obj. 1 and 2) (Project VII.4); and
- Monitor catch-and-release activity (Obj. 1 and 2) (SMR VII.9).

- Incorporate the goals and objectives of EO 13508 (Obj. 1).

7.3.2 Population Management

To promote population management, NAS staff should conduct comprehensive sportfish inventory surveys during the late spring and fall of each year (Obj. 2) (Project VII.5). This inventory should consist of a complete current set of sampling data (e.g., netting, seining and electroshocking). To supplement this information, a current creel census can also be taken. Issues to be addressed include population densities, catches per trip and total number of trips, stocking rates, egg production, and species lengths and weights. In keeping with the ecosystem management approach, a focus of this survey should be determining if an overall balance exists between predator-prey species relationship (e.g., primarily Largemouth Bass to Bluegill). Coordination with USFWS Office of Fishery Assistance in Gloucester, Virginia, or the MDNR fishery staff at Manning Fish Hatchery in Cedarville, Maryland, is encouraged when making this determination. With this knowledge base, aquatic biologists and fisheries management experts could be consulted when planning fishing activities to determine appropriate use and improvements.

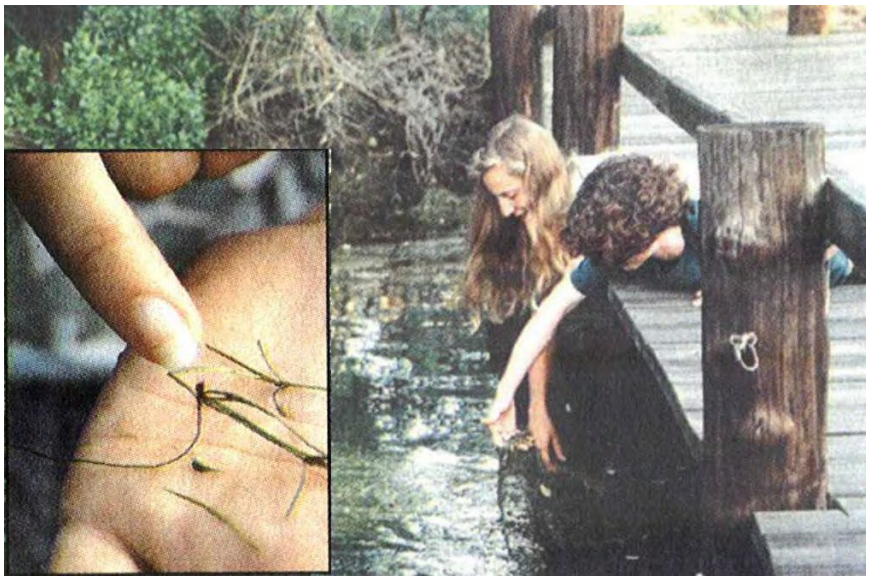
Electrofishing – a common method used by fisheries managers.
Photograph by James Swift.

7.3.3 Habitat management

The Station is committed to working with the Chesapeake Bay Executive Council in their effort to restore the Bay's SAV to its historic levels, especially in light of the fact that SAV species composition, biomass and distribution likely will be significantly impacted by climate change. To this end, the Station should:

- Work with the Council to establish local SAV population goals (Obj. 1 and 5) (SMR VII.10). This will require coordinated interpretation of Baywide aerial surveys and water quality monitoring in terms of dissolved oxygen, pH, and oxidation-reduction potential;
- Conduct SAV surveys for both PAX and WOLF twice each year. Ideally, this should be done during the last week of May and then again in August (Obj. 1) (Project VII.6).
- Continue to share SAV survey data with the USFWS (Obj. 5) (SMR VII.11).

- Minimize shoreline erosion, which can adversely impact water quality, using rip-rap and/or vegetative methods as discussed in Chapter V. Other minimization practices include active participation in Chesapeake Bay habitat restoration programs (Obj. 5) (SMR VII.12).



Submerged Aquatic Vegetation (SAV) at PAX:
Common species include Widgeon Grass (Ruppia maritima) and
Horned Pondweed (Zannichellia palustris).

7.3.4 Management Prescription for Each Habitat Type

7.3.4.1 Freshwater Ponds

Some of the management techniques that should be continued or initiated to manage the PAX and WOLF ponds include:

- Stock fish in PAX freshwater ponds, only as necessary to supplement reproduction (Obj. 2) (Project VII.7).
- Conduct regular periodic monitoring of pond fish populations, using electrofishing or seining, to determine species composition, age class distribution, and forage/game fish ratio for the fishery resource (see the PAX Freshwater Fish Sampling Plan in Annex VII-C). Collect scale samples for age determination and use with length-weight ratios to assess growth rates and overall fish health (Obj. 1, 2 and 4) (Project VII.8).
- Install fish attractors (Obj. 2) (Project VII.9).
- Sample water to determine water chemistry (Obj. 1, 2 and 4) (GMR VII.5).
- Correct any water chemistry problems (Obj. 1, 2 and 4) (GMR VII.6).
- Employ aquatic weed control as required, using winter drawdowns where possible and consistent with other objectives (Obj. 1, 2 and 4) (SMR VII.13)

- Develop a program to educate and notify fishermen about the negative impacts of illegal fish stocking, especially the stocking of fish like Black Crappie and Golden Shiner. In addition, inform them of how the use of non-native live bait can result in similar negative effects (Obj. 1 and 2) (SMR VII.14).

- Survey perennial and intermittent streams at PAX and WOLF, using seining or electrofishing, to determine fish species composition (Obj. 1, 2 and 4) (Project VII.10).

All PAX ponds have been tested for contaminants in the past (see Section 7.1 of this chapter). However, it is not clear whether the contamination found was strictly from former aquatic use of DDT or exacerbated by material washing overland through the watershed. Therefore,

- Collect and analyze sediment and fish tissue samples from Gardiner's, Sewall, Calvert, Sacawaxhit, and Richneck Ponds, as well as Finger and Fishing Ponds at WOLF (Obj. 2) (GMR VII.7).

- If this screening finds contaminants, collect and analyze additional sediment samples, as well as water and fish tissue (Obj. 2) (GMR VII.8).

- Follow this with development and implementation of a plan (perhaps in conjunction with the Environmental Restoration [ER] program) to mitigate any potential health risks (Obj. 2) (GMR VII.9).

7.3.4.2 Streams

Plans concerning the future of the Station's streams must include prevention of sedimentation and erosion stabilization. In addition, consideration should be given to the potential for climate-related stream degradation and temperature increases resulting from intensified rain events and flash-runoff from warmer surfaces. To that end, a goal should be to establish and maintain vegetated streamside buffer areas (Obj. 1 and 4) (GMR VII.10/SMR VII.15).

Other practices should include construction of stormwater management devices or facilities and implementation of stormwater BMPs to mitigate the impacts on streams from untreated stormwater off Station roadways and older construction sites (Obj. 1 and 4) (GMR VII.11).

Barriers to fish passage, such as culverts and dams, that inhibit fish access to upstream spawning areas, should be surveyed and information should be compared to that found in the 1996 impediments report. Known stream blockages should be identified and mapped in GRX (Obj. 1 and 4) (Project VII.11). Any existing structures that serve to block fish passage should be removed or modified to accommodate fish movements (Obj. 1 and 4). This can be done in cooperation with the MDNR, Fisheries Division.

Stream restoration and enhancement projects sponsored or sanctioned by NAS are also an important part of stream management and improvements.

In the early 1990's two new PAX buildings, the Navy Exchange and the Commissary, were built in the Cuddihy watershed. The impervious surface from these buildings and associated parking lots drastically changed the flow of water in one particular tributary of the Cuddihy stream. A

detention basin was built to capture stormwater runoff from this area, but it was inadequate to prevent the stream channel from changing and caused some severe erosion of the stream channel and banks. On one section of stream, the bank erosion was enough to trigger a large slope failure.

This slope failure was contributing an estimated 121 tons of sediment into the Cuddihy each year. In addition to this area there were several other large head-cuts (areas where the stream channels were down-cutting) that contributed sediments to the stream.

The West Cuddihy stream restoration project occurred in two parts. The first was a stormwater retro-fit to control the stormwater runoff at the detention basin and create a steady, even flow of water into the stream. The second was to stop the stream erosion by stabilizing the failed slope and head-cuts. The project was completed in February of 2006 through a cooperative agreement with the Southern Maryland Resource Conservation and Development Board. Total cost for this project was over $230,000.

Two other stream restoration projects have been completed on PAX. The first was at the headwaters of Gardiner's Run (near Gate 2) and was completed in 2020. This stopped an eight- to nine-foot headcut from contributing additional sediment to the stream and prevented the eroding and undermining of Cuddihy Road. A second project, near the headwaters of Pine Hill Run (and also near Gate #2), was completed in 2021. An additional section was completed in 2022. Both were mitigation for wetland impacts caused by construction at another location on the Installation.

Additional projects should be carried out in other streams and watersheds with similar problems. Presently, problems such as these are being avoided by adherence to Maryland's environmental site design (ESD) requirements when designing construction projects and associated stormwater management features.

7.3.4.3 Estuaries

The estuaries of the Station interface with and are influenced by the Patuxent River and Chesapeake Bay at PAX, and the St. Mary's River at WOLF.

- The Station's tidal creeks need management to restore, enhance, and maintain their ecological integrity (Obj. 4 and 5) (SMR VII.16). This creates a need for continued monitoring and precautionary management of these waters.
- To the greatest extent practicable, the Navy should provide state agencies with assistance, such as data collection, and work toward the prevention of water runoff contamination, to ensure ecosystem balance (Obj. 5) (GMR VII.12).
- Plans should be developed to conduct regular, periodic monitoring of estuarine fish populations (using electrofishing or seining) to determine species composition and age-class distribution for the fishery resource (Obj. 1, 2 and 4) (Project VII.12). In addition, fish scale samples should be collected for age determination, and length-weight ratios used to assess growth rates and overall estuarine fish health.

To honor DoD's commitment to assisting with the Chesapeake Bay nutrient reduction plan, nutrient management must remain an essential part of the Station's fisheries program (Obj. 5)

(SMR VII.17). Aquatic vegetation needs nutrients, but heavy nutrient enrichment can lead to eutrophication and ultimately to an imbalance in existing delicate food webs. Waters become clogged with vegetation, leading to the elimination or decline of sensitive species that cannot tolerate the low dissolved oxygen levels that result from decomposition of massive quantities of dead plants, or toxicity due to secretions from certain algal blooms. A balance has to be maintained that enhances SAV, reduces weeds, and preserves the natural blend of fish and other aquatic organisms.

Another principal focus in the estuaries is on shellfish.

- The Station should fully commit to support the Chesapeake Bay Program in its effort to restore the oyster population (Obj. 1, 2, 4 and 5) (SMR VII.18).
- Station staff should promote efforts to cultch the sparse natural oyster beds to encourage increased reproduction (Tomasewski, 1994) (Obj. 1, 2, 4 and 5) (Project VII.13). A cultch of shells, allowed to dry for over a year, would be best.
- After the cultch is established, it can be used as a seed area; that is, relocate shells with young oysters attached to marginal areas (Obj. 1, 2, 4 and 5) (Project VII.14).

Concomitant with this management technique are harvest restrictions allowing collection by hand and prohibiting snorkeling in areas of cultch relocation (GMR VII.13). Wading could be permitted. Other techniques using the precepts in Dugas et. al (1991) could be effectively implemented to improve reproductive rates and recruitment of oysters.

7.3.4.4 Chesapeake Bay, Patuxent River, St. Mary's River, and St. Inigoes Creek

MDNR has expressed a willingness to work with the Navy to improve recreational fishing (Foster, 1994). The Station can develop additional artificial reefs using "clean materials" to encourage fish habitation (Obj. 2) (Project VII.15). To implement this management approach, the Navy would modify some of its scrap materials, such as old radio towers, to rid them of any pollutants (if necessary), and then place them at mutually agreeable, predetermined sites. This is a vastly different endeavor than dumping or selling as scrap; rather, it is an environmental benefit achieved through alternate utilization.

The Chesapeake Bay Program has established strategy teams (Sandberg, 1994), composed of county and municipal representatives and concerned citizens, that attempt to reduce nonpoint source pollutants on all ten Chesapeake Bay tributaries. Maryland's strategy teams incorporate individuals from MDNR, MDE, Maryland Department of Agriculture, and the University of Maryland. Representatives from the Station should serve as NAS points of contact to the Patuxent and Lower Potomac River Tributary Strategy Implementation Teams (Obj. 5) (SMR VII.19). This participation would foster the Navy's partnership approach.

7.3.4.5 Essential Fish Habitat

Habitat degradation and loss and also increasing fishing pressure pose a real threat to the nation's commercial and recreational fisheries. As a result, Congress has reauthorized the Magnuson-Stevens Fishery Conservation and Management Act (detailed in Section 2.1.4 of this chapter)

which requires that fish habitat be given strong consideration when making resource management decisions.

Essential fish habitat (EFH) is defined as those waters and/or substrate used by fish for the purpose(s) of spawning, breeding, feeding and/or growing. It is designated and described by Regional Fishery Management Councils and NOAA Fisheries on a species-specific level.

In essence, EFH incorporates all creeks/waterways located on or adjacent to (and/or impacted by) PAX and WOLF. In the event that a project may adversely impact EFH, the project planner(s) should review the Essential Fish Habitat Consultation Guidance referenced in Section 2.3.2 of this chapter (GMR VII. 14). Adverse impacts may result from dredging, filling or other activities that alter aquatic habitat. Generally, if regulatory permits are required for implementation of a Navy project that also requires a Corps of Engineers permit, EFH issues will be resolved through the Corps permit process (if applicable).

8.0 Additional Research Needs

Some of the specific research needed to meet/implement the long-term fisheries management objectives include:

- Introduce appropriate monitoring programs necessary for collecting stock assessment data (Obj. 2) (SMR VII.20).
- Collect biological information from recreational fishermen on the distribution, size, age, and sex composition of their catches. Share local data with MDNR for use in calculating total Baywide landings (Obj. 2 and 5) (Project VII.16).
- Begin user surveys of NAS saltwater fishermen and crabbers to calculate effort and quality of experience (Obj. 2) (Project VII.17).
- Calculate catch-per-unit effort using biological data and user surveys (Obj. 2) (Project VII.18).
- Determine fish mortality rates for use in setting creel limits (Obj. 2) (Project VII.19).
- Determine economic characterizations of each major component of the Station fishery (SMR VII.21).
- Determine optimum fish size limits for harvesting in order to achieve population objectives (Obj. 2) (SMR VII.22).
- Continue specific surveys for aquatic threatened and endangered species and maintain this data in GRX (Obj. 3) (Project VII.20).
- Conduct annual monitoring surveys to assess the status of known aquatic threatened and endangered species (Obj. 3) (Project VII.21).
- Develop and implement recovery plans for aquatic threatened and endangered species (Obj. 3) (Project VII.22).

- Conduct periodic monitoring surveys to determine population trends of non-game aquatic species (Obj. 6) (Project VII.23).

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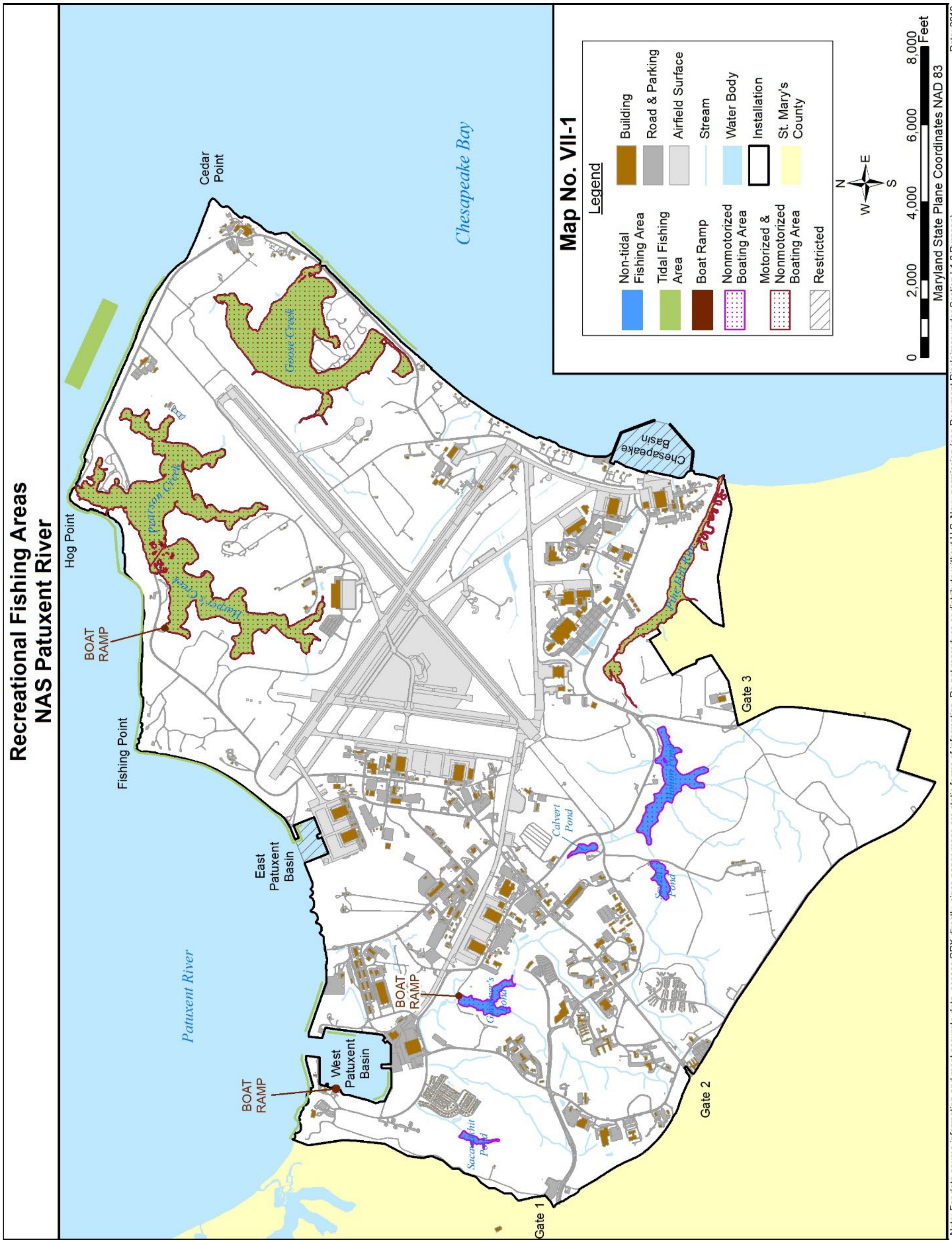
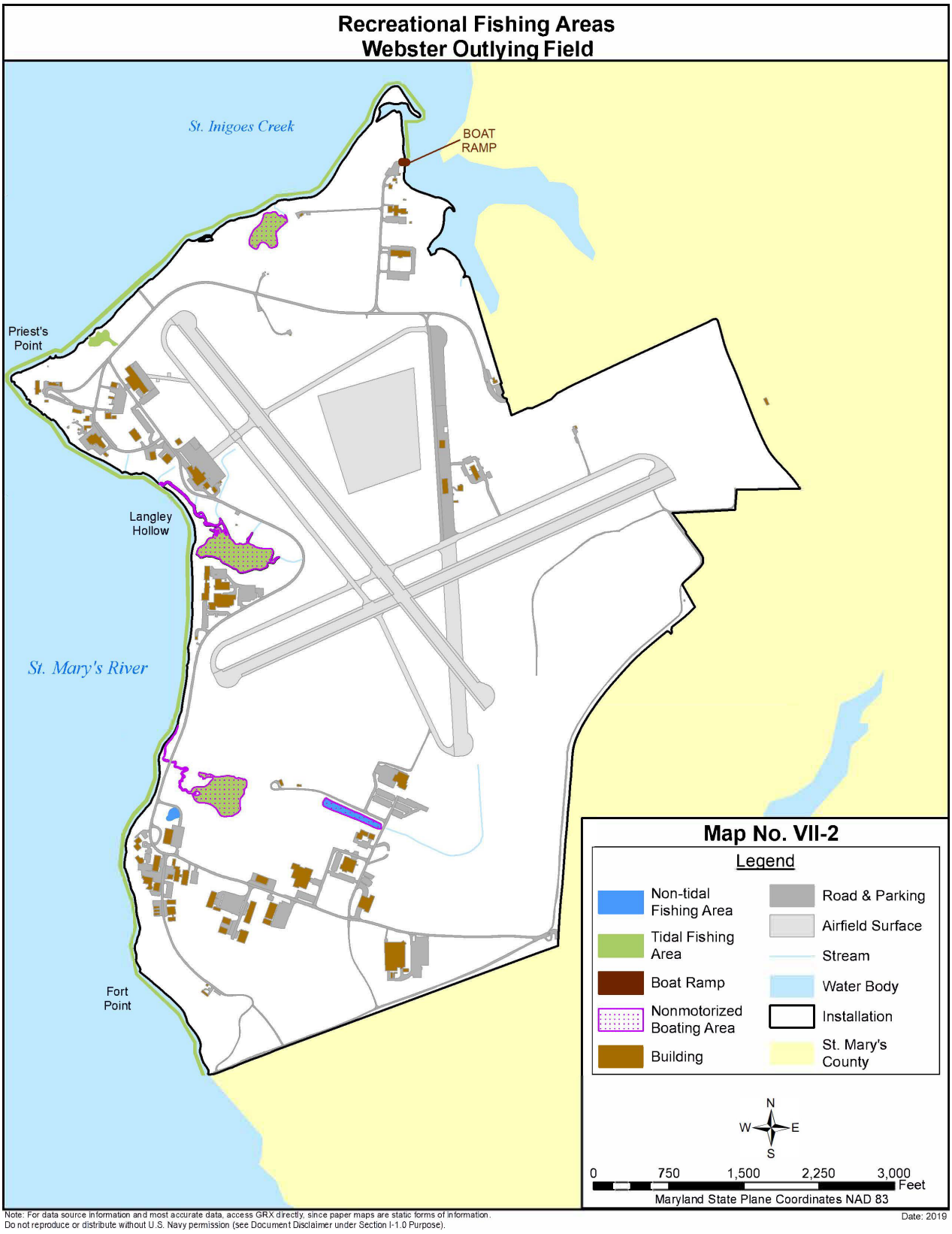
ANNEX VII-A

MAPS


Recreational Fishing Areas
NAS Patuxent River
Map No. VII-1
Legend
Non-tidal Fishing Area
Tidal Fishing Area
Boat Ramp
Nonmotorized Boating Area
Motorized & Nonmotorized Boating Area
Restricted
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Cedar Point
Hog Point
Fishing Point
BOAT RAMP
East Patuxent Basin
Patuxent River
West Patuxent Basin
BOAT RAMP
BOAT RAMP
Goose Creek
Pearson Creek
Harper's Creek
Chesapeake Basin
Pine Hill Run
Calvert Pond
Gate 1
Gate 2
Gate 3



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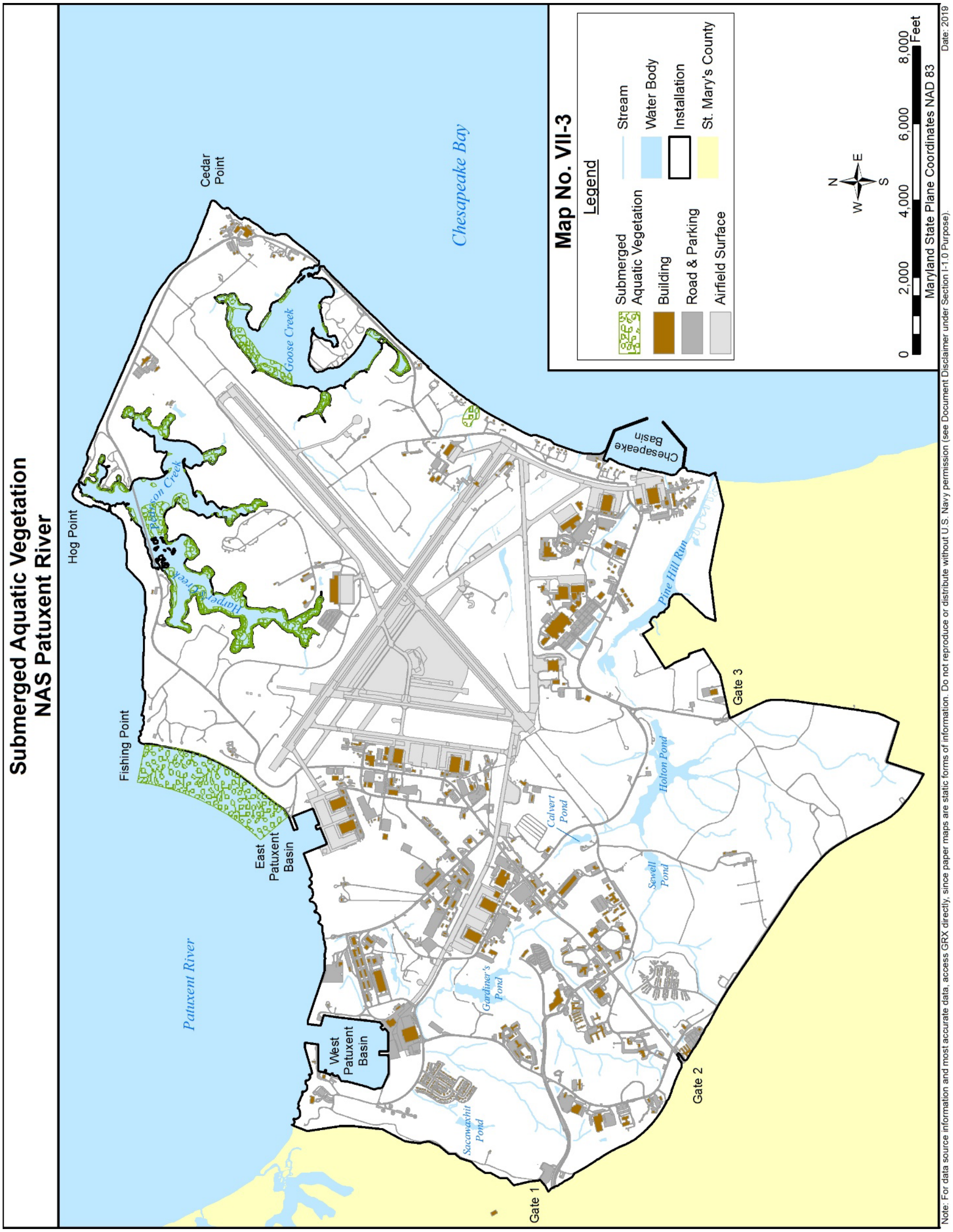
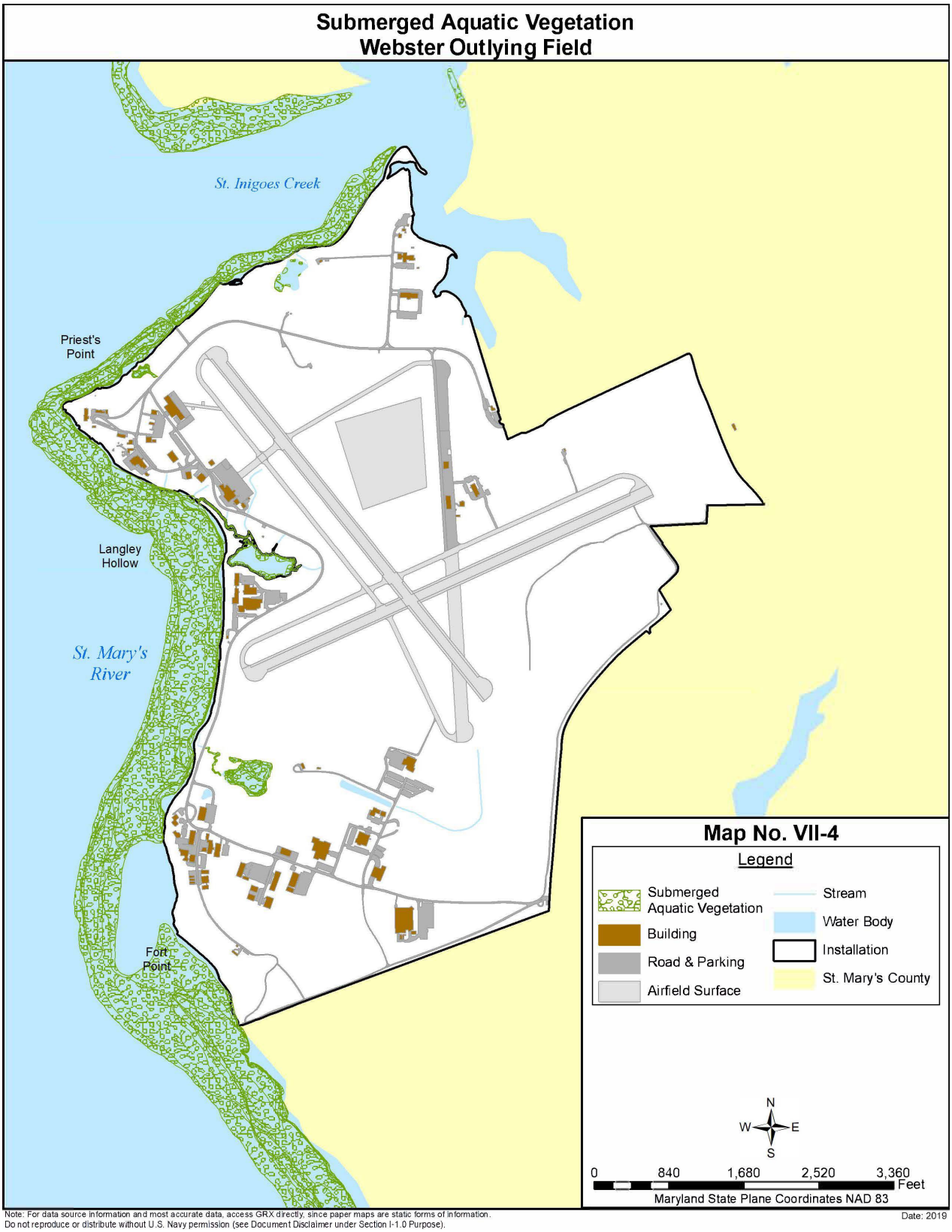

Submerged Aquatic Vegetation
NAS Patuxent River
Map No. VII-3
Legend
Submerged Aquatic Vegetation
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0 2,000 4,000 6,000 8,000 Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Harper's Creek
Pine Hill Run
Holton Pond
Calvert Pond
Sewell Pond
Gardiner's Pond
Sacawaxhit Pond
Gate 1
Gate 2
Gate 3


Submerged Aquatic Vegetation
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. VII-4
Legend
Submerged Aquatic Vegetation
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0
840
1,680
2,520
3,360
Feet
Maryland State Plane Coordinates NAD 83
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.
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Date: 2019

ANNEX VII-B

TABLE

Table VII-B-1. Fish Species List for NAS Freshwater Ponds.	
COMMON NAME	**SCIENTIFIC NAME**
Gardiner's Pond	
Golden Shiner	*Notemigonus crysoleucas*
Redear Sunfish	*Lepomis microlophus*
Bluegill	*Lepomis macrochirus*
American Eel	*Anguilla rostrata*
Largemouth Bass	*Micropterus salmoides*
Pumpkinseed	*Lepomis gibbosus*
Brown Bullhead	*Ameiurus nebulosus*
Channel Catfish*	*Ictalurus punctatus*
Sewall Pond	
Bluegill	*Lepomis macrochirus*
Largemouth Bass	*Micropterus salmoides*
Brown Bullhead	*Ameiurus nebulosus*
Black Bullhead	*Ameiurus melas*
Redear Sunfish	*Lepomis microlophus*
Pumpkinseed	*Lepomis gibbosus*
Golden Shiner	*Notemigonus crysoleucas*
American Eel	*Anguilla rostrata*
Channel Catfish*	*Ictalurus punctatus*
Northern Snakehead**	*Channa argus*
Holton Pond	
Redear Sunfish	*Lepomis microlophus*
Bluegill	*Lepomis macrochirus*
Largemouth Bass	*Micropterus salmoides*
Black Bullhead	*Ameiurus melas*
Golden Shiner	*Notemigonus crysoleucas*
Channel Catfish*	*Ictalurus punctatus*
Blue Catfish*	*Ictalurus furcatus*
American Eel	*Anguilla rostrata*
Green Sunfish	*Lepomis cyanellus*
Pumpkinseed	*Lepomis gibbosus*
Black Crappie	*Pomoxis nigromaculatus*
Northern Snakehead**	*Channa argus*
Calvert Pond	
Redear Sunfish	*Lepomis microlophus*
Bluegill	*Lepomis macrochirus*
Largemouth Bass	*Micropterus salmoides*
Black Bullhead	*Ameiurus melas*
Golden Shiner	*Notemigonus crysoleucas*
Channel Catfish*	*Ictalurus punctatus*
Northern Snakehead**	*Channa argus*

Table VII-B-1. Fish Species List for NAS Freshwater Ponds.	
COMMON NAME	**SCIENTIFIC NAME**
Sacawaxhit Pond	
Bluegill	*Lepomis macrochirus*
Largemouth Bass	*Micropterus salmoides*
Pumpkinseed	*Lepomis gibbosus*
Channel Catfish*	*Ictalurus punctatus*
Richneck Pond	
Largemouth Bass	*Micropterus salmoides*
Bluegill	*Lepomis macrochirus*
Golden Shiner	*Notemigonus crysoleucas*
Redear Sunfish	*Lepomis microlophus*
Pumpkinseed	*Lepomis gibbosus*
Finger Pond (WOLF)	
Bluegill†	*Lepomis macrochirus*
Largemouth Bass†	*Micropterus salmoides*
Fishing Pond (WOLF)	
Bluegill†	*Lepomis macrochirus*
Largemouth Bass†	*Micropterus salmoides*
*Stocked, not reproducing †Stocked, production unknown Based on actual sightings of Kyle Rambo, Natural Resources Branch Manager, 1994 **Confirmed in Calvert and Holton Ponds; presumed occurrence in Sewell Pond due to hydrologic connection to Holton Pond	

ANNEX VII-C

NAVAL AIR STATION PATUXENT RIVER FRESHWATER FISH SAMPLING PLAN

Naval Air Station Patuxent River
Freshwater Fish Sampling Plan
April 02, 2012

Purpose:

The purposes of sampling the freshwater fishing ponds at NAS Patuxent River are to: 1) implement management techniques that provide a quality recreational fishing opportunity for Station personnel, 2) determine the occurrence (if any) and abundance of exotic species, and 3) determine the occurrence of any rare, threatened, or endangered species in Station ponds.

Sample Sites:

There are six man-made ponds located throughout the Station: of these, recreational fishing is permitted on five. The total acreage available to fishing is 54 acres. Streams feed five of the Station's ponds, while one (Richneck Pond – formerly Pond 6) is fed by groundwater. Gardiner's Pond (formerly Pond 1) comprises 10 acres, and is located between Hangars 305 and 301. There is a public boat ramp located near the spillway, and a boyscout camping area along one side of the pond. Sewell Pond (formerly Pond 2) is six acres in size and borders Priester Road and the Mattapany Day Camp. Holton Pond (formerly Pond 3) is 33 acres in size and is located along Tate Road, behind the Mattapany Rod and Gun Club, and has a boat ramp available to the public. Holton Pond was drained in 2009 as part of an environmental restoration project. The dam was inspected as part of the project and determined to be unsafe and is not allowed to be filled until the dam is replaced. Calvert Pond (formerly Pond 4) constitutes 2.5 acres located at the intersection of Tate and Buse Roads. The liquid oxygen storage plant is located near the bank of this pond. Sacawaxhit Pond (formerly Pond 5) is 2.5 acres in size and is located near the Conrad Heights housing area. Richneck Pond comprises one acre and is located next to the Station golf course. It is primarily used for irrigation, but has also been utilized as a brood pond for Largemouth Bass. Fishing is not allowed in Richneck Pond.

Methods:

Each pond will be sampled biennially, and always during the same season (e.g., Calvert Pond might only be sampled in the spring or Gardiner's Pond might only be sampled in the fall). Largemouth Bass begin spawning in the spring, when water temperatures reach 16-18 degrees Celsius (typically mid-April through June). To minimize the disturbance to fish during the spawning season, sampling should be completed by the middle of April, or before the water temperature reaches 16 degrees Celsius. If sampling cannot be completed prior to this time, it should be postponed until fall. In addition, sampling will not be conducted in the rain due to decreased visibility of stunned fish.

Sampling of Station ponds will be conducted using a boat-mounted electro-shocking unit (2.5GPP), purchased through Smith-Root, Inc. A minimum of three people will be needed to conduct the sampling - one person to operate the boat, generator and control box, and two people to net fish and record data. During the first 100 seconds of actual sampling time, only Largemouth Bass will be collected. This will allow for calculation of Catch Per Unit Effort (CPUE) while

analyzing data. After the first 100 seconds of sampling, all fish will then be collected. Once sampling is complete, all fish collected will be identified, weighed, and measured. If the fish holding tanks become too full, time will be taken from sampling to process the fish collected before proceeding. Once fish are processed they will be returned to the pond promptly to avoid additional stress and reduce mortality.

NOTE:

Fish are able to sense an electric field and avoid an area without being stunned; thus, to collect the best representative sample, the electrical current should be turned on and off at irregular intervals. Electrical current should be set at a voltage that allows for no more than two amps of electricity. More than two amps are enough to kill a fish and anything much less than two amps are not enough to stun fish.

Equipment:

- Electro-shocking boat
- Outboard motor with gas
- Oars
- Generator
- Control box
- 4 nets
- Holding tank
- Scale
- Measuring tape
- Rubber gloves
- Sunglasses (optional, but recommended)
- Data sheets and clipboard with pencils
- Fish identification key
- Life jackets

Analysis:

Recording the species, length, and weight of each fish netted allows for a number of different indices to be calculated. For this sampling effort the concentration is on Catch Per Unit Effort (CPUE) and Proportional Stock Density (PSD). Other calculations can also be made from the data as needed; however, CPUE and PSD will provide the information needed to maintain a quality fisheries management program. Calculating CPUE consists of dividing the number of fish caught by a given unit of time.

For electro-shocking, CPUE is calculated by dividing the number of fish by the number of seconds sampled. It is assumed that the number of fish caught during a certain time interval is proportional to the total number of fish present at the beginning of the interval (Kohler and Hubert, 1993). Thus, fluctuations in CPUE can indicate changes in population size. If the need arises, CPUE, through linear regression, can also be used to estimate the original size of the population.

Proportional Stock Density measures the proportion of fish of quality size in a stock. The PSD is expressed as a percentage and is calculated as:

$$PSD = \frac{\text{Number} > \text{minimum quality length}}{\text{Number} > \text{minimum stock length}} \times 100$$

The quality and stock lengths for several popular species of game fish are listed in table 15.1 of Fisheries Techniques (Nielsen and Johnson, 1983). If the PSD is calculated for both predator and

prey, they can be compared in a Tic-tac-toe chart that will give a quick interpretation of the predator/prey relationship for the pond being sampled. An example of this chart can be found in figure 6.4 of Inland Fisheries Management in North America (Kohler and Hubert, 1993). A PSD of 40-70 for Largemouth Bass and 20-40 for Bluegill are indicative of a balanced population.

In addition to calculating CPUE and PSD for game fish, this sampling can help with the detection and/or monitoring of exotic and rare, threatened, and endangered species. The presence of one or more exotic species can degrade the native community of plants and animals. Thus, monitoring the presence and/or abundance of exotic species and implementing techniques to manage them are important to maintaining the balance of the pond ecosystem.

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 8

Wildlife Management

Table of Contents

VIII WILDLIFE MANAGEMENT

1.0 Introduction

The Naval Air Station Patuxent River Complex occupies a strategic position on Maryland's Western Shore for populations of both resident and migratory wildlife. NAS, for purposes of this Wildlife Management chapter, is made up of the 6,781-acre PAX facility, situated on a narrow Coastal Plain peninsula between the Chesapeake Bay and Patuxent River and the 859-acre Webster Outlying Field (WOLF), which is situated along the eastern shore of the St. Mary's River. The 50-acre Grayson property, located just east of WOLF, is also included. Wildlife management at NRC SOL and BIR is described in separate INRMP documents.

The Station supports a wide array of habitats which, together with their important geographic positions, support and produce abundant, diverse, and valuable natural resources. Promoting the best stewardship possible while implementing the intended mission of the Station, with no net loss of mission capability is challenging.

This chapter of the INRMP addresses a wide range of issues, some complimentary, some contradictory. The intent is to achieve a stewardship program for the conservation and rehabilitation of natural resources that highlights biodiversity and resource use, while providing best guidance for the military mission to continue uninterrupted. The INRMP addresses the policies and practices that eliminate or reduce conflicting wildlife and mission goals. In addition, this plan proposes to enhance natural diversity and reduce overall wildlife management costs.

1.1 Purpose

The defined purpose of this chapter is to establish and integrate a set of goals designed to maintain and enhance biodiversity, outdoor recreation opportunities and military use as they relate to the wildlife component of local ecosystems. Objectives to meet these goals have been established for PAX and WOLF using the best practices and the most recent scientific studies applicable for each mission. In addition, specific recommendations for attainment of these goals and objectives are given, as well as general management recommendations (GMRs) and specific management recommendations (SMRs).

The intention of the Wildlife Management Program is to develop and maintain a series of natural wildlife habitats that will benefit native species found on this portion of Maryland's Coastal Plain. Additionally, implementation of the wildlife management recommendations herein will allow continued resource use, while limiting conflicts with the intended military mission sanctioned by the United States Congress and implemented by DoD. The Plan will present a cognitive approach to understanding the natural resources and practical programs for wildlife harvesting, observation, and recreational use, while limiting impacts to the military use.

1.2 Scope

The wildlife addressed in this plan includes all native and alien fauna known or suspected to occur within PAX, WOLF, and surrounding environments. Game, non-game, and nuisance species alike will be identified, and recommendations developed to address each. Problematic species will be

addressed to reduce their impacts, while other species will be addressed with accepted management techniques to enhance or sustain their populations, as appropriate.

2.0 Applicable Laws, Regulations, and Policies

A series of federal, state, and local public laws apply to the protection and use of native wildlife occurring on PAX and WOLF. These laws have been drafted to protect and sustain populations of common, threatened, and endangered wildlife. The following descriptions detail the applicable rules and regulations.

2.1 Federal Laws and DoD/DoN Instructions

The Federal Government, through Acts of Congress, enacted a wide range of public laws and policies that directly affect the use and treatment of wildlife resources. Most of these laws have been described in a number of the earlier chapters of this document. Redundant listing will focus only on the impacts on wildlife resources.

2.1.1 Fish and Wildlife Coordination Act, as amended; Public Law 85-624, 16 USC 661 et seq.

This law was enacted to ensure that fish and wildlife conservation receives consideration equal to, and coordinated with, other features of water resources programs. Actions that would modify any stream or water body require consultation with USFWS and the state wildlife agency, as the Navy must give full consideration to the wildlife aspects of that action.

2.1.2 Sikes Act, as amended; Public Law 86-797, 16 USC 67(a) through (o)

This act requires federal military installations with adequate wildlife habitat to implement cooperative agreements with other agencies and develop long-range wildlife management plans. This act also sets guidelines for the collection of fees for the use of natural resources, such as in hunting, fishing, and trapping.

2.1.3 National Environmental Policy Act of 1969 (NEPA), as amended; Public Law 91-190, 42 USC 4321 et seq.

NEPA requires all projects with federal funding to conduct environmental impact analyses that address activities such as land development and their compliance with the standards of applicable federal and state laws. The law requires consideration of alternatives, as well as public participation in the environmental planning process.

2.1.4 Fish and Wildlife Conservation Act; Public Law 96-366, 16 USC 2901 et seq.

This act provides for conservation, protection, restoration, and propagation of non-game fish and wildlife species and their habitats.

2.1.5 Oil Pollution Act of 1990, Public Law 101-380

Redefines the requirements of the National Contingency Plan to include planning for, rescue of, minimization of injury to, and assessment of damages for injury to fish and wildlife resources. This Act extensively amended the Federal Water Pollution Control Act (33 USC 1301 et seq.).

2.1.6 Endangered Species Act of 1973 (ESA), as amended; Public Law 93-205, 16 USC 1531 et seq.

This act protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. ESA also requires consultation with the U.S. Fish and Wildlife Service (USFWS) and the NOAA Fisheries and the preparation of a biological assessment when such species are present in an area that is affected by federal activities.

2.1.7 Bald and Golden Eagle Protection Act, 16 USC 668a-d et seq.

This act prohibits any form of possession or taking of Bald and Golden Eagles. The statute imposes criminal and civil sanctions as well as an enhanced penalty provision for subsequent offenses. Further, the Act provides for the forfeiture of anything used to acquire eagles in violation of the statute. The statute prohibits possession and use of eagles or eagle parts for exhibition, scientific, and Indian religious uses. This act is especially important from a compliance perspective because the Complex supports several active Bald Eagle nests, and PAX and WOLF have experienced increased Bald Eagle activity in response to the species' population increases in the Chesapeake Bay and Patuxent River estuaries.

Compliance with the Bald and Golden Eagle Protection Act has become increasingly more important to NAS resource managers since the delisting of the Bald Eagle and loss of federal ESA protections on July 9, 2007.

On June 5, 2007, USFWS clarified its regulations implementing the Bald and Golden Eagle Protection Act and published a set of National Bald Eagle Management Guidelines[1]. The guidelines provide direction for landowners seeking to protect eagles while conducting activities on their property and are intended to help landowners avoid violating the Act by disturbing Bald Eagles. For example, the guidelines recommend buffers around nests to screen nesting eagles from noise and visual distractions caused by human activities. These actions are designed to provide clear guidance on how to ensure that federal actions they take on their property are consistent with the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

While the Bald Eagle was listed under the ESA, a permit was available under ESA to take Bald Eagles incidental to an otherwise lawful activity. Because there were no regulations under the Bald and Golden Eagle Protection Act to allow disturbance and other incidental take of either species of eagle, regulations were proposed to establish permits for activities or projects that result in such take. In April 2009, USFWS published a Final Environmental Assessment (FEA) for issuance of Bald and Golden Eagle permits. The FEA analyzes the proposal to permit take of eagles, their nests, eggs, or young that may result from otherwise legal activities. It also considers take of nests where necessary to protect public health and welfare. In the FEA, USFWS considered three alternatives to address eagle permitting in the United States.

The Final Rule was published on September 11, 2009, and the regulations took effect on November 10, 2009. The regulation set forth in 50 CFR § 22.26 provides for issuance of permits to take Bald and Golden Eagles where the taking is associated with but not the purpose of the activity and

[1] Source: USFWS bald and golden eagle website at: www.fws.gov/migratorybirds/BaldEagle

cannot practicably be avoided. Most take authorized under this section will be in the form of disturbance; however, permits may authorize non-purposeful take that may result in mortality. The regulation at 50 CFR § 22.27 establishes permits for removing eagle nests where: (1) necessary to alleviate a safety emergency to people or eagles; (2) necessary to ensure public health and safety; (3) the nest prevents the use of a human-engineered structure; or (4) the activity or mitigation for the activity will provide a net benefit to eagles. Only inactive nests may be taken, except in the case of safety emergencies. Inactive nests are defined by the continuous absence of any adult, egg, or dependent young at the nest for at least 10 consecutive days leading up to the time of the take.

2.1.8 Migratory Bird Treaty Act (MBTA), 16 USC 703-712 et seq.

This Act protects migratory birds and their habitats, and establishes a regulatory permitting process for legal taking. Except as permitted, actions of the Navy may not intentionally result in pursuit, hunting, taking, capture, killing, possession, or transportation of any migratory bird, bird part, nest, or egg thereof. Several legal opinions and court rulings occurred debating the terms of the MBTA. The USFWS issued a final rule in the Federal Register on October 4, 2021, effective December 3, 2021, returning the scope of the MBTA to prohibiting incidental take and applying enforcement discretion that was established prior to 2017. The Migratory Bird Treaty Reform Act of 1998 (Public Law 105-312) amended the law to make it unlawful to take migratory game birds by the aid of bait. These amendments also make it unlawful to place or direct the placement of bait on or adjacent to an area for the purpose of taking or attempting to take migratory game birds, and makes these violations punishable with fines up to $100,000 for individuals and $200,000 for organizations), imprisonment for not more than 1 year, or both. The Act amendment also changed the fine structure for misdemeanor convictions to be up to $15,000 rather than $5000 per count.

FY2003 National Defense Authorization Act – Military Readiness Activities:

While some courts had held that MBTA did not apply to the federal agencies, in July 2000, the United States Court of Appeals for the District of Columbia ruled that federal agencies are subject to the take prohibitions of the Migratory Bird Treaty Act. In May 2002, the Center for Biological Diversity obtained an injunction prohibiting live-fire military training exercises by the Department of the Navy that killed migratory birds on the island of Farallon de Medinilla in the Pacific Ocean. In December 2002, following a series of legal determinations on the case from the District Court for the District of Columbia and the Circuit Court, Congress authorized (in the FY2003 National Defense Authorization Act, Section 315) an interim period during which the prohibitions on incidental take of migratory birds would not apply to otherwise authorized military readiness activities. Congress believed the authorization to be an appropriate balance between the needs of national security and those of bird conservation.

The Final Rule was published in the Federal Register on February 28, 2007. The measure directs DoD to assess the effects of military readiness activities on migratory birds, in accordance with the National Environmental Policy Act. It also requires DoD to develop and implement appropriate conservation measures if a proposed action may have a significant adverse effect on a migratory bird population. The rule also provides that when conservation measures require monitoring of migratory bird populations, DoD retain the data for five years.

Memorandum of Understanding – Military Non-readiness Activities:
On July 31, 2006, DoD and USFWS entered into a Memorandum of Understanding (MOU) to Promote the Conservation of Migratory Birds, in accordance with Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds." The MOU was renewed September 5, 2014, and extended in 2022 while both parties work to revise the MOU. This MOU describes specific actions that should be taken by DoD to advance migratory bird conservation, avoid or minimize the take of migratory birds, and ensure DoD operations - other than military readiness activities - are consistent with the Migratory Bird Treaty Act. The MOU also describes how USFWS and DoD will work together cooperatively to achieve these ends. The MOU does not authorize the take of migratory birds; USFWS, however, may develop incidental take authorization for federal agencies that complete an Executive Order MOU. It strongly encourages all DoD personnel to work cooperatively with USFWS to implement the actions described in the MOU and to take steps to further migratory bird conservation. This MOU specifically pertains to the following categories of DoD activities:

1. Natural resources management activities, including, but not limited to, habitat management, erosion control, forestry activities, hunting, fishing, agricultural outleasing, conservation law enforcement, invasive weed management, and prescribed burning;
2. Installation support functions, including, but not limited to, the maintenance, construction or operation of administrative offices, military exchanges, road construction, commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, non-tactical equipment, laundries, morale, welfare, and recreation activities, shops, landscaping, and mess halls;
3. Operation of industrial activities;
4. Construction or demolition of facilities relating to these routine operations; and
5. Prevention or abatement of pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

The MBTA statute, subsequent legal decisions and the MOU are significant for the Station because it is an important migratory bird activity area. Full compliance with all of these has become an increasingly important oversight activity for the NR Program at NAS. Development of season-specific surveys and mitigation planning for all projects in or adjacent to migratory bird nesting, feeding or roosting areas has become more important for compliance documentation. The USFWS has identified bird strikes on buildings as adversely impacting migratory bird populations and through the MOU, installations have a responsibility to conserve migratory bird populations. The USFWS is developing recommendations for assessment protocol and mitigation strategies for structures to determine and address the risk for bird strikes. These changes will be captured in annual updates and addressed where practicable.

2.1.9 Marine Mammal Protection Act (MMPA), 16 USC 1361 et seq.

Protects marine mammals (cetaceans, pinnipeds, polar bears) and their habitats, and establishes a marine mammal commission. federal agencies must not take (i.e., harass or kill) any marine

mammal on the high seas, or in waters or lands under U.S. jurisdiction. The Station's proximity to the Chesapeake Bay places the Naval operations in potential juxtaposition to marine mammals, especially cetaceans (whales and dolphins), but occasionally also pinnipeds (seals and walruses).

2.1.10 OPNAVINST 6250.4 (series), Pest Management Program

This instruction, dated 27 August 1998, provides recommendations to implement policy for Pest Management Programs on Navy and Marine Corps properties. Specifically, the instruction directs pest management operations against pests that conflict with or affect the mission of the DoD; the health and well-being of Navy and Marine Corps personnel and their dependents; attack or damage real property, supplies, or equipment; adversely impact the natural environment; or are otherwise undesirable. Section 8 (c) (6) of this instruction directs NAVFACENGCOM to provide recommendations for a Bird Strike Reduction Program. Solutions include habitat alterations and behavioral modifications designed to discourage nuisance species from areas of possible conflict. Also recommended are education programs for Station personnel, and the continued identification of wildlife involved in air and ground strikes, as well as the monitoring of those that have the potential to do so.

An Integrated Pest Management Plan (IPMP) was adopted for PAX and WOLF in 1994 and most recently revised in November 2016. The 2016 IPMP is a comprehensive document that captures all the pest management and pesticide-related activities conducted at NAS. The plan incorporates an Integrated Pest Management (IPM) approach that focuses on safe, environmentally sound, and cost-effective control of pests.

2.1.11 NAVFAC MO-100.3, Fish and Wildlife Management

This Manual of Operation provides tri-service (Army, Navy and Air Force) technical guidance in fish and wildlife management practices.

2.1.12 CNICINST 3700, Navy Bird/Animal Aircraft Strike Hazard (BASH) Program

This program is designed to increase the reporting and identification of strike events and to reduce BASH incidences at Navy airfields.

2.1.13 NASPAXRIVINST 3750.5 (series), Bird/Animal Aircraft Strike Hazard (BASH) Program

This program is designed to reduce the wildlife strike hazard posed to aircraft at PAX and WOLF by prescribing avoidance procedures, monitoring all bird, mammal, and reptile populations and movements through habitat manipulation, land use planning, and manipulation of behavior.

2.1.14 NASPAXRIVINST 5090.2, Oil and Hazardous Substance Spill Contingency Plan

This plan has been prepared for NAS to provide site-specific procedures for responding to oil and hazardous substance spills in areas where these materials are handled or stored. Additionally, this plan designates the persons or groups responsible for special phases of containment, clean-up, and coordination of response for such spills. Finally, it sets forth requirements for training programs to provide and maintain proficiency in spill containment and clean-up. The involvement of the NR Program in the spill program is primarily with the recovery and treatment of oil-soaked birds and mammals, as well as the identification of priority-protection sensitive areas and the preparation of natural resource damage assessments.

2.1.15 NASPAXRIVINST 11015.6 (series), Hunting and Trapping Regulations

The most recent revision of this instruction provides regulations, procedures, and restrictions governing hunting and trapping at the Station, as well as guidance concerning violations of the instruction. The instruction also provides health notes concerning Lyme disease, rabies, and tularemia ("rabbit fever"); identifies permissible methods of hunting and trapping; and presents accompanying maps delineating approved hunting/trapping/training areas and assigned buffer zones.

2.1.16 NASPAXRIVNOTE 11015, Hunting and Trapping Seasons and Bag Limits

This NAS Notice, updated annually, is associated with NASPAXRIVINST 11015.6 and focuses on revisions to regulations and procedures related to hunting and trapping at PAX, WOLF and BIR. This note focuses on seasons, shooting hours, waterfowl hunting, tagging and bag limits, as well as permits and fees for hunting and trapping at NAS.

2.2 State and Local Government

As a general rule, the federal government is protected from regulation by the state government through the principle of sovereign immunity. Sovereign immunity exists with respect to all state laws unless, and until, the federal government has affirmatively waived it. However, it is the policy of the United States Navy and this installation to abide by the spirit and intent (if not the letter) of state and local laws to the greatest extent practicable, subject to available funding and compatibility with the military mission.

Maryland fish and wildlife regulations govern wildlife use anywhere within the state boundaries. Although the Installation would otherwise be exempt from state regulation, the Sikes Act requires that hunting and fishing programs on military lands be conducted in accordance with all state fish and wildlife laws and regulations. A cooperative agreement signed among NAS, USFWS, and Maryland Department of Natural Resources (MDNR) details how NAS will manage wildlife. Harvesting of game on the Station is done in accordance with state regulations, including the seasonal and daily bag limits, except when waived by the state. In addition, NAS may establish local regulations that are more restrictive than the state's.

3.0 Key Issues and Concerns

The most important features of the wildlife at NAS are their diversity and location proximal to other important regional natural resources. The wildlife species composition is derived from the natural regional diversity that reflects three hundred and fifty years of European colonial land use patterns, as well as long-term impacts from native human populations, natural disasters, time, climate, and other features that shape our landscape. The ability to sustain viable populations of diverse species in natural ecosystems is a concern of the Station.

NAS occupies a significant portion of land in St. Mary's County, on the large erosion-prone point between the Patuxent and Potomac Rivers. The coastline of PAX incorporates both the Patuxent River and the Chesapeake Bay, while WOLF is located on the St. Mary's River near its confluence with the Potomac River. Their peninsular positions and the isolation factors attributed to them provide numerous ecological advantages for migration, as well as interesting population

compositions. Both of these features suggest that NAS has an obligation to sustain natural habitats, where possible, for the continued existence of native wildlife.

There has been a clear movement in wildlife management in the last decade or two away from single species management or total game species concentration, and towards management of resources in the context of an ecosystem (i.e., ecosystem management). This change focuses on managing habitat communities, which in turn benefits native species, including native wildlife. This would also provide habitat important to many migrating and wintering species.

The ability of native wildlife species to sustain their populations within the northern Coastal Plain is a problem that has been identified in many of the states adjacent to Maryland as well. A patchwork of stream corridors, agricultural fields, and residential development is replacing contiguous forest cover, necessary for many area-sensitive species such as forest interior birds, from Washington, DC, to Boston, MA. This loss of habitat has resulted in dramatic declines of many species of animals, including reptiles, amphibians and neotropical migratory birds. These concerns are exacerbated by the growing human population within the Patuxent and Potomac River watersheds. This increased population will result in increased demands on the natural resources of NAS. Key issues become the sustaining of native populations of both common and rare wildlife, and continuation of sustainable resource usage by Station personnel and the general public.

4.0 Program Goals and Objectives

The goals of wildlife management at PAX and WOLF are as follows:

A. Wildlife-related human health risks, safety risks, and environmental damage are minimized.

B. Station wildlife resources support an optimal mix of multiple uses, both consumptive and non-consumptive.

C. The Station Wildlife Management Program employs a systematic and adaptive approach to managing wildlife resources, utilizing a process that includes inventory, monitoring, modeling, management, assessment, evaluation, and rehabilitation.

D. Restore or maintain diversity of wildlife species.

E. The Station maintains partnerships with other groups or agencies involved in wildlife management.

Above all else, human safety and welfare are top priorities on NAS. A tremendous amount of time and energy have already been devoted to programs associated with reducing operational safety impacts from wildlife. These programs were developed out of a need to address wildlife's impact on the safe conduct of the military mission, and the Navy's requirement to minimize adverse impacts, where possible.

Through various multiple uses of wildlife, where appropriate, NAS is in compliance with DON directives and federal law. Most non-military uses of the Station are for recreational activities that incorporate wildlife, such as hunting, photography, and wildlife study (such as bird-watching).

NAS allows recreational use of the forests and other natural habitats when they are not actively being used to satisfy the military mission.

The restoration and/or maintenance of natural biodiversity is one of the most important topics in the field of biology (Wilson, 1988). In a landscape dominated by modern human land uses, wildlife is dependent on our ability to preserve open space and suitable habitat.

In order to meet the goals specified above, the following objectives are established (note that each is followed by the letter designation of the goal or goals supported):

1. When applying wildlife management prescriptions, managers should follow steps in the model process known as adaptive management. (A, B, C, D and E)
2. Natural habitats remaining on NAS are restored or maintained to support wildlife species typical of native ecosystems. (D)
3. Rare, threatened, and endangered species are afforded special consideration for conservation and rehabilitation, as required by law. (C and D)
4. Game species populations are maintained at levels that provide recreational hunting opportunities that is sustainable for game species populations and ecosystems. (B and C)
5. All wildlife populations are maintained at or below carrying capacity that provide recreational viewing opportunities. (B and C)
6. The Station has in place a system for the efficient storage, retrieval, and manipulation of biological data. (A, B, C and D)
7. Wildlife populations are maintained at or below carrying capacity to prevent damage to their habitats. (A and C)
8. Alien or exotic wildlife species populations are reduced or eliminated. (A, C and D)
9. Annual numbers of dangerous and nuisance wildlife complaints are reduced or maintained at a tolerable level. (A)
10. The number of deer/aircraft strikes averages less than one per year, and deer/automobile strikes are minimized. (A)
11. The Station has a BASH Plan approved by CNIC and the Naval Safety Center. (A)
12. Artificial habitats that resemble now-absent natural ecosystems are managed for their potential to produce wildlife benefits. (D)
13. State and federal agencies and Non-Government Organizations are assisted by the Station through collection and sharing of data and participation in interagency cooperative efforts. (E)
14. The Station uses innovative wildlife management techniques in reducing wildlife conflicts. (A and C)

Each objective listed above can be attained through the use of recommendations that appear throughout the chapter. The number of the objective(s) supported by each recommendation is parenthetically recorded after that recommendation. General management recommendations (GMRs) and specific management recommendations (SMRs), supporting no particular objective and/or requiring no funding, also occur throughout the chapter. These are identified parenthetically as such.

5.0 Habitat Descriptions

NAS supports a wide variety of natural cover types and human land uses, which are listed in Tables VIII-1 and VIII-2. These habitats reflect pre-Navy land uses (woodcutting and farming) as well as conditions produced since the start of Naval operations in 1943. Human impacts have profoundly shaped the landscape and, likewise, the available wildlife habitats and their distribution. Locations of the various habitat types at PAX and WOLF are displayed on Maps VIII-1 and VIII-2 in Annex VIII-A.

Holocene erosion into Tertiary and Quaternary deposits with subsequent submersion has resulted in a landscape interspersed with typical Coastal Plain vegetation characteristic of interior forests associated with shallow and moderate depth brackish and saline ecosystems. PAX supports an assemblage of upland and wetland habitats distributed on soils derived from the Tertiary and Quaternary deposits. Its position towards the southern end of the Chesapeake Bay, and on the western shore at one of the Bay's narrowest points, makes the area a strategic landfall for migrating birds. Observations of migrations indicate this land is a major regional staging area for some migrants, as well as an important wintering area for several species of waterfowl and passerines.

5.1 Terrestrial Habitats

PAX and WOLF support mature forests, young woodlands, shrub-dominated land, old fields, marshes, and barren lands. Each represents a vegetative response associated with a past human land use. Based on the land use and forest mapping produced for this plan (Chapters 5 and 6), approximately 58.4% of the land within PAX and 75.6% within WOLF reflect a recent human disturbance. This has resulted in a high degree of young forest types, old fields, and brush lands.

Only 42% of the landscape at PAX and 24% at WOLF support forest and other vegetative communities that have developed without obvious indications of recent human impacts. These community types include mature hardwood forests, mature palustrine forests, and saline marshes; however, even these forests and marshes are not entirely without signs of severe ecological impact. This is made evident by the relatively recent loss of the American Chestnut (*Castanea dentata*) as a dominant landscape species, and by the fragmentation of regional forests by agriculture and residential development.

5.1.1 Upland Forest Types

PAX and WOLF support deciduous, mixed deciduous/coniferous, and coniferous forests. Each forest type is represented by a number of different canopy species, reflecting the degree of habitat diversity. The following descriptions generalize the forest wildlife habitats present on NAS.

5.1.1.1 Beech-Oak and Oak-Beech Forests

Beech-oak stands, while well-represented throughout St. Mary's County, are sparse on PAX. In addition, there have been no beech-oak stands identified at WOLF. The near-absence of American Beech (*Fagus grandifolia*) on the Station may be attributed to past over-timbering of the species for use as charcoal, slack cooperage, or fuel wood. The small stands that do exist on PAX represent the oldest forests on the Station. They are scattered throughout, but are best represented by very narrow corridors along streams and a small, semi-contiguous forest occupying the Tertiary landform on the southern and western boundaries of PAX. Dominant canopy species in this forest type typically include American Beech, White Oak (*Quercus alba*), Chestnut Oak (*Q. montana*), and Southern Red Oak (*Q. falcata*), with the sparse understory plants represented by juveniles of the same trees. The beech-oak forest type is the best example of climax or old-growth forest on the Station, supporting mammalian and avian species that require large trees for mast, shelter, and nesting locations. White-tailed Deer (*Odocoileus virginianus*) and Eastern Gray Squirrel (*Sciurus carolinensis*), ubiquitous species on both PAX and WOLF, are the most commonly observed mammals.

Table VIII-1. Habitats of PAX

Habitat Type	Acreage	Dominant Location
Mowed Airfield Areas	342.16	Airfield edges
Agricultural Land	390	Eastern and central areas of Station
Deciduous Upland Forest	800.28	Southern and western sides of Station and around creeks
Coniferous Upland Forest	173.96	Southern and western sides of Station and around Goose Creek
Shrub/Scrub-Successional	692.69	Throughout Station
Old Field Successional	237.94	Center of Station
Open Fresh Water	66.18	Southern and western sides of Station
Open Saline Water	366.66	Northern and eastern edges of Station
Saline Marshes	54.21	Eastern side of Station
Other Marshes	27.74	Throughout Station
Palustrine Forested Wetlands	220.3	Western, southern and eastern edges of Station
Palustrine Shrub-Dominant Wetlands	82.53	Edges of Station
Sandy Beaches	35.49	Patuxent River and Chesapeake Bay shorelines
Totals Habitat Acres	**3,490.17**	**Throughout Station**

Other smaller species associated with this mature forest type are the Gray Fox (*Urocyon cineroargenteus*); Raccoon (*Procyon lotor*); Virginia Opossum (*Didelphis virginiana*); Eastern Mole (*Scalopus aquaticus*); White-footed Mouse (*Peromyscus leucopus*); Short-tailed Shrew (*Blarina brevicauda*); and several species of bats, including the Red Bat (*Lasiurus borealis*), Little Brown Bat (*Myotis lucifugus*) and Tri-colored Bat (*Perimyotis subflavus*). Both the Little Brown Bat and Tri-colored Bat populations have sharply declined in recent years due in part to White-nose Syndrome. The federally endangered Northern Long-eared Bat shares the same habitat requirements, although not currently documented on the Station. The Southeastern Bat (*Myotis austroriparius*) was first identified at PAX (acoustically) in 2018 and again in 2020; however,

there was very little detection and likely this species uses this habitat infrequently while passing through the installation. The Wild Turkey (*Meleagris gallopavo*), reintroduced to PAX in 1984, also prefers these areas.

Table VIII-2. Habitats of WOLF

Habitat Type	Acreage	Dominant Location
Mowed Airfield Areas	129.47	Airfield edges
Agricultural Land	122	Western half of Station
Deciduous Upland Forest	5.32	Southern half of Station
Coniferous Upland Forest	23.98	Northern and southern tips of Station
Shrub/Scrub-Successional	12.91	Airfield edges
Old Field Successional	5.74	Southern end of the airfield
Open Fresh Water	1.2	Central southern area of Station
Open Saline Water	10.12	Western half of Station
Saline Marshes	13.63	Western half of Station
Other Marshes	42.88	Throughout Station
Palustrine Forested Wetlands	27.28	Southeastern part of Station
Palustrine Shrub Dominant Wetlands	10.81	Western and central eastern part of Station
Sandy Beaches	2.26	Western edge of Station
Totals Habitat Acres	**407.6**	**Southern half of Station**

In larger contiguous stands, beech-oak forests support many nesting neotropical migratory birds and cavity nesting species. The patchy condition of the stands at PAX may exclude or limit some of the more sensitive forest interior dwelling species (e.g., certain warblers), or at least reduces their breeding numbers due to habitat limitations. This forest type has the temporal continuity necessary for the assemblage of amphibians, reptiles, and insects typically associated with mature systems. This includes the potential to support common Eastern Deciduous Forest species such as the Wood Frog (*Lithobates sylvaticus*), American Toad (*Anaxyrus americanus*), Redback Salamander (*Plethodon cinereus*), Spotted Salamander (*Ambystoma maculatum*), Northern Red Salamander (*Pseudotriton ruber*), Northern Ring-neck Snake (*Diadophis punctatus edwardsii*), and Redbelly Snake (*Storeria occipitomaculata*).

5.1.1.2 Mixed Oak-Hardwood Forests

This cover type is located mainly in the western and southernmost areas of PAX, as well as around Harper's and Pearson Creeks. It is also found at the end of Runway 36 (inactive) at WOLF. Mixed oak-hardwood forests are dominated by White Oak, Chestnut Oak, and Southern Red Oak, with an association of other hardwoods such as Sweetgum (*Liquidambar styraciflua*), Red Maple (*Acer rubrum*), Black Cherry (*Prunus serotina*), Pignut Hickory (*Carya glabra*), and Yellow-poplar (*Liriodendron tulipifera*). This is a mature forest type, but not as old or complete in development as the beech-oak forest. It supports the same mammal species as the beech-oak assemblage, but may also include the Meadow Jumping Mouse (*Zapus hudsonius*), Boreal (or Southern) Red-backed Vole (*Myodes gapperi*), and Southeastern Shrew (*Sorex longirostris*) because of the increased ground cover and openings in the canopy.

5.1.1.3 Mixed Oak-Pine Forests

This forest type is predominant in the southern and western portions and around the creeks of PAX, and in the southern part of WOLF. Oak species such as White, Southern Red, Northern Red, and Black Oaks (*Quercus velutina*) are associated with Loblolly (*Pinus taeda*) and Virginia Pine (*Pinus*

virginiana). The presence of these pines indicates disturbance, as this forest community is a successional phase. Wildlife typically associated with oak-pine forests includes all large mammals described for the deciduous forest as well as those that require evergreen species for nesting or as a food source. Species commonly associated with this cover include the Southern Flying Squirrel (*Glaucomys volans*), Boreal Redback Vole, Pine Warbler (*Setophaga pinus*), Summer Tanager (*Piranga rubra*), and Common Grackle (*Quiscalus quiscula*).

5.1.1.4 Pine-Hardwood Forests

This pine-dominated cover type is limited to small patches scattered primarily in the northwestern, southern, and eastern portions of PAX, as well as the southern and northern points of WOLF. Two concentrations of these mixed coniferous and deciduous forests exist on PAX by the Gate 3 area and near Goose Creek Campground. No pine regeneration occurs within these stands, and hardwood associates such as Sweetgum, Black Gum (*Nyssa sylvatica*), Southern Red Oak, Willow Oak (*Quercus phellos*), and Black Oak will replace the pine in time. These forest areas were formerly cleared lands that reforested more than 50 years ago. All mammals found in the earlier forest associations are possible residents in these pine woodlands.

5.1.1.5 Pine Plantation Forests

These forests are composed entirely of Loblolly Pine planted as a cover crop. They are located throughout PAX as small patches, and in a few scattered locations at WOLF. These forests lack a significant shrub understory, but include species such as Multiflora Rose (*Rosa multiflora*) or Black Cherry saplings. Wildlife that are tolerant of the thick pine-needle duff, lack of understory, and dense canopy may use this cover type as part of their home range. The Pine Warbler, Eastern Towhee (*Pipilo erythrophythalmus*), Carolina Chickadee (*Poecile carolinensis*), and Tufted Titmouse (*Baeolophus bicolor*) tolerate these conditions, as do the Boreal Redback Vole, Pine (or Woodland) Vole (*Microtus pinetorum*), and White-footed Mouse.

5.1.2 Upland Successional Habitats

The remaining uplands are covered with vegetation indicative of recent land clearing. Activities such as farming; timber harvesting; small-game food plot development; maintenance clearing for houses, utility lines, airfield facilities and runway approaches; and historic uses have resulted in a mosaic that includes abandoned farm fields, old fields, shrub-dominated cover, and young woodlands focused in the center of PAX. Maps VIII-3 and VIII-4 in Annex VIII-A illustrate the upland successional habitat distribution for PAX and WOLF, respectively. Approximately 23% of the land cover at PAX and 21% at WOLF are in this vegetation form. The following descriptions identify this successional mosaic.

5.1.2.1 Abandoned or Inactive Farm Fields

These secondary successional features occupy about two percent of PAX and just under one percent of WOLF on either side of the airfields. This land has active farm leases, but some parcels were left fallow between 1991 and 1994. These fields, when not tilled, support a dense annual herbaceous growth of Northern Crabgrass (*Digitaria sanguinalis*), Common Ragweed (*Ambrosia artemisiifolia*), Horseweed (*Conyza canadensis*), Common Evening Primrose (*Oenothera biennis*), and other species typical of young succession stages in southern Maryland. Many common species use this habitat, primarily as a food source.

5.1.2.2 Old Fields

This vegetative cover type occupies approximately four percent of PAX land area (Maps III-22 in Annex III-B). Most of it exists in linear patches formed through food plot development and agriculture. Old fields differ from the agricultural stage of vegetation development in that they shift from weedy annuals and weak perennials (many of an alien source) to a mixture of native perennial grasses and composites. The dominant species include members of the grass, composite, legume, and sedge plant families.

This successional phase provides an important mix of cover, food, and nesting areas for a wide variety of animals. Old fields can be expected to support native grassland bird species such as the Field (*Spizella pusilla*), Song (*Melospiza melodia*), Grasshopper (*Ammodramus savannarum*), and Savannah (*Passerculus sandwichensis*) Sparrows; Bobolink (*Dolichonyx oryzivorus*, in migration only); Eastern Meadowlark (*Sturnella magna*); Eastern Bluebird (*Sialia sialis*); and Indigo Bunting (*Passerina cyanea*). Many small mammals use this open habitat for nesting and foraging, such as the Eastern Cottontail (*Sylvilagus floridanus*), Woodchuck (*Marmota monax*), Meadow Vole (*Microtus pennsylvanicus*), Eastern Mole, Short-tailed Shrew, and Meadow Jumping Mouse. Many reptiles and amphibians use this kind of upland terrain as part of their foraging territory. The Black (or Eastern) Rat (*Pantherophis alleghaniensis*), Corn (*P. guttatus*), Eastern Garter (*Thamnophis sirtalis sirtalis*), Eastern Ribbon (*Thamnophis saurita*), and Rough Green (*Opheodrys aestivus*) Snakes use this habitat, as do the Eastern Kingsnake (*Lampropeltis getula getula*) and Northern Black Racer (*Coluber constrictor*). Fowler's Toad (*Anaxyrus fowleri*) and the Eastern Box Turtle (*Terrapene carolina carolina*) also use this open vegetation for food and cover. Open sands within this type of habitat are important nesting sites for many snakes and turtles, as well as the Eastern Spadefoot Toad (*Scaphiopus holbrookii*).

5.1.2.3 Shrub-Dominated Cover

This vegetation type represents an advanced old field that supports a high percentage of young seral tree species [Sassafras (*Sassafras albidum*), Black Cherry, Persimmon (*Diospyros virginiana*), Eastern Redcedar (*Juniperus virginiana*), and Scrub Pine] and dry upland shrubs [Groundsel-tree (*Baccharis halimifolia*), Northern Bayberry (*Morella pensylvanica*), Multiflora Rose, and blackberry (*Rubus* spp.)], in addition to herbaceous species typical of the old field description. Approximately 11% of PAX and less than 2% of WOLF support this vegetation type, which is located in the vicinity of the old fields (Maps III-23 and III-24 in Annex III-B). At PAX, this cover type is concentrated around the runways and approaches at the eastern end of the Station, in utility line rights-of-way and in hedgerows between old fields. Some of the brushland on the southern property limits of PAX represents regrowth from past timber harvesting. The brushlands associated with the old field support flora and fauna similar to that of the old field, as well as species of animals tolerant of highly interspersed cover types. Game species found in this type of cover include White-tailed Deer (common) and Northern Bobwhite (*Colinus virginianus*) (rare). Common bird species typically associated with this habitat are Common Yellowthroat (*Geothlypis trichas*), Prairie Warbler (*Setophaga discolor*), Northern Mockingbird (*Mimus polyglottos*), Brown Thrasher (*Toxostoma rufum*), Yellow-breasted Chat (*Icteria virens*), and Gray Catbird (*Dumetella carolinensis*).

5.1.2.4 Young/Seral Woodlands

This vegetation type includes older shrubland that has 50% or greater cover by seral tree species, and young woodlands composed of forest canopy species. It contains both a deciduous and an evergreen component, and supports species similar to the brushland habitat. Deciduous species such as Sassafras, Black Cherry, Sweetgum, Red Maple, and Black Locust (*Robinia pseudoacacia*); and evergreen species such as Virginia Pine, Loblolly Pine and Eastern Redcedar represent more than half of this cover category. The remaining young woodlands are primarily dominated by basal sprouts of canopy species such as White, Black, Northern and Southern Red, and Chestnut Oaks, in addition to pine seedlings. Seral woodlands act as gap features in the surrounding forest and support edge-dwelling birds and mammals.

The Station coverage for this general habitat classification is included in the acreage for shrub-dominated cover in the previous section.

5.2 Wetland Habitat Types

Palustrine wetlands are found on the Station in linear forests associated with stream corridors. This part of the terrestrial ecosystem has a community structure dependent on the presence of water. Six types of wetland vegetative cover predominate on PAX and WOLF, making up 9% and 22%, respectively (Maps III-9 and III-11 in Annex III-B). Forested wetlands include deciduous and coniferous canopies, plus successional stages. Marsh conditions also occur in freshwater and saline environments. In addition to vegetated habitats, open water environments associated with beaver ponds, manmade ponds and lakes, and natural Chesapeake embayments produce a wide array of aquatic environments that form an important link in this wetland ecosystem.

5.2.1 Deciduous Forested Wetlands

This habitat occupies approximately one percent of PAX and less than one percent of WOLF land area. It is the dominant wetland feature for interior terrestrial habitats. Deciduous forested wetlands include palustrine forests dominated by Red Maple, Black Gum, Sweetgum, and Sweetbay Magnolia (*Magnolia virginiana*). Most of the palustrine forests are associated with stream corridors, but a few exist as isolated or poorly connected systems near the stream headwaters. This habitat type is crucial for the survival of many terrestrial mammals, birds, reptiles, and amphibians; and plays an important role for upland species as a source of food and refuge.

5.2.2 Coniferous Forested Wetlands

These wetlands, which result from late successional stages from past intrusive land uses, are poorly represented on PAX. Coniferous forested wetlands are dominated by Loblolly Pine with associated canopy species similar to the deciduous forested wetlands. Species such as Red Maple, Black Gum, and Sweetgum are important associate trees in most wetland Loblolly pine stands. This habitat type is limited to less than one percent of PAX and makes up four percent of WOLF, and greatly influences the type and number of wildlife that exist there. Yellow-throated Warbler (*Setophaga dominica*) and Brown-headed Nuthatch (*Sitta pusilla*) are strongly linked to these areas.

5.2.3 Shrub-Dominated Wetlands

The successional wildlife habitats within wetlands include seral forest and shrub-dominated conditions. Common shrubs include Buttonbush (*Cephalanthus occidentalis*) and Smooth Alder

(*Alnus serrulata*). These habitats exist primarily within stream corridors where beaver or past active land uses have disturbed the forest canopy and released this form of successional vegetation. This habitat occupies approximately one percent of PAX and one percent of WOLF, and provides important habitat for mammals and birds dependent on dense cover for nesting and forage.

5.2.4 Nontidal Marshes

These are present on NAS in the form of wet old fields and herbaceous fringes around nontidal water bodies and beaver pond edges. Nontidal marshes are dominated by grasses, sedges, and other wetland forbs – these are often ephemeral, seasonal wetlands as shallow depressions and vernal pools. This habitat includes non-vegetated, nontidal shorelines and open ground, both of which are important habitats for local wildlife as a source of food and nesting. Nontidal marshes are restricted in size to less than one percent of the land area of PAX and five percent at WOLF; however, they play a larger role in wildlife support than size indicates. Many authors list this type of habitat as some of the most productive, especially for dabbling ducks (Anatinae subfamily) and other water-dependent birds (McCormick and Sommes, 1982).

5.2.5 Freshwater Tidal Marshes

This is another habitat that is limited within PAX but is important to wildlife. Dominated by sedges and grasses, it provides similar opportunities for wetland and upland terrestrial vertebrates and insects. Less than one percent of PAX land area is comprised of freshwater tidal marshes that are concentrated at the upper edges of the tidal saline areas. This habitat type is not found on WOLF.

5.2.6 Saline Marshes

This habitat is predominantly influenced by the saline waters of the Chesapeake Bay. Saline marshes occupy a peripheral habitat associated with the larger tidal water bodies on the northern and eastern edges of PAX, and the northern and western edges of WOLF along the St. Mary's River. Approximately one percent of PAX and nearly two percent of WOLF support habitat dominated by salt-tolerant sedges such as three-squares (*Scirpus* spp.), Saltmarsh Bulrush (*Bolboschoenus robustus*), Black Needlerush (*Juncus roemerianus*), and Smooth Cordgrass (*Spartina alterniflora*). This habitat is well documented in the literature as a highly productive community that supports a wide variety of water-oriented birds and insects. Common birds include several species of rails, herons, and egrets, as well as Saltmarsh Sparrows (*Ammospiza caudacuta*) and Marsh Wrens (*Cistothorus palustris*). Mammals are limited in this environment to occasional usage because of the saline water chemistry. Species such as the River Otter (*Lontra canadensis*), Mink (*Vison vison*), Muskrat (*Ondatra zibethicus*), and Marsh Rice Rat (*Oryzomys palustris*) typify the mammalian component of this wetland community type. Included in this habitat type are the sparsely vegetated shorelines associated with the Chesapeake Bay and Patuxent River, as well as the four tidal creeks at PAX; and the shorelines and tidal creeks associated with St. Mary's River, St. Inigoes Creek, and Molls Cove at WOLF.

5.3 Aquatic Habitat Types

PAX and WOLF support a number of open water environments. For this plan, four important habitats will be described: nontidal ponds; saline embayments; the Patuxent, Potomac, and St. Mary's Rivers; and the Chesapeake Bay.

5.3.1 Nontidal Freshwater Ponds

Nontidal freshwater ponds on NAS are manmade impoundments primarily associated with the minor stream systems that originate on this property and discharge into saline embayments. These open freshwater bodies include Gardiner's, Sewall, Holton, Calvert, Sacawaxhit, and Richneck Ponds at PAX; and Finger and Fishing Ponds at WOLF. The continuity of open water environments plays an important role in the production of aquatic wildlife such as anadromous marine fishes, which include Alewife (*Alosa pseudoharengus*), Blueback Herring (*A. aestivalis*), and Rockfish (*Morone saxatilis*). The catadromous American Eel (*Anguilla rostrata*) also needs to be able to move between the freshwater and saline environments. Aquatic mammals such as the River Otter, Muskrat and Beaver (*Castor canadensis*) are typical associates of this wetland feature. Many dabbling ducks, such as Wood Duck (*Aix sponsa*), American Black Duck (*Anas rubripes*), and Mallard (*Anas platyrhynchos*), use these waters for feeding and nesting.

Buffleheads (*Bucephala albeola*)
Photograph by Ben Springer

5.3.2 Tidal Bays/Saline Embayments

Goose Creek, Pearson Creek, Harper's Creek, and Pine Hill Run are the primary saline bays on PAX. Langley Hollow and Fort Point Cove are the primary saline bays at WOLF. These features are drowned stream systems that now support an aquatic system dependent on the ebb and flow of the Chesapeake Bay tidal cycle. These are very important for the local production of marine fishes such as Bluefish (*Pomatomus saltatrix*), Weakfish (*Cynoscion regalis*), and White Perch (*Morone americana*) that use near-shore environments during juvenile stages. These open water features also provide resting sites and food for saline water-dependent avian wildlife such as loons (*Gavia* spp.), grebes (*Podiceps* spp.), and diving ducks [e.g., Bufflehead (*Bucephala albeola*), Common Goldeneye (*B. clangula*), Canvasback (*Aythya valisineria*), scaup (*Aythya* spp.), and mergansers (*Lophodytes* and *Mergus* spp.)].

6.0 Species Associations

The wildlife found on PAX and WOLF are distributed based on their habitat needs and the location of available habitats. The wildlife habitats present on Station support some or all of the conditions

necessary for the survival of existing resident and migrating species. NAS has five major species associations and many smaller ones. In general, the wildlife habitats can be categorized as forest (deciduous, coniferous, mature, and successional); open land (mowed, agricultural, old field); freshwater wetlands (marshes, forests); saline marsh (cordgrass, rush-dominant); and open water (freshwater impoundments, estuarine bays, Chesapeake Bay) communities. Many species of birds and mammals utilize two or more of these communities; for example, White-tailed Deer use all communities as part of their home range. Conversely, some species are restricted to single communities, such as Redback Salamanders (deciduous forests) and Grasshopper Sparrows (old fields). A representation of the wildlife community associations on NAS is presented in Tables VIII-B-1 (reptiles and amphibians), VIII-B-2 (mammals), and VIII-B-3 (birds) in Annex VIII-B.

7.0 Status of Habitats and Associated Species Groups

The resident and transient wildlife of PAX and WOLF, and the habitats that support them, are generally well understood (especially the vertebrates and larger invertebrate organisms). NR personnel have monitored the wildlife, and their information has resulted in a list of known species and their associated habitats. There is, however, data missing on the overall habitat available for any particular species, species numbers, and status. The land-use mapping produced for this document (Chapter 5) defines the site conditions for PAX as interpreted from 1991 aerial photography and field-checked in 1993, 1994, and 1995. The land-use mapping of WOLF defines the site conditions as interpreted from 1990 aerial photography and field-checked in 1995 and 1996 (and updated since that time in GIS.) This results in a data set that can define acreage for each wildlife habitat.

7.1 Forest Habitats

Wildlife habitats on the Station are dominated by forests of various age classes, indicative of a managed forest. Large, rectangular clear-cuts have resulted in a mosaic of openings within the existing forest of what are primarily young woodlands, rather than the mature forests which would have been characteristic of this landscape if not for large-scale human interference. At risk are the species associations that require old growth forest as all or part of their home range. This includes many neotropical migratory birds and some amphibians. Forest losses are attributed to direct destruction for human uses by pre-Navy agricultural practices and long-term expansion of the Station to meet a changing mission, as well as short-term losses attributed to forestry activities. Large, contiguous forest cover exists in the southeastern portion of PAX and (to a lesser degree) the eastern portion of WOLF.

7.2 Open Habitats

Open habitats situated in the central portion of PAX and in the south-central portion of WOLF have suffered some losses due to recent development. Old field converted from agricultural land is replacing this landscape unit. As with any other early successional condition, the open habitats will eventually become part of the surrounding forest. The trend for the eastern edge of PAX is a gradual shift to pine woodlands. The openings by the south and west boundaries of PAX are re-sprouting with coppice growth of the cut canopy trees and will eventually (60-100 years) attain canopy closure. Wildlife which benefit from this forest intrusion will slowly be replaced with typical forest-dwelling species that require large patches of contiguous woods, such as regionally

common, summer-resident neotropical migrants like the Scarlet Tanager (*Piranga olivacea*) and year-round residents like the Pileated Woodpecker (*Dryocopus pileatus*).

Permanent open habitats, maintained in airfield clear zones and runway approaches, provide some important early successional habitats. Although artificial, these areas can be managed to provide important migratory stopover and overwintering habitat for several declining species of grassland birds. For some species, they may occasionally serve as breeding habitat. These management practices, however, may be exercised only through compatibility with BASH objectives.

7.3 Saline Habitats

Most of the saline marshes at PAX and WOLF are located in portions of the landscape that are relatively inaccessible to man. These areas are regulated by strict wetland laws that prohibit their use for all but some water-dependent activities. Most NAS saline marshes do not appear to be directly impacted by human activity. However, indirect impacts, such as upland land uses, have caused erosion along the upland/marsh edges. Marshes located on Pearson and Harper's Creeks, and those of the Patuxent River and bayshore edge at PAX, are experiencing losses from wave action and sea level rise. Marshes along St. Mary's River and St. Inigoes Creek at WOLF are suffering from the same. Upland erosion does not appear to be a significant problem, but it could be a concern with the juxtaposition of significant acreage of open lands upslope of the saline marshes.

7.4 Open Water Habitats

The open water communities are also protected from land uses by wetland laws. The conditions of these communities depend on water quality issues related to stormwater runoff. Most freshwater ponds within PAX and WOLF exhibit evidence (e.g., excessive algae, especially *Spirodela* sp.; abundance of weedy plants on waters' edge; and water column turbidity) of excess nutrients and sediment reaching this aquatic system. The saline bays do not exhibit the same extreme conditions because of tidal flushing.

8.0 Management History

Wildlife management on PAX has been ongoing since the mid-1950s, when an onsite sportsman's club participated in wildlife conservation efforts, primarily for game species. Chapter 2 details the resulting events and offices associated with wildlife management throughout the history of NAS.

In 1983, the first Wildlife Management Plan was written by PAX's Wildlife Biologist to cover all aspects of wildlife use and conservation (Rambo, 1983). It was adequate and appropriate until the requirements for (1) development of an integrated plan for the management of natural resources, (2) conservation of biodiversity, (3) ecosystem management, and (4) implementation of recommendations made in this plan. Based on these requirements, the INRMP was postulated, containing a chapter that integrates wildlife management with biological diversity and the principles of ecosystem management.

9.0 Proposed Management and Conservation Measures

To continue proper wildlife stewardship, this management plan has been developed to reflect current philosophies and understandings. The following paragraphs provide a series of operations for habitat manipulations, plantings, and enhancement of existing site conditions that can be implemented in order to meet the goals and objectives stated earlier.

9.1 Habitat Management

The wildlife habitat management program is dichotomous in that efforts are made to both enhance wildlife habitat (to achieve certain objectives) and render habitat less attractive (as in the case of BASH reduction objectives).

One of the goals for this chapter of the INRMP is that an assemblage of species that reflects the natural, potential biodiversity is restored or sustained. This will be accomplished through the elimination, where practicable, of practices that negatively impact native wildlife populations; thereby enhancing the potential to support additional species displaced by current land use practices.

An objective of this chapter is that recreational hunting opportunities are provided for through the management of game species and their habitats. However, habitats will rarely be managed for the sole benefit of game species, and never to the detriment of overall biodiversity conservation or airfield safety objectives. Appropriate habitat manipulation to the benefit of game species (and hunters) has occurred at NAS in the past, and is mentioned in this and other chapters.

9.1.1 Manipulation of Vegetative Succession

Habitat management has long been seen as the best means by which to manage wildlife populations, and manipulation of vegetative succession is often the manager's favorite tool. Modern ecosystem management guidelines, however, emphasize the use of techniques that mimic an ecosystem's natural disturbance regime in severity, timing, and frequency.

A major habitat problem on PAX and WOLF in terms of biodiversity is the fragmentation of the existing forests. Returning forests within the NAS forest preserve to "old growth" condition would offset this habitat problem (Obj. 4). This will be to the detriment of many game animals and edge-loving species of mammals and birds, but will return the forest to a condition better able to support the potential diversity that existed prior to intense farming and military land uses. Gaps within forests, especially those in the forest preserve, should be allowed to close (Obj. 4) (SMR VIII.1). To accomplish this:

- First, identify and map all gaps within forest areas (Obj. 4) (SMR VIII.2).
- Then, with the assistance of Station utility managers, conduct a feasibility study for closing identified forest gaps (Obj. 4) (GMR VIII.1/SMR VIII.3).
- In addition, avoid prescribed burns in most hardwood forested areas (Obj. 4) (SMR VIII.4). Fire should only be used in forest habitats as necessary for safety reasons around structures, reduction of tick populations in the duff layer of pine-forested recreation areas (such as the

Goose Creek Campground), and keeping and maintaining certain desirable habitats, such as native old fields and unique xeric sites.

There are numerous recommendations with respect to old field management:

- Encourage old fields and seral woodlands development adjacent to core forest areas where practicable (Obj. 4) (SMR VIII.5).
- In locations where this would negatively impact air operations, such as in the open farmland and mowed land immediately adjacent to the runways and approaches, BASH considerations should be followed. In areas that must be maintained in grass cover, shift the plant assemblage to native eastern prairie grass species (Obj. 4) (GMR VIII.2/SMR VIII.6).
- Eliminate all alien plants, as they can artificially encourage wildlife to overpopulate (Obj. 4) (Project VIII.1).
- Maintain most woody vegetation in old field areas at low density and where practicable, shift the assemblage to a native grass/composite species mixture through use of controlled burning, mowing or other similar manipulation every three to five years (Obj. 4) (Project VIII.2).
- Enhance natural systems in favor of an intense successional habitat creation and maintenance program (Obj. 4) (SMR VIII.7). This will increase the number of native forest species, decrease the number of deer, and produce an island of forest within a large scale landscape of agriculture and suburban development.

9.1.2 Wildlife Plantings

The native wildlife adapted to the Eastern Deciduous Forest is dependent on the forest vegetation and its subtle successional changes. The NR Program should enhance biodiversity, restore native plant communities and treat lands with a high degree of alien plant species with herbicide or, where possible, repeated mowing (Obj. 4) (Project VIII.3).

Alien species are of great concern in open wildlife habitats. To benefit game species, prior conservation efforts planted alien species such as Multiflora Rose, Shrubby Lespedeza *(Lespedeza bicolor*), Chinese Lespedeza (*Lespedeza cuneata*), Autumn Olive (*Elaeagnus umbellata*), and various food crops.

The planting of small wildlife food plots near airfields and large forest blocks is prohibited (Obj. 4) (SMR VIII.8). Modern wildlife research has shown that animals rarely need supplemental planting to survive and increase in numbers. In fact, these food plots can be detrimental to game species by creating predator traps and unnatural concentrations of wildlife that can foster the spread of disease. Their only measurable benefit is in making it easier for hunters to locate game, which may assist in population control.

9.1.3 Artificial Nesting Structures

The use of artificial nesting structures is a legitimate way of providing habitat and producing larger numbers of cavity-nesting birds where natural cavity trees are limited. Currently, the Station maintains Osprey platforms, squirrel boxes, Wood Duck boxes, Barn Owl boxes, bluebird boxes, and Purple Martin houses. Species like Osprey (*Pandion haliaetus*), Eastern Gray Squirrel, Southern Flying Squirrel, Wood Duck, Eastern Screech-Owl (*Megascops asio*), Barn Owl (*Tyto alba*), Eastern Bluebird, Tree Swallow (*Tachycineta bicolor*), Carolina Wren (*Thryothorus ludovicianus*), Carolina Chickadee, Tufted Titmouse, Purple Martin (*Progne subis*), and Great Crested Flycatcher (*Myiarchus crinitus*) have benefited from this program.

The NR Program should expand the nest-box program to also include structures for the American Kestrel (*Falco sparverius*) at Fishing Point or other appropriate open spaces (Obj. 3, 4 and 11) (Project VIII.4) Open banks of soil, such as in excavations, can be used as short-term nesting areas for Belted Kingfishers (*Megaceryle alcyon*) and Bank Swallows (*Riparia riparia*). The maintenance of artificial nesting structures can be very labor intensive, however, and so lends itself well to support from wildlife volunteers.

The nest-box program should have adequate personnel assigned to handle the weekly monitoring necessary for nest boxes (Obj. 3, 4 and 11). This level of upkeep is necessary to keep production at its maximum and limit nest parasites. In addition, suitable protection against predators should be provided to the nest boxes (Obj. 3, 4 and 11) (Project VIII.5). Protection may be offered in the form of collars or tubes on nest-box poles, or by means of other predator-limiting devices.

9.2 Species Management

The primary intent of this aspect of wildlife management at NAS is to encourage native species in native habitats. This includes game species as well as common non-game and protected species. The known animal species found at NAS, both terrestrial and aquatic, are listed in the Biodiversity Database for NAS Patuxent River Complex (Appendix C). This Biodiversity Database is currently being maintained in a spreadsheet format. To better facilitate access to and updating of this information, develop a more user-friendly database to capture and display occurrence information for biological elements of the Station (Obj. 5).

Although this is not normally part of overall ecosystem management, individual species occasionally need special attention because of declining populations, over-predation, or other human-induced conditions. In these cases, special management practices should be applied. Annex III-D provides a discussion of state and federal (legal) status categories and codes, as well as rankings (state, federal, and global) that apply to special-concern species. These codes are used throughout the text of this chapter.

9.2.1 Game Species

Some of the original conservation efforts were specifically focused on game species. These included the development of 107 food plots throughout PAX, short-term old field rotation, and disking. Each of these techniques enabled species such as Northern Bobwhite, Eastern Cottontail and White-tailed Deer which are native edge species, dependent on a diverse set of successional habitats, to prosper.

Now, INRMP management techniques aimed at lowering deer numbers to minimize safety risk to aircraft will keep the deer herd well below the natural carrying capacity of the forest, reducing possible forest damage from deer over-browsing, and human health threats associated with deer. The other early successional species, including Northern Bobwhite and Eastern Cottontail, should not be encouraged in forested areas, but can be supported, as appropriate and practicable, in those areas to be kept as open spaces (e.g., the areas surrounding runway approaches that are not regularly mowed) (Obj. 2 and 4) (SMR VIII.9). The aim is not to discourage these species from the contiguous forest, but to continue reduction of forest breaks, ROWs and other openings that create too much internal forest edge, thus increasing deer populations and limiting the breeding success of many neotropical migratory birds.

9.2.2 Non-Game Species

The ecosystem approach to wildlife management puts emphasis on creating a stable vegetative community that, in turn, can support native populations of birds, mammals, reptiles, amphibians, and invertebrates. While no particular common, non-game species demands special attention, management activities at the PAX Complex provides sufficient habitats for all common and characteristic non-game species (Obj. 3, 4 and 11) (SMR VIII.10). As stated earlier, closing forest gaps and increasing the age of the forest benefits many declining non-game species. The Station already supports sufficient numbers of successional forest components, so the attention should be focused on attaining and protecting old growth stands by further reducing internal forest barriers such as fire lanes, food patches, and clear cuts (Obj. 4) (SMR VIII.11). Non-game species highlighted in this section include migratory birds, reptiles, and bats.

9.2.2.1 Bird Conservation

Many native birds on the base are migratory species that either spend the winter in the area (moving north during the spring and summer) or they arrive during the spring and summer from farther south to breed. As a result of documented population declines, migratory birds are the subject of international conservation efforts. As an important biological resource and a good indicator of ecosystem health, NAS bird populations must be managed effectively and in accordance with applicable resource laws.

The international Partners in Flight (PIF) program began in 1990 as an interagency partnership for the conservation of neotropical (New World) migratory land birds. PIF has produced a number of valuable planning documents that can all be found on the PIF website at https://partnersinflight.org. The Department of Defense joined with PIF in 1991 to establish the DoD PIF program, a cooperative network of natural resources personnel from military installations across the U.S.

In 1999, the North American Bird Conservation Initiative (NABCI) was formed as a coalition of government agencies, private organizations, and bird initiatives in the United States working to ensure the long-term health of North America's native bird populations. The NABCI Committee is dedicated to advancing integrated bird conservation, based on sound science and cost-effective management, to benefit all birds in all habitats. NABCI divides the North American continent into various Bird Conservation Regions (BCRs) – based on physiographic regions/provinces – and encourages development of strategic Conservation Plans for each BCR while promoting Joint

Venture partnerships to implement these plans. Additional information about NABCI can be found at www.nabci-us.org. NR staff members have been very active in both PIF and NABCI and should continue their involvement in these programs (Obj. 13) (SMR VIII.12).

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Like NABCI, PIF divides the continent into BCRs. In addition, the PIF program publishes a strategic plan known as The Flight Plan, which outlines goals, objectives and recommendations for bird conservation – essentially providing a process blueprint for the successful conservation of neotropical migratory birds. NAS has adopted this process as a model. The basic concepts are as follows:

1) Conduct baseline bird inventories at each installation.
2) Conduct monitoring surveys to assess bird population status and evaluate possible changes or trends.
3) Identify which BCR each installation falls within.
4) Review the PIF Species of Concern (SOC) list to identify which of those species are known to occur, or could occur, on each installation.
5) Develop specific, habitat-based population goals for each SOC and devise management prescriptions to attain these goals.
6) In keeping with the principles of adaptive management, monitor and evaluate the effectiveness of management actions, and make adjustments/corrections as necessary.
7) Work in conjunction with other local, state and federal partner agencies, nonprofit organizations, universities and others who share common goals.

Species of Concern are derived from a consolidated list based on eight different priority lists, which can be seen on the DoD PIF website at https://denix.osd.mil/dodpif/. Those SOC that occur at the Complex have been identified in the Biodiversity Database in Appendix C. At NAS, most bird SOC fall into one of two major categories – forest interior dwelling species (FIDS) or grassland birds. Management for FIDS can be accomplished by following the FIDS guidelines established by Maryland's Chesapeake Bay Critical Area Program. Grassland birds can best be addressed by establishing and restoring areas of native warm-season grasses and by managing airfield grassland habitats, where appropriate (considering BASH concerns).

The DoD PIF program sustains and enhances the military testing, training, and safety mission through proactive, habitat-based management strategies that maintain healthy landscapes and training lands. DoD PIF supports a coordinated bird monitoring (CBM) program and encourages installations with bird monitoring programs to follow standard protocols, archive data centrally in the CBM database, and share monitoring data with other installations and agencies. The DoD PIF program has produced its own Strategic Plan and established a number of priorities for each region of the country. Maryland installations straddle the border of the Northeast and Southeast regions,

so recommendations from both regions are incorporated as management guidelines in this INRMP. Some are as follows:

1. Manage airfields for grassland species while reducing BASH risk.
2. Ensure timber operations are done in a sustainable way that provides adequate habitat in appropriate forest age classes.
3. Remove unused communications towers, especially in key migration corridors and coastlines. Review communication tower lighting systems, and encourage changes as recommended by the USFWS guidelines. Maximize co-location of new communications equipment on existing towers.
4. Encourage the removal of exotic species, including feral cats and invasive plants. Educate Installation personnel on the negative impact of cats to birds and other wildlife.
5. Identify military lands where restoration of native warm-season grasses and associated fire regimes are feasible. Maintain large warm-season grasslands where they currently exist, and identify potential restoration sites. Promote the establishment and use of native warm-season grasses as a late-season hay crop.
6. Support wintering grassland bird research on military lands, through Project Prairie Birds and other sources.
7. Maintain bottomland hardwood forests, especially in or near coastal areas. Identify DoD sites that can satisfy the PIF acreage requirements for desired forested floodplain wetlands.
8. Document all maritime communities under DoD management.
9. Monitor and protect colonially nesting waterbirds and vulnerable shorebirds.
10. Working through the NAWMP and the U.S. Shorebird Conservation Plan, identify and conserve critical shorebird and nongame waterbird habitats.
11. Reduce or eliminate pesticide use in sensitive habitats, especially in and around riparian areas.
12. Incorporate guidelines for recreational use (hiking, off-road vehicles [ORVs], dogs, noise) of military lands in ecologically sensitive areas.

PIF regional and technical working group representatives are available to assist installation staff with bird conservation issues. Points of contact can be found on the DoD PIF website, along with additional planning documents and management guidance that should be consulted for purposes of bird management at NAS (Obj. 14) (SMR VIII.13).

The Avian Knowledge Network (AKN) is a collaborative effort between a multitude of stakeholders to facilitate and enhance bird conservation. AKN provides a variety of interactive tools, data products and information. In 2022, the Office of the Secretary of Defense issued a memo endorsing and requiring the use of AKN for data management. The DoD AKN Portal is located at www.dodakn.org.

There are other bird conservation initiatives that can also provide assistance to installations. The National Audubon Society web4.audubon.org/bird/iba sponsors the international Important Bird Areas (IBA) program in the United States. Through state and local Audubon chapters, it implements plans and programs towards attaining its stated goal of identifying and conserving areas that are vital to birds and other biodiversity. They endeavor to interest and activate a broad network of supporters to ensure that all IBAs are properly managed and conserved. The Maryland-District of Columbia (MD-DC) Audubon Society md.audubon.org/important-bird-areas-program is the state chapter which implements the program in Maryland. The MD-DC IBA Program is overseen by a Technical Review Committee (TRC) representing state and federal agencies, academic ornithologists, the birding community, and regional biologists. The former NAS Conservation Director served on the MD-DC IBA TRC; if possible, this representation should continue.

9.2.2.2 Conservation of Other Non-Game Species

Similar to PIF, numerous federal and state agencies have also joined non-governmental organizations in a partnership dedicated to the conservation of reptiles and amphibians. Partners in Reptile and Amphibian Conservation (PARC) was joined by DoD in 2009, which has also produced a strategic plan to guide management of these valuable wildlife resources. The DoD PARC network was established to provide leadership, guidance, and support for the conservation and management of amphibians and reptiles on DoD lands in ways that help sustain the military's mission activities. A variety of technical resources, including guidance and policy, are located on the DoD PARC website at https://denix.osd.mil/dodparc.

NR staff members have been very active in numerous important species conservation organizations (e.g., PIF, NABCI, MD-DC IBA TRC, and PARC). Their involvement in these programs should continue, within DoD and beyond (Obj. 13).

The Diamondback Terrapin (*Malaclemys terrapin*) is North America's only endemic estuarine turtle, able to tolerate a wide range of salinity levels. The Northern Diamondback Terrapin (*M. t. terrapin*), found in the tributaries and marshes of the Chesapeake Bay and NAS, has declined significantly over several decades due to historic over-harvesting, habitat loss, climate change, predation, and drowning in crab pots. Ongoing terrapin conservation efforts at NAS (detailed further in Section 10.3 of this chapter) should continue (Obj. 1, 3 and 13).

Bat species throughout the United States are facing a rapidly spreading, unprecedented disease called White-nose Syndrome (WNS). WNS threatens the recovery of federally listed bat species populations and may hasten the listing of additional bat species. Strategies to incorporate WNS management should be implemented to identify, avoid, and mitigate effects of WNS to conserve the status of bat species (Obj. 12) (SMR VIII.14).

9.2.3 Rare, Threatened, and Endangered Animal Species

Species that are listed as rare, threatened, or endangered are those normally with extremely low and/or declining populations. Two levels of listings occur in Maryland. The state prepares and maintains a listing through the Maryland Natural Heritage Program, administered through the Maryland Department of Natural Resources (MDNR, 2010a; 2010b), and the federal list contains

species that meet the requirements of the Federal Endangered Species Act. A federally listed species automatically occurs on the Maryland State list.

The rank of a listed species differs from its status in that the rank is a scientific categorization while the status is a legal one. The ranking system was developed and instituted by The Nature Conservancy and can be used to set inventory, protection, and management priorities for species both at the state and the regional level. The status of a species is determined by government authorities such as USFWS at the federal level and MDNR at the state level.

Generally, rare species are defined as regionally uncommon, or being at the limits of their geographical distribution. Threatened species are those that are likely to become endangered within the foreseeable future. Endangered species are those that are in danger of extinction throughout their respective ranges. Annex III-D provides an explanation of global and state species ranks that are relevant to this document. Management for threatened and endangered species (TES) is a high priority in the overseeing of wildlife on NAS. This may include tracking population stability and monitoring of local threats.

Additional protection designations are made in an effort to keep other species from being formally listed. "Candidate species" are plants and animals that the USFWS has determined to be eligible for federal listing, but which fall below other species with respect to listing priority. Similarly, "species at risk" (SAR) are species that are not yet federally listed, but are either designated as candidates for listing or are regarded by NatureServe (a non-profit conservation organization that represents international natural heritage programs) as critically imperiled or imperiled throughout their range.

Rare species surveys will continue to include appropriate species from all of these lists, which will be revisited regularly to determine if new species are added or listing statuses have changed (Obj. 12) (SMR VIII.15)

NAS species that meet these global and state designations should be encouraged to increase their populations, provided that this would not contradict the overall wildlife and ecosystem management scheme or the military mission (Obj. 12 and 14) (SMR VIII.16). In addition, impacts to these species will continue to be avoided through use of the installation Planning Checklist to review proposed projects.

An example of a species with a protected status that the Navy should discourage under certain circumstances, while encouraging under others, is the Least Tern (*Sternula antillarum*). This state-listed species has historically nested near runways in the center of the PAX airfield. However, Least Terns have not been observed on NAS since the 2000-2001 nesting season. Least Terns also historically nested at Cedar Point Beach. At this favorable location, Least Tern occupation, breeding activity and nesting should be encouraged and enhanced by reducing the human disturbance on the beach, such as through public education signs and published articles in the Station newspaper, and by creating more beach on Cedar Point for use as nesting habitat (Obj. 12) (Project VIII.6).

Certain rare species are known to be residents at NAS and some are confirmed breeders on the Complex. Many rare species are only transients, representing post-breeding dispersals of northerly or southerly migrants passing through, or temporary residents, such as over-wintering birds. Tables III-C-6 and III-C-7 in Annex III-C summarizes data for rare animal species occurrences at NAS, as well as data for species with potential, but unconfirmed or even unlikely, occurrence at NAS, respectively. The following projects and recommendations support the continued understanding of rare species occurrences at NAS:

- The first step in understanding the status of listed wildlife is accomplished by continuing specific biological surveys to identify and document all species with special protection status. The newly acquired Grayson parcel, for example, must be surveyed to document presence or absence of rare species (particularly listed or candidate species such as bats and Spotted Turtle) prior to any construction or habitat changes on the parcel (Obj. 12) (Project VIII.7).

- Next, share the rare species data with MDNR's Natural Heritage Program (NHP) and USFWS, as appropriate (Obj. 1 and 13) (SMR VIII.17).

- Enter location data and status of listed species, as well as land-use constraints applicable to them, into GRX (Obj. 5) (SMR VIII.18).

- Consult MDNR and USFWS when any proposed activity has the potential to impact a rare species (Obj. 1 and 13) (SMR VIII.19). This will ensure the necessary protection for these species of concern and their respective habitats, as well as the uninterrupted continuation of the Naval mission at NAS.

- Continue comprehensive survey efforts to monitor known listed or candidate species (Obj. 1 and 12) (Project VIII.8).

  Locate newly listed or candidate species and/or taxa that have not yet been adequately researched (primarily invertebrates) (Obj. 1 and 12) (Project VIII.9).

One particular species of note retains stringent federal protection despite lacking ESA listing. The Bald Eagle (*Haliaeetus leucocephalus*), which was formally delisted from federal Endangered Species Act protection on July 9, 2007, has been observed on most NAS properties and has been documented as nesting on PAX, WOLF, and BIR. The Bald Eagle is found throughout the Chesapeake Bay region with a healthy population in the general vicinity of NAS. In addition to five to eight known nests on the Complex, Bald Eagles are often observed soaring above the marsh fringe and water's edge hunting for fish, waterfowl, and carrion. While the Bald Eagle was delisted at the state level in April 2010, it remains ranked as S3 (Vulnerable/Watchlist) / S4 (Apparently Secure) in Maryland. The protections afforded to the Bald Eagle under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA) remain in effect.

NAS is concerned with the impact that military activity may have on this species throughout the year, and especially during the nesting season. As a result, the NR Program coordinated with the Sustainability Office to have noise-monitoring devices placed at/near nest sites for several years. Nests were visually monitored from the ground during this timeframe in order to determine if

adults or nestlings appear to be impacted by aircraft operations. No adverse impacts have been identified.

In addition, there is concern with flight operations and BASH issues. Incidental take of Bald Eagles through collision with aircraft has been documented at the installation, and (as noted by the local USFWS field office during review of the INRMP) the expanding eagle population along the Patuxent River could increase frequency of these strikes. The installation will ensure that the USFWS Maryland Office of Law Enforcement and Region 5 Migratory Bird Program Office are notified of any eagle strike within 48 hours of discovery (GMR VIII.3). Specific contact details, already in use, will also be included in the next revision of the installation BASH program instruction.

NR, in collaboration with Air Operations and the Center for Conservation Biology out of the College of William and Mary, is conducting a project to trap Bald Eagles and place GPS transmitters on them to track their movements (Obj. 1 and 10) (Project VIII.10). This is in response to a dramatic increase in the number of Bald Eagles at PAX during September – November. The study is designed to determine 1) what the daily movements and patterns are of these eagles while they are on the installation, 2) if there is a roost site on or near the airfield, 3) how long they remain in the area and 4) where they come from and where they go during other times of year. The data will be used to implement management strategies to reduce the BASH risk during this time of year. A total of 16 transmitters will be deployed. Data is already being collected from 10 transmitters that were attached in 2020 and 2021.

Annual aerial surveys for Bald Eagle nests performed by the NR Program (supported in the past by the NAS Search and Rescue Unit and historically supplemented by MDNR efforts), investigate all NAS property and flight corridors for nesting eagles. Through this effort, active nests have been discovered and monitored on the Complex. It is mission-critical to closely monitor those birds that nest in close proximity to the NAS airfields. Therefore NR staff efforts to survey nests should continue (Obj. 1 and 10) (Project VIII.11). The NR Program will adhere, to the extent applicable, to National Bald Eagle Guidelines as currently in use by USFWS, and to the provisions of the Bald and Golden Eagle Protection Act.

9.2.3.1 Federal Endangered Animal Species

NAS has documented certain federally listed endangered species (as well as suitable habitat for others); however, none are considered to be "occurring" on NAS. The Shortnose Sturgeon (*Acipenser brevirostrum*) is found in the lower Chesapeake Bay. It is a fresh- to brackish water fish capable of sustaining populations in the Patuxent and Potomac Rivers, where it may use the adjacent small bays as part of its foraging area. The Atlantic Sturgeon (*A. oxyrhyncus*), listed as federally endangered in 2012 within the Chesapeake Bay Distinct Population Segment (which includes NAS), occurs throughout the Bay and spawns in the Potomac River.

The Leatherback (*Dermochelys coriacea*) and Kemp's Ridley (*Lepidochelys kempii*) are transient sea turtles with habitat in the estuarine waters surrounding NAS. They are found in the adjacent Bay and Ocean, and may use the open waters surrounding the Station during visits to the region. Kemp's Ridley turtle carcasses have been found stranded on Station beaches.

Almost all of the oceanic cetaceans are listed as endangered, and the presence of unobstructed waters from the Atlantic Ocean creates the potential for their presence in NAS waters. The Humpback Whale (*Megaptera novaeangliae*) and North Atlantic Right Whale (*Eubalaena glacialis*) have each been observed in the vicinity of the Station. The West Indian Manatee (*Trichechus manatus*), which has been reported from the Patuxent River, is also a very rarely documented vagrant into the Chesapeake Bay from warmer waters to the south.

Acoustic bat calls recorded at WOLF in 2019 were plausibly identified (via software and hand verification) as Indiana Bat (*Myotis sodalis*); however, there is a high degree of call signature overlap with other *Myotis* species, and WOLF is 45 miles east of the nearest confirmed extent of the species. Subsequent acoustic surveys (stationary and mobile transect, in-house and contracted) conducted in 2020 did not record any additional Indiana Bat calls. Recordings from in-house 2021 acoustic surveys (stationary and mobile transect) have not yet been analyzed. Further investigations with increased capture efforts in early May are recommended in order to reduce uncertainty or confirm species presence at WOLF. In general, mist-netting should be repeated at PAX and WOLF at least every five years in order to reevaluate occurrence of all listed, candidate and proposed bat species (Obj. 12) (Project VIII.12). NR staff should continue stationary acoustic surveys (in-house) and include analysis of these recordings in the next bat survey contract (Obj. 12) (Project VIII.13).

9.2.3.2 Federal Threatened Animal Species

The following federally threatened animal species have been documented on PAX but do not "occur" on the installation at this time: Atlantic Loggerhead Sea Turtle (*Caretta caretta*), Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*), and Piping Plover (*Charadrius melodus*). These listed species are dependent on the estuarine ecosystem that surrounds the Station. However, all are known through just a handful of adult occurrences. Additionally, PAX has audio recordings that are potentially attributable to the Northern Long-eared Bat (*Myotis septentrionalis*), which was listed in May 2015.

The Atlantic Loggerhead Sea Turtle has been observed alive only once at PAX, but numerous carcasses have washed up on the beaches. At WOLF, injured and dead Loggerheads and Kemp's Ridley Sea Turtles have been recovered on the beaches. NAS biologists have collected data from these and forwarded the information to NOAA Fisheries. The practice of reporting dead sea turtles or marine mammals to NOAA Fisheries, as well as to the Cooperative Oxford Laboratory and the Virginia Institute of Marine Science, should be continued (Obj. 12 and 13) (SMR VIII. 20). In addition, reporting of all live marine mammal or sea turtle sightings or strandings to the Marine Mammal/Sea Turtle Stranding Network should continue (Obj. 12 and 13) (GMR VIII.4/SMR VIII.21). NR personnel are members of the Stranding Network and respond to reported strandings throughout the Southern Maryland area. This practice should be continued (Obj. 12 and 13). NR personnel, at the request of NOAA Fisheries, will continue to conduct beach/shoreline surveys immediately following significant storm events and at the on-set of colder water temperatures in order to spot stranded marine life.

A few adult individuals of the Northeastern Beach Tiger Beetle have been observed in past years at PAX; however, it is assumed that these were dispersed from known breeding sites located across

the Patuxent River in Calvert County. To date, no larval tiger beetles of this species have been observed on NAS, and surveys conducted as recently as 2012 showed that the NAS properties currently lack the proper habitat (sand grain size) to support the Northeastern Beach Tiger Beetle. In order to determine occurrence of this, future efforts should focus on repeated adult surveys (at least 2-3 days) conducted during the peak of the adult flight period (Obj. 1 and 12) (Project VIII.14).

For decades, the Piping Plover was documented at PAX by a single migratory record dating from the 1960s; however, three individuals were photographed on the installation during a 2021 Breeding Bird Atlas survey (discussed further in Section 10.2 of this chapter). Subsequent surveys conducted specifically for Piping Plover that season and the next (2022) resulted in no additional sightings and the species is still considered to be "transient" for the Complex.

The NAS properties fall within the geographic range of and support habitat for the Northern Long-eared Bat. Mist-netting and acoustical surveys conducted at PAX and WOLF (2012-2013) identified *Myotis* calls that could be attributed to this species; however, no Northern Long-eared Bats were physically captured, and subsequent reexamination of the calls was inconclusive. Additional surveys conducted at both PAX and WOLF have not verified species presence. The proposed endangered Tri-Colored Bat occurs at PAX and WOLF. NAS will follow the USFWS Chesapeake Bay Field Office recommendation to suspend tree-clearing in potential maternity/roosting habitat for listed bat species from 15 April through 01 September when applicable.

9.2.3.3 Federal Candidate Animal Species

Federal candidate species are those that are currently being studied by the USFWS for official federal listing as either threatened or endangered. One such species is the Monarch Butterfly (*Danaus plexippus plexippus*), which is known to occur on NAS properties. Although the species has often been sighted on the installation, surveys specific to Monarch Butterfly and its habitat have not been conducted. To assess the occurrence, distribution, and quality of Monarch Butterfly habitat as well as determine the extent of Monarch Butterfly presence within the identified habitat, surveys should occur during the active flying season (Obj. 12) (Project VIII.15). In an effort to create more habitat for the Monarch Butterfly and other pollinator species, NAS began proactive measures in October 2021 such as, continued invasive species control, site maintenance, and native plant introduction on six acres, and the project is contracted to continue through fiscal year 2024. NR should conduct additional plant species management on these sites as needed, and consider establishing additional pollinator areas in the future (Obj. 12) (Project VIII.16).

Numerous other invertebrates (mollusks, beetles, butterflies, and moths) are also presently listed for study. NAS supports forest and old field habitats for a portion of these species.

The Little Brown Bat is under review for listing mainly as a result of being heavily-impacted by White-nose Syndrome. The Little Brown Bat is documented as occurring at PAX and WOLF.

The Spottled Turtle (*Clemmys guttata*) was petitioned for listing under the ESA in 2015. The USFWS determined that petition action was warranted and initiated a status review of the species. Presence of the Spottled Turtle was documented by contracted surveys in 2019, with confirmation

of presence at WOLF and first documented occurrence at PAX. To understand presence, turtle movement, and habitat use at PAX, WOLF and the Grayson property, surveys conducted in 2019-2022 captured and marked a total of 137 individuals and tracked 30 of these.

9.2.3.4 State-Listed Animal Species

MDNR's Natural Heritage Program (MD NHP) lists 519 animal species that are considered rare, threatened or endangered (MDNR, 2021). This list includes insects, fish, amphibians, reptiles, mammals, and birds. While the state endangered species law and its regulations may not be legally applicable to NAS because of the principle of federal sovereign immunity, state-listed species should be afforded the same protection as federally listed species to the greatest extent possible (Obj. 12 and 13) (SMR VIII.22). Potential affects to state-listed species and their habitats shall be evaluated and mitigations proposed in NEPA documents, as appropriate. Conservation of these species and their habitats shall be addressed in INRMPs. Many of the species have known occurrence or potential habitats on the Station. These are listed, along with information pertaining to their state statuses and ranks, in Tables III-C-6 and III-C-7 in Annex III-C.

Through the DoD Legacy Resources Management Program, staff of the Maryland NHP completed a survey of PAX in 1995 for plants and animals that were listed as natural heritage resources by MDNR. In addition, comprehensive rare, threatened and endangered species surveys have more recently been completed at both PAX and WOLF in areas that are scheduled for (or have the potential for) development in the near future. The Station will ensure that surveys are conducted to determine the presence and distribution of candidate species and state/territory rare and endangered species as required by the Sikes Act Improvement Act and reference (b). A 1998 report, completed by ecologist Charles Davis, summarizes all known occurrences of rare species on NAS - including all historical occurrences in addition to results of the two comprehensive surveys. The Davis report is incorporated into this INRMP by reference. All known geographical data for occurring species has been entered into the Station's GIS. The report's management recommendations for rare animal species can be summarized as follows:

- Expand survey efforts to include the less conspicuous species of lower taxa, particularly invertebrates (Obj. 12) (SMR VIII.23).
- Conduct additional focused surveys for rare species during their periods of greatest conspicuousness (Obj. 12) (SMR VIII.24).
- Monitor known populations or occurrences to determine changes in abundance (Obj. 12) (Project VIII.17).
- Identify potential factors contributing to any observed changes in species abundance (Obj. 12) (SMR VIII.25).
- Update management plans and programs to mitigate any negative impacts to rare species (such as human disturbance, beach erosion, vegetative succession, grounds maintenance, etc.) (Obj. 12) (Project VIII.18).

- Update and maintain a database of all rare species occurrences, for use in applications such as the Station PWD Planning Checklist (Obj. 5 and 12) (SMR VIII.26).
- Produce educational materials and develop educational programs to inform Station personnel and the general public on rare species issues (Obj. 12) (Project VIII.19).

9.2.3.4.1 State-Endangered Animal Species

MDNR defines endangered species as those whose continued existence as a viable component of Maryland's flora or fauna is determined to be in jeopardy. There are 16 animal species with state-endangered status that are known or expected to occur at PAX, and three with a possibility of occurrence. Of these species, only two are known to occur at WOLF, while others are considered probable, possible or unlikely to occur there.

9.2.3.4.2 State-Threatened Animal Species

MDNR defines threatened species as those flora and fauna that appear likely, within the foreseeable future, to become endangered in Maryland. There are four animal species with state-threatened status that are known from PAX. Of these species, two are known to occur at WOLF, one is probable and one is possible to occur there.

9.2.3.4.3 State Animal Species in Need of Conservation

MDNR defines species in need of conservation as animal species whose populations are limited or declining in Maryland such that it may become threatened in the foreseeable future if current trends or conditions persist. There are nine animal species in need of conservation that are known from PAX, and one that probably occurs there. Of these nine species, four are known to occur at WOLF, three probably occur, one possibly occurs, and two are unlikely to occur there.

9.2.3.4.4 State-Rare Animal Species

MDNR defines rare species (S2) as those at high risk of extinction or extirpation due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors (typically occurring in 6 to 20 populations). MDNR defines highly rare species (S1) as those at very high risk of extinction or extirpation due to very restricted range, very few populations or occurrences, very steep declines, very sever threats, or other factors (typically occurring in five or fewer populations). There are 20 animal species with state-rare rank (S1 or S2 rank, and that are not listed endangered, threatened, or in need of conservation) that are known to occur at PAX. There are 11 rare species known to occur at WOLF, with another 8 at WOLF that are probable or possible to occur there.

9.2.3.4.5 State-Watchlist Animal Species

MDNR defines watchlist (S3) species as those at moderate risk of extinction or extirpation due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors (typically occurring in 21 to 80 populations). Those species whose ranks are listed as S3.1 are tracked by MDNR, but S3 species are not. There are no S3.1 species in the current MDNR heritage lists for animals. There are 33 watchlist species known to occur at PAX. There are 12 watchlist species known to occur at WOLF, with another 20 that are probably, possible, or unlikely to occur there.

9.2.4 Rare, Threatened, and Endangered Plant Species

As described in Chapter 3 (Physical Description), NAS supports no federally listed species of endangered or threatened plants requiring strict legal protection. The Station does, however, have numerous species of plants listed as rare by the State of Maryland, with statuses ranging from watchlist to endangered (and even a few species formerly believed to be extirpated within the state). While the legal principle of federal sovereign immunity applies to the protection of state-listed species on this federal property, it is the intent of NAS in this plan and management actions to afford them protection to the greatest extent practicable without compromising the military mission. NAS considers this a stewardship obligation.

The Station's most comprehensive rare plant survey report, entitled *Rare, Threatened and Endangered Species, NAS Patuxent River, Webster Field Annex, and NRC Solomons – Management Plans for Threatened and Endangered Species 2009 Update* (Davis, 2010), contains a number of detailed management recommendations that are species- and habitat-specific. The preceding draft report, *Rare, Threatened and Endangered Species aboard the Patuxent River Naval Air Station, Maryland - Current Status and Results of 1997-1998 Field Surveys*) (Davis, 1998), included rare animal survey results and management prescriptions as well. These recommendations are incorporated by reference into this INRMP and implemented, where appropriate (Obj. 12). As some of the species addressed in this report have since been delisted, those associated, species-specific recommendations are no longer applicable. A survey was conducted in 2012 to confirm the occurrence of previously mapped rare, threatened, and endangered plant species as well as identify additional species.

The draft report general management recommendations can be summarized as follows:

- Species with a rank designation of S1 (highly state rare), a few S2 (state rare), and some SU (state status uncertain) warrant strict in situ conservation with frequent monitoring and active programs to protect the biological communities that support these species. Species with a rank of S3, other S2, and SU (of the subset found to be somewhat abundant) warrant study and tracking, but not absolute protection of every occurrence (Obj. 12) (Project VIII.20).
- All known occurrences of rare elements should be re-inventoried at least once in five years – unless changing conditions suggest declines, then more frequent monitoring is warranted (Obj. 12) (Project VIII.21).
- All new occurrences of rare species should be reported (Obj. 12) (SMR VIII.27).
- For state rare and state highly rare species, protection strategies should be developed and implemented, as appropriate (Obj. 12) (SMR VIII.28).
- GIS should be used to model potential locations for alternative rare plant sites and locations for conserving relict natural communities (Obj. 12) (SMR VIII.29).
- Census populations of S1 and S2 species should be taken to determine changes in abundance and the effects of current disturbances (mowing, right-of-way management,

etc.); prevent direct destruction of these plants; and identify and implement the appropriate cultural practices that would favor expansion of these populations – particularly by developing mowing schedules that would favor successful fruit and seed production (Obj.12) (Project VIII.22).

- Encroachment of invasive species that would negatively impact rare plant populations should be prevented (Obj. 12) (Project VIII.23).
- Educational materials and education programs should be developed to educate Station personnel on rare species issues (Obj. 12) (SMR VIII.30).
- Specific emergency salvage plans for rare species should be developed (Obj. 12) (SMR VIII.31).

9.2.4.1 Rare Habitats

A number of rare and unique habitat types occur on the Station, with an accompanying suite of unique plants and animals. These habitats should receive more intensive survey effort and protection. Refer to Davis' 1998 and 2010 rare species reports for more specific recommendations. Rare habitats include: 1) streamside clay seeps or wooded hillside seeps; 2) xeric sand meadows; and 3) sandy beaches. They are examples of relict communities, indicating past conditions of the local landscape. These relict plant communities continue to be relatively free of non-indigenous native species; conserving them means conserving the landforms, ecosystem flows and disturbances that have shaped and continue to maintain them.

General rare habitat management recommendations (Obj. 1 and 4) include:

1. Control upstream development and mitigate stormwater impacts in watersheds containing hillside seeps.
2. Control non-indigenous invasive species.
3. Conduct additional research, as necessary, to better understand these sites for future management purposes.
4. Prepare and implement restoration plans for those areas that are already degraded to some extent.
5. Maintain necessary disturbance regimes and other processes required to perpetuate these habitats, ensuring appropriate timing and frequency.
6. Restrict use of herbicides in these plant communities.
7. Assess opportunities for establishing additional sites or expanding existing sites.

The intent of management of rare species is not to foster dependency on humans but rather to restore biological communities that are self-sustainable with the least degree of human intervention.

9.3 Nuisance and Problematic Wildlife

Occasionally, wildlife interactions with human landscapes occur to the degree that the animals are considered a nuisance. Raccoons (*Procyon lotor*), Opossums (*Didelphis virginiana*), and Striped Skunks (*Mephitis mephitis*) get into residential garbage, and sometimes occupy spaces within homes and other buildings. Many other animals such as squirrels, snakes, and birds may also gain access. This happens when populations, human or wildlife, grow disproportionately or expand into new areas so that activity between the two overlap. Some of these species may become destructive, increasing facility maintenance or project costs or impacting employee morale. In some cases, the sheer presence of a nuisance species can cause human injury or sickness to the point where general human safety is compromised.

Other types of nuisance animals are those non-native to this landscape, but associated with the human presence. Overpopulation of these species could damage native wildlife habitats. These nuisance and problematic species include the Norway Rat (*Rattus norvegicus*), House Mouse (*Mus musculus*), European Starling (*Sturnus vulgaris*), House or English Sparrow (*Passer domesticus*), Rock Pigeon (*Columba livia*), and feral animals (cats and dogs). Dangerous and poisonous wildlife may also interact with Station personnel, though precautions can be made to avoid these species. They include, but are not limited to, the Northern Copperhead (*Agkistrodon contortrix mokasen*), the Black Widow (*Latrodectus mactans*) and the myriad of wasps and bees to which certain humans have allergies.

The first measure to be employed in mitigating wildlife/human conflicts should be the long-term control or elimination of conditions that create or support the conflict. This may involve physical exclusion through structural modification, improved sanitation, or elimination of food sources (such as pet food left outside). NR personnel should be consulted to determine if an on-site inspection is warranted for such problems, as they can make recommendations and refer issues to the appropriate NAS contact (Obj. 8) (GMR VIII.5).

In some cases, it is appropriate to use lethal measures in order to control the problem species. If reimbursable funds are made available, Conservation staff can perform mission-essential nuisance wildlife inspections and implement subsequent control measures in-house (Obj. 8) (GMR VIII.6). Otherwise, they can make recommendations and the building facilities coordinator can submit a service order to the Public Works Department for contract execution.

When the animals in question are game species, control may be accomplished by increasing harvest numbers or extending the hunting season to accomplish a drop in population. Some species may be controlled or discouraged through constant harassment, as is the case with beavers. NR staff should conduct bi-weekly beaver surveys to monitor potential conflicts from dam-building activities (Obj. 8) (GMR VIII.7/SMR VIII.32). Other game species may be problematic in areas that are not open to hunting. For example, woodchucks may create burrows on top of capped landfills and underground ammo bunkers, or in leased agricultural fields or other public access areas, causing extensive damage and safety problems.

NR personnel should manage (and, as applicable, direct contractors to perform) nuisance wildlife inspections and control activities at environmental restoration sites, such as landfills (Obj. 8)

(GMR VIII.8/SMR VIII.33). If other wildlife species suffer from known nuisance animals, as in the case of feral cats, control measures should also be initiated, but only with consideration of compliance requirements and necessary nuisance wildlife control permits from state and federal agencies. NR personnel should track any contractor-acquired special purpose wildlife permits (Obj. 2, 3, 5 and 7) (GMR VIII.9/SMR VIII.34).

Continued implementation of BASH and Deer-Auto Strike Hazard (DASH) programs will mitigate some of the effects of wildlife on human safety. Other methods of population management include lethal control, such as increased hunter harvests, trapping, shooting, or professionally administered poison through various carriers; behavioral modification; physical exclusion; and habitat or reproductive manipulation. Each of these techniques is directed at some unique aspect of a problem species' life cycle. All wildlife control activities by contractors should be coordinated with the Conservation staff (Obj. 8, 9 and 10) (GMR VIII.10). As a safety precaution, all personnel participating in nuisance wildlife control activities should receive pre-exposure rabies immunizations prior to performing such work (GMR VIII.11).

The Public Works Department manages a grounds maintenance and pest control contract. In 2008, historic provisions for nuisance arthropod and rodent species control were expanded in this contract to include all vertebrate wildlife species, with the exception of rare species and white-tailed deer. Removal or control of species such as the Norway Rat should be carried out via this contract in accordance with the Integrated Pest Management Plan (described in Section 9.3.4 of this chapter) (Obj. 7 and 8) (GMR VIII.12). Conservation staff should review and approve all contract provisions for vertebrate wildlife control (Obj. 8, 9 and 10) (GMR VIII.13). Problems with free-roaming domestic animals on the Station should be reported to the Public Works Department for control through the grounds maintenance and pest control contract (Obj. 7 and 8) (GMR VIII.14). NR personnel should work with the private, contract Housing Manager to develop a plan for elimination of recurring feral domestic animals and nuisance wildlife conflicts in or near housing areas (Obj. 8) (SMR VIII.35).

9.3.1 Bird/Animal Aircraft Strike Hazard Reduction

This program is a Navy-wide effort to reduce the impact of birds, deer and other wildlife on aircraft operations. Aircraft strikes are almost always fatal to the wildlife. More importantly, these strikes are sometimes fatal to the human pilots operating the sophisticated air vehicles. Bird/animal aircraft strike damage falls into three basic categories: engine ingestions, canopy penetrations and impacts to the fuselage or attached equipment. It is usually an expensive encounter to aircraft, resulting in many millions of dollars in damage annually. It is in the best interest of NAS to eliminate possible conflicts between birds/animals and aircraft by rendering habitat in the airfield environment as unattractive as possible. The BASH program should be the Installation's highest natural resources management priority (Obj. 7 and 10) (GMR VIII.15/SMR VIII.36).

A comprehensive and integrated approach is the key to a successful BASH program. OPNAVINST 6250.4 (series) lists many techniques for limiting bird/aircraft strikes. Some of these suggestions would involve physically altering or eliminating inviting habitat through vegetation manipulation or water drainage around the airfield, therefore discouraging the use of these areas for feeding, roosting, loafing and/or nesting. The diligent use of bioacoustics and pyrotechnics can be a

valuable tool for dispersing birds from the airfield. Reinforcement of these frightening methods through lethal control is sometimes necessary. State and federal permits are required for these depredation activities. Other methods that prove effective include active wildlife dispersal using sound or flashing lights. Hunting and trapping can reduce populations of nuisance game species, but these techniques have limited effect on small and elusive animals. Recent studies indicate certain potential repellents, such as artificial grape flavoring (methyl anthranilate), may act as a deterrent for some species of birds.

NASPAXRIVINST 3750.5 (Bird/Animal Aircraft Strike Hazard Program) is the local guidance for operation of the Station BASH program. It assigns actions, responsibilities and requirements for implementing the program at NAS. It contains detailed prescriptions for reducing the strike risk, as well as descriptions of BASH Condition Codes, strike reporting forms, an SOP for mammal and bird dispersal and depredation (lethal control) on the airfields, wildlife dispersal log forms, an SOP for strike reporting, and an articulation of the Station Imminent Threat policy. Imminent threat determinations are based on location and animal behavior, as described in the policy. It also contains requirements for firearms/ammunition storage, inventory, training and withdrawal in support of the program.

In November of 2020, a Wildlife Hazard Management Plan (WHMP) was signed by the installation Commanding Officer. This WHMP provides final BASH program component that marries the local BASH program concept of operations and identifies wildlife hazards with specific Integrated Wildlife Damage Management (IWDM) actions to mitigate, control, remove or depredate those hazards to local airfield operations. The WHMP also infuses risk management into resource planning by identifying those habitat modification techniques and wildlife management actions for priority funding which will afford the greatest improvement to aviation safety and reduced margin of error. The Air Operations Officer and the Bird Hazard Working Group will review and update the WHMP annually.

The US Air Force has developed a model to predict the presence of nuisance birds, especially turkey vultures (BioScience, 1995). The Bird Avoidance Model (BAM) is used to warn of circumstances likely to produce aircraft and bird encounters. This computer program can cover the Patuxent River area and produce predictive data for the NAS BASH program. Additionally, modifications to programs like BAM can be developed for all migratory birds. NAS should develop a system to monitor and report all local bird strike hazards (Obj. 10) (GMR VIII.16).

The Conservation Branch previously used (2006-2009) an avian radar system called eBirdRad that was designed for plotting and tracking potential bird movements. This system was used as a wildlife management tool on and around the Station's airfield as part of the BASH program, and was used to monitor sensitive areas for bird activity - especially at night, when traditional survey methods are ineffective. Unfortunately the site that housed this system was lost to another program. This system is efficient at establishing bird movement patterns and trends, but was not developed for real-time response for pilots, air traffic controllers or wildlife managers. Recent developments in these systems allow for near real-time responses to bird activity by air traffic controllers and wildlife managers. Bird/Wildlife alert areas can be set up to warn air traffic controllers and wildlife

managers of hazardous bird activity. NR and Naval Test Wing Atlantic staff are working to secure funding for a newer avian radar system. Siting for this radar has already been completed.

Natural areas or other vegetated areas in the proximity of the airfield that harbor high strike-potential birds (gulls, raptors, crows, doves and mixed flocks of blackbirds) should be modified or eliminated to an extent that the target species are discouraged from using the area. Farm fields should use bird-proof crops only. Proper grass height (maintained between seven and fourteen inches) is the best available airfield use-deterrent to gulls, blackbirds, and raptors. Annex VIII-C contains NASPAXRIVINST 3750.5J - the NAS Bird/Animal Aircraft Strike Hazard (BASH) Program Instruction (signed in April 2019). It provides guidelines for proper airfield maintenance and reducing the BASH potential.

The single largest area of wildlife assemblage on the airfield consists of the altered wetlands and vegetated buffers found in the infield area. The majority of these altered wetlands were cleared and the upland vegetated buffers were minimally graded in 2015. The Clear Zone Management Plan should be implemented to fill and clear the remaining area (Obj. 10 and 11) (GMR VIII.17). Compensatory wetlands mitigation may be required as a permit condition, which may elevate the project cost substantially. However, the long-term savings realized by strike reduction should substantially offset the cost.

As discussed later in Section 10.0 of this chapter, NAS NR personnel historically conducted summer deer surveys in order to establish deer hunting quotas for the subsequent hunting season. Using a statistical model that was developed specifically for PAX, deer-count survey data was used to calculate a harvest objective that, if met, resulted in a population level considered safe for airfield operation. However, changes in BASH management strategies implemented by Air Operations have precluded the use of deer harvest modelling; subsequently, harvest goals have not been set since the 2014-2015 hunting season. The NR Program continues the nighttime surveys during the summer, but the purpose now is for detection and dispersal of deer and other species hazardous to aircraft. This BASH/DASH reduction effort is supplemented by a state depredation permit that allows NR personnel to shoot deer that pose an immediate threat to aircraft safety. Under the conditions of this permit, deer taken therein must be consumed or donated for purposes of consumption. The NR BASH/DASH program manager shall apply for and obtain this depredation permit on an annual basis (Obj. 9 and 10) (SMR VIII.37).

As with any airfield, there may be situations where animals pose an imminent threat to aircraft operations such as take-offs and landings. In some such instances, it may be necessary to depredate the animal. “Imminent” is defined as “about to happen, likely to occur at any moment.” A “threat” is defined as “an indication or warning of probable trouble.” Normal, documented standard operating procedures state that the situation responder shall first attempt to disperse the animal that is posing a threat. This would/could occur on a regular basis. The Environmental Planning and Conservation Branch is staffed and permitted to handle these situations on a daily basis, and will do so in the same consistent manner. At no time shall the mere existence of a species be considered an imminent threat (Obj. 10) (GMR VIII.18/SMR VIII.38).

There are, however, some instances in which a species' population may be such that depredation is warranted to reduce the population numbers to a suitable carrying capacity for that species, as shown by existing algorithms, Population reduction at NAS shall occur only in direct coordination with the N45 staff on the depredation permit (Obj. 10) (GMR VIII.19/SMR VIII.39).

The installation supports a deer shooting moratorium on antlerless deer during the period of 15 May through 31 August, to prevent the orphaning of fawns. This moratorium does not extend to antlered deer observed within the imminent threat zone, nor to antlerless deer that do not respond to hazing and dispersal attempts. With the assistance of summer interns, NR Program staff will conduct twice weekly dispersal efforts during this period (Obj. 2 and 3) (Project VIII.24). In 2011, a U.S. Department of Agriculture (USDA) Wildlife Services (WS) biologist was assigned to NAS to assist with the BASH program and complete a Wildlife Hazard Assessment. Their responsibilities include assessing and helping to control wildlife on the airfield. USDA WS conducts monthly nighttime infrared surveys on the airfield to assess wildlife movement. In 2016, they began removing all deer seen on and around the airfield during these surveys, regardless of time of year. The model that NR staff previously used for calculating a harvest objective is no longer reliable since deer are now being taken from the spotlight survey area year-round.

Research involving the capture and marking of deer with radio collars and ear tags has already yielded some valuable information on deer movements at the installation and should be continued (Obj. 9).

The installation also plans to initiate a program of raptor research and management that involves trapping, banding, auxiliary marking, and relocation of hawks on and around the airfield. The program will be designed to mimic the successful programs implemented at NAS Whidbey Island and Seattle-Tacoma Airport. Resident raptor species (such as Red-tailed Hawk [*Buteo jamaicensis*], Red-shouldered Hawk [*B. lineatus*], Cooper's Hawk [*Accipiter cooperii*], American Kestrel, Osprey, and Bald Eagle) will be trapped, banded, fitted with conspicuous auxiliary markings, and then released on Station to serve as "sentinel" birds, preventing the incursion of transient and migratory individuals into their territories. Overwintering and migratory, non-resident raptor species (such as Northern Harrier [*Circus cyaneus*], Sharp-shinned Hawk [*Accipiter striatus*], Merlin [*Falco columbarius*], Rough-legged Hawk [*Buteo lagopus*], and Snowy Owl [*Bubo scandiacus*]) will be trapped, banded and relocated away from the installation. PAX possesses the necessary Master Station bird banding permits that authorize such activities.

9.3.2 Deer-Auto Strike Hazard (DASH)

A similar problem exists with ground-dwelling species on PAX roadways, runways, and taxiways. Wildlife such as deer and other small- to medium-sized animals can cause severe property damage to aircraft and injury to pilots, as well as automobile drivers and passengers. Manipulating forest habitat, monitoring deer populations, and increasing harvests when the deer population is determined to be high, along with eliminating travel and feeding cover in close proximity to paved surfaces, should prevent most collisions between wildlife and vehicles. Swareflex™ Wildlife Warning Reflectors have been evaluated for use on PAX. However, deer continue to be struck at the reflector locations. In addition, half of all strikes occur during daylight hours, when the

reflectors are ineffective. Based on these trials in high deer-strike areas, the reflectors will not be used at NAS on a large scale (Obj. 9) (GMR VIII.20).

Deer movement patterns between different areas of the Station should be tracked and monitored (Obj. 9) (SMR VIII.40). As a precaution against negatively altering deer movement patterns, all proposed security fencing projects should be evaluated for their impact on deer movements and potential to increase deer-auto collisions (Obj. 9) (GMR VIII.21/SMR VIII.41).

The best way to reduce accidents resulting from wildlife and human interaction is to keep their respective habitats separate. One method for discouraging wildlife access is the use of electric fencing. This system is employed in forestry, where animal damage is severe, and its application in this case is appropriate, but very expensive.

9.3.3 Structural Bird Problems

PAX has many facilities that inadvertently offer ideal nesting and convenient roosting locations for a variety of birds. Those birds that roost on towers, antennas, and some other structures are both a nuisance and a hazard. Their droppings and physical presence damage equipment, including aircraft; lower morale of personnel that must work in this environment; and pose a possible health hazard through disease transmitted in droppings, such as *Histoplasmosis*, or through bird lice. Surveys of locations reported as problem areas to locate bird access points and nesting sites will aid in the removal of offending birds. Procedures have been developed to reduce a structure's attractiveness for roosting and nesting. This is done on new construction by changing engineering designs of internal building conditions, adding netting, designing superstructures without roosts, and limiting bird access into buildings.

- A regular maintenance schedule should be implemented to exclude nesting or roosting birds from structures, particularly hangars, by eliminating access points other than main doors (Obj. 7 and 8) (GMR VIII.22).
- In addition, all external hangar doors should remain closed when not in use (GMR VIII.23).
- Hangars need to be individually evaluated to determine the appropriate method of nuisance bird control. All methods and options should be weighed; however, a combination of methods usually shows the greatest cost effectiveness and the best results. Lethal control of nuisance birds can be used after structural modifications to hangars have been made and failed. Coordination with NR staff is required (Obj. 7 and 9) (GMR VIII.24).

Priority should be given to those buildings and structures that put birds and humans in immediate conflict, jeopardizing personnel safety.

Various methods of eradication, exclusion, and frightening of birds have been and are still being tried. Through this trial and error approach, certain methods have been found to be more effective than others. Control methods include, but are not limited to:

- *Exclusion* - Correcting structural flaws in a way that will make them inaccessible to nuisance birds.

- *Predator Decoys* - Placing decoys of bird predators, such as hawks, have been proved ineffective, as the birds quickly recognize the decoys as harmless.
- *Falconry* - Using falcons or other hawks to frighten or capture nuisance birds has also been proven ineffective, as the nuisance birds recognize the trained hawks and either leave the hangar only temporarily or remain motionless inside until the threat of danger is gone.
- *Live Owl Hacking* - Rearing of young owls in hangars has been tried, in an attempt to establish owls in those areas, thus warding off nuisance birds. This can be effective as long as the owls remain in the hangar. However, in many cases, they move out before the nuisance birds and must be replaced.
- *Scare-Eye Balloons* – Balloons are available that mimic the eyes of a predator. This has proven to be somewhat effective, but difficult to maintain.
- *Rotating Beacons/Shiny Objects* - A scare tactic that initially frightens birds, this method becomes ineffective when there is no threat of danger associated with the devices.
- *Ultrasonic Devices* – Use of high-frequency, sound-generating devices has never been successful in removing birds and is prohibited in any military structure.
- *Poisoned Bait* – Use of Avitrol (a poison) with bird baits, such as cracked corn can kill and frighten nuisance birds effectively. However, there are some disadvantages, such as the inability to limit poison intake to only nuisance birds, which is something that requires caution and careful monitoring.
- *Trapping* - Commercial and homemade baited traps have proven effective, but require many man-hours to maintain. In addition, other birds eventually become wary and avoid the traps.
- *Carbon Monoxide* - Attempts were made in the past to evaluate carbon monoxide levels in hangars after all bay doors and windows were closed, but proved ineffective because hangars were not airtight enough.
- *Loud Music/Noise* - Using loud noises to frighten birds has reported limited success. Unfortunately, in most cases, birds may move a short distance away from the noise but not leave the hangar entirely.
- *Chemical Irritants* - Applying gel or liquid irritant products to perches can be somewhat effective. However, it is virtually impossible to cover all possible perches within a hangar and dust cover soon renders the irritants ineffective.
- *Sharp Projections* - Applying needles or sharp wires to perches can be somewhat effective. However, it is virtually impossible to cover all possible perches within a hangar.
- *Bird-Proof Netting* - Installation of light-weight, inexpensive netting in the hangar superstructure is very effective, but can be costly.

- *High-Pressure Fire Hoses* - Used to physically drive birds from an area, this method has proven ineffective, as the water pressure is insufficient to reach the tops of the hangars and into tight corners.
- *Plastic Stripping* - Thin strips of plastic to keep birds out, yet allow air to flow into the hangar can effectively be used on truck doors in the hangars.
- *Shooting* - This method of selective removal has been found to be very effective and relatively inexpensive, but does require careful coordination.
- *Toxic Perches* - Installing toxin-laden perches can be very effective, but should be used only as a last resort. This method is very time-consuming and expensive, and, most importantly, is not species-specific.

Any modification to existing structures and/or design of new structures should take into consideration the problems associated with nuisance birds. NR staff can make recommendations (Obj. 8) (GMR VIII.25).

Maintenance officers should be trained in the recognition of nuisance bird problems and how to take appropriate actions before workers take inappropriate ones (Obj. 8) (GMR VIII.26).

In addition, personnel should be encouraged not to feed the birds inside or near hangars (Obj. 9) (GMR VIII.27). This alone will not eliminate the problem, but it will, at least, not attract more birds or encourage any to stay.

9.3.4 Integrated Pest Management

IPM is a relatively dynamic and growing field of applied ecology involving the use of biological agents in concert with controlled use of approved chemical agents to limit problems formerly controlled by massive, regular doses of pesticides. NAS has an IPMP that employs the principles of IPM (NAVFAC, 2016). By using IPM philosophies, the Station will help control increasingly expensive chemical costs and reduce the introduction of unnecessary, dangerous pesticides and herbicides into the natural environment. Currently, the Navy uses pest scouts to determine pest species problems, operating in a curative rather than preventative manner. Pest treatments are then contracted to private companies. NAS NR personnel should review pest control procedures used by contractors, and require use of IPM practices when appropriate (Obj. 8) (GMR VIII.28/SMR VIII.42).

9.3.5 Rabies, Lyme Disease, Tularemia and West Nile Virus Threats

The rabies virus, transmitted by the bite or saliva of an infected animal, infects nerve tissue to cause irreversible, fatal damage to the brain. Throughout the eastern part of the United States, cases of rabies in wild animals and free-ranging domestic animals have been on the rise. Public health standards apply in cases where animals are identified as rabid. Generally, any wild or domestic animal suspected of having rabies should be captured, if possible, or destroyed for examination (GMR VIII.29). Regulated hunting and trapping can prevent the dangerous buildup of wildlife population levels that encourages epizootic outbreaks.

Lyme disease is a crippling condition caused by infection with the bacterium *Borrelia burgdorferi*, which is transmitted by tick bites. Humans may be exposed to these disease vectors directly, or through contact with the mammals that carry them. Symptoms include a rash at the site of the tick bite and flu-like complaints (fever, chills, headache, and fatigue), followed by a severe arthritic condition. Lyme disease, like other vector-borne diseases (e.g., malaria), is considered to be climate-sensitive and could exhibit increased infection rates as winter temperature become milder.

Tularemia, caused by the bacterium *Francisella tularensis*, is another disease that can be transmitted by ticks or through direct contact with infected animals or carcasses, especially rabbits. Human infections usually result from handling or skinning infected rabbits. As such, tularemia can be avoided by wearing rubber gloves while dressing these animals and by thoroughly cooking rabbit meat.

To minimize the spread of tick-borne diseases, consider habitat manipulation (which can also benefit DASH objectives) in areas where ticks come in contact with Station personnel (Obj. 8). Specifically, prescribed burning can be used to combust the leaf litter that conceals these arthropod pests. While this is destructive to certain wildlife and inappropriate under many circumstances, it is quite applicable for areas such as campgrounds and picnic sites. In instances where infestations of ticks are found in residential areas, tick-specific pesticides can be used. Research has shown that cotton balls treated with acaricide is an effective way of killing ticks on one of their hosts, the White-footed Mouse. The cotton balls are gathered by mice and used as bedding material. This close, continuous contact between the mice and the pesticide in the nests kills ticks on their bodies.

West Nile virus, commonly found in Africa, West Asia and the Middle East, was first reported in the United States in August 1999. The virus is transmitted by mosquitoes, which become infected when they feed on the blood of infected birds. West Nile virus is not transmitted from person to person, nor is there evidence that infection can result from handling infected birds. As a rule, however, it is recommended that all dead animals be handled with gloves (GMR VIII.30).

Rabies and Lyme disease are both true hazards to human and other mammal health. As the mammals that harbor these threats are present throughout the Station, it is possible for anyone aboard the Station to become exposed to them. The existing education program continues to disseminate basic information on rabies, Lyme disease, tularemia, and West Nile virus (as well as other wildlife-related health hazards) to all Station personnel (Obj. 8). Information on these threats, their possible locations at NAS, and protocol to be followed in the event of an encounter may be made available in the form of handouts and lectures or exhibits at Station events (Obj. 8) (Project VIII.25).

Station NR personnel should remain vigilant for outbreaks of any wildlife disease, whether it threatens human health or impacts animal populations (Obj. 8) (SMR VIII.43).

9.3.6 Hunting and Trapping Program

The active harvesting of wildlife resources to achieve other wildlife population needs will serve an integration need required by the INRMP. It will also achieve multiple-use goals set by other chapters of the INRMP, such as Forest Management (Chapter 6), Land Management (Chapter 5), and Outdoor Recreation (Chapter 9). The outdoor consumptive sports focus primarily on White-

tailed Deer, waterfowl, and small game. Wildlife hunted and trapped on the Station includes deer, turkey, squirrel, Mourning Dove (*Zenaida macroura*), ducks, geese, rails, woodcock, snipe, coyote, foxes, and rabbit. Quail, formerly a hunted game bird, closed after the 2002-2003 season due to population declines related to habitat loss. Tables VIII-B-4 and VIII-B-5 in Annex VIII-B provide game harvest data for PAX and WOLF, respectively. Refer to Chapter 9 for details on current hunting policies and procedures.

NAS should continue its emphasis on safety and ethics in the hunting and trapping program (Obj. 2) (SMR VIII.44). The use of hunting to lower the number of animals on the Station, especially deer, is the preferred means by which to remove excess animals and manage populations. As appropriate, recreational hunting should be the primary means of deer population control on the Station (Obj. 2, 6 and 9) (SMR VIII.45). This method distributes the animal products to local families, and provides valuable recreational opportunities. In addition, the collection of biological data at the PAX deer check station should continue (Obj. 5 and 6) (SMR VIII.46). This is an effective way to monitor reproductive success of the population, as well as other measures of herd health and population status.

10.0 Additional Research Needs

As with any investigative effort, gaps that are discovered in available information must be filled to better understand the resource. There are holes in the wildlife resources data at NAS, and filling these will enable the Station to better meet its management needs. A more thorough understanding of the many population parameters is required for better management of NAS wildlife resources (Obj. 2 and 3) (SMR VIII.47). One of these data gaps is the Station's contribution toward understanding rare, threatened, and endangered species population dynamics. In addition, specific information is lacking on the influence of the Station's forests on local animal populations, particularly forest interior-dwelling species and neotropical migratory birds.

Currently, NR Program personnel monitor many of the existing wildlife populations. For example, SCA interns conduct twice-weekly spotlight count surveys on the airfield during the months of May through August. All deer seen are recorded, including the location, number of animals, and whether they are antlered, antlerless, or fawns. Deer are dispersed when possible, driving them to the closest habitat away from the runways and taxiways. (Obj. 2 and 3). This spotlight data, along with biological information collected from harvested deer, contributes to the accurate assessment of deer population trends. While roadway deer-crossing locations are documented through auto-strike reports, it is not known whether deer reach these sites randomly or via established travel routes. For DASH management purposes, this information is important in determining effective DASH-reduction techniques. In order to determine deer travel routes adjacent to roadways and within the airfield as a whole, conduct a trapping and radio-tagging effort to monitor deer movements (Obj. 9) (Project VIII.26). Current surveys that regularly update lists and population estimates of all mammals, birds, and other animals at NAS should continue (Obj. 1, 3 and 6) (SMR VIII.48). Although some baseline surveys have been conducted, more quantitative information is needed on small mammals, reptiles, amphibians, and invertebrates to determine and plan for their basic habitat needs (Obj. 1, 3 and 6) (Project VIII.27). Generally, continuing data collection will

provide long term information on population cycles, population health, and maintenance. This is true for all species, common or rare.

In a past effort to expand the wildlife information database, MDNR assisted the Navy in studying small mammals on PAX, focusing primarily on the Southeastern and Masked Shrew (*Sorex cinereus*). Similar collaborative efforts should be encouraged for future species surveys (Obj. 13) (SMR VIII.49).

10.1 Station Natural Resources Research

The object of integrated resources management is to link all aspects of NAS natural assets in a cohesive plan. Research is needed to understand the impacts of wildlife management on other resources. It is suggested that information for gaps in baseline data be collected prior to the institution of any INRMP actions that may impact resources beyond the results intended (Obj. 1 and 3). The data collected should reflect the entire biota within the affected community (Obj. 1 and 3). An example of this integration would be to record the loss of old-field insects and animal species that occur as portions of NAS are converted into forest by documenting wildlife features concurrently with the documentation of forest cover rehabilitation.

The potential ecological impacts of an INRMP task/project should be considered before implementing it, especially as site conditions may have changed since the time the project was proposed (Obj. 1) (SMR VIII.50).

Species data collected should reflect the entire biota within the affected community. In particular, all studies that are not species-specific should have an ecosystem management vantage point (Obj. 1) (SMR VIII.51). Integration of this management plan will naturally occur by including the entire range of species and landscape conditions within each site review. This already occurs to some extent, but an emphasis can be made for practicable biota review and abiotic physical limitations.

10.1.1 Deer Contaminants and Genetics

The Station provided tissue samples from hunter-killed deer to Indiana State University for the purpose of conducting genetic analysis from 2003-2020. Small samples of heart muscle and skeletal muscle are used for the analysis to determine the genetic diversity of the Station deer herd. The Station had also been providing the University with kidney and liver tissue which were used in contaminants studies focusing on the levels of heavy metals in the tissue of the deer, specifically in the liver and kidneys. The contaminants portion of this research was stopped several years earlier as no contaminants were being found in the tissue samples.

10.2 Regional Research and Conservation Efforts

NAS contains a number of varied wildlife habitats, but not all of those normally associated with St. Mary's County are represented. Within these, not all wildlife is dispersed evenly, as animals occupy available habitat or those sites that are more advantageous to survival. NAS should coordinate research efforts among NAS, MDNR NHP, and USFWS (Obj. 1 and 13) (SMR VIII.52). Agreements have existed between NAS and some outside wildlife managing agencies including USFWS, US Forest Service, U.S. Biological Survey, and other Department of Interior interests; as well as MDNR's NHP, Fisheries Division and Wildlife Division. However, more

cooperation can help further document the plant and animal communities present (Obj. 1 and 13) (SMR VIII.53).

Regional research goals involve understanding the multi-faceted and dissected Coastal Plain landscape that includes the Chesapeake Bay, a nationally important estuary. Federal/interstate agreements exist between the federal government and all states that border the Susquehanna River drainage. Central to this partnership is the Chesapeake Bay Agreement, renewed in 2000, which was established to study and protect this estuarine treasure. The Chesapeake Bay Watershed Agreement was signed in 2014 and amended in 2020, which identifies goals, outcomes, and management strategies to achieve watershed restoration. Other research goals for this altered landscape involve land use patterns, neotropical migratory and forest interior dwelling birds, and forest development. A multitude of methodologies exist for determination and understanding of species parameters. Regardless of the method used, it should be consistent with the short- and long-term research objectives.

PAX occupies public land at a strategic position on the Chesapeake Bay and along its tributaries - this can provide participating agencies with the space and time needed to achieve results for long-term studies. The federal and state agencies have personnel and resources to study a wide array of wildlife, while NAS offers many academic and applied ecosystem research opportunities, many of which are associated with the estuarine component surrounding Chesapeake Bay. Integrated research can provide key data, such as limits to natural populations of native wildlife, for those communities at NAS requiring restoration. A cursory regional landscape review of St. Mary's County, and eastern Maryland in general, indicates that contiguous upland forest and its associated wildlife are prime examples of a poorly represented community. This community could benefit from wildlife research to assist restoration activities at the Station.

Activities such as the interagency PIF program, which focuses on migrating neotropical land birds that are in a Western Hemisphere-wide decline, provide a forum for natural resources managers from a diverse group of public, private, and international agencies to cooperate in the stewardship of the Western Hemispheres' natural resources. Many programs have been established through the PIF effort, especially standardized policies and procedures for reporting and studying both resident and neotropical migratory birds.

NR personnel and SCA resource assistants are collaborating with MDNR, Maryland Ornithological Society, and Cornell Laboratory of Ornithology by participating in the third Maryland/DC Breeding Bird Atlas (BBA3) at all NAS properties, including PAX, WOLF, NRC SOL, BIR, and a handful of theodolite stations. The new acquired Grayson property will be added to future BBA3 surveys. Every 20 years, Maryland does this survey to monitor the breeding bird populations and look for any changes. Three of the five annual surveys (2020-2022) have been completed, and this effort will continue provided that interns are available to take on the intense field work.

10.3 Long-term Population Monitoring Program

In order to reestablish and/or maintain natural biodiversity, it is necessary to understand all the pieces of the ecosystem puzzle. In the interest of restoring biodiversity, NAS has the charge of

considering reintroduction of species once native to the area that have been eradicated (Obj. 2 and 3) (SMR VIII.54). Conversely, preservation of biological diversity on NAS can only be done through a long-term, continual monitoring program that records species occurrence, abundance, and population trends. This program is described in the original Wildlife Management Plan for PAX (Rambo, 1983). Historically, PAX conducted seasonal avian point count surveys, weekly shorebird surveys, and raptor migration surveys as part of the avian population monitoring program. Two monitoring programs are currently in effect at PAX, these include:

- weekly waterfowl surveys from October through April, and
- nesting Bald Eagle surveys from February through June.

In addition, the artificial nesting structures program highlighted in Section 9.1.3 of this chapter allows for monitoring and banding of species using man-made nesting boxes, such as the Eastern Bluebird. In order to continue this and other banding programs, the Station's Master Banding Permit should be maintained (Obj. 2, 3 and 5) (SMR VIII.55).

These monitoring activities should be coordinated with the Audubon Society and other natural history groups for assistance on bird counts, especially during Audubon's yearly Christmas Bird Counts or Maryland Ornithological Society's North American Migration Count (Obj. 3 and 13). Also, USFWS's Breeding Bird Survey can add data on regional populations. Furthermore, a Great Blue Heron nest survey is conducted at Bloodsworth Island each year to gauge the viability of the breeding population there. This effort is explicitly requested by the regional USFWS when performing annual INRMP metrics reviews, and should be continued indefinitely (Obj. 11 and 13) (Project VIII.28).

A herpetological survey known locally as the "Frog Log" should be continued and expanded on NAS. Additionally, the Station should be an active participant in the Maryland Amphibian and Reptile Atlas (MARA) project – a 5-year (last conducted 2010-2014) effort to map the distribution of "herps" in the state of Maryland (Obj. 1, 3 and 13) (Project VIII.29).

Additional herpetological research began in 2013, at the request of the USFWS field office, with the establishment of a Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) nest monitoring program at the PAX and NRC SOL. The diamondback terrapin is the only endemic estuarine turtle species in North America; rising sea level and land subsidence have put the coastal habitats used by this species at risk. Habitat is also lost as a result of storm erosion. Through the efforts of seasonal Student Conservation Association interns and numerous volunteers, terrapin nests are located, documented and protected. As of the end of the 2022 season, this dedicated team has protected 715 nests and released 6,646 hatchlings, the majority of which would otherwise have been lost to predation and storm surge. This project should be continued indefinitely (Obj. 1, 3 and 13) (Project VIII.30).

Northern Diamondback Terrapin hatchlings

Since the health of the wildlife community is based on the health of its individual components, it is important that a careful accounting be made of the natural members, both plant and animal. This would include status reports for individual imperiled species, or species expanding beyond their normal population limits. The use of an existing off-the-shelf computer database would enhance the effectiveness of this monitoring. Computer-aided mapping from the Regional GIS system can provide detailed updates to land use and coverage as new development displaces former wildlife habitats.

11.0 Completed Research

11.1 Grassland Bird Survey

NAS, along with two other military installations in the Northeast (Westover AFB and NAES Lakehurst), participated in a multi-year, DoD Legacy-funded research study of grassland birds on military airfields from 2009-2012. Station biologists conducted much of the field work, with assistance from biologists with the New Jersey Audubon Society (who was awarded the contract to perform this study). The purpose of the research was to determine grassland bird affinity to different types of grassland habitats, estimate densities of migrant and breeding birds in different types of grassland, and determine the effect of various airfield mowing and grassland management prescriptions on bird abundance and therefore BASH risk. Field work included conducting line transects and area searches for grassland bird species during spring and fall migration, as well as nest searches during the breeding season. Staff also collected vegetation data from sample plots associated with each transect to characterize the grasslands in that area.

Behavioral observations of birds were also made at key airfield locations to assess local bird movements and their potential for BASH risk. Follow-on work included nest searches to assess productivity of breeding grassland birds in these habitats.

11.2 Feather Isotope Studies and Other Avian Research

As part of a joint project with the Cornell Laboratory of Ornithology (CLO), biologists at NAS took feather samples from the tails of songbirds captured in other banding studies. Analysis of

isotope composition in the feathers will yield information on the breeding origin or overwintering location of migrant birds without the need for banding and band returns.

NR staff also participated in an avian acoustic monitoring project, funded by DoD legacy, in cooperation with the CLO. NR staff supported deployment of several arrays of automated recording units which tracked nocturnal migrations patterns and stopover habitat usage. Support included device placement, calibration, and device recovery for spring and fall migrations seasons. Data were collected and submitted to CLO for three consecutive seasons.

NR staff biologists also performed cloacal swabs of captured birds as part of an important disease study in cooperation with University of California, Los Angeles (UCLA) -- the MAPS UCLA North American Migratory Bird Avian Influenza Virus (AIV) surveillance program.

NR staff collected ticks from bird specimens as part of another cooperative study. The Department of Epidemiology and Public Health at Yale School of Medicine is doing research on Lyme disease to look at the role of birds in the spread of ticks, (*Ixodes scapularis* in particular) and *Borrelia burgdorferi*, the bacteria that causes Lyme disease.

The Station participated in the MAPS banding program for 16 consecutive years from 1992 through the 2007 banding season. Data collected was sent to the Institute for Bird Populations (IBP) where it was combined with data from other MAPS stations and then analyzed for productivity and over-winter survivorship. The Station program participation was ultimately halted for two reasons; first, finding local qualified volunteers or volunteers that could attend the two week MAPS training session became increasingly difficult and second, the data entry became very time-consuming and difficult to complete. There were multiple software programs to use; however, none were approved by the Navy's IT network. This prevented the data from being delivered to the IBP or the United States Geological Survey (USGS) Bird Banding Lab in the required format.

11.3 White-tailed Deer Movement Study

A White-tailed Deer GPS collaring project was conducted from August of 2013 to April of 2015. A total of 10 deer were collared (four bucks and six does) and data recorded including sex, estimated age, number of antler points, evidence of lactation, and observations of parasite load. This study had a small sample size and should be noted when making any conclusions from this data. Overall, bucks had a larger home and core area than does. This is not unexpected as does tend to stay in a smaller area during the fawning season and during the rut. Bucks travel more, especially during the rut while searching for does in estrus. In general, deer movements avoided the interior of the airfield and moved along the edges instead. This is probably due to the reduced amount of cover leaving the deer more exposed and less able to escape to cover if spooked. Additional analysis of deer movements with regard to the time of day would be helpful to make and can be made with the data that was collected. Due to habitat changes, it is recommended that this project be conducted again using the collars the Navy purchased for this initial project. The focus again would be on travel corridors in relation to habitat, size of home range and core areas, and time of day travel and distances.

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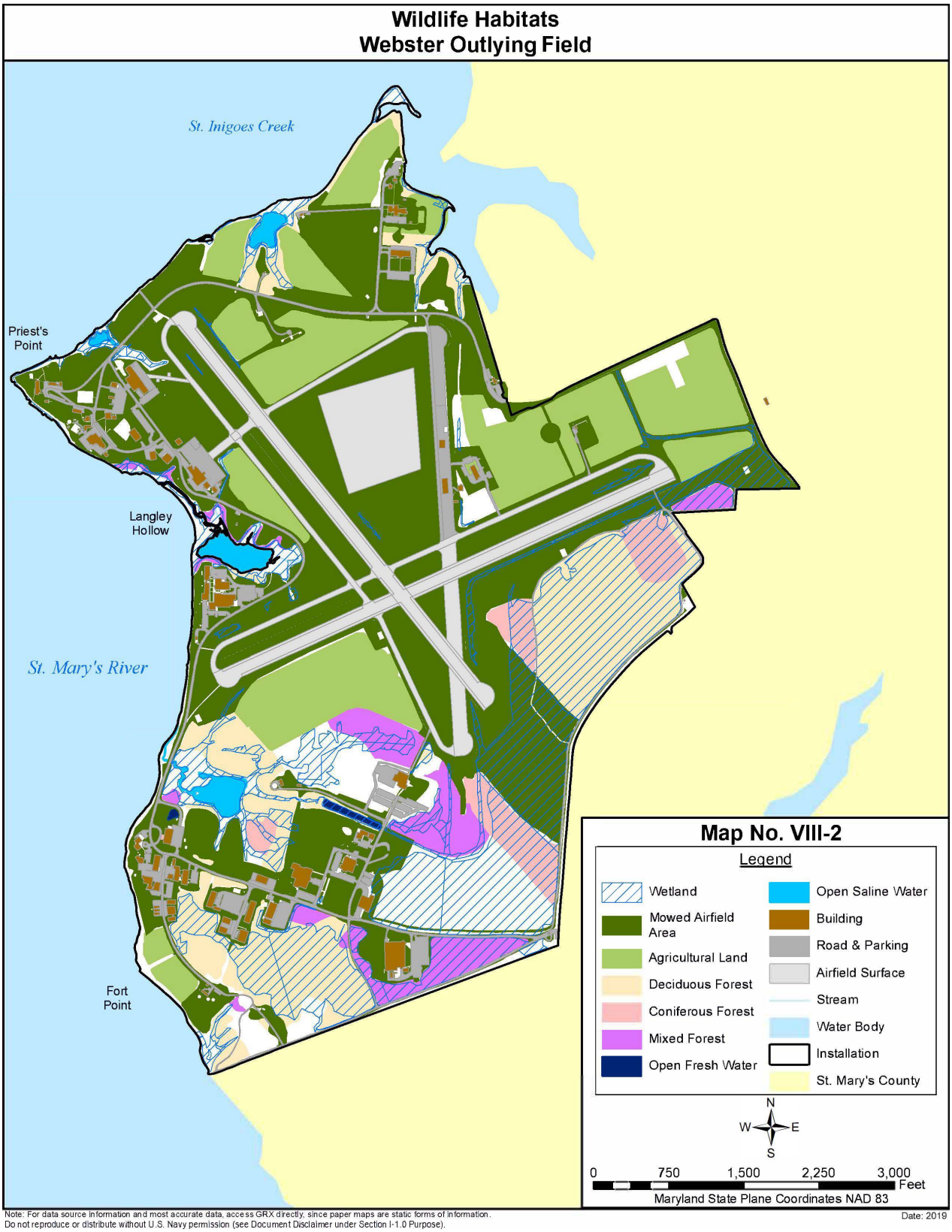
ANNEX VIII-A

MAPS


Wildlife Habitats
NAS Patuxent River
Map No. VIII-1
Legend
Wetland
Mowed Airfield Area
Agricultural Land
Deciduous Forest
Coniferous Forest
Mixed Forest
Open Fresh Water
Open Saline Water
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
S
E
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Chesapeake Bay
Patuxent River
Hog Point
Cedar Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Calvert Pond
Gate 1
Gate 2
Gate 3
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).


Wildlife Habitats
Webster Outlying Field
St. Inigoes Creek
Priest's Point
Langley Hollow
St. Mary's River
Fort Point
Map No. VIII-2
Legend
Wetland
Mowed Airfield Area
Agricultural Land
Deciduous Forest
Coniferous Forest
Mixed Forest
Open Fresh Water
Open Saline Water
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
W
E
S
0 750 1,500 2,250 3,000 Feet
Maryland State Plane Coordinates NAD 83
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information.
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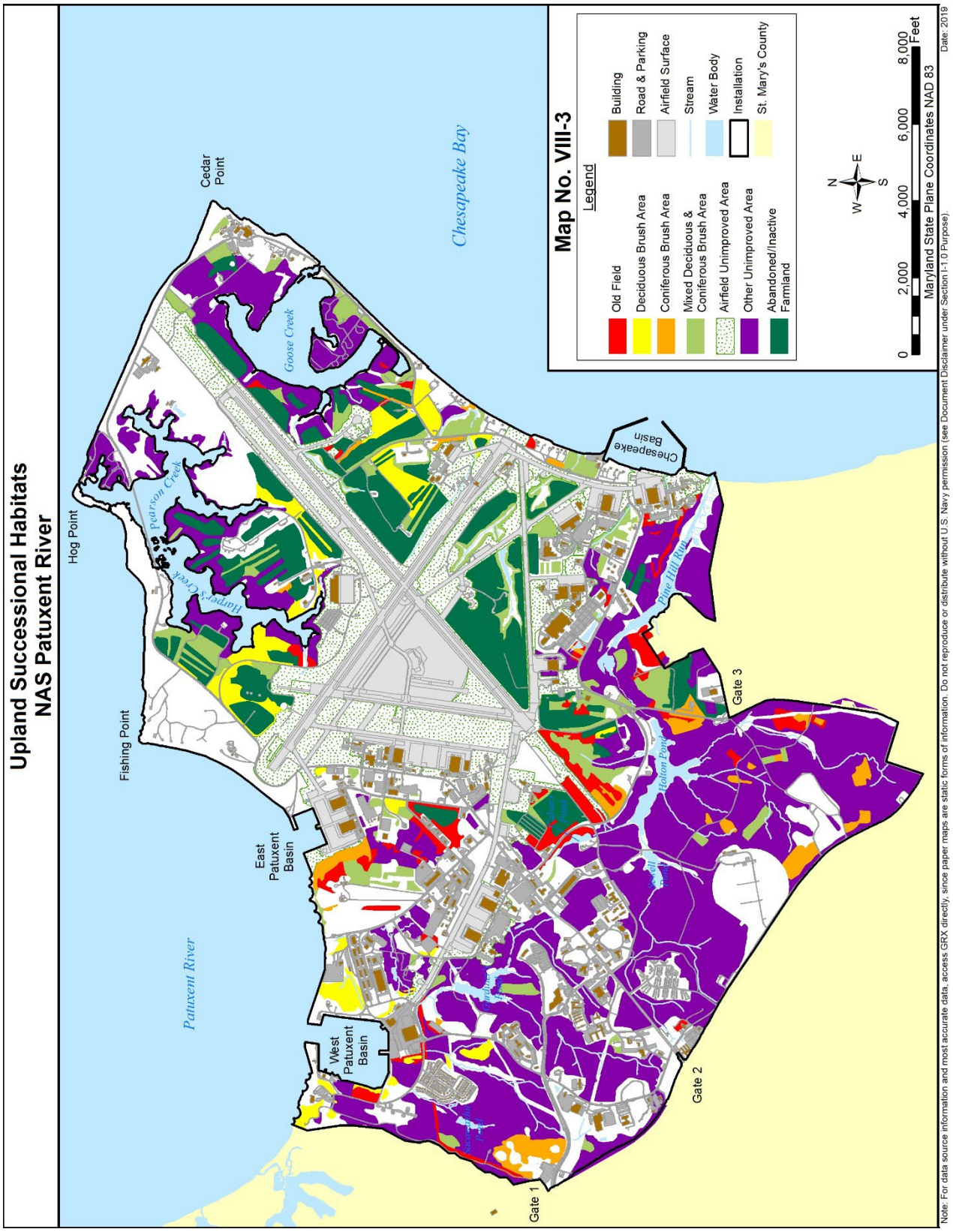
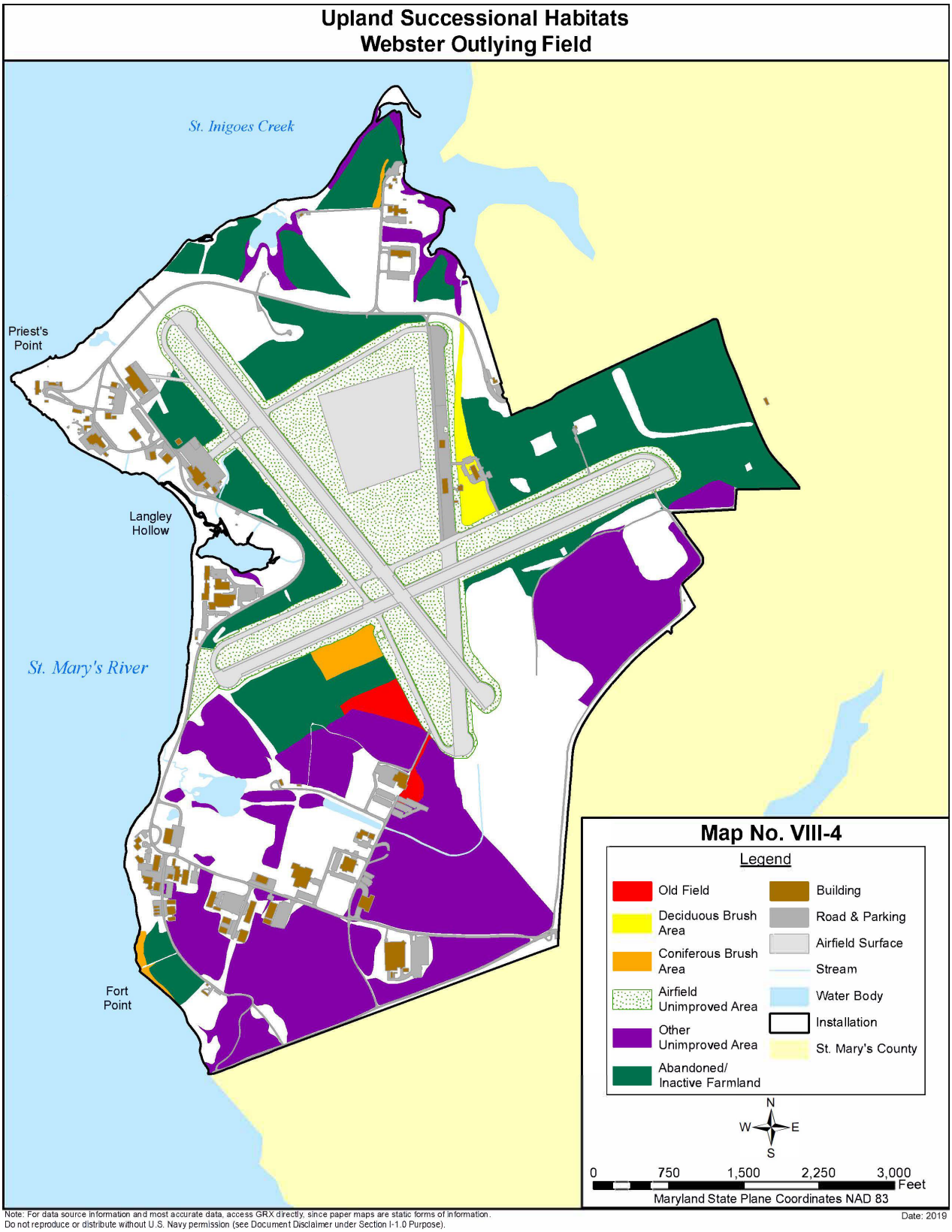
Date: 2019


Upland Successional Habitats
NAS Patuxent River
Map No. VIII-3
Legend
Old Field
Deciduous Brush Area
Coniferous Brush Area
Mixed Deciduous & Coniferous Brush Area
Airfield Unimproved Area
Other Unimproved Area
Abandoned/Inactive Farmland
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Date: 2019
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
Pearson Creek
Harper's Creek
Goose Creek
Chesapeake Basin
Pine Hill Run
Halfon Point
East Patuxent Basin
West Patuxent Basin
Gate 1
Gate 2
Gate 3
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).



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ANNEX VIII-B

TABLES

Table VIII-B-1. NAS Reptile and Amphibian Community Associations		
Species	**Habitat**	**Subset**
Amphibians		
American Toad	Forest	Upland Deciduous
Eastern Spadefoot	Forest, Open	Upland
Fowler's Toad	Forest, Open	Upland
Northern Cricket Frog	Forest, Marsh	Wetlands
Spring Peeper	Forest, Marsh	Wetland
Green Treefrog	Forest, Marsh	Wetland
Cope's Gray Treefrog	Forest, Marsh	Wetland
Upland Chorus Frog	Forest	Upland, Wetland
Eastern Narrowmouth Toad	Marsh, Open water	Freshwater margins
Bullfrog	Marsh, Open water	-
Green Frog	Marsh, Open water	-
Southern Leopard Frog	Marsh, Open water, Forest	-
Pickerel Frog	Marsh, Open water	-
Wood Frog	Forest	Wetland
Spotted Salamander	Forest	Upland, Wetland
Marbled Salamander	Forest	Upland, Wetland
Northern Dusky Salamander	Forest	Wetland
Redback Salamander	Forest	Upland, Wetland
Northern Red Salamander	Forest	Upland, Wetland
Eastern Mud Salamander	Forest	Upland, Wetland
Reptiles		
Snapping Turtle	Wetland	Streams, Open water
Common Musk Turtle (Stinkpot)	Wetland	Streams, Open water
Redbelly Turtle	Wetland	Streams, Open water
Eastern Mud Turtle	Wetland	Streams, Open water
Spotted Turtle	Wetland	Open water
Eastern Box Turtle	Forest, Old field	Upland, Wetland
N. Diamondback Terrapin	Wetland	Saline
Eastern Painted Turtle	Wetland	Open water
Red-eared Slider	Wetland	Open water
Loggerhead	Aquatic	Saline Bay
Atlantic/Kemp's Ridley Turtle	Aquatic	Saline Bay
Northern Fence Lizard	Forest, Old field	Open water
Ground Skink	Old field	Upland
Five-Lined Skink	Old field	Upland
Broadhead Skink	Old field, Forest	Upland
Six-lined Racerunner	Dunes, Barren Areas	Upland
Northern Water Snake	Wetland	Open water
Northern Brown Snake	Forest	Upland

Table VIII-B-1. NAS Reptile and Amphibian Community Associations		
Species	**Habitat**	**Subset**
Eastern Garter Snake	Forest, Old field	Upland, Wetland
Eastern Ribbon Snake	Forest, Old field	Upland, Wetland
Rough Green Snake	Forest, Old field	Upland
Northern Black Racer	Forest	Upland
Eastern Kingsnake	Forest	Upland
Corn Snake	Forest	Upland
Black Rat Snake	Forest, Old field	Upland
Eastern Worm Snake	Forest, Old field	Upland
Eastern Smooth Earth Snake	Forest	Upland
Eastern Hognose Snake	Forest	Upland
Northern Ringneck Snake	Forest	Upland
Coastal Plains Milksnake	Forest	Upland
Red-bellied Snake	Forest	Upland
Northern Red Racer	Forest	Upland
Northern Copperhead	Forest	Upland

Table VIII-B-2. NAS Mammal Community Associations		
Species	**Habitat**	**Subset**
Opossum	Forest	Upland, Wetland
Southeastern Shrew	Forest, Old field	Upland, Wetland
Masked Shrew	Forest, Old field	Upland, Wetland
Least Shrew	Forest, Old field	Upland, Wetland
Shorttail Shrew	Forest, Old field	Upland, Wetland
Eastern Mole	Forest, Old field, Lawn	Upland
Little Brown Bat	Forest	-
Tri-colored Bat	Forest	-
Southeastern Bat	Forest	-
Hoary Bat	Forest	-
Eastern Red Bat	Forest	-
Silver-haired Bat	Forest	Upland
Evening Bat	Forest	Upland
Big Brown Bat	Forest	-
Raccoon	Forest	-
Long-tailed Weasel	Marsh	-
Mink	Marsh	-
River Otter	Marsh	-
Striped Skunk	Forest	Upland
Red Fox	Old field, Forest	Upland
Gray Fox	Forest	-
Coyote	Forest, Old field, Lawn	-
Woodchuck	Forest, Old field	Upland
Eastern Gray Squirrel	Forest	-
Meadow Vole	Old field	Upland, Wetland
Pine Vole	Forest	Coniferous
Muskrat	Marsh	Freshwater
Norway Rat	Marsh, Forest, Lawn	Throughout
House Mouse	House area	Associated with humans
Eastern Cottontail	Old field	Upland, Wetland
Southern Flying Squirrel	Forest	Upland
Beaver	Marsh, Wetland	Freshwater
White-footed Mouse	Forest, Old field	Upland
White-tailed Deer	Forest, Old field	Throughout
Atlantic Bottlenose Dolphin	Aquatic	Saline Bay

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Acadian Flycatcher	Forest, Clearing, Deep shade of mature woodlands	Common summer resident
Alder Flycatcher	Forest, Bogs, ponds, birch and alder thicket	Occasional migrant
American Bittern	Marshes (freshwater)	Rare summer resident
American Black Duck	Marshes	Uncommon winter resident
American Coot	Freshwater marshes, wetlands, Open water	Rare winter migrant
American Crow	Throughout	Abundant resident
American Golden-Plover	Open fields, Groomed grass	Rare fall migrant
American Goldfinch	Old, weedy fields, open second-growth	Common resident
American Kestrel	Open fields, telephone wires	Uncommon resident
American Oystercatcher	Coastal beaches, jetty, and mudflats	Rare
American Pipit	Fields and beaches, airfields	Uncommon migrant and winter resident
American Redstart	Forest, second-growth woodlands	Common resident
American Robin	Throughout - Woodlands, swamps, parks, lawns	Abundant year-round
American Tree Sparrow	Forest edges, weedy fields, marshes	Uncommon winter resident
American Wigeon	Marshes, lakes, rivers, wetland	Rare winter resident
American Woodcock	Wetland forest, Moist woodlands and thickets	Uncommon resident
Ash-throated Flycatcher	Field, Deserts, chaparral, woodlands	Rare vagrant
Baird's Sandpiper	Upper beaches, lakeshores, wet field	Rare migrant
Bald Eagle	Throughout	Common resident
Baltimore Oriole	Forest, Open woodlands, river groves	Uncommon summer resident
Bank Swallow	Steep river banks, gravel pits, open lowland near water	Uncommon summer resident
Barn Owl	Throughout, Farm buildings, cliffs, dark cavities	Very rare resident
Barn Swallow	Buildings, Farm buildings, under bridges, inside barns	Abundant summer resident
Barred Owl	Wetland forest, coniferous or mixed woods, upland	Uncommon resident
Barrow's Goldeneye	Open water	Rare winter resident
Bay-breasted Warbler	Forest - Open coniferous forests	Uncommon migrant
Belted Kingfisher	Wetlands, rivers, ponds, lakes, and estuaries	Common summer resident
Bicknell's Thrush	Mountain coniferous or mixed	Rare migrant
Black Scoter	Open water	Uncommon winter resident
Black Skimmer	Open Bay, along coasts, beaches	Rare summer resident

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Black Tern	Open water, along coast, beaches, saltwater	Uncommon migrant
Black Vulture	Throughout	Common resident
Black-and-white Warbler	Forest - Mixed woodlands	Common migrant
Black-bellied Plover	Sandy beaches, open fields	Uncommon migrant
Black-billed Cuckoo	Forest - woodlands and along streams	Uncommon migrant
Blackburnian Warbler	Forest, coniferous or mixed woodlands	Rare migrant
Black-crowned Night-Heron	Marshes	Uncommon summer resident
Blackpoll Warbler	Forest - Coniferous forests	Common migrant
Black-headed Gull	Beach, open water, along coast, farm fields, parking lot,	Rare winter visitor
Black-throated Blue Warbler	Forest - Deciduous forests	Common migrant
Black-throated Green Warbler	Forest - Coniferous or mixed woodlands	Common migrant
Blue Grosbeak	Forest - Low, overgrown fields, streamsides,	Uncommon summer resident
Blue Jay	Forest - Suburbs, parks, woodlands	Abundant resident
Blue-gray Gnatcatcher	Forest - Woodlands, thickets	Common summer resident
Blue-headed Vireo	Forest, mixed woodlands	Uncommon migrant
Blue-winged Teal	Marshes, ponds	Uncommon winter resident
Blue-winged Warbler	Forest - Brushy meadows, second-growth	Uncommon migrant
Boat-tailed Grackle	Throughout - Coastal saltwater marshes	Rare summer resident
Bobolink	Old field - hayfields, weedy meadows	Uncommon migrant
Bonaparte's Gull	Wetlands, along coast, farm fields, sewage treatment plant	Rare winter resident
Brant	Marshes	Rare winter resident
Broad-winged Hawk	Forests	Rare summer resident
Brown Creeper	Forest - coniferous, mixed, or swampy forest	Uncommon winter resident
Brown Pelican	Open water	Summer visitor
Brown Thrasher	Forest - Hedgerows, brush, woodland edges	Common resident
Brown-headed Cowbird	Throughout - Open woodlands, farmlands, suburbs	Common resident
Brown-headed Nuthatch	Forest - Pine woodlands	Uncommon resident
Buff-breasted Sandpiper	Mowed field, shortgrass fields, dry open ground	Uncommon fall migrant
Bufflehead	Open water	Common winter resident
Canada Goose	Throughout	Common resident
Canada Warbler	Forest, dense woodlands and brush	Uncommon migrant

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Canvasback	Marshes, open water	Common winter resident
Cape May Warbler	Forest, black spruce forests	Uncommon migrant
Carolina Chickadee	Forest, open deciduous forests, woodland	Common resident
Carolina Wren	Forest, underbrush of moist woodlands	Common resident
Caspian Tern	Along coasts, beaches	Uncommon migrant
Cattle Egret	Open fields	Uncommon summer resident
Cedar Waxwing	Woodland, along streams	Common resident
Cerulean Warbler	Forest, tall tree swamps	Rare migrant
Chestnut-sided Warbler	Forest, second-growth deciduous woodlands	Common migrant
Chimney Swift	Forest, houses, chimneys, barns, hollow trees	Common summer resident
Chipping Sparrow	Forest, grassy fields, woodland edges	Common summer resident
Chuck-will's-widow	Forest, Oak-pine woodlands	Uncommon summer resident
Clapper Rail	Salt marshes	Uncommon resident
Clay-colored Sparrow	Open field, brushy fields, groves, streamside	Rare migrant
Cliff Swallow	Cliff, banks, bluff, bridges, rural settlements	Rare migrant
Common Eider	Open water	Rare winter resident
Common Goldeneye	Open water	Common winter resident
Common Grackle	Throughout, open fields, marshes, parks	Common resident
Common Loon	Open water	Common winter resident
Common Merganser	Open water	Rare migrant
Common Gallinule	Freshwater marshes	Rare vagrant
Common Nighthawk	Forest, open woodlands, suburbs, towns	Rare migrant
Common Snipe	Wetland, marshes and bogs	Common migrant
Common Tern	Along coasts, beaches	Common migrant
Common Yellowthroat	Brush, open land, grassy fields, shrubs, marshes	Common summer resident
Connecticut Warbler	Forest, spruce bogs, moist woodlands	Rare migrant
Cooper's Hawk	Forest, deciduous broken woodlands	Uncommon resident
Dark-eyed Junco	Throughout	Abundant winter resident
Dickcissel	Open weedy meadows, grainfields	Occasional vagrant, summer resident
Double-crested Cormorant	Open water	Summer resident
Downy Woodpecker	Suburbs, forests, orchards	Common resident
Dunlin	Beach	Uncommon winter resident
Eastern Bluebird	Open field, woods edge, open woodlands, farmlands, orchard	Common resident

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Eastern Kingbird	Open field, woodland clearings, farms, orchards	Common summer resident
Eastern Meadowlark	Fields, meadows	Common resident
Eastern Phoebe	Forest, barns, woodlands, farmlands, suburbs	Common summer resident
Eastern Screech-Owl	Forest, woodlots, forests, swamps, orchard,	Common resident
Eastern Towhee	Forest, dense undergrowth, streamside	Common resident
Whip-poor-will	Forest, open coniferous and mixed woodland	Rare summer resident
Eastern Wood-Pewee	Forest, woodland areas, mature deciduous	Common summer resident
European Starling	Throughout	Abundant
Evening Grosbeak	Throughout, woodlots, shade trees, mixed woods	Rare winter visitor
Field Sparrow	Open field, brushy woodlands, fields	Common resident
Fish Crow	Tidewater marshes, farmland, near water	Common resident
Forster's Tern	Open water, along coast, beaches, saltwater	Uncommon summer resident
Fox Sparrow	Old field, dense undergrowth in woodland edges	Uncommon winter resident
Gadwall	Marshes, lakes, ponds	Uncommon winter resident
Glaucous Gull	Beach, Open water	Rare vagrant
Glossy Ibis	Marshes	Rare summer resident
Golden Eagle	Throughout	Rare winter resident
Golden-crowned Kinglet	Forest, coniferous woodlands	Common winter resident
Grasshopper Sparrow	Pastures, grasslands, old fields	Common summer resident
Gray Catbird	Throughout, low, dense thickets in deciduous forests	Common resident
Gray-cheeked Thrush	Forest, coniferous or mixed woodlands	Uncommon migrant
Great Black-backed Gull	Beach, open water, along coast, farm fields, parking lot	Common resident
Great Blue Heron	Marshes, wooded wetlands	Common resident
Great Cormorant	Open water	Uncommon winter resident
Great Crested Flycatcher	Open woods	Common summer resident
Great Egret	Marshes	Uncommon summer resident
Great Horned Owl	Forests	Common resident
Greater Scaup	Open water	Common winter resident
Greater Yellowlegs	Beach, coastal mud flats, marshes	Common migrant
Green Heron	Wooded wetlands, lakesides	Common summer resident
Green-winged Teal	Marshes, rivers, bays	Common winter resident
Hairy Woodpecker	Forest, open and dense forests	Common resident
Harlequin Duck	Open water	Rare winter visitor

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Hermit Thrush	Forest, coniferous or mixed woodlands	Common winter resident
Herring Gull	Wetland, Throughout, along coast, farm fields, parking lot,	Abundant resident
Hooded Merganser	Wooded lakes, ponds, rivers	Uncommon resident
Hooded Warbler	Forest, swamps, moist woodlands	Uncommon summer resident
Horned Grebe	Open water, lakes, ponds	Uncommon winter resident
Horned Lark	Open field, dirt fields, gravel ridges, shores	Common resident
House Finch	Throughout	Common resident
House Sparrow	Throughout	Common resident
House Wren	Throughout, brush and shrub, orchards, parks	Uncommon summer resident
Indigo Bunting	Open field, woodland clearings and borders	Common summer resident
Kentucky Warbler	Rich, moist woodlands	Uncommon summer resident
Killdeer	Open ground, usually gravel	Common resident
King Rail	Freshwater or brackish marshes	Rare migrant
Lapland Longspur	Open field, grassy fields, grain stubble, shores	Uncommon winter resident
Lark Sparrow	Field, farmlands, Open woodlands, mesas	Rare vagrant
Laughing Gull	Wetland, along coast, farm fields, parking lot,	Common summer resident
Least Flycatcher	Forest, open deciduous woods, orchards,	Rare migrant
Least Sandpiper	Wet habitats	Common migrant
Least Tern	Along coast, beaches, saltwater	Uncommon summer resident
Lesser Black-backed Gull	Beach, Open water, along coast, farm fields, parking lot,	Rare visitor
Lesser Scaup	Sheltered areas of coastal bays, rivers	Common winter resident
Lesser Yellowlegs	Marsh, Beach, open woodlands, sheltered tundra	Uncommon migrant
Lincoln's Sparrow	Brushy bogs, thickets, hedgerows, old field	Uncommon migrant
Little Blue Heron	Marshes	Uncommon summer resident
Loggerhead Shrike	Open or brushy areas	Rare vagrant
Long-eared Owl	Thick woods, open fields, marshes	Rare winter resident
Long-tailed Duck	Open water	Abundant winter resident
Louisiana Waterthrush	Forest, along streams in dense woodlands	Uncommon summer resident
Magnolia Warbler	Forest - Moist coniferous forests	Common migrant
Mallard	Marsh, Pond	Common resident
Marsh Wren	Reedy marshes, cattail swamps	Uncommon resident
Merlin	Open woods, marshes	Rare winter resident
Mississippi Kite	Open woodlands, swamps	Rare vagrant
Mourning Dove	Throughout, grassy fields, farm fields, backyard	Common resident
Mourning Warbler	Forest, dense undergrowth, thickets	Rare migrant

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Mute Swan	Marshes	Rare resident
Nashville Warbler	Forest, second-growth woodlands, spruce bogs	Uncommon migrant
Northern Bobwhite	Open field, Young woods	Rare resident
Northern Cardinal	Throughout, woodland edges, swamps	Common resident
Northern Flicker	Forest, open woodlands, suburban areas	Common resident
Northern Gannet	Open water	Uncommon winter resident
Northern Goshawk	Open field, forest, conifer-dominated mixed woodlands	Rare migrant, winter resident
Northern Harrier	Open field, wetlands	Common winter resident
Northern Mockingbird	Throughout, rural thickets, woodland edges	Common resident
Northern Parula	Forest, coniferous or mixed woodlands	Common summer resident
Northern Pintail	Marsh	Rare winter resident
Northern Rough-winged Swallow	Riverbanks, cliffs, culverts	Uncommon summer resident
Northern Saw-whet Owl	Dense coniferous or mixed forests	Rare winter resident
Northern Shoveler	Marsh, Open water	Rare winter resident
Northern Waterthrush	Forest, woodland swamps, bogs, and thickets	Uncommon migrant
Olive-sided Flycatcher	Coniferous forests, bogs	Occasional migrant
Orange-crowned Warbler	Open, brushy, woodlands, forest	Rare migrant, winter resdient
Orchard Oriole	Forest, suburban shade trees, orchards	Uncommon summer resident
Osprey	Throughout	Common summer resident
Ovenbird	Mature forest	Common summer resident
Palm Warbler	Forest, brush at edge of spruce bogs	Uncommon migrant
Pectoral Sandpiper	Beach, wet meadows, marshes, pond edges	Uncommon migrant
Peregrine Falcon	Open field, bluffs, tall structures	Rare resident
Pied-billed Grebe	Open water	Uncommon winter resident
Pileated Woodpecker	Mature forest	Uncommon resident
Pine Siskin	Forest, Coniferous and mixed woods	Uncommon winter residents
Pine Warbler	Forest, pine forests and mixed woodlands	Common summer resident
Piping Plover	Beach, sandy beaches, dunes	Rare vagrant
Prairie Warbler	Forest, Open woodland, scrublands	Common summer resident
Prothonotary Warbler	Forest, wooded swamps	Rare summer resident
Purple Finch	Forest, coniferous or mixed woodlands, park	Uncommon winter resident
Purple Martin	Open area, where suitable nest sites exist	Common summer resident
Red Crossbill	Forest, coniferous woods	Rare winter visitor
Red Knot	Sandy beaches and mud flats	Rare winter visitor

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Red-bellied Woodpecker	Forest, open woodlands, parks	Common resident
Red-breasted Merganser	Open water	Common
Red-breasted Nuthatch	Forest, conifers	Uncommon winter resident
Red-eyed Vireo	Forest	Common summer resident
Redhead	Lakes, estuaries	Rare winter resident
Red-headed Woodpecker	Open woods, dead timber, farmlands, backyards	Common summer resident
Red-necked Grebe	Open water	Rare winter resident
Red-necked Phalarope	Wetland	Rare migrant
Red-shouldered Hawk	Forest, moist, mixed woodlands	Common resident
Red-tailed Hawk	Throughout, woods with nearby open fields	Common resident
Red-throated Loon	Open water	Rare winter resident
Red-winged Blackbird	Marsh, thick vegetation of freshwater	Common resident
Ring-billed Gull	Along coast, farm fields, parking lot, wetlands	Abundant summer resident
Ring-necked Duck	Marsh, wooded lakes and ponds	Uncommon winter resident
Ring-necked Pheasant	Marsh, open fields, woodland edges	Former rare resident
Rock Pigeon	Throughout, high window ledges, bridges, barns	Common resident
Rose-breasted Grosbeak	Forest, open, second-growth woodlands and orchards	Uncommon migrant
Rough-legged Hawk	Open fields, marshes	Rare winter resident
Royal Tern	Open water, along coast, beaches, saltwater	Uncommon summer resident
Ruby-crowned Kinglet	Forest , woodlands, thickets	Uncommon winter resident
Ruby-throated Hummingbird	Forest, gardens and woodland edges	Common summer resident
Ruddy Duck	Open water	Common winter resident
Ruddy Turnstone	Beach	Rare migrant
Rusty Blackbird	Forest, wet woodlands, swamps, open fields	Rare winter resident
Saltmarsh Sparrow	Old field, salt marshes, lakeshores, Spartina stand	Rare migrant
Sanderling	Sandy beaches, along surf's edge	Common winter resident
Sandhill Crane	Marsh	Rare migrant
Savannah Sparrow	Old field, open habitats, marshes, grasslands	Common winter resident
Scarlet Tanager	Forest, deciduous forests	Common summer resident
Seaside Sparrow	Beach, dune, grassy tidal marshes	Rare summer resident
Sedge Wren	Wet, grassy meadows; shallow marsh	Rare migrant
Semipalmated Plover	Beaches, lakeshores, tidal flats	Uncommon migrant

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
Semipalmated Sandpiper	Beach	Uncommon migrant
Sharp-shinned Hawk	Forest, mixed woodlands	Uncommon resident
Short-billed Dowitcher	Beach, mud flats, tidal marshes	Rare migrant
Short-eared Owl	Marsh, near the ground, open country	Uncommon winter resident
Snow Bunting	Old field, sand dunes, beaches, grain stubble	Rare winter resident
Snow Goose	Marshes	Rare winter resident
Snowy Egret	Marshes	Uncommon summer resident
Solitary Sandpiper	Beach, shallow backwaters, pools, riverbanks	Common migrant
Song Sparrow	Old field, brushy areas, dense streamside	Common resident
Sora	Freshwater or brackish marshes	Uncommon migrant
Spotted Sandpiper	Beach, sheltered streams, ponds. marshes	Uncommon summer resident
Summer Tanager	Forest, Pine-oak woods	Common summer resident
Surf Scoter	Open water	Uncommon winter resident
Swainson's Thrush	Moist woods, swamps, thickets	Common migrant
Swamp Sparrow	Forest, tall vegetation, fresh and brackish marsh	Common migrant
Tennessee Warbler	Forest, Coniferous and mixed woodlands	Uncommon fall migrant
Tree Swallow	Open marsh, meadows, or lakes	Common summer resident
Tricolored Heron	Marshes	Rare summer resident
Tufted Titmouse	Deciduous woodlands, parklands	Common resident
Tundra Swan	Marshes, open water	Uncommon winter resident
Turkey Vulture	Throughout	Common resident
Upland Sandpiper	Old fields and open meadows	Uncommon migrant
Veery	Forest Dense, moist woodlands	Common migrant
Vesper Sparrow	Dry, open grasslands, farmlands, roadsides	Uncommon migrant
Virginia Rail	Freshwater or brackish marshes	Uncommon resident
Warbling Vireo	Forest, open deciduous woods	Uncommon migrant
Western Sandpiper	Beach, wet habitats	Uncommon migrant
Whimbrel	Beaches, mud flats, wet fields	Occasional migrant
White Ibis	Marshes, swamps, mangroves	Rare vagrant
White-breasted Nuthatch	Forest, leafy trees	Uncommon resident
White-crowned Sparrow	Forest, open woodlands, brushy grasslands	Uncommon winter resident
White-eyed Vireo	Forest, dense, moist thickets	Common summer resident
White-throated Sparrow	Throughout, woodland undergrowth, brush	Common winter resident

Table VIII-B-3. NAS Avian Community Associations.		
Species	**Habitat**	**Comments**
White-winged Dove	Throughout, riparian woodlands, deserts, citrus groves	Rare vagrant
White-winged Scoter	Open water	Uncommon winter resident
Wild Turkey	Open forested areas	Uncommon resident
Willet	Wet fields, marshes, beaches	Uncommon summer resident
Willow Flycatcher	Forest, dry, bushy upland pastures, especially willows	Rare summer resident
Wilson's Phalarope	Grassy borders of shallow lakes, wetlands	Occasional migrant
Wilson's Storm-petrel	Open water	Rare vagrant
Wilson's Warbler	Dense, moist woodlands, bogs, wooded streams	Uncommon migrant
Winter Wren	Field, forest, dense brush, along stream banks	Uncommon winter resident
Wood Duck	Wooded wetlands	Common resident
Wood Thrush	Swamps, moist deciduous forests	Common summer resident
Worm-eating Warbler	Forest, dense undergrowth on wooded slope	Uncommon summer resident
Yellow Warbler	Forest, wet habitats, open woodlands	Uncommon summer resident
Yellow-bellied Flycatcher	Forest, bogs, swamps, damp coniferous forests	Rare migrant
Yellow-bellied Sapsucker	Mixed forests	Uncommon winter resident
Yellow-billed Cuckoo	Forest, open woodlands, orchards, stream-side groves	Common summer resident
Yellow-breasted Chat	Forest edge, dense thickets and brush	Common summer resident
Yellow-rumped Warbler	Forest - Coniferous or mixed woodlands	Common winter resident
Yellow-throated Vireo	Forest edge habitat, it actually requires large blocks of forest to breed successfully.	Uncommon summer resident
Yellow-throated Warbler	Forest - Live oak and pine woodlands	Uncommon summer resident

Table VIII-B-4. PAX Game Harvest Data

Year	Small Game									
	Hours	**Squirrel**	**Rabbit**	**Dove**	**Crow**	**Woodchuck**	**Woodcock**	**Quail**	**Pheasant**	**Snipe**
1960-1969	28.8*	374	4764	1887	49	5	39	3441	11	1
1970-1979	7227*	528	4726	6841	142	0	42	3087	193	0
1980-1989	26980.2	804	1504	3563	73	0	19	3451	39	0
1990-1999	12816.9	839	1512	2297	20	0	0	182	0	0
2000-2009	4517.8	244	326	864	19	0	1	0	0	0
2010-2019*	2284.5	46	479	53	2	2	0	Closed season	0	0
2019-2020	474	19	39	3	0	0	0	Closed season	0	0
2020-2021	217.38	2	18	11	1	0	0	Closed season	0	0
2021-2022	310.35	16	52	13	0	0	0	Closed season	0	0

*indicates incomplete dataset

Year	Fur-bearer			Waterfowl		Turkey	
	Hours	**Fox**	**Raccoon**	**Hours**	**Kill**	**Hours**	**kill**
1960-1970	0	0	0	0	46	0	0
1970-1979	0	0	0	727	1013	0	0
1980-1989	35.5	0	0	8374	1391	0	0
1990-1999	201	19	5	5458	73	0	130
2000-2009	14	23	0	6706.5	1378	1202	2
2010-2019*	12.4	1	0	5368.1	1098	819.75	5
2019-2020	0	0	0	2099.46	258	1127.96	15
2020-2021	0	0	0	1445.08	261	563.92	7
2021-2022	19.88	0	0	524.97	48	800.58	11

*indicates incomplete dataset

Table VIII-B-4. PAX Game Harvest Data (Cont.)

Year	Deer Archery		Deer Muzzleloader		Deer Firearms	
	Hours	Kill	Hours	Kill	Hours	Kill
1960-1970	0	0	0	0	0	25
1970-1979	2225.5	4	0	0	7203	183
1980-1989	41382	231	3032	31	28057	510
1990-1999	45718	383	11859.1	148	25341	505
2000-2009	34030.5	318	14804.2	211	20483.3	317
2010-2019*	17579	458	3541.1	152	7313.1	306
2019-2020	2336.6	30	701.29	6	429.16	10
2020-2021	2500.02	16	338.33	1	722.03	4
2021-2022	1571.27	8	187.42	0	337.55	3

*indicates incomplete dataset

Table VIII-B-5. WOLF Game Harvest Data

Year	Small Game					Fox	
	Hours	Squirrel	Rabbit	Dove	Crow	Hours	Kill
1990-1999	258.1	43	8	31	2	1.3	1
2000-2011*	637.9	13	35	114	1	424.4	11
2011-2018*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2019-2020	88.4	16	0	0	0	0	0
2020-2021	0	0	0	0	0	0	0
2021-2022	0	0	0	0	0	0	0

*indicates incomplete dataset

Year	Waterfowl		Deer Firearm		Deer Archery		Deer Muzzleloader	
	Hours	Kill	Hours	Kill	Hours	Kill	Hours	Kill
1990-1999	461.3	111	1425.2	49	2191.6	30	395.8	17
2000-2011*	1565.1	110	2655.7	50	4748.7	59	2439.7	72
2011-2018*	N/A	N/A	N/A	26	N/A	43	N/A	15
2019-2020	130.8	2	77.8	0	104.6	0	1.6	0
2020-2021	30.5	2	24.3	0	32	0	26	1
2021-2022	0	0	49.5	2	0	0	10.4	0

*indicates incomplete dataset

ANNEX VIII-C

BIRD/ANIMAL AIRCRAFT STRIKE HAZARD (BASH) PROGRAM INSTRUCTION

DEPARTMENT OF THE NAVY
NAVAL AIR STATION
22268 CEDAR POINT ROAD
PATUXENT RIVER, MARYLAND 20670-1154

NASPAXRIVINST 3750.5J
N32
11 Apr 2019

NAS PATUXENT RIVER INSTRUCTION 3750.5I

From: Commanding Officer, Naval Air Station Patuxent River

Subj: BIRD/ANIMAL AIRCRAFT STRIKE HAZARD PROGRAM

Ref: (a) OPNAVINST 3750.6 SERIES
(b) CNIC BASH Program Manual
(c) CNICINST 3750.1 SERIES
(d) NASPAXRIVINST 11015.6J CH-1
(e) Maryland Department of Natural Resources (DNR) Letter of Authorization for Depredation and Personnel
(f) USDA/CNIC Work/Financial Plan

Encl: (1) Bird/Animal Strike Report Form
(2) SOP for Mammal and Bird Dispersal and Depredation on the Airfield
(3) Natural Resources Firearms Storage, Inventory, Training, and Withdrawal Requirements
(4) Training Outline for Safe Pyrotechnics Handling and Use
(5) SOP for Reporting and Notification of Bird and Deer Strikes at NAS Patuxent River
(6) Bird/Animal Tracking Sheet and Airfield Grid

1. Purpose. To reduce the wildlife strike hazard to aircraft aboard Naval Air Station (NAS) Patuxent River, Maryland, including Navy Outlying Field (NOLF) Webster, St. Inigoes, Maryland, and Bloodsworth Island Range, Dorchester County, Maryland by creating an integrated Mammal and Bird Control and Hazard Abatement Program as per references (a) through (c). The program is designed to minimize the hazard wildlife pose to aircraft and reduce the risk of a bird/animal aircraft strike.

2. Cancellation. NASPAXRIVINST 3750.5H

3. Discussion. The Bird/Animal Aircraft Strike Hazard (BASH) Program is inclusive of all birds, mammals, and reptiles. The hazard posed by birds and other wildlife, such as deer, to safe flight operations at an airfield is an ever-present problem. Total elimination of the hazard is impossible due to its very nature; however, an active program can be implemented to greatly reduce aircraft exposure to wildlife activity on and around the airport surface and airspace. This instruction is designed to reduce the wildlife/aircraft strike potential by increasing awareness of avoidance procedures, monitoring bird and deer activity, actively controlling deer and bird populations, and influencing wildlife behavior through frightening techniques, habitat manipulation, and proper land use planning.

4. Action

a. The Air Operations Officer (AOPS), in conjunction with the duties and responsibilities set forth in reference (c), shall:

NASPAXRIVINST 3750.5J
N32
11 Apr 2019

NAS PATUXENT RIVER INSTRUCTION 3750.5I

From: Commanding Officer, Naval Air Station Patuxent River

Subj: BIRD/ANIMAL AIRCRAFT STRIKE HAZARD PROGRAM

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4. Action

a. The Air Operations Officer (AOPS), in conjunction with the duties and responsibilities set forth in reference (c), shall:

(1) Provide liaison with all aviation activities at NAS Patuxent River, Maryland to develop and maintain awareness of this instruction.

(2) Inform the Natural Resources Manager of any changes to low-level routes, training areas, or special use airspace.

(3) Ensure that those airfield areas under Air Operations control which may harbor wildlife are open to hunting to whatever extent is operationally tenable, and that the hunting program aligns with BASH priorities.

(4) Oversee the United States Department of Agriculture (USDA) Wildlife Biologist as it relates to references (c) and (f) and additional responsibilities as set forth in this instruction.

(5) Ensure storage and maintenance of all pyrotechnics follows all procedures in enclosure (3).

(6) Review all low-level routes, training areas, and special use airspaces or proposed changes to the existing routes/areas for BASH potential.

(7) Chair the BASH Hazard Working Group (BHWG) meetings once a quarter, and direct the production of a Wildlife Hazard Management Plan (WHMP) per reference (c).

(8) Coordinate with all airfield users to ensure BASH refresher training is conducted annually.

(9) Direct and participate in the completion of an annual BASH self-assessment.

b. The Air Operations Duty Officer (AODO) shall notify the base Command Duty Officer (CDO) of all incidents involving aircraft/animal/bird collisions and ensure the base CDO is calling all necessary responders as per enclosure (1).

c. The Aviation Safety Officer (ASO) shall:

(1) Monitor the effectiveness of the BASH Program.

(2) Assist the Air Operations Officer in conducting a periodic review of this instruction.

(3) Report all bird strikes into the Web-Enabled Safety System (WESS) which are not reportable by tenant aviation commands.

(4) Ensure that all BHWG and BASH Tenant Council meeting minutes are documented and distributed appropriately.

(5) Serve as a member of the BHWG.

d. The Air Traffic Control Facility Officer (ATCFO) shall:

(1) Issue bird hazard warnings, via Automatic Terminal Information Service (ATIS) whenever bird activities are observed or reported within the designated Approach Control airspace.

(2) Utilize the BASH condition codes (page 7-of this instruction) to report general bird activity levels around the installation as well as significant bird activity noted away from the installation. Report sightings of all substantial bird concentrations to the Natural Resources Manager at 301-342-3670, as well as USDA Wildlife Services at 301-342-5905, and advise aircrew of hazardous conditions.

(3) Initiate bird and animal dispersal/abatement procedures when potentially hazardous bird activities are observed or reported on NAS Pax River and NOLF Webster.

(4) Serve as a member of the BHWG.

e. The Airfield Services Division Officer (AFSO) shall:

(1) Establish a Wildlife Detection and Dispersal Team (WDDT) to be available during all shifts or at any time the airfield is open for operations. These personnel shall be ready to begin dispersal with the proper equipment as soon as possible.

(2) Ensure proper training for the WDDT designated to conduct wildlife dispersal activities, and ensure that dispersal activities are conducted in a manner consistent with state or federal permit conditions and the established Standard Operating Procedures (SOP) found in Enclosure (2). During night Field Carrier Landing Practice (FCLP) evolutions, personnel shall train to look specifically for deer and other large mammals approaching or crossing the active runway and approach path, as airborne animals will be difficult or impossible to spot at night.

(3) Maintain records of significant wildlife activity and dispersal and ensure information is accessible to all tenant commands immediately following airfield surveys.

(4) Advise the Air Operations Officer and Air Traffic Control Facility Officer in determining aircraft and airfield procedures to abate wildlife hazards.

(5) Serve as a member of the BHWG.

(6) Ensure the WDDT conducts a survey of the airfield once every three hours (every 1.5 hours during night FCLP evolutions) and log any observed animal activity utilizing the Bird/Animal Tracking Sheet and airfield grid in enclosure (6).

(7) Report all adverse wildlife activity to the Tower.

(8) Deliver all bird/animal remains found on or near the airfield after reported strikes or during airfield surveys and maintenance activities to the Natural Resources Manager and/or USDA Wildlife Services. Remove all remains of animals hit or found dead on the runways. Do not throw them into the grass or weeds alongside a runway, as they may attract scavengers and create another safety hazard.

(9) Procure, store, and maintain necessary bio-acoustic and pyrotechnic equipment required for bird/animal abatement and dispersal.

f. The NAS Patuxent River Explosive Safety Officer (ESO) shall:

(1) Oversee and approve the storage and maintenance of firearms and ammunition for bird dispersal or depredation. The ESO is not responsible for physically storing or maintaining any firearms or ammunition, only the oversight and approval of the storage and maintenance. See enclosure (3).

(2) Annually review SOP guidelines in enclosure (3) to ensure alignment with DoD and Navy guidelines.

(3) Monitor handling and storage of BASH-related small arms, ammunition, and pyrotechnics to ensure compliance with DoD and Navy guidelines.

(4) Maintain a list of personnel authorized to draw firearms and ammunition for wildlife depredation activities.

(5) Maintain a list of airfield facilities personnel authorized to use pyrotechnics for wildlife dispersal activities.

g. The Natural Resources Manager shall:

(1) Manage the NAS Patuxent River Land Use Program to minimize potential wildlife/aircraft strike hazards.

(2) Serve as a member of the BHWG.

(3) In conjunction with the BHWG, review the annual planting schedule for each agricultural outlease parcel to avoid inadvertently creating a potentially hazardous bird or deer attractant.

(4) Maintain required permits for the dispersal and depredation programs.

(5) Maintain necessary records, prepare and submit reports, and maintain appropriate correspondence between NAS Patuxent River, state and federal wildlife agencies.

(6) Continually monitor wildlife activity levels and conduct regular wildlife activity surveys. Maintain and update a database of wildlife strike locations, species, and other pertinent data. Provide wildlife activity analysis to the ASO and Air Operations Officer at quarterly BHWG meetings or when requested.

(7) Identify high risk areas, such as landfills and wildlife refuges, to establish procedures to avoid them and disseminate information. At the request of flight planners or aviation safety personnel, review test plans and training activities for an assessment of known and likely bird hazards.

(8) Review all locally generated Bird/Animal Strike Hazard Reports. Attempt to identify and find all bird remains. Forward all bird remains to the Smithsonian Institute for identification.

(9) Assist the BHWG in developing a WHMP by recommending appropriate habitat modifications to mitigate the most severe wildlife hazards to aviation.

(10) Approve and appoint Natural Resources personnel to assist with depredation and disposal activities when lethal methods are required. Provide the appropriate personnel and training to ensure that depredation activities are carried out in a manner consistent with state or federal permit conditions and the established SOPs found in enclosure (2).

(11) Provide dispersal assistance to Airfield Services Division Officer (AFSO) when sufficient Airfield Services Division (AFS) or USDA Wildlife Services personnel are not available, or when Natural Resources can respond in a more timely manner. Natural Resources will request depredation assistance from the USDA Airport Wildlife Biologist and anyone else delineated by the MDE DNR Letter of Authorization for Depredation and Personnel.

(12) Ensure storage and maintenance of all firearms, ammunition, and pyrotechnics follows all procedures in enclosure (3).

(13) Assist USDA Wildlife Services with programs to disperse and limit birds such as pigeons, starlings, and house sparrows from hangars and other structures.

(14) Review, as requested, low-level routes, training areas, and special use airspaces or proposed changes to the existing routes/areas for BASH potential.

(15) Provide any additional information on migratory, local, and seasonal bird activities through contact with the U.S. Fish and Wildlife Service, Audubon Society, local ornithologists, and other agencies/groups.

(16) Report all hazardous wildlife activity to the Tower.

h. The USDA Biologist shall:

(1) Comply with all the duties and responsibilities set forth in reference (c) and (f).

(2) Participate in the BHWG and provide recommendations for mitigating wildlife concentrations.

(3) Assist with the preparation and training of the WDDT and installation tenant commands with regard to the BASH program.

(4) Complete a Wildlife Hazard Assessment and provide survey data to the Natural Resources Manager and the other members of the BHWG.

(5) Conduct wildlife control on the airfield per reference (f), this instruction, and the WHMP.

(6) Advise the Natural Resources Manager following all depredation activities and assist, as necessary, with processing the remains in accordance with enclosure (2).

(7) Assist with preparation of a Form 37 (USDA Animal and Plant Health Inspection Service, Wildlife Service permit review) for renewal of the NAS Patuxent River depredation permit.

(8) Assist with the collection of strike remains, delivery of remains to the Natural Resources Manager, and submission of Web Enabled Safety System (WESS) reports.

(9) Identify wildlife concentration areas on base and report them to the Natural Resources Manager and the BHWG.

(10) Assist in WHMP development by providing recommendations to the BHWG for mitigating hazardous wildlife activity.

(11) Monitor the effectiveness of the BASH program through strike reports and strike remains identification in conjunction with the ASO and Natural Resources.

(12) Notify the Airfield Services Division Officer and the Natural Resources Manager when not available to conduct bird detection and dispersal efforts for extended periods of time.

(13) Approve and appoint USDA personnel to conduct depredation and disposal activities when lethal methods are required. Provide the appropriate personnel and training to ensure that depredation activities are carried out in a manner consistent with state or federal permit conditions and the established SOPs found in enclosure (2).

(14) Maintain records of animal activity and dispersal utilizing an established Bird/Animal Tracking Sheet and airfield grid in Enclosure (6) that is then submitted to NR for their review and records. Report all animal activity to AFS (Airfield Services Division) at 301-342-4790.

(15) Coordinate with Natural Resources and the BHWG to plan and prepare for future trapping of birds and mammals, habitat modification, relocation, and depredation.

(16) Coordinate with Natural Resources and the BHWG on programs to disperse and limit birds such as pigeons, starlings, and house sparrows from hangars and other structures.

(17) Carry out all USDA functions in accordance with the NAS Patuxent River Integrated Natural Resource Management Plan (INRMP).

i. The Installation Environmental Program Manager shall:

(1) Ensure BASH programs are in compliance with all applicable state and federal environmental laws and regulations, including but not limited to the National Environmental Policy Act, the Clean Water Act, the Sikes Act, the Migratory Bird Treaty Act, the Endangered Species Act, the Bald and Golden Eagle Protection Act, and the Coastal Zone Management Act.

(2) Monitor BASH programs to ensure compliance with all applicable DoD, DoN, and U.S. Navy environmental policies, directives, and instructions.

(3) Participate in the local BHWG, in on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys and in annual BASH self-assessments.

(4) Ensure any applicable survey data is disseminated to BHWG in a timely manner.

j. The Public Works Officer (PWO) shall:

(1) Comply with all the duties and responsibilities set forth in reference (c).

(2) Participate in the local BHWG, in on-site technical reviews of the installation BASH programs during periodic Naval Safety Center surveys, and in annual BASH self-assessments.

(3) Provide facilities support services and maintenance (mowing, vegetation and landscape management, trash removal, facilities and sign maintenance, etc.).

(4) Procure, store, and maintain necessary pyrotechnic equipment and other supplies required for bird/animal abatement and dispersal.

k. The Airfield Manager shall:

(1) Oversee the monitoring of grass height, foliage growth, drainage ditches, persistent standing water, etc., and report any issues to Public Works and the Natural Resources Management Office (NRMO).

(2) Establish a BASH awareness-training program for all airfield management, ATC, and airfield facilities personnel.

(3) Request and maintain annual funding for the BASH Program Coordinator in support of the BASH Plan.

(4) Serve as a member of the BHWG.

l. All Naval Air Station and Tenant Activities shall:

(1) Periodically brief aircrew on bird/animal strike hazards and prevention, emphasizing the importance of reporting all significant wildlife activity that poses a wildlife strike hazard.

(2) Deliver any BASH remains (including minute quantities of feathers or flesh) to the Natural Resources Office following bird strike in accordance with Enclosure (1). Accurate identification is essential for useful bird activity analysis.

(3) Ensure aircrew participation in the BASH Program by promptly reporting all hazardous conditions to the Tower, and wildlife strikes to the Natural Resources Manager at 301-342-3670, USDA Wildlife Services at 301-342-5905, and NAS Patuxent River ASO at 301-342-6218.

(4) Submit an online BASH report through the Naval Safety Center WESS reporting system, www.safetycenter.navy.mil. Copy all strike information to the Natural Resources Manager as well as USDA Wildlife Services.

(5) Report all animal activity to AFD at 301-342-4790 utilizing the Bird/Animal Tracking Sheet and airfield grid in Enclosure (6).

(6) Conduct airfield BASH sweeps during after-hours operations. Training for these sweeps will be coordinated and completed with the assistance of Natural Resources and USDA.

m. The BHWG shall hold a quarterly meeting with all tenant commands and their safety representatives to assess the effectiveness of the BASH Program. Additional working meetings may be held on a case-by-case basis with the BHWG leadership as time-sensitive issues arise. Provide minutes of all meetings to CO, NAS Patuxent River, and all members of the BHWG. In addition, a BASH self-assessment will be completed annually by all members of the BHWG leadership. The BHWG leadership shall consist of:

(1) Air Operations Officer (Chairperson)

(2) Base Aviation Safety Officer

(3) NTWL Aviation Safety Officer

(4) Air Traffic Control Facility Officer

(5) Airfield Services Division Officer

(6) Airfield Managers for Webster and Trapnell fields

(7) Natural Resources Manager

(8) Natural Resources Specialist

(9) USDA APHIS Wildlife Services personnel

(10) Installation Environmental Program Manager

(11) Public Works Officer

5. BASH Condition Codes. The following terminology can be used for rapid communication to disseminate bird activity information and implement unit operational procedures. Bird locations should be given with the condition code. The Control Tower Supervisor is responsible for setting and downgrading bird condition codes.

a. Code Red. Heavy concentration of wildlife on or directly above the active runway, in the immediate vicinity of a low-level route or training area, or other locations that represent an immediate hazard to safe flying operations. Aircrews should thoroughly evaluate mission need before operating in areas under Code Red. Wildlife dispersal crews should be dispatched immediately to these areas.

b. Code Yellow. Concentrations of wildlife are observable in locations that represent a probable hazard to safe flying operations; or conditions exist (such as weather or known flight/migration patterns) which are likely to result in the presence of dangerous concentrations of birds, and other wildlife on or around the airfield. This condition requires increased vigilance by all agencies and extreme caution by

aircrews. Wildlife dispersal crews should monitor these areas closely and conduct dispersal activities as deemed necessary.

c. Code Green. Normal wildlife activity with a low probability of hazard. All airfield personnel should be alert for any change in wildlife condition.

6. Records Management. Records created as a result of this instruction, regardless of media and format, must be managed as per SECNAV Manual 5210.01 of January 2012.

7. Review Authority. Per OPNAVINST 5215.17A, the NAS Patuxent River ASO will review this instruction annually around the anniversary of its issuance date to ensure applicability, currency, and consistency with Federal, Department of Defense, Secretary of the Navy, and Navy policy and statutory authority using OPNAV 5215/40 Review of Instruction. This instruction will be in effect for 10 years, unless revised or cancelled in the interim, and will be reissued by the 10-year anniversary date if it is still required, unless it meets one of the exceptions in OPNAVINST 5215.17A, paragraph 9. Otherwise, if the instruction is no longer required, it will be processed for cancellation as soon as the need for cancellation is known following the guidance in OPNAV Manual 5215.1 of May 2016.

C. A. COX

Releasability and distribution:
This notice is cleared for public release and is available electronically only via
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BIRD/ANIMAL STRIKE REPORT FORM

In the event of a reported animal/bird strike, including suspected strike, obtain the following information. Do not attempt to obtain information if doing so may adversely affect safety of flight. Information may be taken by radio or phone once the aircraft is safely on deck or airborne. It is important that all animal/bird strikes be expeditiously reported. If possible, record the following information:

a. Date/Time of strike (specify local or Zulu time):_____

b. Name and phone number of person making report:_____

c. Aircraft Type/Callsign/Squadron:_____

d. Geographic location of strike (be as exact as possible):_____

e. Phase of flight (takeoff, landing, level, climbing, descending, taxiing, stationary) and effect on flight (continuance, termination)
:_____

f. Lights being used (none, landing, strobe, both, N/A):_____

g. Type of strike: bird, deer, other, (if known, what type of bird: gull, blackbird, vulture, etc):_____

h. Number of animals/birds seen at strike (few, many, exact #):_____

i. Who removed the remains (none found, Natural Res., USDA, AFD, Crash/Fire,other):_____

j. If known, what was the extent of damage to the aircraft?_____

k. Weather: Surface Wind (direction & speed):_____

l. Altitude at strike:_____

m. Airspeed at strike:_____

n. Visibility:_____

o. Name and phone number of person receiving report:_____

2. The AODO shall notify the base CDO (301-342-1095). In turn, the base CDO shall notify the appropriate airfield personnel using the BASH phone list.

3. The AODO shall fax copies of this report to NAS Patuxent River Air Operations (301-342-3928) and Natural Resources Branch (301-342-3546).

4. All animal remains are to be delivered to the Natural Resources Office (Bldg. 1410). There will be a clearly marked metal trash can behind the building in which to leave the remains. The remains should be left in a sealed plastic bag and identified by whatever means available to label them. The label should include, at a minimum, point of contact information and incident date.

Standard Operating Procedures for Mammal and Bird
Dispersal and Depredation on the Airfield

1. For BASH purposes, the airfield is defined as the paved surfaces of the runways and taxiways, and the mowed grass around these paved areas. The BASH program is all inclusive; mammals, birds, reptiles, etc. However, dispersal techniques for mammals, such as deer, are addressed separately from dispersal techniques for birds.

2. The Air Traffic Control Tower must be notified prior to conducting any dispersal or depredation activities. Because bird dispersal puts birds into the air and could actually increase strike risk, all activities should be closely coordinated with the tower.

3. Before conducting any dispersal or depredation effort involving firearms or pyrotechnics in the vicinity of the VQ-4 Alert Facility, be sure to contact the Air Traffic Control Tower and notify the VQ-4 Chief Master at Arms Watch Commander at 342-4542. Verify notification prior to commencing.

Note: Successful, effective wildlife dispersal requires knowledge of animal identification and wildlife behavior as well as aircraft and airport operations. Dispersal personnel should have the latest dispersal tools available to them, and be allowed the flexibility to use whatever methods (within the law and DoD Guidance) that they deem most appropriate to the situation at hand. No one better understands the situation and specific needs better than the individual on the field. In matters of judgment, one should always err on the side of caution and safety.

4. It is imperative that all personnel conduct themselves in a highly professional manner at all times. The objective of wildlife dispersal and depredation is to maintain airfield safety. It is not done for the sake of recreation, target practice, or simple harassment. It is to be done with a clear purpose and to achieve the stated objective. It must be kept in mind that any activities with potential to harm or kill wildlife may be placed under close public scrutiny. State and federal permits also contain strict conditions, which are enforceable as law and must be followed. Careless or reckless actions can jeopardize continued use of dispersal and depredation tools. Once revoked, permits are difficult to have reinstated. These standard operating procedures are written to provide guidelines for proper methodology under normal circumstances. They are not rigid regulations which must be followed without deviation, but deviations must be justified by unusual circumstances and fully documented in writing. Prior approval, from the Air Operations Officer, for radical departures from the standard operating procedures is appropriate.

To Disperse or Not?

5. The first step in wildlife dispersal is assessing the situation and determining if and when dispersal is necessary. This will depend on a number of variables (location of wildlife, behavior of wildlife, aircraft operations, etc.) and require the professional judgment of the dispersal crew. Simply put, the dispersal crew must use its judgment to determine if an animal is posing or likely to pose a hazard to air operations. Once a decision to disperse has been made by the dispersal crew, they will coordinate with tower to begin the dispersal effort. Ultimately, it is the decision of the Tower when the dispersal will take place.

6. Dispersal Guidelines

a. All wildlife on or within 750 feet of an active landing surface and 1000 feet of approach paths should be dispersed immediately. See number 7 for specific deer dispersal guidelines.

b. All wildlife on inactive runways should also be dispersed to prevent them from habituating to use of these areas, including times when there are no flight operations. Extreme caution must be exercised to be sure wildlife are not pushed from an inactive runway toward an active one.

c. All flocking birds using areas surrounded by runways should be dispersed.

d. Flocking birds within mowed grass areas or agricultural parcels within 750 feet of active runways should be dispersed.

e. All large birds such as raptors, wading birds, and waterfowl within 750 feet of active and inactive runways should be dispersed. This includes 1000 feet at the approach and departure ends of the active runway.

f. When the airfield is open, or during flight operations, disperse all deer within mowed grass areas on or adjacent to the airfield, as well as deer within any agricultural field adjacent to a runway.

g. Some species of birds are usually sedentary, and typically move only when disturbed. If they are at a questionable distance from the airfield, and appear to be roosted, the dispersal crew must determine if they may create a greater hazard by flushing the bird(s).

7. MAMMAL DISPERSAL. All mammals are hazards to aircraft and have the potential of causing severe damage to aircraft and injury to aircrews. All mammals, including raccoons, skunks, possums, fox, coyotes. groundhogs, and deer should be dispersed when they are within 750 feet of active and inactive runways, as well as 1000 feet at the approach and departure ends of the active runway. When dispersing mammals from the airfield, the following procedures should be followed:

a. Notify the tower of the situation. This includes location, species and number of animals, and dispersal efforts to be used.

b. A spotlight permanently mounted to the vehicle can be used by AFS personnel to conduct runway deer sweeps at night. Sweeps will be conducted from the actual runway surface, unless active operations preclude driving on the runway. If arriving or departing traffic prevents driving on the runway, dispersal crews may drive on service roads immediately adjacent to runways.

c. When approaching the animal(s) to be dispersed, always keep your back to the runway/taxiway and remain between the animal and the runway/taxiway. This is best done with a team of two or more people.

d. When in proper position, move toward the animal(s). Once the animal(s) begin moving, maintain a position between the runway/taxiway and the animal(s) and continue toward the animal(s) until it is a safe distance from the airfield.

e. When dispersing a group of two or more deer, it is important to move the deer as a group. The dispersal team should consist of a minimum of two people, if available, but the dispersal works best with three or more. Determine the safest direction in which to move the deer and position the team in such a way that ensures the deer move in the desired direction. Begin moving toward the deer in a steady and deliberate manner. Continue moving the deer until they are determined to be a safe distance from the airfield.

f. Pyrotechnics can be effective for mammal dispersal if used appropriately. They are especially useful when a single person must disperse deer. Using pyrotechnics can reinforce movement in the desired direction. Screamers and whistlers work fine at short distances, but shellcrackers fired from a 12-gauge shotgun work best for greater distances.

g. If, after dispersing a mammal(s), they persist with attempts to cross the airfield, be sure to get clearance from the Air Traffic Control Tower before following a deer or other animals across the runway.

h. Propane cannons can also be set up along the duty runway for nighttime operations to supplement runway sweeps by dispersal crews. Before propane cannons are used, dispersal crews must first notify the Tower Supervisor.

> **Note:** Propane cannon use should be limited to what is necessary to keep animals off the active runway at night. They should not be left on continuously, especially when the airfield is inactive. Overuse will result in habituation by wildlife, and their effectiveness will be diminished.

i. If deer become habituated to vehicles, pyrotechnics, and propane cannons, or otherwise show extreme reluctance to disperse, more extreme measures can be taken. Frightening techniques can be reinforced with the use of rubber buck shot or rubber slugs fired from 12 gauge shotguns, if necessary. Prior to using these techniques, however, dispersal crews must obtain permission from the Facilities Watch Supervisor (FWS). Entries must be

made in the AFS duty log book documenting the failure of previous dispersal attempts and the justification for using these measures.

j. If at any time during a dispersal effort or during a daily routine an animal is observed behaving strangely (e.g. disoriented, lethargic, unable to walk, or is unable to be dispersed) contact Natural Resources immediately. When removing animal carcasses found on or near the airfield, personnel should use a shovel or wear gloves, and place the carcass in a plastic bag if possible. Rabies and other diseases can survive for a short while in freshly killed animals.

k. If problems persist in the same location, or with the same type of animal, notify the BHWG of the situation. This may be due to the presence of food and water sources or a denning site, requiring land use or habitat modifications.

8. BIRD DISPERSAL. During bird dispersal, the following procedures should be followed:

a. Notify the Tower of the situation. Include the location, species, number of birds, and dispersal effort to be used.

b. When birds are present on or near the airfield, they should be dispersed with a combination of bioacoustics and pyrotechnics.

c. Drive vehicle within 50 to 150 yards of birds, if possible, to broadcast bioacoustic distress call recordings. Prior to playing the tape, it is important to consider wind direction. If birds are downwind from the vehicle, it won't be necessary to get as close as it would be if they are upwind.

d. Select a bioacoustic distress call recording for the predominant species present on the airfield at the time (in a mixed flock of gulls or blackbirds, select the tape for the predominant species, but be prepared to play additional tapes for other species as necessary). Birds may initially come to the tape. In this case, let as many as possible come in, then disperse them with pyrotechnics.

e. Once the tape is started it should not be played longer than 20 seconds. It should only be played once every 3 minutes. This procedure (of playing the tape and waiting) should only be done a total of three times. If nothing happens after the third time, see number 7. This effort must be closely coordinated with the Tower, as it requires approximately 10 minutes per evolution. Therefore it should be timed to take place during a window of at least 10 minutes between aircraft arrivals and/or departures.

f. If, while playing the tape, birds start to get up and move, two things should be noted. If the birds look like they are going to fly away and clear the area, let them go. However, if they look hesitant to fly away but are getting off the ground, use pyrotechnics to reinforce the tape.

g. If birds do not take off after playing the tape three times, proceed to drive the truck through the flock, honking the horn. Persistence pays off. This can also be reinforced with the use of pyrotechnics once birds get off the ground. Propane cannons may then be needed to prevent birds from returning. Before propane cannons are used, dispersal crews must first notify the Tower Supervisor.

> **Note:** Propane cannons should be limited to what is necessary to keep the birds off the active runway. They should not be left on continuously, especially when the airfield is inactive. Overuse will result in habituation by birds and other animals, and their effectiveness will be diminished.

h. If dispersal using bioacoustics and pyrotechnics fails to yield a reasonable response, further measures will be necessary. On larger birds (geese, herons, etc.), these techniques can be reinforced with rubber buckshot fired from a 12-gauge shotgun. When dispersal becomes ineffective, contact Natural Resources for use of the depredation (lethal control) permit.

i. Maintain detailed and accurate bird dispersal records. These are necessary to document necessity for use of depredation in accordance with our Federal Permit.

j. Bird Dispersal Notes

(1) Safety glasses, leather gloves, and hearing protection shall be worn when using pyrotechnics. Pyrotechnics shall never be fired from inside a vehicle. Be alert for fire or FOD hazards created by pyrotechnic devices.

(2) All birds on the airfield should be dispersed away from the entire airfield, not just the current duty runway. If birds are allowed to use non-duty runway areas, they will become accustomed to using them. This increases the likelihood of their return during an active flight period, and makes them much more difficult to disperse when necessary.

(3) Persistence pays off with all wildlife. Certain species need constant harassment. Be sure to maintain vigilance.

(4) Always be conscious of aircraft traffic and the direction the birds disperse.

9. DEPREDATION (LETHAL CONTROL). The Station's depredation permit is a Federal Permit with strict guidelines for its use, enforceable by law. This permit may be revoked if these guidelines are not followed. Thus, it is important to have written documentation of all bird and mammal dispersal activity, including: date, time, location, personnel, dispersal effort, and results of the effort.

a. Remember to notify the VQ-4 Chief Master at Arms, 301-342-4542 (and verify acknowledgment) before carrying and/or using firearms or ammunition near the VQ-4 Alert Facility.

b. All Natural Resources pyrotechnics and live ammunition is stored inside an appropriate storage locker. Sign out sheets are located there as well. Keys for the firearms and live ammunition boxes are located at building 1410. All USDA/AFS pyrotechnics are stored in an RSL locker outside of building 2388. All USDA live ammunition and firearms inside building 2388. The live ammunition is stored in a secure safe, and all firearms are stored inside a GSA approved safe.

c. Once firearms, live ammunition, and pyrotechnics have been obtained, notify the Tower of the situation. Include the location, species and number of birds or mammals being harassed or depredated.

d. Follow the SOP for bird dispersal (steps 4-7) and inform USDA if the need for depredation arises.

e. Notify dispatch prior to the discharge of a firearm. Based on the nature of the threat, when personnel cannot make prior contact, they shall inform dispatch immediately following depredation.

f. Remove all animal remains. Do not throw them into the grass or weeds alongside a runway, as they may attract scavengers and create another safety hazard.

g. When the depredation effort is complete, it is important to document, in writing, the events that took place. Be sure to include: date, time, location, time, personnel involved, and how the depredation took place. Also record the number and species of birds that were taken.

h. It is also important to revisit the problem area over the next few days to be sure that birds do not return. If birds continue to frequent the area, it may be necessary to repeat the depredation effort until the birds refuse to use that area.

i. Depredation Notes

(1) Stay in communication with the Tower and keep them informed of wildlife movements.

(2) Be aware of aircraft traffic and patterns.

(3) Safety glasses and hearing protection shall be worn during all dispersal and depredation efforts using pyrotechnics or firearms.

(4) A combination of pyrotechnics and live ammunition will offer better results in future dispersal efforts.

(5) The Natural Resources Manager and/or USDA Biologist, or appointed personnel, must be present during all depredation efforts and will ensure that protected species are not inadvertently killed. Some rare or endangered species closely resemble common airfield nuisance species (i.e. - Piping Plover vs. Killdeer, immature Bald Eagle vs. Turkey Vulture). Under no circumstances are active duty DoD personnel authorized to operate firearms during any depredation effort.

(6) All firearms, unused pyrotechnics, and live ammunition must be returned to the storage locker (by personnel on the access list) upon completion of the event in which they are needed.

(7) Document, in writing, all dispersal and depredation efforts.

(8) Be persistent and frequently visit trouble areas. Inform the Tower if any FOD is suspected on the runway or taxiway after a dispersal or depredation effort.

(9) In the event of a runway incursion of deer or other large mammals ATC should immediately notify in the following order: USDA, Natural Resources, Airfield Services Division (AFS), and Air Operations.

(10) Per ref (c), deer will be disposed of by donating to a local processor or charity or by burial on station. When the Natural Resources Manager determines that no acceptable burial locations exist on station, deer should be delivered to the Farmers and Hunters Feeding the Hungry (FHFH) Program where all costs are covered by Natural Resources. For more information see:

http://www.dnr.state.md.us/wildlife/Hunt_Trap/FHFH/fhfh.asp

The two donation locations within St. Mary's County are:

Nice Rack Butcher Shop	Wild Game Processors
27000 Glebe Farm Lane	22399 Indian Bridge Rd.
Mechanicsville, MD 20659	California, MD 20619
Contact: Paul Trossbach	Contact: Mike McWilliams
240-587-0246	301-475-9667 (home)

10. IMMINENT THREAT POLICY. Per ref (c), paragraph 5, section C, number 6, "Installation COs who conduct or support air operations shall establish procedures for a rapid response capability to deal with emergent BASH issues that threaten daily operations."

a. Depredation may be required to deal with wildlife that poses an imminent threat to aircraft. This is not to be confused with depredation for population control, which is coordinated by N45 and is outside of the scope of this instruction. Per refs (c) and (e), N45 maintains the depredation permits and letters of authority that recognize those persons authorized to depredate on station.

b. Via reference (e), the NAS Patuxent River CO authorizes the only personnel permitted to depredate onboard NAS Patuxent River. Enclosure (2), the "Map of Wildlife Imminent Threat Zones," delineates imminent threat zones in which wildlife may be dispersed or depredated. Wildlife inside the red line, or approximately 750 feet from the perimeter of runways and taxiways, is an imminent threat. Wildlife within the potential threat zone should be dispersed. However, depredation is permitted in the potential threat zone if wildlife exhibit behaviors that make it an imminent threat. Such behavior includes, but is not limited to, movement towards the imminent threat zone and lack of response to dispersal attempts. Wildlife within the imminent threat zone is authorized for immediate depredation unless it disperses prior to the arrival of a depredation asset.

11. PERTINENT PHONE NUMBERS:

Airfield Services Division: 301-342-3570
Air Operations Duty Office: 301-342-3836
NAS Command Duty Office: 301-342-1096
Natural Resources: 301-342-3670
USDA Wildlife Services: 301-342-5905

* Refer to the "Natural Resources call back list" for after-hours emergencies

Pyrotechnic and Firearms Storage, Inventory, Training, and Withdrawal Requirements for NAS Patuxent River

1. Storage. Natural Resources (NR) will have all firearms and live ammunition is stored at building 1410. USDA Wildlife Services will have all firearms and live ammunition is stored at building 2388. All firearms and live ammunition will be stored under the guidance of the NAS Explosive Safety Officer (ESO). Firearms will be stored in a GSA safe and live ammunition will be kept in a separately locked container. The ESO will approve of all initial firearms storage and withdrawal procedures. Natural Resources and USDA will be responsible for all maintenance on firearms. All Natural Resources pyrotechnics will be stored in an RSL provided by the Weapons Detachment and shared with Airfield Facility Services (AFS). AFS will maintain key access for the RSL.

2. Inventory. Natural Resources will maintain a master inventory sheet at building 1410 for Natural Resources live ammunition and firearms. USDA will maintain a master inventory sheet at building 2388 for USDA live ammunition and firearms All access and withdrawal procedures and requirements will be provided by the ESO. All firearms and any unused ammunition will be returned to the proper storage safe or container upon completion of the event in which they are needed.

3. Training. Prior to removing any Natural Resources firearm, ammunition, or pyrotechnics from the storage locker, individuals must be trained in the use of that firearm, ammunition, and/or pyrotechnic. Training for the safe use of pyrotechnics will be conducted by qualified personnel from Natural Resources or USDA Wildlife Services. Persons completing the training will receive a certificate that will be available upon request. A list of persons trained will be maintained by the person(s) doing the training; either Natural Resources or USDA Wildlife Services.

4. Withdrawal requirements. Withdrawals will follow guidance provided by the ESO and only authorized persons are able to access the firearms and/or live ammunition. 24-hour access to the storage locker is required.

5. Natural Resources Firearms Training and Live Fire Familiarization.
Any person authorized to use these firearms must complete the firearms training and live fire familiarization that was developed in coordination with the NAS Police Department to accommodate the special needs of the Public Works Natural Resources Branch. All personnel receiving this training are obligated to abide by the Lautenburg Amendment which requires applicants to disclose whether they have ever been convicted of a misdemeanor crime of domestic violence within the meaning of the statute. All training and familiarization regarding firearms for Natural Resources personnel will be conducted by NAS Police Department. USDA Wildlife Services personnel are exempt from this requirement due to their own separate training requirements as provided by their agency. Training will include a discussion on proper handling of firearms, followed by a live fire familiarization session. NAS Police Department will coordinate times and dates for use of firing range and provide an instructor. Natural Resources will provide firearms and ammunition. Persons wishing to be listed on the Natural Resources weapons access list must complete this training. The formal classroom training sessions will cover the following topics: Safe carrying methods, loading and unloading, and safe transportation. NAS Police Department will provide the instructor, the classroom (the classroom in building 1410 can be made available), and any handouts. Natural Resources will provide the firearms, ammunition, eye and hearing protection. The live fire familiarization session will include:

a. Rifle (.22 caliber), 30 rounds at a distance of 15 yards at a standard 50 foot pistol target provided by NAS Police (10 rounds standing, 10 rounds kneeling, 10 rounds sitting).

b. Shotgun Slugs and Buckshot (12ga): 6 rounds of each per person at 25 yards at a cardboard silhouette of a deer provided by Natural Resources (3 rounds standing, 3 rounds kneeling).

Training Qualification for Wildlife Detection and Dispersal Team (WDDT)

This training Personal Qualification Standard (PQS) is to be used as a guideline for instructing personnel in the safe handling and use of pyrotechnics for airfield bird and wildlife dispersal. Pyrotechnic equipment includes: bioacoustic systems, starter pistols, starter caps, bird bangers, bird screamers, shellcrackers, firearms, propane cannons, and propane tanks. Safe handling and use of each of these pieces of equipment must be discussed and each participant must demonstrate their knowledge of how to safely use each piece of equipment to the satisfaction of the presenter.

Student/Instructor/Date

1. Safety Gear _____
   a. Ear protection
   b. Eye protection
   c. Suggested additional protective wear
2. Bioacoustic System _____
   a. System Set-up
   b. Storage
3. Propane Cannons _____
   a. Cannon set-up (Demonstrate)
   b. Cannon shut off (Demonstrate)
4. Pyrotechnics _____
   a. GPIS 6 round pistol
      1. How to load caps
      2. How to load pyrotechnics (Demonstrate)
      3. Firing pistol (live or simulated)
   b. Revolver pistol
      1. How to load caps (Demonstrate)
      2. How to load pyrotechnics (Demonstrate)
      3. Firing pistol (Live or simulated)
      4. Firing Failure
      5. Check for FOD
   c. Pyrotechnics
      1. How to load (Demonstrate)

2. Firing pyrotechnics with shellcracker (Live or simulated)

3. Check for FOD

5. Vehicular Dispersal _____

a. Designated Operating Areas

b. Radio Communication Procedures

c. Proper Dispersal Techniques

6. Additional Information _____

a. Local BASH Instruction

b. Permit Restrictions

c. Local, state, and federal (MBTA/ESA) wildlife

d. Wildlife Management techniques

7. Written Exam _____

8. Division Officer Recommendation _____

9. Air Operations Officer Approval _____

Standard Operating Procedure for Reporting and Notification of Bird and Deer Aircraft Strikes at NAS Patuxent River

All wildlife/aircraft strikes must be reported, and strike remains collected and identified, in order to evaluate the effectiveness of the BASH program and identify new and changing hazards. The purpose of this enclosure is to establish reporting and notification responsibilities after a wildlife strike occurs.

Squadron

1. Pilots will report all strikes or the likely occurrence of a strike to the Tower.

2. All tenant commands are required to complete a WESS report for all wildlife strikes and forward the WESS number to the Natural Resources Office. In addition, all tenant commands will contact flight planning to report a confirmed strike (342-3836).

3. Collect all bird remains and deliver them to Natural Resources for identification. For assistance collecting bird or animal remains, contact the Natural Resources Office or the USDA Wildlife Services Biologist.

4. If the strike involved a deer, assist with the clean-up and removal of remains from the airfield.

Air Operations Tower/Flight Planning

1. Upon notification of a wildlife strike or potential strike, the Tower will request that AFS conduct a sweep of the runway where the strike occurred.

2. In the event that a deer/aircraft strike occurs contact the Airport Manager, the Natural Resources Office and the USDA Wildlife Services Biologist. If the strike occurs after hours, refer to the call-back list located in flight planning for the Natural Resources Office.

3. The Tower will record all wildlife strikes in the wildlife log.

Airfield Facilities Division

1. Conduct a sweep of the airfield in areas of a reported strike and collect any remains. In the event of a deer strike, contact the squadron, the Natural Resources Office, and the USDA Wildlife Services Biologist for assistance.

2. Deliver all animal remains to the Natural Resources Office in building 1410 for identification. There is a metal trash can behind the building clearly marked for animal remains.

3. Report any animal remains found on the airfield to the Tower.

Natural Resources Department

1. Maintain all wildlife strike records for the installation.

2. Assist with the removal of all animal remains from the airfield and from aircraft.

3. Ensure all strike remains are identified.

USDA Wildlife Services

1. Respond to the area of a wildlife strike to pick up and remove remains.

2. Deliver all remains to the Natural Resources for identification.

3. Assist with the collection of remains from an aircraft, if requested.

Whenever a bird, deer or other animal, alive or dead, is found on or around any runway or taxiway, it must be reported to the Tower. When calling the Tower, include the location on the airfield, the type of animal and the number of animals so airfield wildlife dispersal personnel can respond appropriately. Additionally, the Tower maintains a wildlife sighting log that is used to identify wildlife hazard areas on the airfield. In the event an aircraft strikes a bird, the following reporting and notification must be made:

1. If the pilot knows the aircraft hit a bird notify the Tower and taxi back to the flight line if able. The Tower will contact AFS for a FOD sweep of the runway and the squadron maintenance department will inspect the aircraft for damage and bird remains. The Tower will contact flight planning, who will contact the BASH coordinator. All animal remains found on the runway or on the aircraft must be collected and delivered to the BASH coordinator in Natural Resources for identification.

2. If bird remains are found on the aircraft during post flight inspection, notify flight planning at 342-3836. All animal remains must be collected off the aircraft and delivered to the Natural Resources Office (building 1410) for identification.

3. A representative from the squadron which hit the bird will complete and submit the required WESS report. If the BASH occurs within the Naval Air Station Patuxent River Class D airspace or the location is undetermined, the WESS report shall use the following coordinates: N38°17'11" / W076°24'36" and report the strike occurred at NAS Patuxent River. This will normalize all BASH reports for the airfield and improve statistical data analysis in the future.

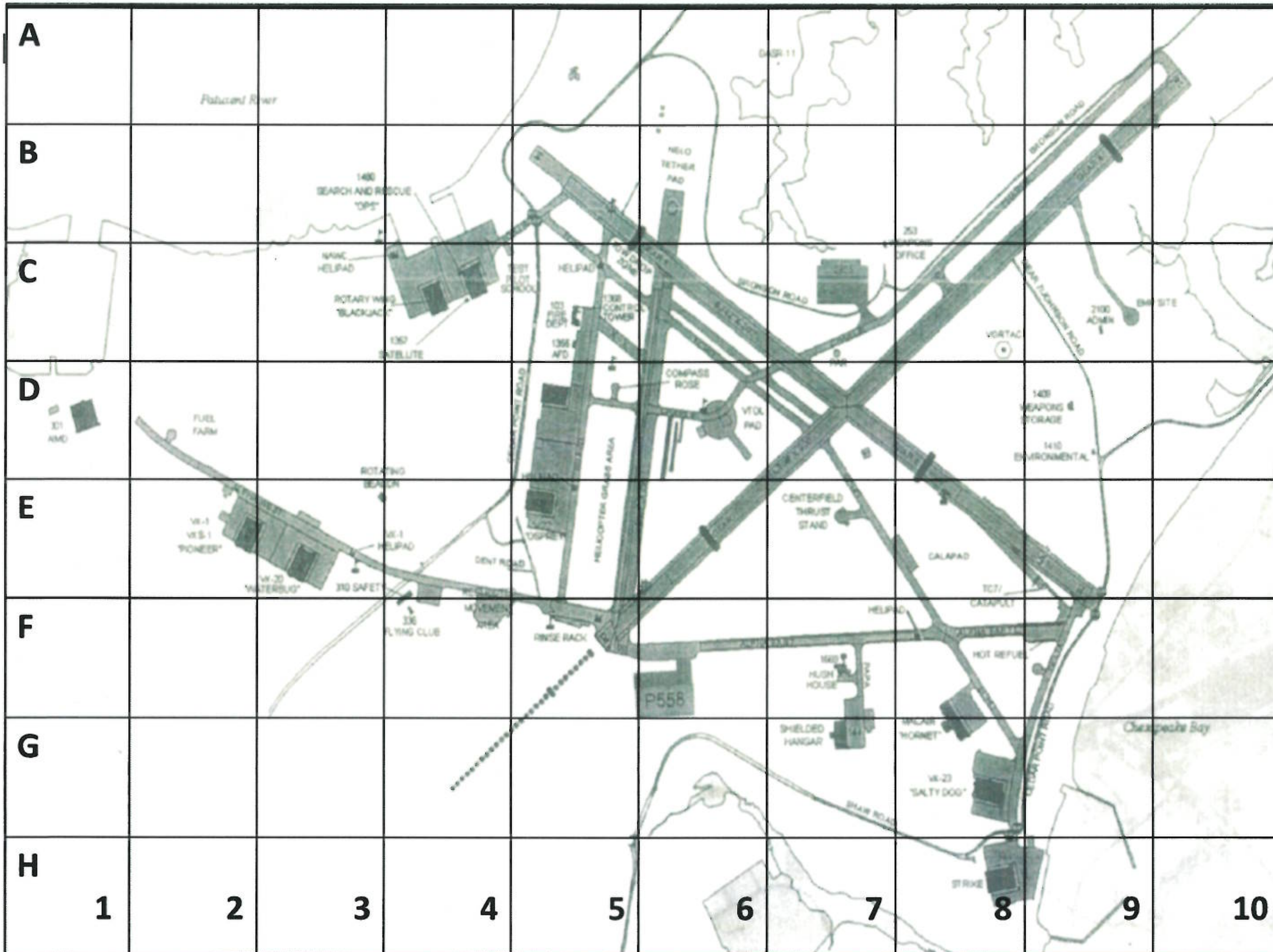
NASPAXRIVINST 3750.5J
11 Apr 2019

BIRD / ANIMAL TRACKING SHEET

DATE: _____

TIME	LOCATION	SPECIES	NUM	DISP	DISPERSAL METHOD AND LOCATION SPECIFICS
(L)	(Ex: C-7)	(Be as detailed as possible)	(#)	(Y/N)	(Ex: in grass on North side of runway 14) (Ex: dispersed with horn, bangers, etc…)

Enclosure (6)


A
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C
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E
F
G
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1
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3
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5
6
7
8
9
10
Patuxent River
Chesapeake Bay
1480 SEARCH AND RESCUE "OPS"
NAWC HELIPAD
ROTARY WING "BLACKJACK"
1367 SATELLITE
HELIPAD
1368 AFD
COMPASS ROSE
VTOL PAD
HELO TETHER PAD
FUEL FARM
ROTATING BEACON
VX-1 VXS-1 "PIONEER"
VX-20 "WATERBUG"
VX-1 HELIPAD
310 SAFETY
336 FLYING CLUB
DENT ROAD
HELICOPTER GRASS AREA
RINSE RACK
P558
CENTERFIELD THRUST STAND
CALAPAD
HELIPAD
HOT REFUEL
SHIELDED HANGAR
"HORNET"
VX-23 "SALTY DOG"
STRIKE
SHAW ROAD
VORTAC
1409 WEAPONS STORAGE
1410 ENVIRONMENTAL
2100 ADMIN
BRONSON ROAD

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

Outdoor Recreation Management

CHAPTER 9

Table of Contents

IX OUTDOOR RECREATION MANAGEMENT

1.0 Introduction

The Department of the Navy, as a holder of Federal lands, has various programs for outdoor recreational opportunities. These programs are designed to be compatible with national defense and security requirements (as defined in the introductory chapter of the INRMP) while ensuring integrated multiple uses of existing recreational resources. In this context, outdoor recreation is the use of natural resources on military installations for both consumptive (finite, quantifiable extraction of a resource, such as hunting or fishing) and non-consumptive (passive use of a resource for leisurely intentions, such as picnicking) purposes. It does not include the more urban recreational resources such as swimming pools, ball fields, and golf courses.

1.1 Purpose

The outdoor recreation chapter of an integrated management plan has, as its core, a discussion of management, conservation, and development of outdoor recreational resources. On a naval base, the Outdoor Recreation Program has the two-fold benefit of taking pressure away from the surrounding local community's outdoor recreation opportunities and generating a positive impact on that station's staff productivity and retention. In this instance, St. Mary's County is not called upon to supply a full range of outdoor recreational opportunities to the Station families, yet personnel can still enjoy an enriched quality of life, which presumably encourages them to remain at the Complex or on active duty.

1.2 Scope

In addition to the numerous recreational facilities available to the general population in the tri-county region, the Station provides a wide range of outdoor recreational activities to military personnel, their dependents, and Federal employees. These include hunting, fishing, trapping, shellfishing, horseback riding, boating, camping, picnicking, nature study (such as birding), hiking, and some bicycling opportunities (Note: Camping and horseback riding opportunities are not available at WOLF). Use of the Station's outdoor recreational facilities is administered through the Public Works Department's Natural Resources (NR) Program and the Morale, Welfare, and Recreation (MWR) Department. Access to WOLF's recreational facilities is more limited than to those at PAX.

This chapter of the INRMP addresses outdoor recreation at the Station by highlighting the pertinent laws, regulations, and policies; delineating the goals and objectives of the Station's Outdoor Recreation Program; and describing the existing resources (excluding the golf course and ball fields, in accordance with NAVFAC P-73, detailed in the Introduction chapter). Subsequent sections propose management and conservation measures for the future, as well as the attendant research and costs involved in implementing those ideas. This includes addressing any potential conflict among competing uses, mission activities, and other management initiatives.

2.0 Applicable Laws, Regulations, and Policies

For the sake of this document, discussion of outdoor recreation regulation is confined to ventures such as hunting, trapping, fishing, boating, non-pool (beach) swimming, camping, hiking, and

picnicking in accordance with NAVFAC P-73. The following sections identify and briefly describe some of the applicable laws, regulations, and policies.

2.1 Federal Laws and DoD/DoN Instructions

There are a number of Federal laws that govern the management of outdoor recreation. Broad-based laws, such as the National Environmental Policy Act and the Coastal Zone Management Act, have been addressed in the introductory chapter of the INRMP. Discussion herein is restricted to the laws most directly associated with outdoor recreation on a military facility.

2.1.1 Military Reservations and Facilities: Hunting, Fishing, and Trapping; Public Law 85-337, 10 USC 2671 et seq.

This Federal statute, an update of the Military Construction Authorization Act, provides that hunting, fishing, and trapping on military lands must follow state law.

2.1.2 National Trails Systems Act; Public Law 90-543, 16 USC 1241-1249

This Act promotes the development of recreational, scenic, and historic trails for people with diverse interests and abilities.

2.1.3 Outdoor Recreation on Federal Lands, 16 USC 460(1) et seq.

This regulation defines a program for managing of Federal lands for outdoor recreation.

2.1.4 DODDIR 6050.2, Use of Off-Road Vehicles on DoD Land

This directive establishes uniform policies, procedures, and criteria for the designation of areas and trails where off-road and special sport vehicles may be permitted; it also specifies their operating conditions.

2.1.5 DODINST 4715.03, Natural Resources Conservation Program

This instruction requires military installations to implement outdoor recreation programs that are made available to the public as appropriate. The instruction goes on to state that installations shall ensure, to the extent consistent with each facility's military mission, that outdoor recreation opportunities (hunting, trapping, fishing, boating, camping and wildlife viewing) are available and that access is provided for persons with disabilities.

2.1.6 Memoranda of Understanding between DoI and DoD for the Development of Public Outdoor Recreation Resources on Military Installations, dated 7 April 1978, and between the US National Park Service and NAVFACENGCOM, dated 27 April 1986

These memoranda establish and provide guidance on the Navy's responsibility in terms of managing natural resources for outdoor recreation.

2.1.7 NAVFAC MO-100.4, Outdoor Recreation and Cultural Values

This Manual of Operation provides tri-service (Army, Navy and Air Force) technical guidance for the establishment and maintenance of an outdoor recreation program.

2.1.8 NASPAXRIVINST 1710.13, Morale Welfare and Recreation Programs

This instruction establishes hours of operation, safety and alcohol consumption rules, and charges governing the recreation program on Station. It extends the privilege of some facility usage to the faculty and staff of St. Mary's College.

2.1.9 NASPAXRIVINST 5510.16, Privately Owned Weapons

This instruction provides procedures for the possession, registration and use of privately owned weapons on the Station. It defines a weapon as a device that is capable of discharging a missile by pressure or propellant (includes BB gun, air pistol, air rifle, slingshot, bow and arrow).

2.1.10 NASPAXRIVINST 6240.11, Firewood Cutting

This instruction provides policy and procedures governing the cutting of trees for firewood or the gathering/collecting of other forest products aboard the Station. It focuses on establishing guidelines concerning harvesting and safety issues.

2.1.11 NASPAXRIVINST 11015.6 (series), Hunting and Trapping Regulations

This instruction provides regulations, procedures, and restrictions governing hunting and trapping at the Station, as well as guidance concerning violations of the instruction. The instruction also provides health notes concerning Lyme disease, rabies, and tularemia ("rabbit fever"); identifies permissible methods of hunting and trapping; and presents an accompanying map delineating approved hunting/trapping/training areas and assigned buffer zones.

2.1.12 NASPAXRIVINST 11015.7 (series); Fishing, Shellfishing, and Crabbing Regulations

This instruction identifies (1) authorized fishing personnel and areas; (2) license and permit requirements; (3) regulations concerning creel and size limits, seasons, and harvesting tools; and (4) violation actions governing fishing, shellfishing, and crabbing on the Station. This instruction should be subject to yearly updates and should be consulted prior to participation in the fishing program.

2.1.13 NASPAXRIVNOTE 11015 (series), Hunting and Trapping Seasons and Bag Limits

This NAS notice, associated with NASPAXRIVINST 11015.6 (series), provides annual updates to regulations and procedures related to hunting and trapping at the Station, focusing on seasons and bag limits as well as permits and fees. This instruction is subject to yearly updates and should be consulted prior to participation in the hunting program.

2.1.14 Chesapeake Bay Protection and Restoration, EO 13508

This Executive Order recognizes the Chesapeake Bay as a national treasure and calls on the federal government to lead a renewed effort to restore and protect the nation's largest estuary and its watershed. Part 7 of this EO directs Federal agencies to expand public access to the Chesapeake Bay on Federal lands.

2.2 State and Local Governments

The Station's public access policy is based on operational security requirements. The degree of public access for recreational purposes is a hybrid Category B/C, as defined by NAVFAC P-73 (see the footnote to Table IX-B-1 in Annex IX-B for description of access categories). The Station has essentially a Category B access policy, with the exception that civilian employees must be employees of the Station, while all military personnel (regardless of duty station) have access for recreation. Retired military personnel also have full access, while retired civilians do not.

Federal civilian employees of the Station (including sponsored dependents); all active duty military (retired, reservists, and dependents) with proper forms of identification; Maryland

Department of Natural Resources (MDNR) Police; and sponsored guests are authorized to hunt, trap, fish, crab, swim, camp, hike, and picnic on PAX, adhering to State rules and regulations as applicable. In addition, Station contractors are allowed a more limited access to these activities. The same activities (except swimming and camping) may be performed on WOLF property. Hunters and fishermen must have State licenses as well as PAX and/or WOLF permits.

Fishing at PAX and WOLF is regulated through base command regulations as well as a fee/permit system that is administered by the NR Program. All fishing activities require both a valid state license and a NAS fishing permit. NAS fishing permits are valid at PAX, WOLF, and NRC SOL. An NRC SOL fishing permit is only valid at NRC SOL, and is not reciprocal at other facilities. Recreational crabbing requires only a base permit for the base where crabbing is allowed.

Fishing permits may be purchased by going to https://naspaxriver.recaccess.com/. The installation fishing instruction can be found on this website as well.

All authorized persons[1], including guests, 12 years old and older must obtain a Station fishing permit to fish in tidal saltwater (including crabbing) or freshwater at PAX and WOLF. Permits must be in possession while fishing. Persons, including guests, between the age of 12 and 15 (inclusive) will be issued a free permit. Children under 12 years of age do not require saltwater or freshwater permits for any type of fishery resource activity. Current fee schedules for authorized persons over 15 are posted on the NAS hunting and fishing website listed above and are included in the respective instructions. Licenses and base fishing permits are valid for a calendar year.

Under a reciprocal agreement between Maryland, Virginia, and the Potomac River Fisheries Commission, the following licenses are acceptable for saltwater fishing in Maryland tidal waters: Maryland State Recreational License, Virginia State Recreational Tidal Fishing License, or Potomac River Fisheries Commission Recreational Fishing License.

Specific license and fishing permit requirements for PAX and WOLF are detailed in Chapter 7, Table VII-1.

Permits and reservations are required for a number of activities and fees are charged in some instances, such as camping along the shoreline at Hog Point. Specific procedures at the Station are governed by Recreation Standard Operating Procedures (RESOPs) promulgated under NASPAXRIVINST 1710.13. Activity-specific RESOPs are cited in Section 5.0 of this chapter.

3.0 Key Issues and Concerns

St. Mary's County has a wide range of recreational programs and park facilities including boating areas, beaches, playgrounds, hiking trails, picnic pavilions, and summer camps. In addition, the State parks located in the County offer fishing, boating, camping, and swimming. Nearby Charles and Calvert Counties also provide much in the way of outdoor recreational activities.

[1] The term 'authorized person' is defined in the base regulations, Instruction 11015.7M, dated March 2, 2007 (NASPAXRIVINST 110157.M, Section 4(b)).

4.0 Program Goals and Objectives

The goal of the Outdoor Recreation Program on the Station is that quality outdoor recreational opportunities are optimized in a manner that neither interferes with the primary mission of the Station nor disturbs the ecosystem. To achieve this goal, the Station has set forth the following objectives:

1) Unique natural and cultural areas are available for recreational use.
2) Recreational uses are compatible with both the Station's mission and natural resources.
3) Levels of consumptive uses are maintained at a sustainable level.
4) Partnerships are established and maintained between the Station and other groups/agencies.
5) Recreational programs emphasize safety and quality.
6) Identify and provide new recreational opportunities.

Each objective listed above can be attained through the use of recommendations that appear throughout this chapter. The number of the objective(s) supported by each recommendation is parenthetically recorded after that recommendation. General management recommendations (GMRs) and specific management recommendations (SMRs), supporting no particular objective and/or requiring no funding, also occur throughout this chapter and elsewhere in the INRMP. These are identified parenthetically as such.

5.0 Analysis of Existing Resources

PAX covers 6,781 acres, of which roughly 3,266 are open for hunting. In addition, 330 acres are classified by the Anderson Land Use and Land Cover Classification System as recreation areas, which include a golf course, formal lawns and landscaped areas, parks, and community recreation. As discussed in the Fisheries Management chapter, there are also 418 acres of water and 6 miles of shoreline open to fishing. Of WOLF's 859 acres, 662 are designated as hunting acreage and 8 acres are considered recreational. Just over 11 acres of water and 3 miles of shoreline are open to fishing.

The following sections describe these resources as a function of whether they are dispersed (occurring within large areas that can accommodate limited use) or concentrated (occurring within limited areas that can accommodate intensive use) outdoor recreation activities. Rules concerning parking and storage of associated recreation vehicles are contained in RESOP #13-00.

5.1 Dispersed Outdoor Recreation Activities

Dispersed outdoor recreation activities that occur on the Station include hunting and trapping; fishing (including shellfishing and crabbing); hiking; nature study; berry picking; horseback riding; non-motorized boating, such as canoeing, rowing, and sailing; and firewood cutting. Graphic locations of the dispersed outdoor recreation activity areas are approximated in Maps IX-1 and IX-2 in Annex IX-A for PAX and WOLF, respectively. Fishing is discussed separately in Chapter 7 of this INRMP. Other dispersed outdoor recreation activities are discussed in the following sections and summarized in Table IX-B-1 in Annex IX-B.

5.1.1 Hunting

The Station's hunting program is managed through consultation with State and Federal fish and wildlife agencies. Hunters must comply with NASPAXRIVINST 11015.6 and NASPAXRIVNOTE 11015, as well as appropriate State and Federal regulations. These instructions and notices are subject to yearly updates and should be consulted before participating in hunting. Hunting is open to active duty military personnel and their dependents, retired military personnel and their dependents, Federal civilian employees of the Station (active only) and their dependents, and reservists. Long-term contractors to the Station (with hard badge) are authorized to hunt deer only (no waterfowl or small game). Authorized personnel, except long-term contractors, may also sponsor guests.

Hunting is regulated by a fee/permit system administered by the NR Program. Station hunting permits and Maryland State hunting licenses are required of all persons who hunt on the Station. Fees for hunting permits are announced annually in NASPAXRIVNOTE 11015. Approximately 200 hunting permits are issued annually, representing roughly 5,000 to 15,000 hunter effort hours (Hall, 2022). Hunting and fishing permit sales and revenue for past years are summarized in Tables IX-B-2 and IX-B-3 in Annex IX-B, for PAX and WOLF, respectively.

NAS hunting permits were historically sold at the MWR and Command Duty Office (CDO) buildings. Currently, these permits may be obtained at the NAS Environmental Planning and Conservation Branch permit sales website (https://naspaxriver.recaccess.com/). The website is also used to control hunting area access and track hunting levels of effort, as all hunters are required to use them to sign into and then out of desired hunting areas.

Enforcement of hunting and fishing laws and regulations should be carried out primarily by a full-time, professionally trained game warden assigned to NAS Police. (That position, however, has remained vacant since retirement of the last Conservation Officer in 2007). Assistance can be given by the remainder of the NAS Police force. NAS should continue to furnish the auxiliary support personnel for this purpose and provide them with the appropriate training (GMR IX.1/SMR IX.1). Law enforcement personnel operating in the more remote recreational areas of the Station have typically detected more criminal activity of all kinds than the counterparts on the streets in the more developed areas (Obj. 5). Maryland Natural Resources Police have been given access to NAS for the purpose of enforcing state conservation laws. They cannot, however, enforce station regulations. Attempts to bring USFWS special agents on board have been hampered by cost (but are still ongoing).

Safety concerns are of utmost importance in the NAS hunting program. Prior to obtaining a hunting permit, all hunters must have proof of successful completion of a Hunter Education Course. The NR Program offers such a safety class at PAX four to five times each year. This is one of only a few State-certified courses offered in St. Mary's County, and is open to those who already have base access.

Historically, an additional emphasis on safety in the hunting program was made through a requirement for weapons qualifications. An individual wishing to hunt on Station lands had to be proficient with each type of weapon he/she intended to use. However, weapons qualifications for

hunting are no longer supported or required. In the event that funding is made available to increase personnel, this safety requirement should resume (Obj. 5).

Species hunted or trapped on the Complex include waterfowl, deer, turkey, dove, squirrel and rabbit. Additional associated information can be found in the Wildlife Management chapter of the INRMP. Hunting areas for PAX and WOLF are displayed on Maps IX-3 and IX-4 in Annex IX-A.

5.1.2 Hiking

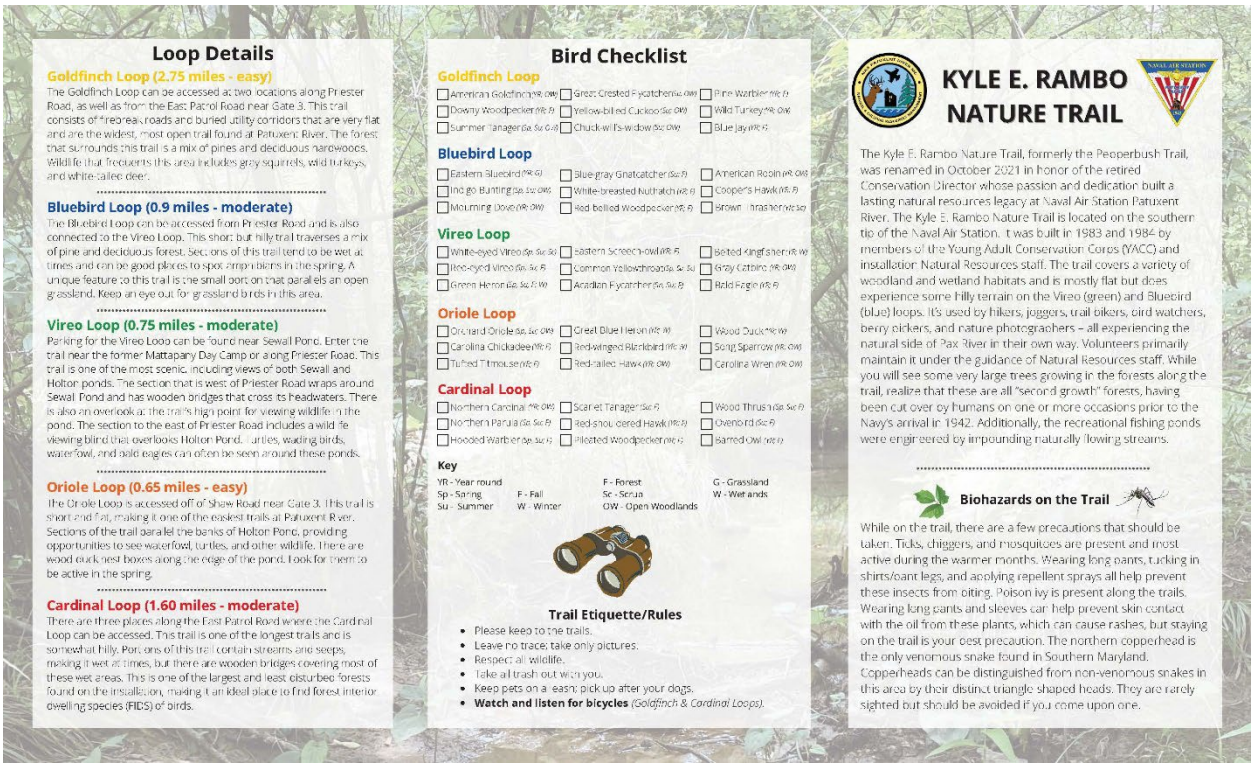
Opportunities for hiking are available in two locations - Paradise Grove and the Kyle E. Rambo Nature Trail. The Paradise Cove area supports a 1/4-mile trail along the bank of Harper's Creek, overlooking the confluence of the Patuxent River and Chesapeake Bay. The Kyle E. Rambo Nature Trail, historically called the Pepperbush Trail, was renamed in honor of Mr. Rambo when he retired in 2021 after serving as the Natural Resources/EPC Branch director for 35 years. It is located in the southern portion of PAX near Sewall and Holton Ponds, covers a distance of about 6 miles (see Map IX-1). The trail is divided into five loops, designated by local bird species (representing the colors formerly used to identify the loops), to accommodate preferences for varying hiking distances. WOLF personnel use the southern portion of the perimeter road for walking and/or jogging purposes. NR staff has prepared a brochure identifying the Kyle E. Rambo Nature Trail loop locations and features of interest, as well as a bird checklist specific to each loop. Trails are typically maintained by Boy Scouts or other groups as service projects, using tools and materials furnished by the installation.

5.1.3 Nature Study

Nature study at the Station is incorporated into a well-developed and successful outdoor education/interpretation program. The Environmental Education Program on the Station is discussed in Chapter 10 of this INRMP.

5.1.4 Bicycling

Although no exclusive bicycle paths/trails exist, bike lanes exist on a number of the Station’s roads (see Map No. IX-5). In addition, the PAX Velo Club, a special interest cycling group, has developed an informal course (Willard, 1995). Mountain bikers were recently approved to use two of the Rambo Nature Trail loops (Goldfinch and Cardinal). Because this activity can contribute to vegetation destruction and accelerated soil erosion, trail riding should be monitored carefully for resource damage and conflicts with other trail users.



Kyle E. Rambo Nature Trail Brochure (Side 1)

5.1.5 Horseback Riding

Horseback riding is permitted at PAX; riders may use the Rambo Nature Trail, abandoned logging roads, and firebreaks as riding trails. Although a privately operated horse stable was once located on PAX, there is no longer a facility for boarding horses aboard the Station, so they must be trailered to the site.

5.1.6 Non-motorized Boating

Non-motorized boating opportunities, which include canoeing, kayaking, paddleboarding, windsurfing, and sailing, are plentiful at PAX. Non-motorized boating may also occur in Goose Creek and Pearson Creek; and in Gardiner's, Sewall, Holton, Calvert, and Sacawaxhit Ponds. Within WOLF, both Langley Hollow and Fort Point Cove can sustain nonmotorized boating. The waters beyond the Station, including the Patuxent and St. Mary's Rivers and the Chesapeake Bay, are also available for non-motorized boating. The Patuxent River Sail Club, an authorized private club not under MWR, maintains a presence there (Willard, 1995).

At PAX, boat ramps are available at the West Basin (within the marina) and Harper's Creek (near the Beach House). Both of these offer motorized and nonmotorized boating opportunities. The boat ramp near the Coast Guard facility at WOLF may be used to launch boats only as permitted by, and with prior approval from, the Coast Guard.

General use guidelines recommended by the State of Maryland for non-motorized boating are as follows: a maximum of two boats per acre of surface water for rowboats and canoes, a maximum of one sailboat per acre of surface water, and a maximum of five canoes per mile of stream/river.

5.1.7 Trapping

The Complex opened its first trapping season during 1974-75, primarily to provide an educational form of outdoor recreation to youth (NRCR, 1976). Since trapping began, approximately 1 to 40 permits have been issued annually to trappers targeting furbearing animals including muskrat, beaver, foxes, and raccoon. It also serves as a means to control potentially nuisance species such as beaver (damming culvert pipes and causing flooding) or muskrat (digging burrows in earthen dams). Specific trapping rules, regulations, and procedures are located in NASPAXRIVINST 11015.6 and NASPAXRIVINST 11015. Individuals wishing to trap must register with the NR office, at which time the trapper will be assigned a trapping area. In addition to compliance with the Station's regulations, trappers must also comply with State and Federal laws governing trapping.

5.1.8 Firewood Cutting

Firewood cutting is permitted in designated areas of PAX on a year-round basis. Active and retired military personnel, Federal civilian employees of the Station and contractors (as quantities of wood permit) are authorized to cut firewood by way of firewood cutting permits, which may be purchased at the Natural Resources office. NR personnel should be consulted for specific firewood cutting areas, as they are constantly changing depending upon the current forest operations being conducted. Firewood permit sales for past years are summarized in Table IX-B-4 in Annex IX-B.

5.2 Concentrated Outdoor Recreation Activities

Concentrated outdoor recreation activities that occur at the Station include camping, use of fitness trails, skeet shooting, motorized boating, and outdoor education/interpretation. Approximate locations of these recreation areas are displayed in Maps VI-8 and VI-9 in Annex VI-A for PAX and WOLF, respectively. Concentrated outdoor recreation activities are summarized in Table IX-B-5 in Annex IXB and discussed in the following sections.

5.2.1 Camping

Goose Creek Campground, which is the only developed camping area at PAX, is permanently closed to all but vetted installation employees. It is located near the northwest section of the Station, and includes a comfort station at the entrance of the campground. Primitive camp sites are also located at Hog Point (2 sites).

Paradise Grove and Hog Point campgrounds, which provide a total of 16 primitive campsites, are located in the northeast section of PAX and are open year-round. Campsites are managed by and reserved through MWR. Specific rules, regulations, and procedures for camping are found in RESOP #03-00.

A scout camp is located on the northeast side of Gardiner's Pond. Anyone authorized to enter the Station may use this area. However, Boy Scouts and Girl Scouts have first priority. Scouts occupy the area on most weekends.

There are no camping opportunities at WOLF.

5.2.2 Picnicking

Six designated picnic facilities are available for use at PAX: Cedar Point Beach, Harper's Creek 1 and 2, Paradise Grove, West Basin Marina Pavilion, and the Beach House. In addition, individual picnic tables are located throughout PAX. Specific rules, regulations, and procedures for these areas are available from MWR and can be found in RESOP #09-00. In addition to these areas, picnic facilities are located near the Mattapany Rod and Gun Club on the northeast side of Holton Pond.

Picnic tables are also scattered throughout WOLF. In addition, there is a picnic/grill facility at Priest's Point.

5.2.3 Fitness Trail

A fitness trail is located on PAX along Tate Road near the Skeet Range. This 20-station fitness trail is approximately 2.4 miles in length. There is also a quarter-mile running track around the ballfield located within the Fortin Road circle, a nearly half-mile running track around the recreation fields at the Drill Hall, and informal running routes that loop 3km, 5km, 10km, and 10-mile tracks using the gymnasium as the point of departure/return (Willard, 1995).

5.2.4 Beach Swimming

Swimming is permitted at the Cedar Point Swimming Beach, which is approximately 1500 feet in length. Specific rules, regulations, and procedures for beach swimming can be found in RESOP #17-00. Maryland's general use guideline for beach swimming is a minimum of 1 foot of beach coastline per user, with a turnover rate of 2.5 per day. Therefore, the optimum number of users per day at the 1,500-foot Cedar Point Swimming Beach would be 3,750.

The Least Tern (*Sternula antillarum*) was last observed nesting at Cedar Point Beach during the 2000 to 2001 season; however, this State-threatened bird species hasn't been observed nesting since. This section of the beach has experienced significant morphological changes and disturbance resulting from storms and beach reclamation. In addition, despite endangered species signage that clearly marks the Least Tern nesting area and separates it from the swimming beach, human disturbance of this nesting area is also a causal factor in the disappearance of the bird. If the Least Tern returns to Cedar Point Beach in the future, NR staff should work with MDNR to produce educational materials that can be made available through MWR, along with additional signs to post both at the nesting boundary and where people enter the swimming beach area (Obj. 2) (SMR IX.2). The NR Program should seek the cooperation of MWR to continue policing this area in the event that the Least Tern attempts to nest again (typically mid-April through mid-September. This could be accomplished through formal amendment to the swimming area RESOP (Obj. 2) (GMR IX.2/SMR IX.3).

5.2.5 Motorized Boating

Motorized boating is permitted on all tidal waters of PAX: Goose, Pearson, and Harper's Creeks; the Patuxent River; and the Chesapeake Bay. Gardiner's, Sewall, Holton, Calvert, and Sacawaxhit Ponds allow for the use of electric trolling motors only. Gas-powered engines are not permitted on any Station ponds. There are no motorized boating opportunities at WOLF proper, although such activity is available along the shoreline (i.e., Moll's Cove, St. Inigoes Creek, and St. Mary's River)

and in the nearby Potomac River. Consult RESOPs #19-00 and #21-00 for further information pertaining to boating in the West Basin Marina and Harper's Creek, respectively. The NR Program should coordinate with MWR to address boating permissions on all Station water bodies through formal amendment to an existing RESOP, or issuance of a new one (Obj. 2) (GMR IX.3/SMR IX.4).

Water skiing is limited to only the Patuxent River and Chesapeake Bay. The written guidance that prohibits water skiing in the tidal creeks, however, does not specifically include jet skis. In the interest of safety, conflict avoidance, and protection of the aquatic resource, jet skis should be prohibited from operation in the creeks through formal amendment to the RESOPs (Obj. 2) (GMR IX.4/SMR IX.5).

As a general use capacity, the State of Maryland recommends no more than one motorized boat per five acres of water, with an average of three people per boat.

5.2.6 Skeet Shooting

A skeet shooting area, operated by a private club, is located at PAX along Tate Road. There are two skeet ranges open that are used predominantly by practicing hunters and competitive marksmen. All military and police training are conducted at an indoor range.

The Station acknowledges that the discharge of lead ammunition into the environment is a contamination concern. However, the Station is not enforcing the use of "green" ammunition (e.g., tungsten/steel blends) at the ranges at this time because of the need by users to practice with the type of shot that will be used in performance (e.g., hunting or marksmen competition). It is important to note that all shot at the skeet range is discharged only in an upland (mowed grass and forest) area, rather than the more sensitive wetland or aquatic habitats. All lead shot discharged at the indoor range is captured and recycled.

As recommended by USFWS, the Station will develop a plan to determine the magnitude and extent of ammunition-related contamination at the skeet range. Investigation will include examining site soil, nearest sediment and surface water, and possibly bird specimens. Resulting data will be used to create a lead management plan, if needed (Obj. 5). EPA provides guidance for lead management at outdoor ranges, including skeet shooting, with templates for developing management plans. Information is available online at the following website: https://www.epa.gov/sites/default/files/documents/epa_bmp.pdf.

5.2.7 Scenic Areas

The Station supports several scenic areas, although the subjective views are not officially designated as scenic areas. Cedar Point and Harper's Creek Overlook at PAX provide excellent vistas of the Patuxent River and Chesapeake Bay. At WOLF, the stretch of beach at Fort Point is generally considered a pleasant walk. Drives along Cedar Point and Tate Roads present both panoramic views and images of vegetation, including forests and open water/marshes. In addition, recreational areas such as campsites and hiking trails afford wildlife viewing potential. Maps III-41 and 42 in Annex III-B indicate the locations of these vistas at PAX and WOLF, respectively.

View from Paradise Grove – one of the several scenic areas supported at NAS.
Photograph by Jacqueline Smith.

5.2.8 Outdoor Education

Key to the Station's outdoor recreation management is its well-developed and successful environmental education/interpretation program. Its broad scope and importance to the Station are discussed in detail in Chapter 10 of this INRMP.

5.3 Special Interests

In addition to the recreational opportunities at the Station, there are a dozen special interests to consider in the development of truly integrated outdoor recreation planning. These considerations include:

- *Archeological areas* - sites with the remains of past societies or ongoing archeological investigations.
- *Botanical areas* - sites with individual specimens or communities of plants that are important because of their form, color, occurrence, location, life history, etc.
- *Ecological reserve areas* - physical or biological units in which current natural conditions are maintained without human intervention (except when that area is introduced to preserve a specific feature).
- *Geological areas* - sites with outstanding geological formations or historical features of the earth's development, including fossils.
- *Historic areas* - sites that commemorate lives or occurrences in American or Naval history.
- *Natural resources areas* - managed areas suitable for education and research, as well as for demonstration of compatibility of different resource uses and sustained yield production.

- *Scenic areas* - individual areas of outstanding natural beauty or scenic splendor that require special management for preservation.
- *Zoological areas* - sites with animals (vertebrates and/or invertebrates) that are significant because of their visibility, rarity, uniqueness, or ecologically significant impact on land character or other feature.
- *Threatened and endangered species (TES) habitat* - existing habitat for listed, proposed, or Category 1 candidate species on the federal or state list. (Category 1 species are those for which there is substantial information on biological vulnerability or threats to support proposals for listing.)
- *Wild areas* - sites with no roads and at least 1,000 acres that possess outstanding opportunities for solitude and primitive recreation.
- *Research natural areas* - sites that serve as baselines for scientific research and are protected from disruptive influence.
- *Other* - sites that can be considered for nomination to the National Register of Historic Places or the National Natural Landmark System.

Table IX-1 summarizes information about known and potential special interest areas.

Table IX-1. Characteristics of Special Interest Areas.

Area Description	Location	Carrying Capacity	Degree of Public Access[1]
Archeological: Two old home sites that contain significant 18th and 19th century assets (ICRMP, 2018)	Mattapany and remains of Susquehanna; between East and West Patuxent Basins at PAX	Restricted for protection	Category B
Botanical: Pollinator habitat sites (see Chapter 5)	Throughout the Station	N/A	Category B
Ecological Forest Block: Large tract of contiguous forest proposed in Chapter 6	Southern tip of PAX	N/A	Category B
Historic: See Archaeological, above; Mattapany listed on National Register of Historic Places (see Station's ICRMP, 2018)	Mattapany and remains of Susquehanna; between East and West Patuxent Basins at PAX	Restricted for protection	Category B
Natural Resource: Forests, eight freshwater ponds, eight estuaries, marshlands, and Patuxent and St. Mary's River and Chesapeake Bay coastlines	Throughout the Station	Varies with activity (e.g., fishing, hiking)	Category B

Area Description	Location	Carrying Capacity	Degree of Public Access[1]
Scenic: Vistas of the Patuxent and St. Mary's Rivers and the Chesapeake Bay	Cedar Point and Harper's Creek Overlook at PAX, and Priest's Point at WOLF	Not determined	Category B
Zoological, TES, Wild, Research natural, and Other: T&E plant & animal species sites (see Chapters 3 and 8)	Throughout the Station	N/A	Category B

[1]Public access for recreational purposes as defined by NAVFAC P-73 includes:
"Category B: Open to DOD employees and guests. This includes all military and civilian employees of DOD and their dependents, relatives and guests, and retired employees. Guests must be accompanied by their sponsor when participating in activities when required by safety or security considerations as set forth in the base regulation pertaining to use of the resource or facility. Dependents and retirees generally do not require accompaniment."
"Category C: Open to installation personnel and guests only. This includes personnel stationed or employed at the installation either PCS or official TDY and their dependents, relatives and guests. It does not include retirees or DOD employees from other installations or military services not PCS or official TDY." **The Complex blends these two categories in many instances.**

5.4 Off-Road Vehicle Program

Off-road vehicles (ORVs) are motorized recreational vehicles manufactured or adapted for off-highway use. The category includes such modes of transportation as trail bikes, four-wheel drive vehicles, all-terrain vehicles, and snowmobiles. While Federal law encourages designating areas that may be used by ORVs, these vehicles are not permitted on other recreational trails, except in the case of snowmobiles (which may use existing trails in their off-season winter periods) and non-motorized mountain bikes (which are now permitted on two loops of the Kyle E. Rambo Nature Trail).

Multiple studies and evaluations at the Station have been unable to identify any areas suitable for motorized ORV use. Their operation would disturb and conflict with other Station land users; cause damage to the vegetation and watershed; and would harass wildlife and disrupt their habitats. Even more importantly, however, is the potential impact the use of ORVs would have on the Station's fragile soil – namely, erosion and attendant loss of topsoil into the Bay. In recognition of these highly significant environmental factors, NASPAXRIVINST 5560.2, which deals with the administration of traffic regulations, prohibits the use of ORVs. It is recommended that this policy be strictly enforced (GMR IX.5).

6.0 Resources Needs and Management Recommendations

In order that the Station's Outdoor Recreation Program may carry on its current exemplary stature and adapt to any changing demands, a number of recommendations have been identified:

- To benefit the program as a whole, establish a tri-partite agreement among DoD, the National Park Service, and the State of Maryland to coordinate the Outdoor Recreation Program (Obj. 4) (SMR IX.6).

- Interface with MDNR in order to explore the possibility of sharing management techniques and resources (Obj. 4) (SMR IX.7).
- On a more local basis, foster a partnership approach to outdoor recreational resource usage through attendance at county-level meetings (Obj. 4) (SMR IX.8).
- Work with private clubs on Station (e.g., Mattapany Rod and Gun, Flying, Rifle and Pistol, and Skeet Clubs) to provide opportunities not available through MWR (Obj. 4) (GMR IX.6/SMR IX.9).
- Continue the present fee program for recreation activities in order to produce funds for management of recreational resources (SMR IX.10). This allows participants to bear an appropriate proportion of the cost of maintaining the recreational opportunities (Obj. 3).

Activity-specific recommendations are provided in the following sections.

6.1 Dispersed Outdoor Recreation

6.1.1 Hunting

The hunting program appears to be quite successful, offering a substantial range of hunting opportunities to a number of individuals. The following suggestions, however, may improve this program:

- Reinstate the hunter survey (which asked hunters to quantify and rate their hunting experiences) for planning purposes as well as monitoring progress towards the outdoor recreation goals and objectives (Obj. 2 and 3) (Project IX.1). This information assists in identifying an acceptable recreational carrying capacity (RCC) compatible with the mission of the Station and the ecological parameters surrounding wildlife populations. RCC is the ability of a land or water area to continuously support a quantifiable amount of recreational activity and number of participants without the degradation or destruction of existing natural resources (including the wildlife resource), Station facilities, public health and safety, or the quality of the recreational experience.

The State of Maryland recommends a hunter capacity of not more than one hunter per ten acres. However, the desirable number of acres per hunter varies according to the type of game pursued, weapon used, variety and density of vegetation, terrain features, and natural resources capacity of the area.

- Game experts familiar with local conditions are to determine desirable densities and formulate harvest bag limits (Obj. 3) (SMR IX.11). Visitor use information captured by a hunter survey would also be valuable in determining desirable densities to ensure a quality recreation experience.
- No harvest decisions and or changes in hunting intensity should be made without full interface with the Station's NR Program as delineated in the INRMP (Obj. 5) (GMR IX.7).

Hunter safety must always be a primary concern. To this end, the Station has developed these guidelines for hunter safety:

- Continue emphasis on safety elements of the hunter safety program (Obj. 5) (SMR IX.12).
- Continue the current hunting policies for clearly delineating hunting areas and restricting other activities in those areas during deer hunting hours (Obj. 2 and 5) (SMR IX.13).
- Strongly encourage the permanence of safety buffer zones between hunting and other activities and/or residential developments (Obj. 2 and 5) (SMR IX.14).
- Consider the addition of a hunting simulation range (e.g., a five-stand sporting clays range) to provide a blend of recreational benefit and hands-on hunter safety training and practice (Obj. 5 and 6) (Project IX.2).

6.1.2 Hiking

Hiking opportunities dictate that maintenance occurs concomitantly with the incurred level of use. To this end, the following recommendations have been developed for the Station:

- Continue maintenance of the Rambo Trail, using volunteers (Boy Scouts, other groups) whenever possible (Obj. 1, 4 and 5) (SMR IX.15).

- If users report conflicts, restrict sections of the trail to a specific activity rather than allowing them to be used for multiple purposes (Obj. 2) (SMR IX.16).

- There is also potential for hiking opportunities in the WOLF landscape. An observation platform and walkway were constructed at Langley Hollow. Implement plans for observation platforms and nature trails in the areas of Chapel Cove and Fort Point. This effort can include: A) Chapel Cove - observation deck, mulch trail and signage, visitor brochures, and handicap access; and B) Fort Point Cove - small parking lot and a 150-foot boardwalk to the observation deck (Obj. 1 and 6) (Project IX.3).

- Follow recommended use guidelines for hiking trails as prepared by the State of Maryland (SMR IX.17), which include a use level of no more than 8 people per mile of trail, with a turnover rate of 12 per day (Obj. 2). Thus, the 6-mile Rambo Trail would accommodate 48 people at one time, and the turnover rate of 12 per day indicates that 576 trail hikers would be the recommended daily use capacity for that trail.

- If future trails are to be constructed, several factors should be considered. Trails should be provided in varying lengths and endurance requirements. They should be sited in areas that have experiential diversity (i.e., have a variety of habitats, slopes, cover types and wildlife habitats) (Obj. 6) (GMR IX.8/SMR IX.18).

Trail development and siting should be accomplished following criteria established in OPNAVINST 6240.3E such that:

- Areas where existing trails or public recreation facilities could be extended to provide an expanded and heightened recreational experience.

- Areas of special ecological, scientific, cultural, archeological or aesthetic interest, where public access would not damage or alter the unique characteristics of the area.

- Areas that have potential to present panoramic views, solitude, or educational experiences.

- Areas that would link previously designated trails developed by private or public agencies.
- Areas that could be developed to divert public pressure from areas where public access is not desired for security or ecological protection purposes.
- Areas where MWR funding could also be allocated to habitat improvements could be made, such as new pollinator habitats and meadows, for dual benefit of recreation such as hiking and birding.

Dispersed Outdoor Recreation opportunities At NAS include the 6-mile Kyle E. Rambo Nature Trail.
Photograph by Jacqueline Smith.

6.1.3 Other Dispersed Outdoor Recreation

The Station has also developed recommendations for incorporating other modes of transportation into the outdoor recreational opportunities.

- In the spirit of the Clean Air Act and in light of the self-contained nature of the Station, encourage bicycle use for both recreational purposes and as a means of local transportation (Obj. 2 and 6) (GMR IX.9).
- The development of lock-up areas and linked bike paths/trail system should be studied (Obj. 2 and 6) (GMR IX.10).
- Encourage and foster use of more non-motorized boating on the PAX tidal creeks (Harper's, Goose, and Pearson) (Obj. 6) (GMR IX.11/SMR IX.19).

6.2 Concentrated Outdoor Recreation

Given the intensive usage of some recreational sites, it is essential to maintain sanitation facilities and provide access to potable water. To that end:

- Assess the adequacy of the existing comfort stations and dumpsters (Obj. 5) (GMR IX.12).
- Provide recreation site users with adequate receptacles for trash disposal, suitable sanitation facilities, and material with which to douse fires (Obj. 5) (GMR IX.13).
- In addition, establish an inspection program that ensures that public health is safeguarded, and post signs to encourage user cooperation (Obj. 5) (GMR IX.14).

Recommendations for specific concentrated outdoor recreational activities follow.

6.2.1 Camping

As a general guideline, 4-7 camping units per acre (6,223 sq. ft. to 10,890 sq. ft. each) of camping area is desirable. A camping unit includes a tent area, table/bench combination, fire pit or grill, and one parking space. The State of Maryland recommends a maximum camping capacity of three people per night per campsite. Following this guideline, the optimum number of camping units for 40 acres at Goose Creek Campground would be between 160 and 280 camping units. Likewise, the nightly camping capacity of three people per campsite for the Goose Creek Campground would translate into an optimum capacity of 480 people per night. These capacities are much higher than current supply at the Goose Creek Campground, where 37 camping units are available. Additional units could be added to this area and still fall within the guidelines of the State of Maryland. If any changes are to be made, however, the specific type of camping and terrain must have a major influence on the number and placement of camping units.

If demand exceeds availability, more sites could be added. However, in order to increase the types of camping opportunities at the Station, a detailed plan would have to be prepared, with the following factors to be considered:

- *Drainage*: Good drainage requires sufficient slope (5% being ideal) and soils that allow water to permeate quickly to avoid muddy conditions, compaction, or erosion.
- *Canopy*: Provide adequate canopy for shade and understory for screening, both to separate campgrounds from other activities and to separate individual campsites for privacy.
- *Access*: Campgrounds should have easy access to roads and utilities and should be located reasonably close to related recreational facilities.
- *Location*: Campgrounds that are associated with water areas, even if only by views, are particularly attractive to campers.

If expansion of existing campgrounds becomes necessary, Goose Creek is the preferred location. If any changes are to be made, however, the specific type of camping and terrain must have a major influence on the number and placement of camping units. Coordination with NR staff is required (Obj. 5) (GMR IX.15).

6.2.2 Picnicking

Picnicking is a very popular activity and is expected to increase in the future. This demand could be accommodated by expanding existing picnic areas or creating new ones.

Due to ongoing management for grassland birds, recreational activities that would require conversion of natural meadows and grasslands to large areas of mowed space are not desirable at PAX. Therefore, preference for any new picnic tables at Fishing Point would be to locate them in existing cleared areas (Obj. 6). The area is a former solid waste landfill; therefore, any planning for use of Fishing Point must be closely coordinated with the Station's Environmental Restoration Program Coordinator. This area has the advantage of being located on the water. Additionally, a large open field located adjacent to Fishing Point could provide areas for activities associated with picnicking (e.g., softball, volleyball, soccer). Therefore, portions of the Fishing Point location satisfy the following picnic site selection criteria: fairly level location with a desirable slope (relatively flat), a desirable view (view of the Patuxent River), and the space for other recreational facilities (e.g., playing fields). A detailed site plan should be completed before a picnic area is developed. NR Staff should work with MWR as appropriate, should they plan for new primitive campsites or picnic areas, to identify areas best suited for these purpose (Obj. 6) (GMR IX.16/SMR IX.20).

General use guidelines for family picnicking recommend no more than eight picnic sites per acre. Each site would contain a picnic table and fire pit/grill. The State of Maryland recommends an optimum occupancy rate of five people per picnic site at a time, with each site potentially being used twice a day. Therefore, a 10-acre picnic area at Fishing Point, with 8 picnic sites per acre, would have an optimum capacity of 800 users per day.

6.2.3 Other Concentrated Outdoor Recreation

Recommendations include:

- Expand efforts to maintain scenic vistas. This may be facilitated by clearly identifying them with discreet signs and incorporating them into the driving tour discussed in Chapter 10 (Obj. 1) (Project IX.4).
- Maintain the jogging trail with periodic exercise stations (VITA exercise course) (Obj. 5) (GMR IX.17). The jogging trail provides personnel with a means of stress release and fatigue reduction that can be accessed as a lunch time activity.
- In addition, establish an archery range as a recreational opportunity (Obj. 6) (Project IX.5).
- Overall, enforce existing recreational policies, such as the prohibition on the use of ORV's (Obj. 2, 3 and 5) (GMR IX.18/SMR IX.21).

6.3 Special Interest Areas

- Communicate with the National Park Service and MDNR prior to taking any action that might foreclose potential wild, scenic, or recreational river status for the Patuxent River (Obj. 4) (SMR IX.22).
- Identify for the public any significant botanical, zoological, and geological areas (Obj. 1) (SMR IX.23).

7.0 Additional Studies Required

In light of the population influx associated with base realignment, design and conduct visitor surveys, as well as visitor mapping and other visitor analysis techniques, in order to identify levels of use, areas of use, and participants' preferences for outdoor recreation opportunities. Evaluate information collected in order to assess the feasibility of implementing recreational desires in a manner that is cost-effective, sensitive to the Station's mission, and compatible with other natural resources goals and objectives (Obj. 1, 3, 5 and 6) (Project IX.6).

8.0 References

The Louis Berger Group, Inc. 2011 Integrated Cultural Resource Management Plan (2011-2016) Naval Air Station Patuxent River, Maryland. Prepared for Naval Air Station Patuxent River, Maryland by The Louis Berger Group, Inc., East Orange, New Jersey.

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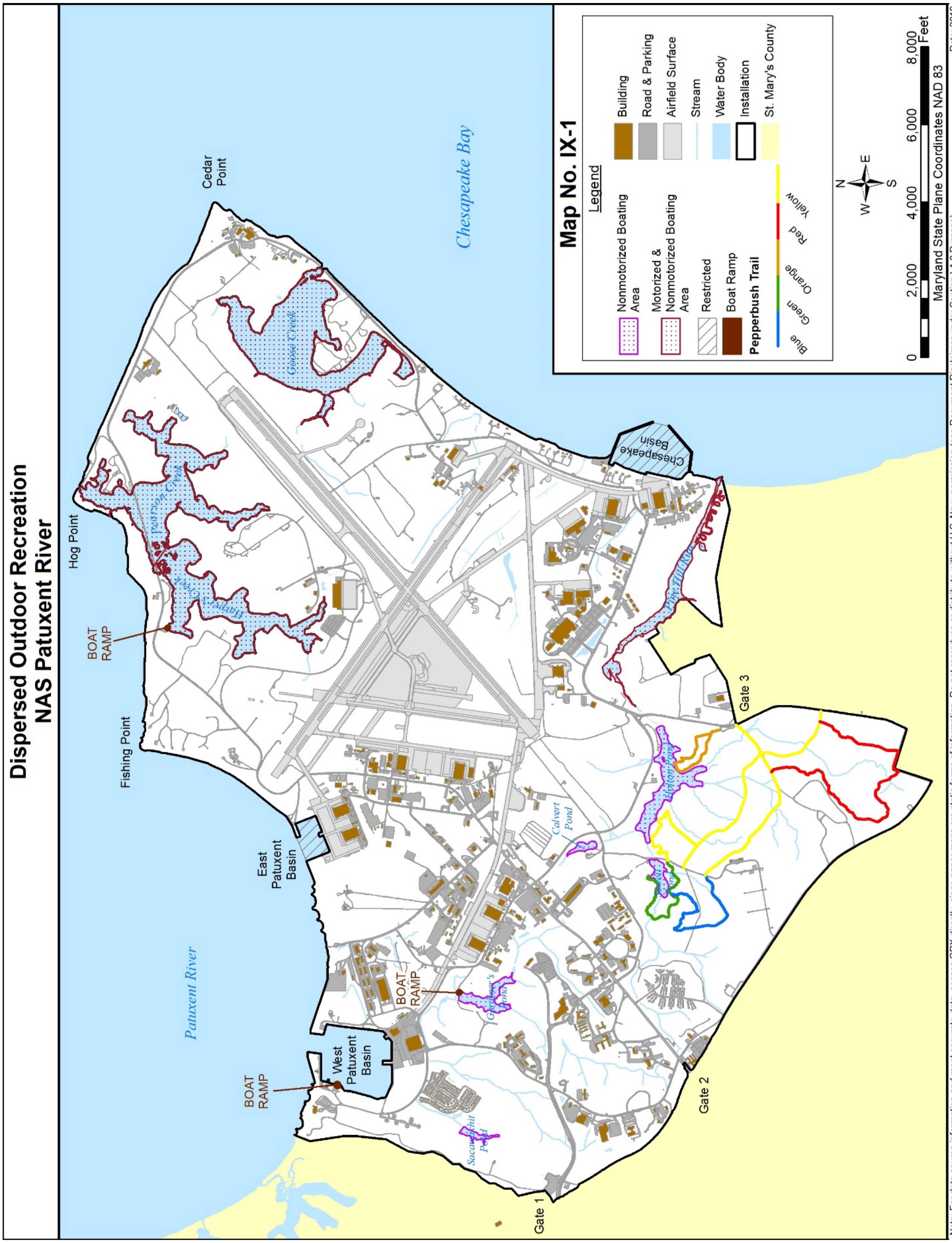
Rambo, Kyle, 1995. Patuxent River Naval Air Station, Natural Resource Manager, personal communication.

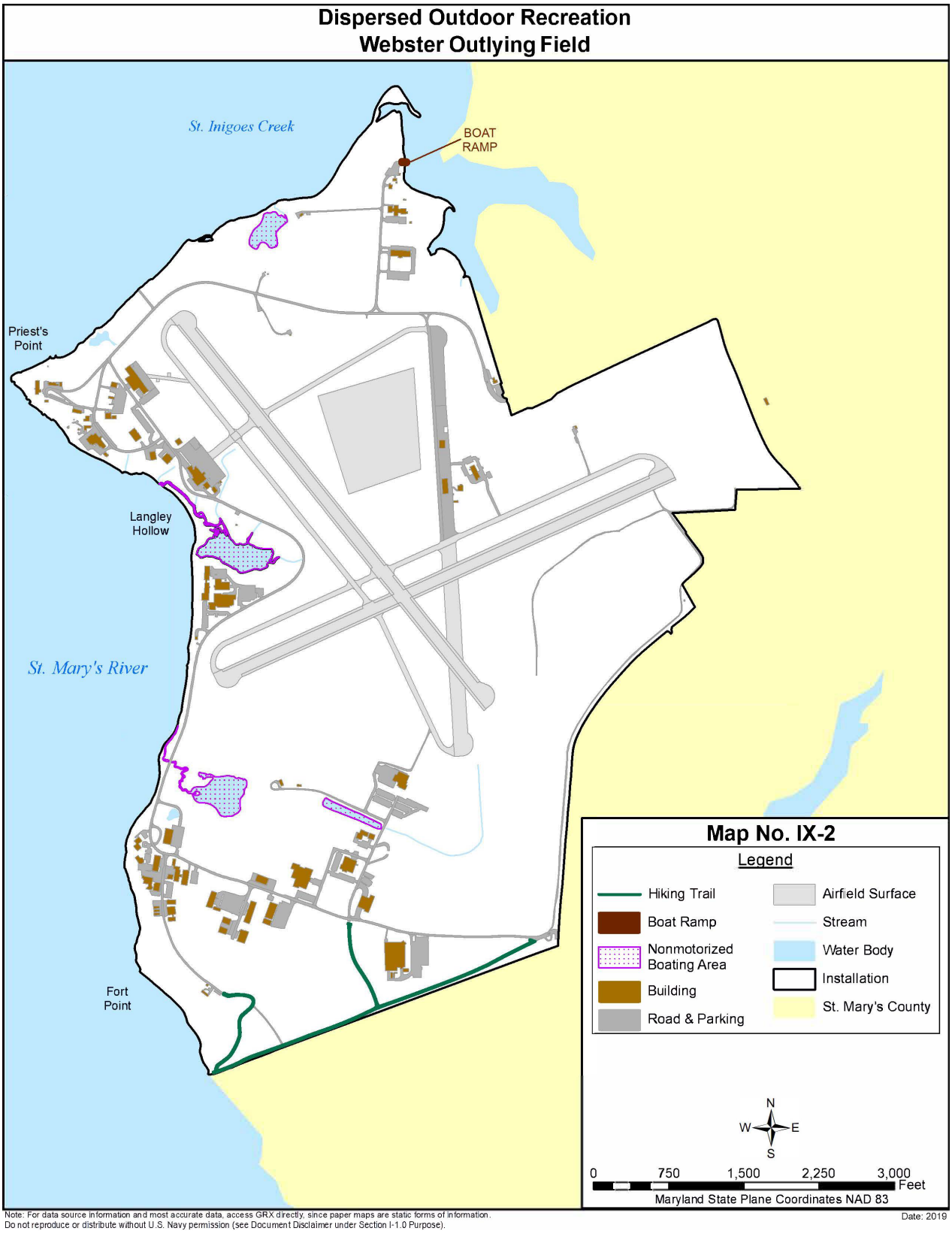
Willard, Hal, 1994. Patuxent River Naval Air Station Morale, Welfare & Recreation Department; personal communication; November 1994.

Willard, 1995. Ibid., January, 1995.

ANNEX IX-A

MAPS


Dispersed Outdoor Recreation
NAS Patuxent River
Map No. IX-1
Legend
Nonmotorized Boating Area
Motorized & Nonmotorized Boating Area
Restricted
Boat Ramp
Pepperbush Trail
Blue
Green
Orange
Red
Yellow
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
N
E
S
W
0
2,000
4,000
6,000
8,000
Feet
Maryland State Plane Coordinates NAD 83
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Date: 2019
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Harper's Creek
Pearson Creek
Pine Hill Run
Calvert Pond
Sacagawea Pond
BOAT RAMP
BOAT RAMP
BOAT RAMP
Gate 1
Gate 2
Gate 3



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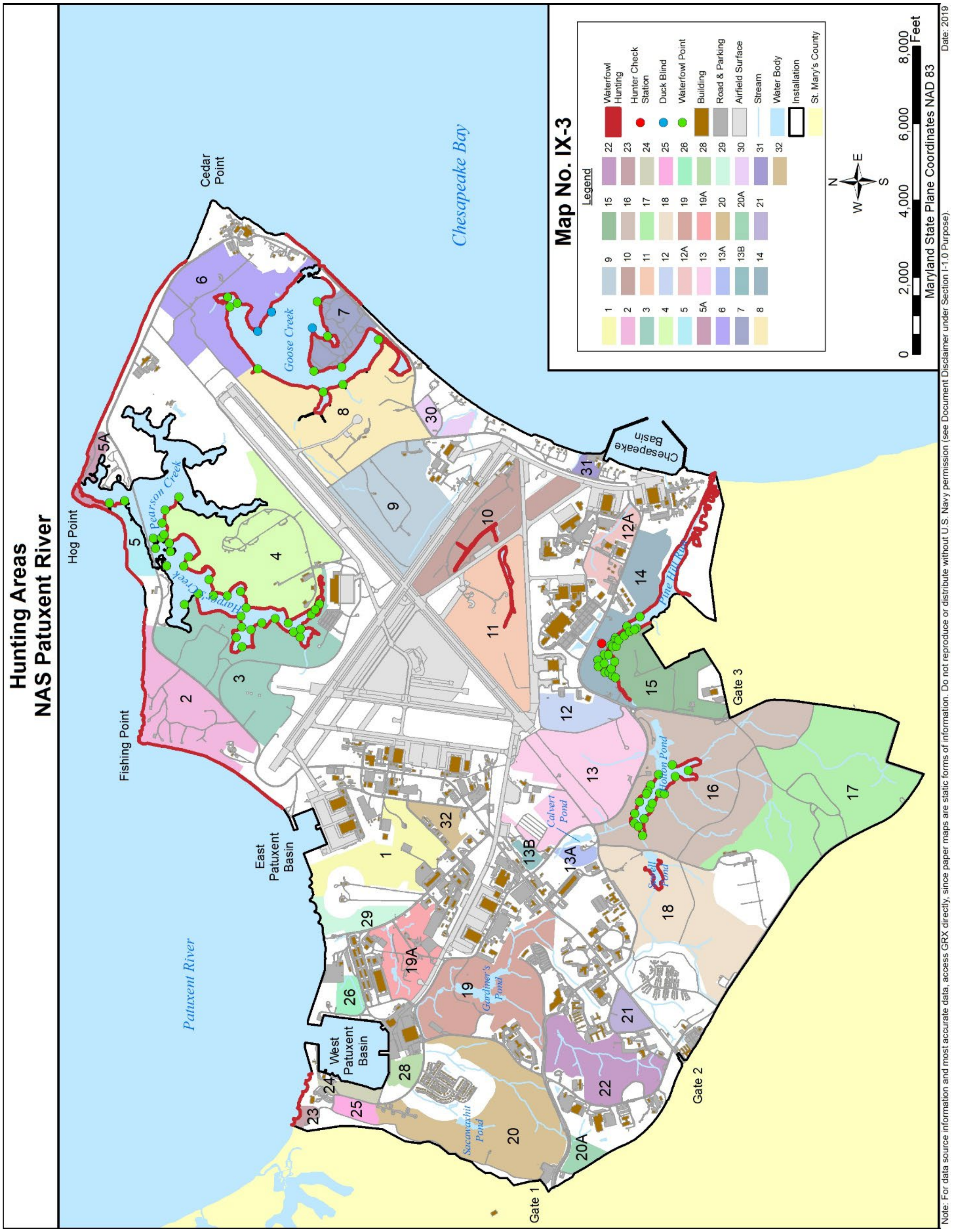
Hunting Areas
NAS Patuxent River
Map No. IX-3
Legend
Waterfowl Hunting
Hunter Check Station
Duck Blind
Waterfowl Point
Building
Road & Parking
Airfield Surface
Stream
Water Body
Installation
St. Mary's County
Maryland State Plane Coordinates NAD 83
0 2,000 4,000 6,000 8,000 Feet
Date: 2019
Note: For data source information and most accurate data, access GRX directly, since paper maps are static forms of information. Do not reproduce or distribute without U.S. Navy permission (see Document Disclaimer under Section I-1.0 Purpose).
Chesapeake Bay
Patuxent River
Cedar Point
Hog Point
Fishing Point
East Patuxent Basin
West Patuxent Basin
Chesapeake Basin
Goose Creek
Pearson Creek
Harper's Creek
Pine Hill Run
Calvert Pond
Gardiner's Pond
Sacawaxhit Pond
Gate 1
Gate 2
Gate 3

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ANNEX IX-B

TABLES

Table IX-B-1. Dispersed Outdoor Recreation Activities Descriptions

Activity Description	Location	Carrying Capacity	Acres/Miles	Degree of Public Access[1]
Hunting: Includes deer, dove, quail, rabbit, squirrel, waterfowl, etc.	Scattered throughout Station (see maps IX-3 and IX-4)	Conform to State guidelines; 1 hunter per 10 acres	3252 acres at PAX; 683 acres at WOLF	Category B/C
Fishing: Fishing, shell-fishing, and crabbing; fresh and saltwater.	Scattered throughout Station in ponds (excluding Richneck Pond at PAX), estuaries, and shoreline	Conform to State guidelines; 2 boats/water acre; 3 persons/boat (shore fishing), 1 person/35' of shoreline	406 acres, 6 miles of shoreline at PAX; 11 acres, 3 miles of shoreline at WOLF	Varies as a function of type of fishing and location (e.g., age restrictions and off-limit areas)
Hiking: Trails used for walking/jogging purposes	Two designated hiking trails at PAX	Conform to State guidelines; 8 people/mile of trail, turnover rate of 12	Paradise Grove, ¼ mile; Kyle E. Rambo Nature Trail, 6 miles	Category B/C
Nature Study: Outdoor education/interpretation	Environmental Education Center	30 people in classroom; 50 total in Center	N/A	Open to public groups and individuals (see Chapter 10)
Bicycling: Along roadways and specific trail sections	Lanes marked on roads; two designated trail loops	N/A	N/A	Category B/C
Horseback Riding: Horses not stabled on Station	Kyle E. Rambo Nature Trail, abandoned logging roads, and fire breaks	Conform to State guidelines; 6 horseback riders/mile of trial, turn-over rate of 25	Kyle E. Rambo Nature Trail, 6 miles	Category B/C

Activity Description	Location	Carrying Capacity	Acres/Miles	Degree of Public Access[1]
Sailing and Canoeing: Numerous non-motorized boating opportunities	Harper's, Pearson, and Goose Greeks; Gardiner's, Sewall, Holton, Calvert, and Sacawaxhit Ponds[2]; and Patuxent River and Chesapeake Bay at PAX. Langley Hollow, Fort Point and Moll's Cove, St. Inigoes Creek and St. Mary's River at WOLF	Conform to State guidelines; 2 boats/surface acre of water for rowboats and canoes; 1 sailboat/surface acre of water; and 5 canoes/mile of stream or river	382 acres, 6 miles of shoreline at PAX; 8 acres, 3 miles of shoreline at WOLF	Category B/C
Other: Trapping and Firewood Cutting	Area assigned to trapper at time of registration; Firewood Cutting area varies as a function of forest operations	Not determined	N/A	Trapping, by permit only; Firewood Cutting, Category C

[1]Public access for recreational purposes as defined by NAVFAC P-73 includes:
"Category B: Open to DOD employees and guests. This includes all military and civilian employees of DOD and their dependents, relatives and guests, and retired employees. Guests must be accompanied by their sponsor when participating in activities when required by safety or security considerations as set forth in the base regulation pertaining to use of the resource or facility. Dependents and retirees generally do not require accompaniment." "Category C: Open to installation personnel and guests only. This includes personnel stationed or employed at the installation either PCS or official TDY and their dependents, relatives and guests. It does not include retirees or DOD employees from other installations or military services not PCS or official TDY." **The Complex blends these two categories in many instances.**

[2]Formerly known as Ponds #1, 2, 3, 4, and 5, respectively.

Table IX-B-2. Hunting and Fishing Permit Sales and Revenue for NAS PAX[1]

Year	Permit Type[2]															
	PAX Hunting (SY)				PAX Trapping (SY)				PAX Fishing & Crabbing (CY)				PAX Shellfishing (CY)[3]			
	Number		$ Amount		Number		$ Amount		Number		$ Amount		Number		$ Amount	
	Free*	Sold	Each	Total	Free*	Sold	Each	Total	Free*	Sold	Each	Total	Free*	Sold	Each	Total
1980s^	673	1,061	$4.5/5	$5,218	21	17	$14.50/15	$254	2,615	3,292	$2.50/3/3.50	$9,872	98	262	$3	$786
1990s^	8	2,541	$5/10/15	$20,635	0	14	$15	$210	1,088	12,141	$2/3/5/7/10	$50,615	3	169	$3/10	$703
2000s^	7	1,971	$5/10/15 $10/20/30	$21,190	0	6	$15/30	$90	449	22,107	$2/3/5/6/7/9/ 10/15	$122,162	-	-	-	-
2010s	39	2,752	$10/20/30	$52,460	0	1	$30	$30	781	20,675	$3/5/6/9/10/ 15	$168,730	-	-	-	-
2020	0	178	$10/20/30	$3,480	0	2	$30	$60	154	2,362	$3/5/9/10/15	$20,630	-	-	-	-
2021	0	142	$10/20/30	$2,580	0	5	$30	$150	121	1,874	$3/5/9/10/15	$15,325	-	-	-	-

[1]All permits are good for one year. Fishing/Crabbing and Shellfishing permits are based on a calendar year (CY) of 01 January to 31 December of the issue year, while Hunting and Trapping permits are based on a seasonal year (SY) of 01 August of the issue year to 31 July of the following year. Therefore, sales shown for a given year are based on CY or SY, depending on the permit type. For example, fishing sales reported for 2020 include those fishing permits sold between 01 January and 31 December 2020, but hunting sales for the same year include those hunting permits sold between 01 August 2020 and 31 July 2021.

[2]Includes regular and guest permits.

[3]Shellfishing permits no longer sold.

*Senior permits (over 65 years of age), junior permits (under 16 years of age), replacements, etc.

^Incomplete sales information. In 2001, PAX and WOLF Fishing & Crabbing permits were combined (and reported here). In 2009, Fishing permits began including NRC Solomons.

Table IX-B-3. Hunting and Fishing Permit Sales and Revenue for WOLF[1]

Year	Permit Type[2]							
	WOLF Hunting (SY)				WOLF Fishing & Crabbing (CY)			
	Number		$ Amount		Number		$ Amount	
	Free*	Sold	Each	Total	Free*	Sold	Each	Total
1990s^	2	125	$5/10	$1,165	5	85	$2/5	$383
2000s^^	2	494	$5/10/20	$5,450	2	21	$2/5	$109
2010s	10	530	$10/20/30	$10,190	^^	^^	^^	^^
2020	0	28	$10/20/30	$500	^^	^^	^^	^^
2021	0	23	$10/20/30	$400	^^	^^	^^	^^

[1]All permits are good for one year. Fishing/Crabbing and Shellfishing permits are based on a calendar year (CY) of 01 January to 31 December of the issue year, while Hunting and Trapping permits are based on a seasonal year (SY) of 01 August of the issue year to 31 July of the following year. Therefore, sales shown for a given year are based on CY or SY, depending on the permit type. For example, fishing sales reported for 2020 include those fishing permits sold between 01 January and 31 December 2020, but hunting sales for the same year include those hunting permits sold between 01 August 2020 and 31 July 2021.

[2]Includes regular and guest permits.

*Senior permits (over 65 years of age), junior permits (under 16 years of age), replacements, etc.

^Incomplete sales information.

^^Permits were not issued by NAS until WOLF was annexed in October 1995. In 2001, Fishing & Crabbing permits for PAX and WOLF were combined (and reported under PAX).

Table IX-B-4. Firewood Permit Sales

Fiscal Year	Total Permits Sold	Total Permit Payment
1995	65	$1,200
1996	46	$950
1997	27	$340
1998	11	$135
1999	19	$245
2000	12	$305
2001	24	$160
2002	16	$275
2003	11	$160
2004	7	$50
2005	15	$140
2006	8	$235
2007	10	$140
2008	19	$200
2009	24	$490
2010	40	$765
2011	85	$2,065
2012	16	$330
2013	19	$455.00
2014	6	$105.00
2015	7	$145.00
2016	14	$2,392.50
2017	9	$255.00
2018	7	$730.00
2019	21	$2,510.51
2020	13	$395.00
2021	33	$565.00

Table IX-B-5. Concentrated Outdoor Recreation Activities Descriptions

Activity Description	Location	Carrying Capacity	Degree of Public Access[1]
Camping: One developed, two primitive/temporary areas, and a Boy Scout area	Developed at Goose Creek (closed to all but vetted installation employees); primitive at Paradise Grove and Hog Point; Boy Scout at Gardiner's Pond (all at PAX)	Goose Creek, 111 in conformance to State guidelines of 3 people/night/camp-site	Category B; Boy Scouts given priority at Boy Scout Camp
Picnicking: Five designated areas (plus scattered tables)	Cedar Point, Paradise Grove, West Basin Marina Pavilion, and Beach House at PAX; Priest's Point at WOLF	Conform to State guidelines of 8 picnic sites/acre, 5 people per site	Category B
Fitness Trails: One 2.4 mile trail with 20 stations. One 0.25-mile and one 0.45-mile running track	2.4 mile trail is along Tate Road, a 0.25-mile running track around the ballfield within the Fortin Road circle, and a 0.45-mile running track around the recreation fields at the Drill Hall – all at PAX	Not determined	Category B
Swimming: One non-pool area	Cedar Point Swimming Beach at PAX	Conform to State guidelines: 1 foot of beach shoreline per user, with a turnover of 2.5	Category B
Target Shooting: Two Skeet Ranges	Skeet is along Tate Road at PAX	Not determined	Both Skeet sites open
Boating (motor): All PAX creeks and all Station surrounding waterways	Pearson, Harper's, and Goose Creeks; Patuxent River; and Chesapeake Bay at PAX; Moll's Cove, St. Inigoes Creek, and St. Mary's River at WOLF	Conform to State guidelines of 1 boat per acre, 3 people per boat	Category B

[1]See note to Table IX-B-1, Annex IX-B for access explanation.

Naval Air Station Patuxent River

Integrated Natural Resources Management Plan

CHAPTER 10

Environmental Education

Table of Contents

X ENVIRONMENTAL EDUCATION

1.0 Introduction

Support for achieving the Station's educational initiatives is found at the highest level within the Navy. The Chief of Naval Operations has stated that part of the DoN Natural Resources Strategic Plan[1] is to emphasize the Navy's stewardship of natural resources by striving to:

1) Build a strong conservation ethic throughout the Navy (DoN).
2) Develop and sustain strong natural resources programs at installations.
3) Earn public confidence in DoN stewardship of the Nation's natural heritage.

The NAS Patuxent River Complex is also charged with local implementation and interpretation of some of the Legacy Resources Management Program precepts. That program was established under the Fiscal Year (FY) 91 Defense Appropriation Act[2] to improve management of natural resources on military installations. A significant part of the Act charters the Legacy Program to maintain educational, public access, and recreational programs designed to increase public appreciation, awareness, and support for national environmental initiatives.

1.1 Purpose

NAS maintains an educational and interpretive system that enhances visitor enjoyment and awareness (which increases respect for both the natural resources and the recreational facilities) and informs the community about the Station's conservation initiatives and stewardship successes. The Environmental Education chapter of this INRMP addresses the Station's approach to involving visitors as participants, rather than mere spectators, while guarding against threats such as pollution and destruction of special interest areas.

1.2 Scope

The Station is dedicated to providing NAS personnel with the knowledge to value natural resources and make a positive contribution to local conservation in a safe manner. Its extensive program, frequently involving a significant portion of the staff's personal time, has achieved media attention and the thanks of the citizenry. As such, rather than being a subheading under Outdoor Recreation, as suggested by the Real Estate Operations and Natural Resources Management Procedural Manual (NAVFAC P-73), Environmental Education is presented as a separate chapter in this INRMP.

2.0 Key Issues and Concerns

The principal role of the Environmental Education Program is, in an atmosphere of partnership, to inform individuals about the natural resources at the Complex and in the greater community, as well as the Navy's management of those resources. Staff training is to be centered on improving compliance with environmental laws and regulations through increased awareness and sensitivity,

[1] CNO ltr 5090 Ser N456/4U596377 of 11 Jul 1994
[2] Public Law 101-511. Sec. 8120; 104 State., 1905

focusing on safety as well as preservation and restoration. In association with that fundamental issue, the Station regards its Environmental Education Program as a focal point for integrating the NAS mission with ecosystem responsibilities.

Another issue is one of ensuring that the host community (i.e., St. Mary's County, southern Maryland, or the State of Maryland) is kept informed of NAS activities, particularly in respect to its adherence to environmental initiatives.

3.0 Program Goals and Objectives

An environmental education program gives the public a greater understanding of the forces that shape the environment; an awareness of the individual as an integral part of the environment; and man's dependency upon, and responsibility for, the quality of his environment. To this end, NAS has established these goals for environmental education:

A. Station employees are knowledgeable of NAS environmental concerns so as to support the military mission.

B. The community is aware of NAS environmental protection and stewardship efforts.

In order to meet these goals, the following objectives are established (note that each is followed by the letter designation of the goal or goals supported):

1) The Station's compliance with environmental laws and regulations will increase through heightened awareness and sensitivity. (A)

   The Station offers informative and entertaining programs in all facets of the natural world to NAS personnel (military, civilian, and dependents). This is done in the hope that increased awareness and appreciation of the Chesapeake Bay environment and its resources will foster increased sensitivity to the rationale behind NAS actions, thereby improving voluntary compliance.

2) Quality of life, and therefore employee productivity, is enhanced through environmental education. (A)

   These employees may be civilians or the military personnel assigned to the Station for a two- or three-year tour. In the case of the latter, enhanced quality of life may lead to increased military re-enlistment (as evidenced by repeated winning of the Golden Anchor Award for retention). In addition, training support personnel in matters of outdoor safety and preparedness, whether on the job or off, saves the Navy lost work time and medical expenses, and improves morale of employees who might otherwise be uncomfortable working outdoors.

3) The community has the opportunity for direct comment or input to the Station command with respect to environmental issues. (B)

4) The Station's unique natural and cultural resources staff expertise and experience is available to the community at large through outreach and education to include specific topics of interest. (B)

5) The Natural Resources (NR) Program maintains formal and informal partnerships with Federal, State and local agencies. (A and B)

Each of these objectives can be attained through the use of recommendations that appear throughout the chapter. The number of the objective(s) supported by each recommendation is parenthetically recorded after that recommendation. General management recommendations (GMRs) and specific management recommendations (SMRs), supporting no particular objective and/or requiring no funding, also occur throughout the chapter. These are identified parenthetically as such.

4.0 Available Resources

A well-developed and successful outdoor education/interpretation program currently exists under the auspices of the Environmental Protection and Education Center, staffed and maintained by NR personnel. The NR Program has been extremely successful in meeting the CNO's stewardship goals, providing a valuable addition to the overall outdoor recreation opportunities at the Station. Training and use of civilian volunteer personnel, historically somewhat unusual at a military installation, has allowed NAS to maximize the services it can provide by permitting the Environmental Education Center staff to assume additional responsibilities and increase the scope of the program. The Center should continue use of volunteers and student interns in the education program (Obj. 1-5) (SMR X.1). The volunteer program has become productive enough to win service awards from organizations such as the National Military Fish and Wildlife Association for their efforts.

There are also a number of wildlife/natural and cultural features on NAS. The following paragraphs describe these and the Center's activities.

4.1 Environmental Education Center

The Environmental Protection and Education Center houses a 40-seat classroom and an assortment of nature-related exhibits and displays including terrariums, live reptiles and aquatic organisms, and over 50 mounts of local wildlife species. Reaching thousands of people, the Center has conducted an award-winning[3] program involving nature study, outdoor education, and interpretation. This program includes media presentations, safety courses, lectures, field trips, and community services as discussed in the following subparagraphs.

4.1.1 Programs Hosted at the Center

The natural resources staff and volunteers provide instruction and conduct tours reaching out to thousands of visitors each year. These vary from preschool groups who may be guided in handling snakes and small animals (in a safe fashion) to elementary school classes or Scouting troops interested in ecology and conservation, to State-certified hunter safety education courses. NR staff also produce and present information on topical subject matter including outdoor hazards (such as ticks, rabies, snakes, spiders, hypothermia) and outdoor survival. Classes and lectures are provided to Station employees on safety topics such as wildlife hazards (poisonous snakes, rabies, Lyme

[3] Individual personnel and the Complex have received numerous environmental and natural resources awards. For a listing, see Annex X-A.

disease, and other wildlife-borne diseases), poisonous plants, firearm or hunter safety, and boating safety. The Station has, in the past, also hosted high school students and instructors from a tri-county natural resources camp studying the aquatic food chain and wildlife capture and marking techniques. Members of the Southern Maryland Audubon Society and other birding groups often tour PAX for bird-watching excursions and use the Center as a meeting place.

Groups tend to average about 20-40 persons per trip, with most tours lasting for an hour or less. Class size is limited only by the classroom space available in the Center.

4.1.1.1 Recommendations

- Provide signage identifying locations of and directions to cultural and natural resources features that provide recreational opportunities (Obj. 2) (SMR X.2)
- Establish handicap-accessible Watchable Wildlife programs at PAX and WOLF (with Public Affairs providing maps and brochures) (Obj. 1) (Project X.1).
- Expand the PAX and WOLF driving tours, which highlight the abundant natural and cultural resources on the Station (Obj. 1 and 2) (Project X.2)

4.1.2 Center Offsite Activities

The NR staff occasionally provides lectures/presentations at schools, particularly at events such as Envirothon and career days. NR personnel have also participated in educational booths at several public functions such as Patuxent River Appreciation Days and National Hunting and Fishing Day, and NR personnel have served as judges at science fairs. Earth Day is celebrated with a 5K fun run, tree plantings, exhibits, storm drain stenciling, Education Center Open House, local school presentations and participation, and poster contests. Arbor Day ceremonies include Navy and invited State/County officials. NR personnel occasionally submit articles and announcements on resource conservation and management or other natural history topics to both Station and community newspapers.

Typical of the regard in which the Complex's Environmental Education Program is held is the following excerpt from a letter of appreciation:

> *"On behalf of the officers, men, women and families ... I would like to express my sincere appreciation for the outstanding support you provided. The outstanding display and snake presentation coupled with willingness to share your wildlife expertise proved highly informative and educational. The lessons learned by our personnel and families will undoubtedly be lasting ones."*

4.1.2.1 Recommendations

- Attend and support public functions and community events (Obj. 3 and 4) (SMR X.3).
- Prepare and present papers or lectures at conferences and symposia (Obj. 4 and 5) (SMR X.4).
- Educate Station law enforcement personnel regarding all natural and cultural resources management policies (Obj. 1 and 5) (SMR X.5).

- Respond to routine inquiries and requests for natural and/or cultural resources information (Obj. 4 and 5) (SMR X.6).

4.2 Environmental Education Points of Interest

A less-structured wealth of environmental education and other points of interest are found with the host of natural and cultural features that can be viewed throughout the Station. As shown in Map III-32 in Annex III-B, this encompasses such areas as Shark's Tooth Beach along the Patuxent River (where fossil sharks' teeth were once collected, and gulls and migrating waterfowl can be observed); the elevated overlook at Paradise Grove (from which osprey nests, ducks, and eagles can be seen). The NR staff participates in a community event the mature hardwood forest at the southern tip of PAX (where squirrels and deer can be seen year-round); and the Pearson Pavilion and the Manor of Mattapany.

Of historical interest is the Tulip Memorial, which sits north of WOLF on the shore of St. Inigoes Creek. The property (which consists of a memorial, flagpole and interpretive signage) commemorates the crew who lost their lives on the USS Tulip during the Civil War. On November 11, 1864, mechanical problems caused the ship to explode; 49 passengers died in the disaster. Eight of these were buried on the shore of St. Inigoes Creek. The United States Government purchased the 0.53-acre property in 1939, and the Navy erected the memorial in 1940 (ICRMP, 2011).

4.3 Passive Recreation Education

Non-consumptive uses of natural resources include passive recreation (hiking, camping, bicycling, and observation), wildlife education, and general aesthetic appreciation which all occur at NAS. It is essential to recognize that passive recreation can have an environmental impact – the simple presence of humans within natural habitats can be disruptive to certain wildlife. Public education is an important tool in wildlife protection and wise stewardship. Educational use of the wildlife resource can provide users with an understanding of the upper Coastal Plain environment of Maryland. Education can focus on human impacts and limitations on uses.

4.4 Recommendations

It is recommended that NAS continue implementation of the DoN's Environmental Outreach Program[4] through the goals and objectives of this chapter to the extent allowed under current DoN policy and to the extent practical with available staffing and funding (SMR X.7). This is a Navy initiative to foster environmental education and proactive community involvement and cooperation. Maintenance of the outdoor education/interpretation program should be priority. The resources of the Station are too valuable not to promote their understanding to visitors.

Recommendations for enhancing the program include the following:

- Seek involvement with Federal, State and/or private organizations to support the outdoor education and interpretation program (Obj. 3-5) (SMR X.8).

[4] OASD memo to CNO (N4) and commandant of the Marine Corps (L) of 24 February 1994.

- Prepare periodic news releases about Station natural resources management activities for both on- and off-Station newspapers (Obj. 1-5) (SMR X.9).
- Coordinate with teachers to support recurring school programs such as the Envirothon training and competition, the University of Maryland natural resources class, and the Tri-County Council Natural Resources Camp (Obj. 4) (GMR X.1/SMR X.10).
- Teach classes with specific emphasis on safety, both occupational and recreational (Obj. 2 and 4) (SMR X.11).
- Share successes and failures of NR Program techniques with others (Obj. 4 and 5) (SMR X.12).

5.0 Resources Needs

5.1 Changes to the Environmental Education Center

An essential change to the Environmental Education Center has to be its relocation. A 2009 study of Air Installation Compatibility Use Zones (AICUZ) showed that the Center is located within Noise Zone 3. This classification is given to areas that are subjected to Station aircraft operation noise levels greater than 75 DNL and are considered the most severely impacted areas from a noise perspective. Educational programs, nature exhibits and public assemblies, all of which are currently conducted at the Center, are not consistent with the noise zone designation. As such, a new location for the Environmental Education Center should be considered (Obj. 1-4).

5.2 Curriculum Enhancements

The existing set of classes, tours, etc., is exemplary; the flexibility and willingness of the staff to tailor to the needs of the requesting group are commendable. However, programmatic changes need to be considered in order to allow the Station's environmental educational program to expand in scope beyond the excellence already achieved. The Center should improve environmental education curriculum by expounding on and better defining the education themes offered (Obj. 1, 2 and 4) (SMR X.13). The following topics are advised:

- *Ecology of the Chesapeake Bay* - to include geologic development, historic interaction with man, detailed discussion of recent decline in Bay health, and the Navy-specific impacts and contributions. Increase awareness of Station employees and their dependents concerning the Chesapeake Bay Restoration Program (Obj. 1 and 5) (SMR X.14).
- *Mitigation of Human/Wildlife Conflicts* - to include wildlife-borne diseases (such as rabies and Lyme disease) and poisonous plants; bird/animal aircraft strike reduction; nuisance wildlife control options; and rehabilitation of orphaned and injured wildlife.
- *Wildlife Appreciateion* - Develop awareness and appreciation of NAS wildlife for the benefit of the animals themselves, as well as for human safety and enjoyment (Obj. 1 and 2) (SMR X.15).

- *Partnership Programs* - to include Partners in Flight (PIF - neotropical migratory land bird conservation), DoD PIF, Partners in Amphibian and Reptile Conservation (PARC), DoD PARC, North American Waterfowl Management Plan, and Partners in Wildlife.
- *Wetlands* - to focus on values, benefits, types, threats, management, and protection.
- *Natural Resources Program at the Station* - to provide a program overview covering major program elements of wildlife, fisheries, land management, forestry, outdoor recreation, cultural resources management, and conservation education. Develop awareness of the various NAS resources and their uses NR staff providing an up-close lesson on the wildlife at NAS (Obj. 1 and 2).
- *Outdoor Recreation Opportunities at the Station* - to provide an overview of the available opportunities.
- *Invasive Species* – to highlight biodiversity impacts caused by invasive/noxious species, including stray or feral animals.

6.0 References

The Louis Berger Group, Inc. 2011 Integrated Cultural Resource Management Plan (2011-2016) Naval Air Station Patuxent River, Maryland. Prepared for Naval Air Station Patuxent River, Maryland by The Louis Berger Group, Inc., East Orange, New Jersey.

NPAP, 1992. Naval Air Station, Patuxent River Air Installation Compatibility Use Zones Plan, 1992; Naval Air Systems Command; Washington, DC

ANNEX X-A

ENVIRONMENTAL AND NATURAL RESOURCES AWARDS PRESENTED TO NAS PATUXENT RIVER

2021

- **National Military Fish and Wildlife Association Lifetime Achievement Award (Kyle Rambo)**

2020

- **Regional (NDW) Community Service Program of the Year Awards (Environmental Stewardship Flagship)**
- **Winner, National Arbor Day Foundation Tree City USA Award (31st year) and Growth Award (27th year)**

  The Tree City USA Award is sponsored by the National Arbor Day Foundation and presented by the Maryland Department of Natural Resources (MDNR). The Station was the first Naval installation (and the third Defense installation) to win the award, which recognizes excellence in urban or municipal tree care programs. Requirements: an annual Arbor Day observation, a tree care board, a tree care ordinance, and a tree care expenditure of at least $2 per capita (for each community resident).

  Growth Award is for five or more years of continuous improvements.
- **Winner, Maryland PLANT Community Award (Green Award) (27th year)**

  PLANT stands for People Loving And Nurturing Trees. Sponsored and presented by MDNR and the Maryland Community Forest Council. Similar to Tree City USA, recognizes excellence in community tree care programs. Communities submit tree projects for evaluation and scoring. Three different awards for different point levels; the Station won Green (the highest).

2019

- **Regional (NDW) Community Service Program of the Year Awards (Environmental Stewardship Flagship)**
- **Winner, National Arbor Day Foundation Tree City USA Award (30th year) and Growth Award (26th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (26th year)**

2018

- **Regional (NDW) Community Service Program of the Year Awards (Environmental Stewardship Flagship)**
- **Winner, National Arbor Day Foundation Tree City USA Award (29th year) and Growth Award (25th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (25th year)**

2017

- **Regional (NDW) Community Service Program of the Year Awards (Environmental Stewardship Flagship)**
- **Winner, National Arbor Day Foundation Tree City USA Award (28th year) and Growth Award (24th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (24th year)**

2016

- **Regional (NDW) Community Service Program of the Year Awards (Environmental Stewardship Flagship)**
- **Winner, National Arbor Day Foundation Tree City USA Award (27th year) and Growth Award (23rd year)**
- **Winner, Maryland PLANT Community Award (Green Award) (23rd year)**

2015

- **NDW Regional Navy Community Service Environmental Stewardship Award**
- **Winner, National Arbor Day Foundation Tree City USA Award (26th year) and Growth Award (22nd year)**
- **Winner, Maryland PLANT Community Award (Green Award) (22nd year)**

2014

- **Winner, Chief of Naval Operations Cultural Resources Management Award (Individual Category – M. Smolek)**
- **NDW Regional Navy Community Service Environmental Stewardship Award.**

  NAS Pax has won 15 of the last 16 years in the NDW Region Large Installation (more than 500 personnel) category. Since 2000, NAS Pax has won the overall CNO award 6 years and taken honorable mention in another 6 years.
- **Winner, National Arbor Day Foundation Tree City USA Award (25th year) and Growth Award (21st year)**
- **Winner, Maryland PLANT Community Award (Green Award) (21st year)**

2013

- **Winner, Navy Environmental Stewardship Flagship Award for Community Service (9th Year)**

  This award recognizes the best year-round volunteer supported program or special project that promotes education and good stewardship of environmental resources. The Environmental Stewardship Flagship is one of five flagships in the Navy Community Service program (the other four are Personal Excellence Partnership; Project Good Neighbor; Campaign Drug Free; and Health, Safety and Fitness). Examples of winning community service initiatives to promote environmental awareness include implementing recycling programs, organizing educational community outreach events, and participating in environmental clean-ups and beautification projects

- **Winner, National Arbor Day Foundation Tree City USA Award (24th year) and Growth Award (20th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (20th year)**

2012

- **Winner, Navy Environmental Stewardship Flagship Award for Community Service (8th Year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (23rd year) and Growth Award (19th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (19th year)**

2011

- **Winner, Navy Environmental Stewardship Flagship Award for Community Service (7th Year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (22nd year) and Growth Award (18th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (18th year)**

2010

- **Winner, Navy Environmental Stewardship Flagship Award for Community Service (6th Year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (21st year) and Growth Award (17th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (17th year)**

2009

- **Winner, Navy Environmental Stewardship Flagship Award for Community Service (5th Year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (20th year) and Growth Award (16th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (16th year)**

2008

- **Department of the Navy Meritorious Civilian Service Award (K. Rambo)**
- **Winner, National Arbor Day Foundation Tree City USA Award (19th year) and Growth Award (15th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (15th year)**
- **Winner, Navy Environmental Stewardship Flagship Award for Community Service (4th Year)**

2007

- **Winner, National Arbor Day Foundation Tree City USA Award (18th year) and Growth Award (14th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (14th year)**
- **Honorable Mention, Navy Environmental Stewardship Flagship Award for Community Service**
- **Winner, Federal Electronics Reuse and Recycling Award**

  Awarded by U.S. Environmental Protection Agency
- **Winner, St. Mary's County Historic Preservation Service Award**
  Awarded for renovation of the chapel sanctuary and development of historic interpretation panels and exhibits at the chapel and chapel annex.

2006

- **Winner, National Arbor Day Foundation Tree City USA Award (17th year) and Growth Award (13th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (13th year)**
- **Honorable Mention, Navy Environmental Stewardship Flagship Award for Community Service**
- **Historic Aerospace Site Designation**

  Bestowed by the American Institute of Aeronautics and Astronautics (AIAA) Historic sites Committee to recognize and preserve noteworthy and significant contributions to culture and technology made in both aeronautics and astronautics.

2005

- **Winner, Coastal America Spirit Award (NAS Patuxent River Gate 4 Shoreline Stabilization Project)**

  A cooperative agreement was established among the Navy, St. Mary's Soil Conservation District, Southern Maryland Resource Conservation and Development Board, Inc., and the National Aquarium in Baltimore to develop a living shoreline project at Gate 4. Over 2500 ft. of shoreline stabilization was completed, and 33,000 Spartina spp. were planted by volunteers to restore 1.5 acres of valuable tidal wetland habitat.
- **Winner, Chief of Naval Operations Natural Resources Conservation Award (Individual/Team Category – Jim Swift)**
- **Winner, Chief of Naval Operations Cultural Resources Management Award (3rd year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (16th year) and Growth Award (12th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (12th year)**
- **Winner, Navy Environmental Stewardship Flagship Award for Community Service (3rd Year)**

2004

- **Winner, Coastal America Presidential Award for Partnerships (Webster Field Annex Shoreline Stabilization Project)**

  The Navy developed a collaborative partnership with various Chesapeake Bay stakeholders (federal, state, and non-profit). Volunteers planted over 30,000 beachgrass plants along 3,500 feet of new shoreline.

- **Winner, National Arbor Day Foundation Tree City USA Award (15th year) and Growth Award (11th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (11th year)**
- **Honorable Mention, NDW Environmental Steward Flagship Award for Community Service**
- **Winner, Historic Preservation Service Award (2nd year)**

  Presented by the Maryland Historical Trust. Recognizes significant contributions to historic preservation in Maryland; specifically for the Station's funding and restoration work at the Point Lookout Lighthouse Complex.

2003

- **Winner, National Arbor Day Foundation Tree City USA Award (14th year) and Growth Award (10th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (10th year)**
- **Honorable Mention, CNO Navy Community Service of the Year Award for Environmental Stewardship Flagship**

2002

- **Winner, National Arbor Day Foundation Tree City USA Award (13th year) and Growth Award (9th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (9th year)**
- **Winner, CNO Award for Environmental Planning**
- **Honorable Mention, CNO Navy Community Service of the Year Award for Environmental Stewardship Flagship**
- **Winner, Naval District Washington Navy Community Service of the Year Award for Environmental Stewardship Flagship**

2001

- **Winner, Secretary of the Navy Cultural Resources Management Award (Individual Category - D. Lister)**
- **Winner, Chief of Naval Operations Cultural Resources Management Award (Individual Category - D. Lister)**
- **Winner, National Arbor Day Foundation Tree City USA Award (12th year) and Growth Award (8th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (8th year)**
- **Winner, USS Bainbridge Award**

  Sponsored by the Navy Personnel Command, this award recognizes one Navy command annually as having given the most time, effort and care to the community through volunteer service.
- **Winner, CNO Navy Community Service of the Year Award for Environmental Stewardship Flagship (2nd year)**
- **Winner, Naval District Washington Navy Community Service of the Year Award for Environmental Stewardship Flagship**
- **Runner-up, Secretary of the Navy Natural Resources Conservation Award**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award**

2000

- **Winner, Secretary of the Navy Natural Resources Conservation Award (5th year)**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award (5th year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (11th year) and Growth Award (7th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (7th year)**
- **Winner, CNO Environmental Restoration Award (Large Installations)**
- **Honorable Mention, CNO Navy Community Service of the Year Award for Environmental Stewardship Flagship**
- **Winner, Naval District Washington Navy Community Service of the Year Award for Environmental Stewardship Flagship**
- **Board of County Commissioners Formal Proclamation**

  Presented to NAS in recognition of the station's commitment to enhancing the environment

1999

- **Runner-up, Secretary of Defense Cultural Resources Management Award**
- **Winner, Secretary of the Navy Cultural Resources Management Award (2nd year)**
- **Winner, Chief of Naval Operations Cultural Resources Management Award (2nd year)**
- **Winner, NAVAIR Cultural Resources Management Award**
- **Winner, Naval District Washington Navy Community Service (Environmental Stewardship) Award**
- **Winner, National Arbor Day Foundation Tree City USA Award (10th year) and Growth Award (6th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (6th year)**
- **Winner, CNO Navy Community Service of the Year Award for Environmental Stewardship Flagship Award**
- **Winner, CNO Environmental Restoration Award EV Quality**
- **Winner, Maryland Recycler's Coalition Government Leadership Award**
- **Board of County Commissioners Formal Proclamation**

  Presented to NAS in recognition of the station's commitment to enhancing the environment

1998

- **Winner, Chief of Naval Operations Natural Resources Conservation Award (4th year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (9th year) and Growth Award (5th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (5th year)**

1997

- **Winner, Secretary of the Navy Cultural Resources Management Award**
- **Winner, Chief of Naval Operations Cultural Resources Management Award**
- **Winner, National Arbor Day Foundation Tree City USA Award (8th year) and Growth Award (4th year)**
- **Winner, Maryland PLANT Community Award (Green Award) (4th year)**

1996

- **Winner, Renew America National Award for Environmental Sustainability (Category: Natural Resource Conservation - Ocean/Coasts)**

  Chosen from the Environmental Success Index, which highlights more than 1,600 nationwide environmental programs that protect, restore, or enhance the environment. Singled out as a leader in land management, the Station received high accolades in natural resource conservation under the oceans and coasts subcategory.

- **Winner, National Arbor Day Foundation Tree City USA Award (7th year) and Growth Award (3rd year)**
- **Winner, Maryland PLANT Community Award (Green Award) (3rd year)**

1995

- **Winner, Secretary of Defense Natural Resources Conservation Award**
- **Winner, Secretary of the Navy Natural Resources Conservation Award (4th year)**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award (3rd year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (6th year) and Growth Award (2nd year)**
- **Winner, Maryland PLANT Community Award (Green Award) (2nd year)**

1994

- **Winner, National Arbor Day Foundation Tree City USA Award (5th year) and Growth Award**
- **Winner, Maryland PLANT Community Award (Green Award)**

1993

- **Winner, National Arbor Day Foundation Tree City USA Award (4th year)**

1992

- **Winner, Secretary of Defense Environmental Quality Award**

  Cited the Station's strength in all major program areas, its ability to balance nature and technology, and its participation in partnerships like the Chesapeake Bay Program.

- **Winner, Secretary of the Navy Environmental Quality Award (2nd year)**
- **Winner, Chief of Naval Operations Environmental Quality Award (2nd year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (3rd year)**
- **Winner, Historic Preservation Service Award**

  Presented by the Maryland Historical Trust. Recognizes significant contributions to historic preservation in Maryland; specifically for the Station's funding and support of the Mattapany - Sewall archaeological investigation and community awareness and interpretation programs.

1991

- **Runner-up, Secretary of Defense Natural Resources Conservation Award (3rd year)**
- **Winner, Secretary of the Navy Natural Resources Conservation Award (3rd year)**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award (2nd year)**
- **Winner, National Arbor Day Foundation Tree City USA Award (2nd year)**

1990

- **Winner, Secretary of the Navy Environmental Quality Award**
- **Winner, Chief of Naval Operations Environmental Quality Award**
- **Winner, National Arbor Day Foundation Tree City USA Award**

1989

- **Winner, Secretary of Defense Natural Resources Conservation Award (Individual Category - K. Rambo)**

  Presented for establishing NAS PAX as a DOD example of how major military missions can be conducted in harmony with the surrounding environment.

- **Winner, Secretary of the Navy Natural Resources Conservation Award (Individual Category - K. Rambo)**
- **Winner, Chief of Naval Operation Natural Resources Conservation Award (Individual Category - K. Rambo)**

1987

- **Runner-up, Secretary of Defense Natural Resources Conservation Award (2nd year)**
- **Winner, Secretary of the Navy Natural Resources Conservation Award (2nd year)**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award**

1985

- **Runner-up, Secretary of the Navy Natural Resources Conservation Award**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award**

1984

- **Winner, Secretary of Defense Natural Resources Conservation Award (Individual Category - L. Adams)**
- **Winner, Secretary of the Navy Natural Resources Conservation Award (Individual Category - L. Adams)**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award (Individual Category - L. Adams)**

1979

- **Winner, Secretary of the Navy Natural Resources Conservation Award**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award**

1975

- **Runner-up, Secretary of Defense Natural Resources Conservation Award**
- **Winner, Chief of Naval Operations Natural Resources Conservation Award**

1973

- **Department of Defense Natural Resources Conservation Citation for Meritorious Achievement (3rd year)**

1971

- **Department of Defense Natural Resources Conservation Citation for Meritorious Achievement (2nd year)**

1968

- **Department of Defense Natural Resources Conservation Citation for Meritorious Achievement**

APPENDIX A

GLOSSARY OF TERMS AND ACRONYMS

GLOSSARY OF TERMS

Annual Increment. A document, prepared annually, to facilitate implementation of a natural resources management plan section. The annual increment concisely provides details of proposed work to be carried out during a fiscal year. The annual increment is prepared in advance of the fiscal year it covers. It serves as the basis for funding authorizations and for evaluating progress in achieving objectives of a natural resources management plan section.

Aquatic Ecosystems. Stream channels, lakes, marshes, ponds, etc., and the plant and animal communities they support.

Basal Area. Area of the cross-section of a tree stem, generally at breast height (1.3 meters or 4.5 feet from the ground), inclusive of bark.

Best Management Practices (BMPs). Resource management decisions that are based on the latest professional and technical standards for the protection, enhancement and rehabilitation of natural and cultural resources. BMPs are usually applied as a system of practices based on site-specific conditions, rather than a single practice. In addition, BMPs are usually prepared by state agencies for land-disturbing activities related to agriculture, forestry and construction.

Biodiversity. Short for "biological diversity". The variety of life and its processes, including the variety in genes, species, ecosystems, and the ecological processes connecting everything in ecosystems.

Broad-leaved. A term applied to angiosperm trees (those flowering trees having seeds that are fully enclosed by fruits).

Brush. A growth of shrubs or small trees, usually of a type undesirable to livestock or timber management.

Candidate Species. Any species, plant or animal, that is being considered for listing as threatened or endangered under the federal Endangered Species Act by the U.S. Department of the Interior. Candidate species go through a formal listing process.

Carrying Capacity. (1) The number of organisms of a given species and quality that can survive in, without causing deterioration of, a given ecosystem through the least favorable environmental conditions that occur within a stated interval of time. (2) In recreation management, the level of recreational use that a site can provide without deterioration of the quality of the recreation experience of the resource.

Climax. The culminating stage in plant succession for a given site where the vegetation has reached a highly stable condition.

Climax Species. Those plant or animal species that dominate a climax stand in either numbers per unit area or biomass.

Code of Federal Regulations (CFR). A codification of the general and permanent rules published in the Federal Register by the Executive Department and agencies of the Federal Government.

Coniferous. Of or pertaining to conifers, which are plants that produce naked seeds in cones, mostly evergreen, with timber known commercially as softwood.

Conservation. Planned management, use, and protection of natural and cultural resources to provide sustainable use and continued benefit for present and future generations. Also, the prevention of exploitation, destruction, waste, and/or neglect.

Coppice. Describes crops or trees that regenerate vegetatively by stump sprouts.

Critical Habitat. The geographic area on which are found those physical or biological features essential to the conservation of a species listed and published by USFWS or NOAA Fisheries (formerly, NMFS) under the authority of the federal Endangered Species Act.

Cultural Resources. Buildings, structures, sites, districts, and objects eligible for or included in the National Register of Historic Places; "cultural items," as defined in 25 U.S.C. 3001 [reference (u)]; American Indian, Eskimo, Aleut, or Native Hawaiian sacred sites for which access is protected under 42 U.S.C. 1996 [ref. (d)]; "archaeological resources," as defined by Section 470 a-11 of 16 U.S.C. [ref. (h)]; and "archaeological artifact collections and associated records," defined under 36 CFR 79 [ref. (e)].

Deciduous. Of or pertaining to perennial plants which are normally leafless due to seasonal dormancy for some time during the year.

Ecosystem. The collection of all living things, plus the non-living environment, within a prescribed place at a particular time. Typically, the spatial extent of an ecosystem follows natural boundaries, such as the waters of a lake or different vegetation communities.

Ecosystem Diversity. The variety of ecosystems across the landscape that have functional identity.

Ecosystem Integrity. The general health and vitality of an ecosystem. A high degree of ecosystem integrity would indicate that all essential components of the ecosystem are intact.

Ecosystem Management. The careful and skillful use of ecological, scientific, social, and managerial principles in managing ecosystems to restore and sustain ecosystem integrity (composition, structure, and function) and produce ecologically acceptable levels of sustainable multiple uses. Ecosystem management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.

Edge. An interfacial area where plant communities meet or where successional stages or vegetative conditions within plant communities come together.

Endangered Species. Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the federal Endangered Species Act (ESA) of 1973, as amended.

Environment. The sum of all external conditions and influences affecting the life, development, and survival of an organism.

Environmental Assessment (EA). A concise public document, providing sufficient evidence and analysis for determining whether to prepare an environmental impact statement or finding of no significant impact. The document are prepared under National Environmental Policy Act (NEPA) procedures and regulations (42 U.S.C. 4321 et seq.).

Environmental Impact Statement (EIS). A statement of the environmental effects of a proposed action and alternatives to it. Required for major federal actions under Section 102 of the NEPA, it is released to the public and other agencies for comment and review. A formal document that must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines, and directives of the agency responsible for the project proposal.

Environmental Protection Agency (EPA). An agency of the executive branch of the Federal Government that has the responsibility for environmental matters of national concern.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents.

Estuarine. The area where saltwater and freshwater meet; brackish.

Evapotranspiration. Combined loss of water through evaporation and transpiration, from the soil and vegetative cover on an area of land surface.

Evergreen. A term describing a tree or shrub that has persistent leaves, and whose crown is never wholly bare.

Exotic Species. Species that occur in a given place, area, or region as a result of direct or indirect, deliberate or accidental introduction of the species by human activity. Exotics are never native to the region in which they are found.

Floodplain. The lowland and relatively flat areas adjoining inland and coastal waters including, at a minimum, those areas subject to flooding.

Forage. All browse and non woody plants available to livestock or wildlife for grazing or harvested for feed.

Game Species. Any species of wildlife or fish for which seasons and bag limits have been prescribed and which are normally harvested by hunters, trappers, and fishermen under State or Federal laws, codes, and regulations.

Genetic Diversity. The variation of inheritable characteristics of a particular species, existing at any of three levels: genetic variation within a single individual, genetic differences among individuals within a population, and genetic differences among populations.

Geographic Information System (GIS). A computer-generated software program that merges digital mapping, drafting capabilities and an interactive data base. This allows creation of intelligent mapped information. The power of a GIS is the ability of the system to query and manipulate information found in a relational database.

Growing Season. The part of the year when temperature and moisture are favorable for vegetation growth. Climatic growing season is the interval of time between spring and fall killing frost dates.

Habitat. An area where a species, plant or animal, lives, grows and reproduces; and the environment that satisfies that species' life requirements.

Hardwood. The wood of angiosperm trees (those flowering trees having seeds that are fully enclosed by fruits).

Herbaceous. An adjective describing seed-producing plants that do not develop persistent woody tissue.

Historic Site. Site associated with the history, tradition, or cultural heritage of Federal, State, or local interest, and of enough significance to merit preservation or restoration.

Hydric (soil). Soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrophytic (vegetation). Plant life growing in water or on substrate that is at least occasionally oxygen deficient as a result of excessive water content. Plants that are typically found in wetlands.

In situ. In position, or in its original place.

Integrated Natural Resources Management Plan (INRMP). A long-range planning document that guides ecologically sound and cost effective management of natural resources to maximize benefits for the installation and neighboring community. The plan integrates the various resource management issues to minimize conflicting activities and maximize the ecology of the installation.

Intermittent Stream. A stream that has flow in most months but does not have flow during the dry season (late summer/fall) of most years.

Landscape. A heterogeneous land area composed of a cluster of interacting ecosystems that is repeated in similar form throughout.

Landscape Diversity. The variation seen in the variety of interacting ecosystems across a large land area.

Mitigation. Avoiding or minimizing impacts by limiting the degree of magnitude of an action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the effected environment; or reducing or eliminating the impact by preservation and maintenance operations during the life of the action.

Mitigation Banking. Actions taken to compensate for future adverse effects of undertakings by providing substitute resources or environments in advance of any specific undertaking at a property that has gone through a formal agency mitigation bank process.

Monitoring. A process to collect significant data from defined sources to identify departures or deviations from expected plan outputs.

Multiple Use, Sustained Yield (MUSY) Management. The integrated, coordinated, and compatible use of natural resources to achieve a sustainable yield of a mix of desired goods, services, and direct and indirect benefits, while protecting the primary purpose of supporting and enhancing the military mission and observing stewardship responsibilities.

National Environmental Policy Act (NEPA) of 1969. An act that declares a national policy to encourage productive and enjoyable harmony between humankind and the environment; to promote efforts that prevent or eliminate damage to the environment and biosphere, stimulating the health and welfare of humanity; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality (CEQ).

National Register of Historic Places (NRHP). The official Federal list of sites, districts, buildings, structures, and objects worthy of preservation consideration because of significance in American history, architecture, archeology, engineering, or culture. Significance may be local, State, or National in scope. National Register eligibility criteria are published in 36 CFR 60 [reference (e)].

Native Americans. American Indians, Eskimos, Aleuts, and Native Hawaiians. *Natural Resources*. Soil, air, land, water, mineral, and fauna and flora resources. *Needle-leaved.* Having linear, commonly pungent leaves (e.g., many conifers).

Non-native Species. As used in the INRMP, refers to a taxon of a plant or an animal which is not indigenous to the region in which it is found growing. The term non-native is approximately equivalent to and is often used interchangeably with the term alien.

Noxious Weeds. Plant species identified by Federal or state agencies as requiring regulatory action for control or eradication.

Palustrine. Of or pertaining to a nontidal wetland.

Perennial Stream. A stream that has flow throughout the year in most years. Exceptions are granted for abnormally dry periods and droughts.

Polygon. A polygon in the context of this INRMP is a demarcated area on a map denoting the boundary of a feature, such as a category of land use or land cover.

Prescribed Burning. Use of fire in forest or brush management for hazard reduction and vegetative manipulation.

Raptors. Predatory birds, such as falcons, hawks, eagles, and owls.

Reforestation. The natural or artificial restocking of an area with forest trees; most commonly used in reference to artificial restocking.

Regulatory Floodplain. The lowland and relatively flat areas adjoining inland and coastal waters including, at a minimum, those areas subject to a 1% or greater chance of flooding in any given year (100-year occurrence).

Rehabilitation. Action taken to restore, protect, or enhance site productivity, water quality, or other resource values over a period of time.

Resource. Anything that is beneficial or useful - - whether animal, vegetable, mineral, a location, a labor force, a view, an experience, etc. Resources, in the context of planning, vary from commodities like timber and minerals to such amenities as scenery, scenic viewpoints, or recreation opportunities.

Riverine. Of or pertaining to a river, stream, or floodplain.

Sediment. Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.

Seral. A term describing a phase in the sequential development of a climax community (which is the final stage of plant succession, in which vegetation reaches a state of equilibrium with the environment).

Silviculture. The application of ecological theory and principles to achieve timber stand management objectives through manipulation of forest vegetation.

Softwood. The wood of coniferous trees.

Species Richness. The number of species contained within a given area. For example, within a single forested landscape, there may be dozens of tree species, and hundreds of other plant and animal species.

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.

Succession. The change in vegetative community composition and structure over a discrete period of time.

Sustainable Yield. A renewable natural resource that provides an annual or periodic harvest of goods, services, and direct and indirect benefits, into perpetuity. That may include, but is not limited to, maintaining economic benefits, ecological processes and functions, and biodiversity.

Threatened Species. Any species listed in the Federal Register or the State of Maryland COMAR regulations that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Wetlands. Wetlands are defined as lands transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water. Regulatory wetlands for federal compliance are defined as those areas that are inundated or saturated by surface or ground water 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.

ACRONYMS

A	
AFB	Air Force Base
AICUZ	Air Installation Compatible Use Zones
AIV	Avian Influenza Virus
APZ	Accident Potential Zones
ASW	Antisubmarine Warfare
B	
BAM	Bird Avoidance Model
BAMS	Broad Area Maritime Surveillance
BASH	Bird/Animal Aircraft Strike Hazard
BBA3	Maryland/DC Breed Bird Atlas 3
BCR	Bird Conservation Region
BGEPA	Bald and Golden Eagle Protection Act
BIR	Bloodsworth Island Range
BMP	Best Management Practices
BRAC	Base Realignment and Closure
C	
CAC	Common Access Card
CAP	Climate Action Plan
CBFL	Chesapeake Bay Sport Fishing License
CBM	Coordinated Bird Monitoring
CDO	Command Duty Office
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLO	Cornell Laboratory of Ornithology
CN	Environmental Planning and Conservation Branch
CNIC	Commander, Navy Installations Command

CNO	Chief of Naval Operations
CNRMA	Commander, Navy Region Mid-Atlantic
COE	Corps of Engineers
COMAR	Code of Maryland Regulations
CPUE	Catch per Unit Effort
CRA	Civilian Recreation Association
CSRFL	Consolidated Senior Resident Sport Fishing License
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
D	
DASH	Deer Automobile Strike Hazard
DBH	Diameter at Breast Height
DDD	Dichlorobiphenyl-dichloroethane
DDE	Dichlorobiphenyl-dichloroethylene
DDT	Dichlorobiphenyl-trichloroethane
DED	Dutch Elm Disease
DENIX	Department of Defense Environmental, Safety and Occupational Health Network and Information Exchange
DIR	Directive (the DoD equivalent of a policy document or regulation)
DNL	Day/Night Noise Level
DNR	Department of Natural Resources
DoD	Department of Defense
DoI	Department of the Interior
DoN	Department of the Navy
DUPA	Dwelling Units per Acre
E	
EA	Environmental Assessment
EFH	Essential Fish Habitat

EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EO	Executive Order
EPA	Environmental Protection Agency
EPO	Environmental Protection Office
EPR	Environmental Program Requirements
ER	Environmental Restoration
ERB	Environmental Review Board
ERDC	Engineer Research and Development Center
ERL	Environmental Readiness Level
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ESD	Environmental Site Design
F	
FEA	Final Environmental Assessment
FECs	Facilities Engineering Commands
FIDS	Forest Interior Dwelling Species
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FPPA	Farmland Protection Policy Act
FWCA	Fish and Wildlife Coordination Act
FY	Fiscal Year
G	
GHG	Greenhouse Gas
GIS	Geographic Information System
GMR	General Management Recommendations
GPS	Global Positioning System
GRX	GeoReadiness Explorer
H	
HQ	Headquarters

I	
IBA	Important Bird Area
IBP	Institute for Bird Populations
ICRMP	Integrated Cultural Resources Management Plan
ID	Intensely Developed Area
IEPM	Installation Environmental Program Manager
ILS	Instrumented Land System
INRCP	Integrated Natural Resources Conservation Plan
INRMP	Integrated Natural Resources Management Plan
INST	Instruction (the DoD equivalent of a policy document or regulation)
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
IR	Installation Restoration
IWDM	Integrated Wildlife Damage Management
J	
JD	Jurisdictional Determination
L	
LID	Low Impact Development
LLC	Limited Liability Company
LRR	Land Resource Regions
M	
MARA	Maryland Amphibian and Reptile Atlas
MBTA	Migratory Bird Treaty Act
MCCC	Maryland Commission on Climate Change
MDANG	Maryland Army National Guard
MD-DC	Maryland-District of Columbia
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDSPGP	Maryland State Programmatic General Permit

MFFL	Maryland State Freshwater Sport Fishing License
MMPA	Marine Mammal Protection Act
MOA	Memoranda of Agreement
MOU	Memoranda of Understanding
mph	Miles per Hour
MPP	Management Practices and Prescriptions
MRTFB	Major Range and Test Facility Base
MUA	Military Use Area
MUMA	Multiple Use Management Area
MUMY	Multiple Use, Maximum Yield
MUSY	Multiple Use, Sustained Yield
MWR	Morale, Welfare and Recreation
N	
NABCI	North American Bird Conservation Initiative
NAES	Naval Air Engineering Station
NARTU	Naval Air Reserve Training Unit
NAS	Naval Air Station Patuxent River Complex (includes associated properties)
NATC	Naval Air Test Center
NAVAIR	Naval Air Systems Command
NAVELEX	Naval Electronics Systems Command
NAVFAC	Naval Facilities Engineering Systems Command
NAVFACENGCOM	Naval Facilities Engineering Command
NAWC	Naval Air Warfare Center
NAWC-AD	Naval Air Warfare Center, Aircraft Division
NAWC-TSD	Naval Air Warfare Center, Training Systems Division
NAWMP	North American Waterfowl Management Plan
NBS	National Biological Survey

NDW	Naval District Washington
NEPA	National Environmental Policy Act
NESEA	Naval Electronic Systems Engineering Activity
NESTED	Naval Electronic Systems Test and Evaluation Detachment
NESTEF	Naval Electronic Systems Test and Evaluation Facility
NFWF	National Fish and Wildlife Foundation
NHP	Natural Heritage Program
NISE-EAST DET	Naval In-Service Engineering Detachment
NOAA	National Oceanic and Atmospheric Administration
NOTW	Navy Owned Treatment Works
NR	Natural Resources
NRC-NAS	National Research Council of the National Academy of Sciences
NRC SOL	Naval Recreation Center Solomons
NRCS	Natural Resources Conservation Service
NSSP	National Shellfish Sanitation Program
NTCHS	National Technical Committee for Hydric Soils
NWP	Nationwide Permit
NWSG	Native Warm-season Grass
O	
O&MN	Operations and Maintenance, Navy
OCS	Outer Continental Shelf
OEP	Office of Environmental Planning
OMB	Office of Management and Budget
OPNAV	Office of Naval Operations
ORV	Off-Road Vehicles
OSD	Office of the Secretary of Defense
P	
PARC	Partners in Amphibian and Reptile Conservation

PAX	Naval Air Station Patuxent River (main installation)
PCB	Polychlorinated biphenyl
PIF	Partners in Flight
PLANT	People Loving and Nurturing Trees
ppt	Parts per Thousand
PPV	Public/Private Venture
PSD	Proportional Stock Density
PWD	Public Works Department
R	
RAB	Restoration Advisory Board
RCC	Recreational Carrying Capacity
RDTA&E	Research, Development, Test, Acquisition & Evaluation
REC	Regional Environmental Coordinators
REPI	Readiness and Environmental Protection Initiative
RESOP	Recreation Standard Operating Procedure
RIMP	Regional Installation Master Plan
ROW	Right-of-Way
S	
SAR	Species At Risk
SAV	Submerged Aquatic Vegetation
SCA	Student Conservation Association
SECNAV	Secretary of the Navy
sf	Square Foot or Feet
SMECO	Southern Maryland Electric Cooperative
SMR	Specific Management Recommendations
SO	Sustainability Office
SOC	Species of Concern
SOP	Standard Operating Procedure

SPGP	State Programmatic General Permits
spp.	Species
STWG	Scientific and Technical Working Group
SUMA	Special Use Management Area
SWPPP	Stormwater Pollution Prevention Plan
T	
TES	Threatened and Endangered Species
TMDL	Total Maximum Daily Load
TPS	Test Pilot School
TRC	Technical Review Committee
U	
UAS	Unmanned Aviation Systems
UAV	Unmanned Aviation Vehicle
UCAS	Unmanned Combat Air Systems
UCLA	University of California, Los Angeles
US	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
V	
VP	Patrol Squadron
VSTOL	Vertical and Short Takeoff and Landing
VW	Early Warning Squadron
W	
WFMP	Wildland Fire Management Plan

WHMP	Wildlife Hazard Management Plan
WHSRN	Western Hemisphere Shorebird Reserve Network
WNS	White-nose Syndrome
WOLF	Naval Air Station Patuxent River, Webster Outlying Field
WS	Wildlife Services
WWII	World War II

APPENDIX B

SUMMARY OF

RECOMMENDATIONS

Table B-1. Specific Management Recommendations (Natural Resources Staff)

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
I	I.1	Individuals requiring geographical information for decision-making purposes should access GRX directly in order to view the desired data in its most up-to-date form.**	I-2	Continual
I	I.2	Ecological gradients on small and large scales should be protected and restored.	I-8	Continual
I	I.3	Unnatural habitat fragmentation, isolation, and artificial boundaries and barriers should be reduced or eliminated where possible.**	I-8	Continual
I	I.4	Altered ecosystems should be managed or maintained to provide the highest degree of function possible.	I-8	Continual
I	I.5	Natural patterns of disturbance should be restored or managed disturbances that mimic natural disturbance regimes should be introduced.	I-8	Continual
I	I.6	Impacts to sensitive areas should be eliminated or reduced.**	I-8	Continual
I	I.7	Forest fragmentation in forest preserves should be avoided. The forest preserve is an informal, non-binding designation internal to the NR Program created to help avoid the fragmentation of large, contiguous forest blocks on the installation.**	I-8	Continual
I	I.8	Management activities that lead to habitat fragmentation and isolation should be avoided where practicable.	I-8	Continual
I	I.9	NR should be managed for natural habitat connectivity both within the Station and between the Station and other land units such as State and natural forests.	I-9	Continual
I	I.10	Rare, threatened and endangered species should be preserved.	I-9	Continual
I	I.11	Management activities should be defined in terms of spatial and temporal impacts.	I-9	Continual
I	I.12	Development should be directed to areas of lower environmental sensitivity.**	I-9	Continual
I	I.13	The NAS community should be educated about the goals and objectives of the INRMP.	I-9	Continual
III	III.1	Continue the protection of natural shorelines and associated resources, including tidal wetlands and vegetated buffers	III-4	Continual
III	III.2	Future adaptation strategies specific to Maryland, as well as climate change tools and guidance produced by DoD Legacy Program efforts, will be reviewed for inclusion in the INRMP as annual updates are conducted	III-5	Continual
III	III.3	Obtain site-specific soils data prior to drawing any conclusions regarding the properties and restrictions of particular portions on the Station.**	III-12	Continual
III	III.4	Continue to identify state and federally listed plant species and map their locations in the Station GIS as they are found	III-19	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
IV	IV.1	To maintain the efficiency of the PWD Planning Checklist, monitor applicable laws, regulations, Navy guidance, and best management practices, updating any questions regarding natural and cultural resources as needed	IV-4	Continual
IV	IV.2	Integrate the INRMP with other current and future plans, including the NAS Master Plan, NAS Integrated Cultural Resources Management Plan (ICRMP), Environmental Restoration plans, Range Management Plan, and major test plans.**	IV-6	As necessary
IV	IV.3	All planners and land managers should be trained in the use of GRX for the interpretation of natural and cultural resources opportunities and constraints.**	IV-6	Continual
IV	IV.4	The NR Program manager should coordinate with the PWD Planning Branch to ensure that the INRMP is incorporated into current and future regional and installation-specific planning documents.**	IV-7	As necessary
IV	IV.5	The feasibility of establishing late successional vegetation on capped landfills should be investigated, possibly by establishing experimental plots	IV-7	As necessary
IV	IV.6	No decision regarding the management of an individual resource should be made without fully considering both the potential impacts to other resources and the possibility of additional consequences resulting from such a management decision.	IV-7	Continual
IV	IV.7	An assessment should be performed prior to execution of contradictory recommendations to determine whether or not the benefits of the project outweigh the fiscal losses or ecological impediments associated with that particular natural resource.**	IV-7	Continual
IV	IV.8	Multiple Use Management Areas (MUMAs) can and should be managed for as many compatible uses as possible within the context of the INRMP goals and objectives.	IV-10	Continual
IV	IV.9	All facility planners, operational planners, land managers, and NEPA coordinators should be trained in the use of these compatibility codes and matrices.**	IV-14	Continual
V	V.1	Continue use of the NEPA-required Environmental Assessment (EA) and Environmental Impact Statement (EIS) development process as an aid for review of major projects.**	V-8	Continual
V	V.2	Comply with applicable measures of the State of Maryland Critical Area Law, Non-Point Source Pollution Control Plan, and other NOAA-approved State Coastal Zone program features in all activities, as required by the Coastal Zone Management Act (CZMA).**	V-8	Continual
V	V.3	Development in core forest areas should be discouraged to the maximum extent possible without compromising the military mission.	V-9	Continual
V	V.4	Compatibility matrices should be used to determine which of a variety of land uses and management practices/prescriptions are appropriate. **	V-9	Continual
V	V.5	To identify candidate parcels for expansion of the agricultural outlease program, a comprehensive land review should be conducted through the GIS.	V-13	As necessary

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
V	V.6	Consider and evaluate the feasibility of both hay and nursery outleases supplemental to the agricultural outlease.	V-13	As necessary
V	V.7	Continue use of the Soil and Water Conservation Plan, revised as recommended by climate change adaptation strategies	V-13	Continual
V	V.8	Renew CNO Exemption No. NAS PAXRIV E1-81 when necessary to continue the agricultural outlease program around the weapons storage facility.**	V-13	Annual
V	V.9	Preserve hedgerows in agricultural parcels, where necessary and permissible, to prevent soil losses from wind erosion and reduce attractiveness to Canada Geese by shrinking parcel size.**	V-13	Continual
V	V.10	When appropriate, assist the ER Program's Remedial Project Manager in identifying potential impacts to natural resources caused by the release of hazardous substances, pollutants and contaminants from ER sites into the environment	V-15	As necessary
V	V.11	Continue NR Program involvement in the ER Program by maintaining a seat on the Restoration Advisory Board and reviewing all monitoring/cleanup plans.**	V-15	Continual
V	V.12	Identify altered marginal/barren land sites and develop plans to reclaim them.	V-15	Continual
V	V.13	Consider increased usage of digested sewage sludge on marginal lands, including ER sites where appropriate, for land reclamation.**	V-15	As necessary
V	V.14	Maintain the use of native warm-season grasses in lieu of tall fescue for revegetation of the closed/capped landfill at Fishing Point.**	V-15	Continual
V	V.15	Continue monitoring of shoreline stability and condition of existing erosion control structures.**	V-16	Continual
V	V.16	Document erosion problems/events as they occur.**	V-16	Continual
V	V.17	Utilize the expertise and resources of partner agencies to conduct erosion studies and design solutions.**	V-17	Continual
V	V.18	Examine the use of fertilizers and pesticides in both agricultural and grounds maintenance practices, especially at WOLF, and reduce application as needed to maintain or improve water quality.**	V-19	Annual
V	V.19	Promote scrub/shrub communities in utility rights-of-way.**	V-21	Continual
V	V.20	Continue mowing reduction efforts by converting turf to other vegetative cover that requires reduced or no maintenance, or agricultural lands that maintain a positive funding flow.**	V-21	Continual
V	V.21	Review grounds landscaping plans for appropriateness of plant materials, methods and locations. Use regionally native plants. Encourage the use of low-maintenance/low-input landscaping techniques to reduce both water consumption for irrigation and the necessity for intensive chemical applications. Consult the US Fish and Wildlife Service document entitled "Conservation Landscaping for Federal Facilities: Guide to Beneficial Landscaping in the Chesapeake Bay Watershed," for environmentally and wildlife-beneficial planting designs.	V-21	Continual
V	V.22	Review grounds maintenance contract for consistency with INRMP objectives.	V-21	Annual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
V	V.26	Ensure that NR Program pesticide and herbicide use is captured in the NAVFAC Online Pesticide Reporting System.	V-22	Continual
V	V.23	Review IPMP updates as a means to strive for continued and improved application of IPM methodologies	V-22	Annual
V	V.24	Review the pest control contract to determine consistency with the objectives of the INRMP and ensure that pest control is conducted with minimal impact to aquatic environments	V-22	Annual
V	V.25	Review pest control activities proposed by the agricultural lessee for consistency with all applicable laws, regulations, and INRMP objectives.	V-22	Annual
V	V.27	Maintain the standards necessary to qualify for, and submit nominations for, the “Tree City USA” and “PLANT Community” awards each year. Include WOLF in these accomplishments	V-23	Annual
V	V.28	Continue to replace lost American Elms with the disease-resistant *Zelkova serrate*, which closely resembles our elms in growth form.	V-23	Continual
V	V.29	Continue monitoring programs for other exotic tree pests, such as Emerald Ash Borer (EAB), Asian Long-horned Beetle (ALB), and Spotted Lanternfly.	V-23	Continual
V	V.30	Updates should be made to the Urban Forestry Program and future INRMPs should include an Urban Forestry Program.	V-24	Continual
V	V.31	Continue to make wetland protection a priority at NAS.**	V-27	Continual
V	V.32	Seek new ways of updating mapped wetland resource data in GRX. Field determination information concerning wetland boundaries across the Complex should be used in conjunction with GPS data collection to improve the GIS coverage.	V-27	Continual
V	V.33	Develop a mitigation banking strategy for the Station which emphasizes offsite mitigation preferences due to BASH concerns.	V-27	Continual
V	V.34	Continue to support requests from recreational beekeepers for placement of managed hives throughout the installation	V-28	Continual
V	V.35	Continue to recommend the use of native pollinator plants in stormwater management and general landscape design, to include reduced mowing areas.	V-28	Continual
V	V.36	Continue to work with SO in the identification of encroachment challenges, prevention and mitigation and ensure that any NR Program responsibilities accrued through REPI actions are addressed in the INRMP.	V-28	Continual
V	V.37	Identify all significant mineral resource areas.	V-29	Continual
V	V.38	Consider the benefits of maintaining access to mineral areas when reviewing development plans.	V-29	Continual
V	V.39	Adhere to the CZMA consistency requirements as identified in the CZMA MOU.	V-30	Continual
V	V.40	Continue to incorporate, as appropriate, land-use guidelines as set forth in the Chesapeake Bay Critical Area Law into the land management program.	V-30	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
VI	VI.4	Allow Station personnel to collect reasonable quantities of fruits/seeds and fallen foliage from trees and plants for individual, personal (i.e., noncommercial) use only, so long as the health and/or quality of the host plant is not adversely affected.	VI-13	Continual
V	V.41	As necessary and appropriate, carry out special resource management projects within or adjacent to the Coastal Zone in order to mitigate negative impacts to these sensitive resources.	V-30	Continual
VI	VI.1	Identify unique flora areas in various habitats that can enhance the observational (non-consumptive) uses of forest resources.	VI-13	Continual
VI	VI.2	Create maps of these areas and make them available to the public.	VI-13	Continual
VI	VI.3	Create and provide maps of forested areas open for consumptive uses.	VI-13	Continual
VI	VI.5	Any area-specific limitations (e.g., Wildlife Trees, wetland boundaries, etc.) to consumptive use should be physically displayed in the field through signage or easily interpreted maps.	V-13	Continual
VI	VI.6	Areas in which human intrusion should be eliminated or reduced should be mapped and this map should be updated periodically as further information becomes available.	V-13	Continual
VI	VI.7	A study on noise levels and the degree of attenuation should be performed in residential and work areas located near large noise generating sources, such as dog pens, rifle ranges, and generators; based on the results of these studies, target specific forest areas for the primary use of noise attenuation, with possible secondary uses where applicable	VI-14	Continual
VI	VI.8	The amount and quality of visual screening provided by particular forest resources should be assessed. The potential impact to this function should be considered in any plans to modify currently existing forest areas.	VI-15	Continual
VI	VI.9	Each watershed area should be analyzed with respect to its hydrological functioning and needs, as well as the water quality needs of downstream areas. Forests within these watersheds should then be managed to provide the functions required based on these studies, when those functions are determined to be of primary importance. When not of primary importance, these functions should still be considered when implementing any other type of management scheme for a particular forest area.	VI-15	Continual
VI	VI.10	To the maximum extent practicable, silvicultural guidelines and BMPs as set forth in the Chesapeake Bay Critical Area law and regulations, as well as those contained in MDNR's Soil Erosion and Sediment Control Guidelines for Forest Harvest Operations in Maryland, should be incorporated.	VI-15	Continual
VI	VI.11	Water Quality Protection Zones should be maintained landward of any permanent or temporary water body, watercourse or wetland border.	VI-16	Continual
VI	VI.12	Trees susceptible to windthrow should be periodically removed from Water Quality Protection Zones.	VI-16	Continual
VI	VI.13	Continue to protect large, contiguous forest blocks at PAX to preserve and maintain the critical ecosystem functions.	VI-17	Continual
VI	VI.14	Ensure that all merchantable timber that is cut on NAS is disposed of properly, with appropriate disbursement to the Navy Forestry Account. This includes clearing for construction, airfield safety, or any other purpose.**	VI-18	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
VI	VI.17	Surveys for Gypsy Moth should be conducted annually. Other forest pests, such as Emerald Ash Borer, Asian Longhorn Beetle, and Spotted Lanternfly, should be monitored and control methods should be implemented, as needed. Survey activities should be coordinated and survey data shared with the US Forest Service and Maryland DNR Forestry Service.	VI-19	Annual
VI	VI.15	Continue to prohibit the wasteful practice of on-site burning of merchantable timber as construction clearing debris.**	VI-18	Continual
VI	VI.16	Fire breaks and other small openings that are not needed should be filled in, thereby increasing forest block sizes and reducing internal forest barriers and sources or fragmentation.	VI-19	Continual
VI	VI.18	Specimen Trees should be continually monitored for health and treated in accordance with the standards established for urban trees.	VI-21	Annual
VI	VI.19	Forest stands should be assessed for additional potential state Specimen Trees at PAX.	VI-21	Continual
VI	VI.20	Potentially qualifying trees should be cataloged and monitored accordingly, and those worthy of nomination should be actively sought out for inclusion in the Champion Tree program.	VI-21	Continual
VI	VI.21	Firewood cutting areas should be harvested selectively, with first priority on dead, dying, or diseased trees.	VI-22	Continual
VI	VI.22	Harvesting should also proceed with the intent of minimizing disturbances in any one particular area, with trees marked for removal being spread throughout the stands.	VI-22	Continual
VI	VI.23	As appropriate and practicable, harvested areas should be allowed to regenerate naturally.	VI-22	Continual
VI	VI.24	Firewood cutting areas should be identified at WOLF.	VI-228	Continual
VI	VI.25	Efforts should be made to follow the BMPs of the National Firewood Task Force Recommendations dated March 2010.	VI-22	Continual
VI	VI.26	Station policy amendments should be drafted which prohibits the bringing of firewood onto the installation, particularly in light of the Animal and Plant Health Inspection Services (APHIS) firewood quarantine in many area counties, including St. Mary's County.	VI-22	Continual
VI	VI.27	Urban forest areas should be managed in conjunction with the general management practices outlined in the Land Management chapter of this plan and the specific management recommendations contained in the Urban Forest Management Plan for the Naval Air Station Patuxent River Maryland, dated June 1994.**	VI-22	Continual
VI	VI.28	The Installation Appearance Plan should be reviewed for consistency with both documents.**	VI-22	Continual
VI	VI.29	Efforts should be made to preserve woody species for landscape elements as a part of the land development plans where appropriate and practicable.**	VI-23	Continual
VI	VI.30	When converting interior pine forest areas to hardwoods, these areas could be initially clearcut, or allowed to remain uncut to eventually be replaced by hardwood species through natural succession. If clearcut, they should be either replanted with hardwood species or allowed to revegetate naturally.	VI-23	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
VI	VI.32	Plantations should be run as an agricultural operation in defined areas where the production of timber is cost effective.	VI-23	Continual
VI	VI.31	Any interior pine forests that appear profitable should be cut as soon as possible to allow for uninterrupted development of the contiguous forest in the preserve area. Any areas remaining uncut after forty years should be considered off-limits and no further clearcutting will be permitted in these areas.	VI-23	Continual
VI	VI.33	In order to remain cost effective, the appropriate harvest method (either clearcutting or selective harvesting) should be utilized to maximize profits from these areas, depending on supply and demand for different tree sizes in the future.	VI-24	Continual
VI	VI.34	Pines in plantation areas should be selectively harvested (thinned) throughout the stand over a fifty-year period, with a suggested harvest of one-fifth of the stems every ten years.	VI-24	Continual
VI	VI.35	Specialty products should be identified in appropriate areas and marketed aggressively to produce the greatest potential revenue.	VI-25	Continual
VI	VI.36	Limited selective harvesting will be allowable within the forest preserve area as long as the following conditions are met: a. designated tree species and size are needed and not available anywhere else on PAX or WOLF; b. the tree can be harvested with minimal disturbance to the surrounding area, including canopy closure; c. the tree to be harvested is not so important for wildlife that the harvest would detrimentally impact the habitat of a particular species in the area; d. the tree is not providing water quality benefits through stabilization of an erosion-prone area; and e. trees to be harvested are not adjacent to each other or other recent harvests so that a clearing would be produced within the preserve area.	VI-25	Continual
VII	VII.1	Assess and evaluate the effectiveness of current aquatic resource management practices.	VII-24	Continual
VII	VII.2	Seek out new aquatic resource management practices and techniques, such as improving habitats in a manner that is endorsed by the American Fisheries Society, and apply those where appropriate.	VII-24	Continual
VII	VII.3	Continue fishing permit fees so that fishermen bear an appropriate proportion of the cost of providing recreational and conservation programs at NAS.	VII-24	Continual
VII	VII.4	Police licensure, creel limits, size limits, and seasons.**	VII-24	Continual
VII	VII.5	Respect State of Maryland usage guidelines for fishing in order to maintain a quality recreational opportunity.	VII-24	Continual
VII	VII.6	Participate in scientific and technical meetings, working with other jurisdictions.	VII-24	Continual
VII	VII.7	Continue to work with Federal and State agencies to conform to coastal zone programs that monitor water quality and shoreline erosion.	VII-24	Continual
VII	VII.8	Continue the fishing surveys to also assist in identifying an acceptable recreational carrying capacity within the missions of NAS and the ecological parameters surrounding fish populations.	VII-24	Continual
VII	VII.9	Monitor catch-and-release activity.	VII-24	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
VII	VII.12	Actively participate in Chesapeake Bay habitat restoration programs.	VII-26	Continual
VII	VII.10	Work with the Council to establish local SAV population goals.	VII-25	Continual
VII	VII.11	Continue to share SAV survey data with the USFWS.	VII-25	Annual
VII	VII.13	Employ aquatic weed control as required, using winter drawdowns where possible and consistent with other objectives.	VII-26	Annual
VII	VII.14	Develop a program to educate and notify fishermen about the negative impacts of illegal fish stocking, especially the stocking of fish like Black Crappie and Golden Shiner. In addition, inform them of how the use of non-native live bait can result in similar negative effects.	VII-27	As necessary
VII	VII.15	Establish and maintain vegetated streamside buffer areas.**	VII-27	Continual
VII	VII.16	Manage the Station's tidal creeks to restore, enhance, and maintain their ecological integrity.	VII-28	Continual
VII	VII.17	Nutrient management must remain an essential part of the Station's fisheries program.	VII-28	Continual
VII	VII.18	The Station should fully commit to support the Chesapeake Bay Program in its effort to restore the oyster population.	VII-29	Continual
VII	VII.19	Representatives from the Station should serve as NAS points of contact to the Patuxent and Lower Potomac River Tributary Strategy Implementation Teams.	VII-29	Continual
VII	VII.20	Introduce appropriate monitoring programs necessary for collecting stock assessment data.	VII-30	Annual
VII	VII.21	Determine economic characterizations of each major component of the Station fishery.	VII-30	Continual
VII	VII.22	Determine optimum fish size limits for harvesting in order to achieve population objectives.	VII-30	Continual
VIII	VIII.1	Gaps within forests, especially those in the forest preserve should be allowed to close.	VIII-21	Continual
VIII	VIII.2	Identify and map all gaps within forest areas.	VIII-21	As necessary
VIII	VIII.3	With the assistance of Station utility managers, conduct a feasibility study for closing identified forest gaps.**	VIII-21	As necessary
VIII	VIII.4	Avoid prescribed burns in most hardwood forested areas.	VIII-21	Continual
VIII	VIII.5	Old fields and seral woodlands adjacent to core forest areas should be encouraged to develop where practicable.	VIII-22	Continual
VIII	VIII.6	In locations where this would negatively impact air operations, such as in the open farmland and mowed land immediately adjacent to the runways and approaches, BASH considerations should be followed. In areas that must be maintained in grass cover, shift the plant assemblage to native eastern prairie grass species.**	VIII-22	Continual
VIII	VIII.7	Enhance natural systems in favor of an intense successional habitat creation and maintenance program.	VIII-22	Continual
VIII	VIII.8	The planting of small wildlife food plots near airfields and large forest blocks is prohibited.	VIII-22	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
VIII	VIII.9	The other early successional species should not be encouraged in forested areas, but can be supported, as appropriate and practicable, in those areas to be kept as open spaces (e.g., the areas surrounding runway approaches that are not regularly mowed).	VIII-24	Continual
VIII	VIII.10	As practicable, the management of the PAX Complex should provide sufficient habitats for all common and characteristic non-game species.	VIII-24	Continual
VIII	VIII.11	The Station already supports sufficient numbers of successional forest components, so the attention should be focused on attaining and protecting old growth stands by reducing internal forest barriers such as fire lanes, food patches, and clear cuts.	VIII-24	Continual
VIII	VIII.12	NR staff members should continue their involvement in both PIF and NABCI.	VIII-25	Annual
VIII	VIII.13	Points of contact can be found on the DoD PIF website, along with additional planning documents and management guidance that should be consulted for purposes of bird management at NAS.	VIII-36	Continual
VIII	VIII.14	Implement strategies to incorporate white-noise syndrome (WNS) management to identify, avoid, and mitigate effects of WNS to conserve the status of bat species.	VIII-27	Continual
VIII	VIII.15	Rare species surveys will continue to include species from all appropriate lists, which will be revisited regularly to determine if new species are added or listing statuses have changed.	VIII-28	Annual
VIII	VIII.16	NAS species that meet global and state designations should be encouraged to increase their populations, provided that this would not contradict the overall wildlife and ecosystem management scheme or the military mission.	VIII-28	Continual
VIII	VIII.17	Share the rare species data with MDNR's Natural Heritage Program (NHP) and USFWS, as appropriate.	VIII-29	Annual
VIII	VIII.18	Enter location data and status of listed species, as well as land-use constraints applicable to them, into GRX.	VIII-29	Continual
VIII	VIII.19	Consult MDNR and USFWS when any proposed activity has the potential to impact a rare species	VIII-29	As necessary
VIII	VIII.20	The practice of reporting dead sea turtles or marine mammals to NOAA Fisheries Service, as well as to the Cooperative Oxford Laboratory and the Virginia Institute of Marine Science, should be continued.	VIII-31	Annual
VIII	VIII.21	Reporting of all live marine mammal or sea turtle sightings or strandings to the Marine Mammal/Sea Turtle Stranding Network should continue.**	VIII-31	Annual
VIII	VIII.22	While the state endangered species law and its regulations may not be legally applicable to NAS because of the principle of Federal sovereign immunity, state-listed species should be afforded the same protection as federally listed species to the greatest extent possible.	VIII-33	Continual
VIII	VIII.23	Expand survey efforts to include the less conspicuous species of lower taxa, particularly invertebrates.	VIII-33	Continual
VIII	VIII.24	Conduct additional focused surveys for rare species during their periods of greatest conspicuousness.	VIII-33	Periodic
VIII	VIII.25	Identify potential factors contributing to any observed changes in species abundance	VIII-33	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
VIII	VIII.26	Update and maintain a database of all rare species occurrences, for use in applications such as the Station PWD Planning Checklist.	VIII-34	Continual
VIII	VIII.27	All new occurrences of rare species should be reported.	VIII-35	Continual
VIII	VIII.28	For state rare and state highly rare species, protection strategies should be developed and implemented, as appropriate.	VIII-35	As necessary
VIII	VIII.29	GIS should be used to model potential locations for alternative rare plant sites and locations for conserving relict natural communities.	VIII-35	Continual
VIII	VIII.30	Educational materials and education programs should be developed to educate Station personnel on rare species issues.	VIII-36	As necessary
VIII	VIII.31	Specific emergency salvage plans for rare species should be developed.	VIII-36	As necessary
VIII	VIII.32	NR staff should conduct bi-weekly beaver surveys to monitor potential conflicts from dam-building activities.**	VIII-37	Periodic
VIII	VIII.33	NR personnel should manage (and, as applicable, direct contractors to perform) nuisance wildlife inspections and control activities at environmental restoration sites, such as landfills.**	VIII-37	Continual
VIII	VIII.34	If other wildlife species suffer from known nuisance animals, as in the case of feral cats, control measures should also be initiated, but only with consideration of compliance requirements and necessary nuisance wildlife control permits from state and federal agencies. NR personnel should track any contractor-acquired special purpose wildlife permits.**	VIII-38	Continual
VIII	VIII.35	NR personnel should work with the private, contract Housing Manager to develop a plan for elimination of recurring feral domestic animals and nuisance wildlife conflicts in or near housing areas.	VIII-38	Continual
VIII	VIII.36	The BASH program should be the Installation's highest natural resources management priority.**	VIII-38	Continual
VIII	VIII.37	The NR BASH/DASH program manager shall apply for and obtain this depredation permit on an annual basis.	VIII-40	Annual
VIII	VIII.38	At no time shall the mere existence of a species be considered an imminent threat.	VIII-40	Continual
VIII	VIII.39	Population reduction at NAS shall occur only in direct coordination with N45 staff on the depredation permit.	VIII-41	Continual
VIII	VIII.40	Deer movement patterns between different areas of the Station should be tracked and monitored.	VIII-42	Continual
VIII	VIII.41	As a precaution against negatively altering deer movement patterns, all proposed security fencing projects should be evaluated for their impact on deer movements and potential to increase deer-auto collisions.**	VIII-42	Continual
VIII	VIII.42	NR personnel should review pest control procedures used by contractors, and require use of IPM practices when appropriate. **	VIII-44	Annual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
VIII	VIII.43	NR personnel should remain vigilant for outbreaks of any wildlife disease, whether it threatens human health or impacts animal populations.	VIII-46	Continual
VIII	VIII.44	NAS should continue its emphasis on safety and ethics in the hunting and trapping program.	VIII-46	Continual
VIII	VIII.45	As appropriate, recreational hunting should be the primary means of deer population control on the Station.	VIII-46	Continual
VIII	VIII.46	The collection of biological data at the NAS PAX deer check station should continue.	VIII-46	Annual
VIII	VIII.47	A more thorough understanding of the many population parameters is required for better management of NAS wildlife resources.	VIII-46	Continual
VIII	VIII.48	Current surveys that regularly update lists and population estimates of all mammals, birds, and other animals at NAS should continue.	VIII-46	Continual
VIII	VIII.49	Similar collaborative efforts [between MDNR and NAS] should be encouraged for future species surveys.	VIII-47	Continual
VIII	VIII.50	The potential ecological impacts of an INRMP task/project should be considered before implementing it, especially as site conditions may have changed since the time the project was proposed.	VIII-47	Continual
VIII	VIII.51	Species data collected should reflect the entire biota within the affected community. In particular, all studies that are not species-specific should have an ecosystem management vantage point.	VIII-47	Continual
VIII	VIII.52	NAS should coordinate research efforts among NAS, MDNR NHP, and USFWS.	VIII-47	Continual
VIII	VIII.53	Agreements have existed between NAS and some outside wildlife managing agencies including USFWS, US Forest Service, U.S. Biological Survey, and other Department of Interior interests; as well as MDNR's NHP, Fisheries Division and Wildlife Division. However, more cooperation can help further document the plant and animal communities present.	VIII-47	Continual
VIII	VIII.54	In the interest of restoring biodiversity, NAS has the charge of considering reintroduction of species once native to the area that have been eradicated.	VIII-48	Continual
VIII	VIII.55	In order to continue this and other banding programs, the Station's Master Banding Permit should be maintained.	VIII-49	Annual
IX	IX.1	Enforcement of hunting and fishing laws and regulations should be carried out primarily by a full-time, professionally trained game warden assigned to NAS Police. Assistance can be given by the remainder of the NAS Police force. NAS should continue to furnish the auxiliary support personnel for this purpose and provide them with the appropriate training.**	IX-6	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
IX	IX.2	If the Least Tern returns to Cedar Point Beach in the future, NR staff should work with MDNR to produce educational materials that can be made available through MWR, along with additional signs to post both at the nesting boundary and where people enter the swimming beach area.	IX-10	As necessary
IX	IX.3	The NR Program should seek the cooperation of MWR to continue policing Cedar Point Beach in the event that the Least Tern attempts to nest again (typically mid-April through mid-September. This could be accomplished through formal amendment to the swimming area RESOP.**	IX-10	As necessary
IX	IX.4	The NR Program should coordinate with MWR to address boating permissions on all Station water bodies through formal amendment to an existing RESOP, or issuance of a new one.**	IX-11	Continual
IX	IX.5	In the interest of safety, conflict avoidance, and protection of the aquatic resource, jet skis should be prohibited from operation in the creeks through formal amendment to the RESOPs.**	IX-11	Continual
IX	IX.6	To benefit the program as a whole, establish a tri-partite agreement among DoD, the National Park Service, and the State of Maryland to coordinate the Outdoor Recreation Program.	IX-14	Periodic
IX	IX.7	Interface with MDNR in order to explore the possibility of sharing management techniques and resources.	IX-15	Continual
IX	IX.8	On a more local basis, foster a partnership approach to outdoor recreational resource usage through attendance at county-level meetings.	IX-15	Continual
IX	IX.9	Work with private clubs on Station (e.g., Mattapany Rod and Gun, Flying, Rifle and Pistol, and Skeet Clubs) to provide opportunities not available through MWR.**	IX-15	Continual
IX	IX.10	Continue the present fee program for recreation activities in order to produce funds for management of recreational resources.	IX-15	Continual
IX	IX.11	Game experts familiar with local conditions are to determine desirable densities and formulate harvest bag limits.	IX-15	Continual
IX	IX.12	Continue emphasis on safety elements of the hunter safety program.	IX-16	Continual
IX	IX.13	Continue the current hunting policies for clearly delineating hunting areas and restricting other activities in those areas during deer hunting hours.	IX-16	Continual
IX	IX.14	Strongly encourage the permanence of safety buffer zones between hunting and other activities and/or residential developments.	IX-14	Continual
IX	IX.15	Continue maintenance of the Rambo Trail, using volunteers (Boy Scouts, other groups) whenever possible.	IX-16	Continual
IX	IX.16	If users report conflicts, restrict sections of the trail to a specific activity rather than allowing them to be used for multiple purposes.	IX-16	As necessary
IX	IX.17	Follow recommended use guidelines for hiking trails as prepared by the State of Maryland.	IX-16	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
IX	IX.18	If future trails are to be constructed, several factors should be considered. Trails should be provided in varying lengths and endurance requirements. They should be sited in areas that have experiential diversity (i.e., have a variety of habitats, slopes, cover types and wildlife habitats.**	IX-16	Continual
IX	IX.19	Encourage and foster use of more non-motorized boating on the PAX tidal creeks (Harper's, Goose, and Pearson).**	IX-17	Continual
IX	IX.20	NR Staff should work with MWR as appropriate, should they plan for new primitive campsites or picnic areas, to identify areas best suited for these purpose.**	IX-19	Continual
IX	IX.21	Enforce existing recreational policies, such as the prohibition on the use of off-road vehicles.**	IX-19	Continual
IX	IX.22	Communicate with the National Park Service and MDNR prior to taking any action that might foreclose potential wild, scenic, or recreational river status for the Patuxent River.	IX-19	As necessary
IX	IX.23	Identify for the public any significant botanical, zoological, and geological areas.	IX-19	Continual
X	X.1	The Environmental Education Center should continue use of volunteers and student interns in the education program.	X-3	Continual
X	X.2	Provide signage identifying locations of and directions to cultural and natural resources features that provide recreational opportunities.	X-4	Continual
X	X.3	Attend and support public functions and community events.	X-4	Continual
X	X.4	Prepare and present papers or lectures at conferences and symposia.	X-4	Continual
X	X.5	Educate Station law enforcement personnel regarding all natural and cultural resources management policies.	X-4	Continual
X	X.6	Respond to routine inquiries and requests for natural and/or cultural resources information.	X-5	Continual
X	X.7	Continue implementation of the DoN's Environmental Outreach Program through the goals and objectives of this chapter to the extent allowed under current DoN policy and to the extent practical with available staffing and funding.	X-5	Continual
X	X.8	Seek involvement with Federal, State and/or private organizations to support the outdoor education and interpretation program.	X-5	Continual
X	X.9	Prepare periodic news releases about Station natural resources management activities for both on- and off-Station newspapers.	X-6	Continual
X	X.10	Coordinate with teachers to support recurring school programs such as the Envirothon training and competition, the University of Maryland natural resources class, and the Tri-County Council Natural Resources Camp.**	X-6	Continual

Chapter	#	Specific Management Recommendation	Page #	Scheduled Implementation (FY)
X	X.11	Teach classes with specific emphasis on safety, both occupational and recreational.	X-6	Continual
X	X.12	Share successes and failures of NR Program techniques with others.	X-6	Continual
X	X.13	The Environmental Education Center should improve environmental education curriculum by expounding on and better defining the education themes offered.	X-6	Continual
X	X.14	Increase awareness of Station employees and their dependents concerning the Chesapeake Bay Restoration Program.	X-6	Continual
X	X.15	Develop awareness and appreciation of NAS wildlife for the benefit of the animals themselves, as well as for human safety and enjoyment.	X-6	Continual
** Also a General Management Recommendation.				

Table B-2. General Management Recommendations

Chapter	#	General Management Recommendation	Page #
I	I.1	Individuals requiring geographical information for decision-making purposes should access GRX directly in order to view the desired data in its most up-to-date form.**	I-2
I	I.2	Unnatural habitat fragmentation, isolation, and artificial boundaries and barriers should be reduced or eliminated where possible.**	I-9
I	I.3	Impacts to sensitive areas should be eliminated or reduced.**	I-9
I	I.4	Forest fragmentation in forest preserves should be avoided. The forest preserve is an informal, non-binding designation internal to the NR Program created to help avoid the fragmentation of large, contiguous forest blocks on the installation.**	I-9
I	I.5	Development should be directed to areas of lower environmental sensitivity.**	I-10
III	III.1	Obtain site-specific soils data prior to drawing any conclusions regarding the properties and restrictions of particular portions on the Station.**	III-12
III	III.2	If construction is planned, and impacts to jurisdictional resources including shores, beaches, waterways, ponds, or wetlands are anticipated, an application must then be submitted to the USACE for a Jurisdictional Determination (JD) and the appropriate permit prior to initiating any construction activity that involves land disturbance.	III-15
III	III.3	Detailed floodplain mapping should be verified on a site-specific basis prior to implementing any type of land disturbing activity.	III-16
IV	IV.1	GRX and the INRMP should be used not only by natural resources management personnel but also by facility planners as a detailed supplement to the Installation master plan.	IV-4
IV	IV.2	NAWCAD Ranges Sustainability Office does and should continue to consult with the PWD Conservation Branch when there is a potential for impacts to installation natural resources.	IV-5
IV	IV.3	A fundamental goal of the Master Plan should be that NAS natural resources are preserved or enhanced to the maximum extent practicable.	IV-6
IV	IV.4	Integrate the INRMP with other current and future plans, including the NAS Master Plan, NAS Integrated Cultural Resources Management Plan (ICRMP), Environmental Restoration plans, Range Management Plan, and major test plans.**	IV-6
IV	IV.5	All planners and land managers should be trained in the use of GRX for the interpretation of natural and cultural resources opportunities and constraints.**	IV-6
IV	IV.6	The NR Program manager should coordinate with the PWD Planning Branch to ensure that the INRMP is incorporated into current and future regional and installation-specific planning documents.**	IV-7

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IV	IV.7	The INRMP contains information vital to preparing an EA/EIS for any area of the Complex and should be used to the maximum extent possible when evaluating potential environmental impacts related to any and all of the natural resources in and around the Complex.	IV-7
IV	IV.8	Any plans to return an environmental restoration (ER) site to its natural condition should be designed consistent with the goals and objectives of the INRMP.	IV-7
IV	IV.9	An assessment should be performed prior to execution of contradictory recommendations to determine whether or not the benefits of the project outweigh the fiscal losses or ecological impediments associated with that particular natural resource.**	IV-7
IV	IV.10	All facility planners, operational planners, land managers, and NEPA coordinators should be trained in the use of these compatibility codes and matrices.**	IV-14
V	V.1	The NR Program should be informed of proposed projects at the earliest planning stage so that it may be an integral part of the decision-making process	V-8
V	V.2	Continue use of the NEPA-required Environmental Assessment (EA) and Environmental Impact Statement (EIS) development process as an aid for review of major projects.**	V-8
V	V.3	Comply with applicable measures of the State of Maryland Critical Area Law, Non-Point Source Pollution Control Plan, and other NOAA-approved State Coastal Zone program features in all activities, as required by the Coastal Zone Management Act (CZMA).**	V-8
V	V.4	To ensure that all resource issues are addressed, GRX must be queried for environmental information in the area of interest.	V-8
V	V.5	Development should be focused on the improved grounds and military use areas where intensive development already exists.	V-9
V	V.6	Reconstruction, renovation, and rehabilitation of obsolete facilities should be opted for over new construction when feasible.	V-9
V	V.7	New land development should focus on improved grounds that are adjacent to other developed areas; semi-improved grounds are the next land types to review.	V-9
V	V.8	Natural or unimproved areas should be the last lands reviewed for development.	V-9
V	V.9	Compatibility matrices should be used to determine which of a variety of land uses and management practices/prescriptions are appropriate. **	V-9
V	V.10	Renew CNO Exemption No. NAS PAXRIV E1-81 when necessary to continue the agricultural outlease program around the weapons storage facility.**	V-13
V	V.11	Preserve hedgerows in agricultural parcels, where necessary and permissible, to prevent soil losses from wind erosion and reduce attractiveness to Canada Geese by shrinking parcel size.**	V-13

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V	V.12	Continue NR Program involvement in the ER Program by maintaining a seat on the Restoration Advisory Board and reviewing all monitoring/cleanup plans.**	V-15
V	V.13	Consider increased usage of digested sewage sludge on marginal lands, including ER sites where appropriate, for land reclamation.**	V-15
V	V.14	Maintain the use of native warm-season grasses in lieu of tall fescue for revegetation of the closed/capped landfill at Fishing Point.**	V-15
V	V.15	Continue monitoring of shoreline stability and condition of existing erosion control structures.**	V-16
V	V.16	Document erosion problems/events as they occur.**	V-16
V	V.17	Conduct an erosion study on WOLF tidal creek shorelines	V-16
V	V.18	In order to determine shoreline protection options for the northeastern portion of WOLF, conduct a bathometric survey of Moll's Cove (adjacent to WOLF)	V-17
V	V.19	Utilize the expertise and resources of partner agencies to conduct erosion studies and design solutions.**	V-17
V	V.20	Update the regional stormwater plan at PAX and WOLF regularly.	V-19
V	V.21	Promote the use of stormwater management design criteria which adhere to Low Impact Development BMPs and produce biological benefits; however, any stormwater design that would result in open, standing water cannot be permitted on or near airfields (due to BASH concerns).	V-19
V	V.22	Implement sound stormwater management practices on both new construction and existing sites.	V-19
V	V.23	Examine the use of fertilizers and pesticides in both agricultural and grounds maintenance practices, especially at WOLF, and reduce application as needed to maintain or improve water quality.**	V-19
V	V.24	Employ BMPs throughout the Complex, but especially at WOLF, to avoid facility contribution to water quality degradation.	V-19
V	V.25	Planting and maintenance specifications were developed for PAX in 1983 and included in a Grounds Conservation Plan. These "Management Practices" are a series of standard operating procedures (SOPs) for mowing, planting, seeding, fertilizing, pruning, and erosion control methods to be used on Complex properties. These specifications are held by the NR Program and should be reviewed and revised if necessary.	V-20
V	V.26	Reduce mowing frequency around remote roads.	V-20
V	V.27	Promote scrub/shrub communities in utility right-of-ways.**	V.21
V	V.28	Continue mowing reduction efforts by converting turf to other vegetative cover that requires reduced or no maintenance, or agricultural lands that maintain a positive funding flow.**	V-21
V	V.29	Consult a Natural Resources Specialist for planting and maintenance specifications.	V-21

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V	V.30	Continue employing BMPs in landscaping and grounds maintenance activities	V-21
V	V.31	The NR Program should be the lead group in overseeing all wetland protection measures.	V-24
V	V.32	Continue to make wetland protection a priority at NAS.**	V-27
VI	VI.1	Air pollution control should be considered a secondary benefit in areas managed for other uses.	VI-18
VI	VI.2	New crossings (as needed) should be constructed at narrow places in the channel and/or the narrowest point on the associated wetland area, and should not impede the flood stage of the steam.	VI-20
VI	VI.3	Any areas of forested or scrub/shrub land scheduled for construction should be logged or cleared during the winter months to lessen impact to nesting migratory birds. Commercial timber harvests should also be conducted during the winter months, when possible.	VI-21
VI	VI.4	Ensure that all merchantable timber is disposed of properly, with appropriate disbursement to the Navy Forestry Account. This includes clearing for construction, airfield safety, or any other purpose.**	VI-23
VI	VI.5	Continue to prohibit the wasteful practice of on-site burning of merchantable timber as construction clearing debris.**	VI-23
VI	VI.6	Urban forest areas should be managed in conjunction with the general management practices outlined in the Land Management chapter of this plan and the specific management recommendations outlined in the Urban Forest Management Plan for the Naval Air Station Patuxent River Maryland, dated June 1994.**	VI-29
VI	VI.7	The Installation Appearance Plan should be reviewed for consistency with both the above documents.**	VI-29
VI	VI.8	Efforts should be made to preserve woody species for landscape elements as a part of the land development plans where appropriate and practicable.**	VI-29
VII	VII.1	If severe enough, fresh water pond fish age-class gaps can be filled with supplemental stockings as necessary.	VII-12
VII	VII.2	In the interest of simplicity and balance, the NAS freshwater recreational fishery should feature only Largemouth Bass, sunfish, and catfish.	VII-12
VII	VII.3	Due to elevated bacterial levels found in tidal waters of the St. Mary's River during the 1989-1991 Maryland Water Quality Inventory, nearly six square miles of shellfish waters are classified as "conditionally approved" and may be closed if rain exceeds one inch in a 24-hour period. A strategy to maintain and improve the present water quality of both the St. Mary's River and St. Inigoes Creek should be developed.	VII-23
VII	VII.4	Police licensure, creel limits, size limits, and seasons.**	VII-24
VII	VII.5	Sample water to determine water chemistry.	VII-26
VII	VII.6	Correct any water chemistry problems.	VII-26
VII	VII.7	Collect and analyze sediment and fish tissue samples from Gardiner's, Sewall, Calvert, Sacawaxhit, and Richneck Ponds, as well as Finger and Fishing Ponds at WOLF.	VII-27
VII	VII.8	If screening finds contaminants, collect and analyze additional sediment samples, as well as water and fish tissue.	VII-27

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VII	VII.12	To the greatest extent practicable, the Navy should provide State agencies with assistance, such as data collection, and work toward the prevention of water runoff contamination, to ensure ecosystem balance.	VII-28
VII	VII.9	Follow this with development and implementation of a plan (perhaps in conjunction with the ER Program) to mitigate any potential health risks.	VII-27
VII	VII.10	Establish and maintain vegetated streamside buffer areas.**	VII-27
VII	VII.11	Construct stormwater management devices or facilities and implement stormwater BMPs to mitigate the impacts on streams from untreated stormwater off Station roadways and older construction sites.	VII-27
VII	VII.13	Concomitant with oyster restoration are harvest restrictions allowing collection by hand and prohibiting snorkeling in areas of cultch relocation.	VII-29
VII	VII.14	In the event that a project may adversely impact EFH, the project planner(s) should review the Essential Fish Habitat Consultation Guidance referenced in Section 2.3.2 of this chapter.	VII-30
VIII	VIII.1	With the assistance of Station utility managers, conduct a feasibility study for closing identified forest gaps.**	VIII-21
VIII	VIII.2	In locations where this would negatively impact air operations, such as in the open farmland and mowed land immediately adjacent to the runways and approaches, BASH considerations should be followed. In areas that must be maintained in grass cover, shift the plant assemblage to native eastern prairie grass species.**	VIII-21
VIII	VIII.3	The installation will ensure that the USFWS Maryland Office of Law Enforcement and Region 5 Migratory Bird Program Office are notified of any eagle strike within 48 hours of discovery	VIII-30
VIII	VIII.4	Reporting of all live marine mammal or sea turtle sightings or strandings to the Marine Mammal/Sea Turtle Stranding Network should continue.**	VIII-31
VIII	VIII.5	The first measure to be employed in mitigating wildlife/human conflicts should be the long-term control or elimination of conditions that create or support the conflict. This may involve physical exclusion through structural modification, improved sanitation, or elimination of food sources (such as pet food left outside). NR personnel should be consulted to determine if an on-site inspection is warranted for such problems, as they can make recommendations and refer issues to the appropriate NAS contact.	VIII-37
VIII	VIII.6	If reimbursable funds are made available, Conservation staff can perform mission-essential nuisance wildlife inspections and implement subsequent control measures in-house.	VIII-37
VIII	VIII.7	NR staff should conduct bi-weekly beaver surveys to monitor potential conflicts from dam-building activities.**	VIII-37
VIII	VIII.8	NR personnel should manage (and, as applicable, direct contractors to perform) nuisance wildlife inspections and control activities at environmental restoration sites, such as landfills.**	VIII-37
VIII	VIII.9	If other wildlife species suffer from known nuisance animals, as in the case of feral cats, control measures should also be initiated, but only with consideration of compliance requirements and necessary nuisance wildlife control permits from state and federal agencies. NR personnel should track any contractor-acquired special purpose wildlife permits.**	VIII-38
VIII	VIII.10	All wildlife control activities by contractors should be coordinated with the Conservation staff.	VIII-38

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VIII	VIII.14	Problems with free-roaming or domestic animals on the Station should be reported to the Public Works Department for control through the grounds maintenance and pest control contract.	VIII-38
VIII	VIII.11	As a safety precaution, all personnel participating in nuisance wildlife control activities should receive pre-exposure rabies immunizations prior to performing such work.	VIII-38
VIII	VIII.12	Removal or control of species such as the Norway Rat should be carried out via this contract in accordance with the Integrated Pest Management Plan.	VIII-38
VIII	VIII.13	Conservation staff should review and approve all contract provisions for vertebrate wildlife control.	VIII-38
VIII	VIII.15	The BASH program should be the Installation's highest natural resources management priority.**	VIII-38
VIII	VIII.16	Modifications to programs like BAM can be developed for all migratory birds. NAS should develop a system to monitor and report all local bird strike hazards.	VIII-39
VIII	VIII.17	The single largest area of wildlife assemblage on the airfield consists of the altered wetlands and vegetated buffers found in the infield area. The Clear Zone Management Plan should be implemented to fill and clear these areas.	VIII-40
VIII	VIII.18	At no time shall the mere existence of a species be considered an imminent threat.	VIII-40
VIII	VIII.19	Population reduction at NAS shall occur only in direct coordination with the N45 staff on the depredation permit.	VIII-41
VIII	VIII.20	Based on past trials in high deer-strike areas, Swareflex™ Wildlife Warning Reflectors will not be used at NAS on a large scale.	VIII-41
VIII	VIII.21	As a precaution against negatively altering deer movement patterns, all proposed security fencing projects should be evaluated for their impact on deer movements and potential to increase deer-auto collisions.**	VIII-42
VIII	VIII.22	A regular maintenance schedule should be implemented to exclude nesting or roosting birds from structures, particularly hangars, by eliminating access points other than main doors.	VIII-42
VIII	VIII.23	All external hangar doors should remain closed when not in use.	VIII-42
VIII	VIII.24	Hangars need to be individually evaluated to determine the appropriate method of nuisance bird control. All methods and options should be weighed; however, a combination of methods usually shows the greatest cost effectiveness and the best results. Lethal control of nuisance birds can be used after structural modifications to hangars have been made and failed. Coordination with NR staff is required.	VIII-42
VIII	VIII.25	Any modification to existing structures and/or design of new structures should take into consideration the problems associated with nuisance birds. NR staff can make recommendations.	VIII-44
VIII	VIII.26	Maintenance officers should be trained in the recognition of nuisance bird problems and how to take appropriate actions before workers take inappropriate ones.	VIII-44
VIII	VIII.27	Personnel should be encouraged not to feed the birds inside or near hangars.	VIII-44
VIII	VIII.28	NR personnel should review pest control procedures used by contractors, and require use of IPM practices when appropriate. **	VIII-44

Chapter	#	General Management Recommendation	Page #
IX	IX.1	Enforcement of hunting and fishing laws and regulations should be carried out primarily by a full-time, professionally trained game warden assigned to NAS Police. Assistance can be given by the remainder of the NAS Police force. NAS should continue to furnish the auxiliary support personnel for this purpose and provide them with the appropriate training.**	IX-6
VIII	VIII.29	Generally, any wild or domestic animal suspected of having rabies should be captured, if possible, or destroyed for examination.	VIII-44
VIII	VIII.30	As a rule, it is recommended that all dead animals be handled with gloves.	VIII-45
IX	IX.2	The NR Program should seek the cooperation of MWR to continue policing Cedar Point Beach in the event that the Least Tern attempts to nest again (typically mid-April through mid-September. This could be accomplished through formal amendment to the swimming area RESOP.**	IX-10
IX	IX.3	The NR Program should coordinate with MWR to address boating permissions on all Station water bodies through formal amendment to an existing RESOP, or issuance of a new one.**	IX-11
IX	IX.4	In the interest of safety, conflict avoidance, and protection of the aquatic resource, jet skis should be prohibited from operation in the creeks through formal amendment to the RESOPs.**	IX-11
IX	IX.5	Strictly enforce off-road vehicles policy.	IX-14
IX	IX.6	Work with private clubs on Station (e.g., Mattapany Rod and Gun, Flying, Rifle and Pistol, and Skeet Clubs) to provide opportunities not available through MWR.**	IX-15
IX	IX.7	No harvest decisions and or changes in hunting intensity should be made without full interface with the Station's NR Program as delineated in the INRMP.	IX-15
IX	IX. 8	If future trails are to be constructed, several factors should be considered. Trails should be provided in varying lengths and endurance requirements. They should be sited in areas that have experiential diversity (i.e., have a variety of habitats, slopes, cover types and wildlife habitats.**	IX-16
IX	IX.9	In the spirit of the Clean Air Act and in light of the self-contained nature of the Station, encourage bicycle use for both recreational purposes and as a means of local transportation.	IX-17
IX	IX.10	The development of lock-up areas and linked bike paths/trail system should be studied.	IX-17
IX	IX.11	Encourage and foster use of more non-motorized boating on the PAX tidal creeks (Harper's, Goose, and Pearson).**	IX-17
IX	IX.12	Assess the adequacy of the existing comfort stations and dumpsters.	IX-18
IX	IX.13	Provide recreation site users with adequate receptacles for trash disposal, suitable sanitation facilities, and material with which to douse fires.	IX-18
IX	IX.14	Establish an inspection program that ensures that public health is safeguarded, and post signs to encourage user cooperation.	IX-18

Chapter	#	General Management Recommendation	Page #
IX	IX.16	NR Staff should work with MWR as appropriate, should they plan for new primitive campsites or picnic areas, to identify areas best suited for these purpose.**	IX-19
IX	IX.15	If expansion of existing campgrounds becomes necessary, Goose Creek is the preferred location. If any changes are to be made, however, the specific type of camping and terrain must have a major influence on the number and placement of camping units. Coordination with NR staff is required.	IX-18
IX	IX.17	Maintain the jogging trail with periodic exercise stations (VITA exercise course).	IX-19
IX	IX.18	Enforce existing recreational policies, such as the prohibition on the use of off-road vehicles.**	IX-19
X	X.1	Coordinate with teachers to support recurring school programs such as the Envirothon training and competition, the University of Maryland natural resources class, and the Tri-County Council Natural Resources Camp.**	X-6
** Also a Specific Management Recommendation.			

Table B-3. Projects

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
I	I-1	The INRMP must be reviewed annually and be revised as needed. The INRMP should be formally updated or revised in advance of these concurrence reviews.	I-14	A) Annual (minor edits) B) FY26 (update for concurrence every 5 years)	O&MN	1	A) and B) under EPR#0428AN9514
III	III.1	Continue to identify, locate and map all nuisance or invasive plant species at all Station properties. Areas having invasive species should be resurveyed every 5 to 10 years.	III-20	FY23, FY27 (PAX, WOLF and SOL)	O&MN	1	under EPR# 0428A29731
IV	IV.1	Review and update (as needed) GIS data layers to provide accurate constraints information to project planners.	IV-5	A) FY23 (update GIS layers every 5 years) B) FY28 (update INRMP maps every 10 years)	O&MN	1	A) and B) under EPR# 0428A00016
IV	IV.2	Identify and map the remaining established Special Use Management Areas (SUMAs) in GRX.	IV-9	FY23 (update every 5 years)	O&MN	1	Combined with Project IV.1 (GIS Update) under EPR# 0428A00016
IV	IV.3	Identify and map the remaining Military Use Areas (MUAs) in GRX.	IV-11	FY23(update every 5 years)	O&MN	1	Combined with Project IV.1 (GIS Update) under EPR# 0428A00016
V	V.1	All natural areas of the Complex should be categorized into Special Use Management Areas (SUMAs) and Multiple Use Management Areas (MUMAs) as a means of greatly enhancing the land use management and development decision process concerning natural areas.	V-9	FY23 (update every 5 years)	O&MN	1	Combined with Project IV.1 (GIS Update) under EPR# 0428A00016
V	V.2	Create and apply a separate coverage of SUMA and MUMA zones through use of GRX.	V-9	FY23 (update every 5 years)	O&MN	1	Combined with Project IV.1 (GIS Update) under EPR# 0428A00016

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
V	V.5	Control invasive plant species. As necessary, focus limied funding and in-house treatment on historically controlled sites that may become reinfested.	V-13	Annual	O&MN	1	under EPR #0428A29259
V	V.3	Continue use of the Soil Conservation Plan contained within the Agricultural Outlease Plan, employing current BMPs on farmland at all times.	V-13	Continual	Ag Funds	3	usually reimbursable work
V	V.4	Update the Agricultural Outlease periodically	V-13	FY23 (update every 5-10 years)	Ag Funds or farmer reimbursable work	3 or 4	(as needed) under EPR #0428A20688
V	V.6	Implement shoreline protection measures for significant problem areas as they occur.	V-17	A) FY23 (Chesapeake Bay Shoreline) B) FY25 (Hog Point Shoreline)	O&MN	1	
V	V.7	Conduct a specific survey of WOLF interior lands to identify all erosion problems. During the survey, recorded information on each problem should include location, scope of the erosion, severity of the problem, and cause of the erosion. The list of problem areas should then be prioritized for remediation using a three-tiered approach. Class I problems would include severe erosion areas that pose a hazardous condition to human health and welfare; Class II, severe erosion problems that do not pose an immediate hazard; and Class III, minor erosion problems. The results of the erosion survey should then be entered into GRX for subsequent use in planning remedial action on erosion areas.	V-17	FY23 (update every 4-5 years)	O&MN	2	under EPR #0428AJRS25
V	V.8	Design interior land erosion control projects. The appropriate remedial practices should be identified for each erosion problem area. The survey projects should generate a priority list for erosion control measure implementation.	V-17	FY23 – FY26	O&MN	2	

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
V	V.9	Implement interior land erosion control projects. Prioritized items in the erosion control plan should be budgeted and programmed for implementation.	V-17	FY23 (initial) (every 2 years thereafter)	O&MN	2	under EPR #0428A29395
V	V.10	Conservation staff should continue to encourage implementation of the Urban Forestry Plan.	V-24	As available	Forestry Reserve	3	
V	V.11	The NR Program should re-inventory PAX (last performed in 1994) and develop a revised Urban Forestry Plan with updated data.	V-24	FY23	Forestry Reserve or O&MN	3	under EPR #0428AUFPU1
V	V.12	The NR Program should inventory and develop an Urban Forestry Program for WOLF and include in future INRMPs.	V-24	FY23	Forestry Reserve or O&MN	3	Combined with Project V.12 (Urban Forestry Plan) under EPR #0428AUFPU1
V	V.13	Periodically update mapped wetlands resource data in GRX so project planners have more reliable constraint information when siting projects. In addition, conduct surveys on PAX property acquisitions (such as the Grayson property near WOLF).	V-27	FY24	O&MN	2	every 5-10 years under EPR #0428AJCS06
VI	VI.1	Re-inventory NAS forest resources prior to every other INRMP update.	VI-12	FY23	Forestry Reserve or O&MN	3	under EPR #0428AFIMP1
VI	VI.2	Continually monitor for the health of FIDS populations.	V-17	Annual	O&MN	2	under EPR# 0428A20975
VI	VI.3	Silvicultural practices should be implemented if there are areas identified on NAS that will be used primarily for commercial forest products production.	V-18	As necessary	Forestry Reserve	3	
VI	VI.4	Apply selective silvicultural practices in areas outside of commercial products areas, but within forested areas being managed for a different primary function.	V-18	Continual	Forestry Reserve	3	Combined with Project VI.3 (silvicultural practices)

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VI	VI.5	Prescribed burning should be implemented as needed, as a means for understory removal in campgrounds and plantations, as well as for wildlife habitat improvement. Coordinate with the Station fire department and State forestry personnel, and adhere to the guidelines of the Station's prescribed burning instruction when conducting prescribed burns.	V-19	As necessary	Forestry Reserve or O&MN	3	under EPR #0428AJS22A
VI	VI.6	Any new plantations established at PAX should be managed in a manner which makes them profitable, meaning large, contiguous tracts of plantations in order to minimize management and harvest costs. These areas should also be selected to be consistent with the purposes of other management areas on PAX.	VI-20	As necessary	Forestry Reserve	3	
VI	VI.7	A survey should be conducted to determine the presence or absence of state Specimen Trees at WOLF.	VI-21	FY24	Forestry Reserve	3	
VII	VII.1	Stream surveys were conducted in 2012 at both PAX and WOLF and all natural blockages were removed. However, stream surveys should be repeated for both properties every 5 to 7 years so that any subsequent natural blockages can be addressed.	VII-13	FY23 (update every 5-7 years)	O&MN	1	under EPR #0428A20913
VII	VII.2	Revive user surveys of freshwater and saltwater fishermen, crabbers and oystermen in order to calculate user effort and quality of experience. Use survey information to help identify future demand, areas of use, and preferences for various fishing opportunities.	VII-24	FY23 (update every 5-7 years)	O&MN or Fish & Wildlife	3	under EPR #0428AJCS12
VII	VII.3	Include fishing survey data pertaining to the usage rates of fishing piers in any upcoming Leisure Needs Assessments.	VII-24	FY12-13	O&MN or Fish & Wildlife	3	Combined with Project VII.2 (user surveys) under EPR# 0428AJCS12

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VII	VII.4	Collect data pertaining to days/hours of consumptive fish and crab resource use as well as catch size.	VII-24	FY23 (update every 5-7 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.2 (user surveys) under EPR# 0428AJCS12
VII	VII.5	To promote population management, NAS staff should conduct comprehensive sportfish inventory surveys during the late spring and fall of each year.	VII-23	FY23 (update every 5-7 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.1 (stream surveys) under EPR# 0428A20913
VII	VII.6	Conduct SAV surveys for both PAX and WOLF twice each year. Ideally, this should be done during the last week of May and then again in August.	VII-25	Annual	O&MN	2	under EPR #0428A20466 and EPR #0428A20675
VII	VII.7	Stock fish in PAX freshwater ponds, only as necessary to supplement natural reproduction.	VII-26	Periodic	Fish & Wildlife	3	
VII	VII.8	Conduct periodic monitoring of pond fish populations, using electrofishing or seining, to determine species composition, age class distribution, and forage/game fish ratio for the fishery resource. Collect scale samples for age determination and use with length-weight ratios to assess growth rates and overall fish health.	VII-26	Periodic	Fish & Wildlife	3	
VII	VII.9	Install fish attractors.	VII-26	As necessary	Fish & Wildlife	3	
VII	VII.10	Survey perennial and intermittent streams at PAX and WOLF, using seining or electrofishing, to determine fish species composition.	VII-27	FY23 (update every 5-7 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.1 (stream surveys) under EPR#0428A20913

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VII	VII.11	Barriers to fish passage, such as culverts and dams, that inhibit fish access to upstream spawning areas, should be surveyed and information should be compared to that found in the 1996 impediments report. Known stream blockages should be identified and mapped in GRX.	VII-27	FY23 (update every 5 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.1 (stream surveys) under EPR#0428A20913
VII	VII.12	Plans should be developed to conduct regular, periodic monitoring of estuarine fish populations (using electrofishing or seining) to determine species composition and age-class distribution for the fishery resource.	VII-28	Periodic	Fish & Wildlife or in-house	3	
VII	VII.13	Station staff should promote efforts to cultch the sparse natural oyster beds to encourage increased reproduction.	VII-29	As necessary	Fish & Wildlife	3	
VII	VII.14	After the cultch is established, it can be used as a seed area; that is, relocate shells with young oysters attached to marginal areas.	VII-29	As necessary	Fish & Wildlife	3	
VII	VII.15	Develop additional artificial reefs using "clean materials" to encourage fish habitation.	VII-29	As Available	Fish & Wildlife	3	to be determined
VII	VII.16	Collect biological information from recreational fishermen on the distribution, size, age, and sex composition of their catches. Share local data with MDNR for use in calculating total Baywide landings.	VII-30	FY23 (update every 5-7 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.2 (user surveys) under EPR# 0428AJCS12

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VII	VII.17	Begin user surveys of NAS saltwater fishermen and crabbers to calculate effort and quality of experience.	VII-30	FY23 (update every 5-7 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.2 (user surveys) under EPR# 0428AJCS12
VII	VII.18	Calculate catch-per-unit effort using biological data and user surveys.	VII-30	FY23 (update every 5-7 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.2 (user surveys) under EPR# 0428AJCS12
VII	VII.19	Determine fish mortality rates for use in setting creel limits.	VII-30	As necessary	Fish & Wildlife	3	
VII	VII.20	Continue specific surveys for aquatic threatened and endangered species and maintain this data in GRX.	VII-30	FY24 (update every 5-10 years)	O&MN	1	under EPR #0428A29809
VII	VII.21	Conduct annual monitoring surveys to assess the status of known aquatic threatened and endangered species.	VII-30	As Applicable	O&MN	1	Combined with Project VII.20 (aquatic species surveys) under EPR #0428A29809
VII	VII.22	Develop and implement recovery plans for aquatic threatened and endangered species.	VII-30	As Necessary	O&MN	1	Combined with Project VII.20 (aquatic species surveys) under EPR# 0428A29809
VII	VII.23	Conduct periodic monitoring surveys to determine population trends of non-game aquatic species.	VII-30	FY23 (every 3 years)	O&MN	3	Combined with Project VII.28 under EPR# 0428A29721
VIII	VIII.1	Eliminate all alien plants, as they can artificially encourage wildlife to overpopulate.	VIII-22	Annual	O&MN	1	Combined with Project V.5 (control invasives) under EPR# 0428A29259
VIII	VIII.2	Maintain most woody vegetation in old field areas at low density and where practicable, shift the assemblage to a native grass/composite species mixture through use of controlled burning, mowing or other similar manipulation every three to five years.	VIII-22	Periodic	O&MN or Forestry Reserve	3	Combined with Project VI.5 (prescribed burning) under EPR# 0428AJS22A

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VIII	VIII.3	Enhance biodiversity, restore native plant communities and treat lands with a high degree of alien plant species with herbicide or, where possible, repeated mowings.	VIII-22	Annual	O&MN	1	Combined with Project V.5 (control invasives) under EPR# 0428A29259
VIII	VIII.4	Expand the nest-box program to also include structures for the American Kestrel (*Falco spavarius*) at Fishing Point or other appropriate open spaces.	VIII-23	FY23	Fish & Wildlife	3	
VIII	VIII.5	The nest-box program should have adequate personnel assigned to handle the weekly monitoring necessary for nest boxes. This level of upkeep is necessary to keep production at its maximum and limit nest parasites. In addition, suitable protection against predators should be provided to the nest boxes.	VIII-23	Annual	O&MN	3	Combined with Project VI.2 (monitor FIDS) under EPR#0428A20975
VIII	VIII.6	Least Terns have not been observed on NAS since 2000-2001 nesting season. Least Terns also historically nested at Cedar Point Beach. At this favorable location, Least Tern occupation, breeding activity and nesting should be encouraged and enhanced by reducing the human disturbance on the beach, such as through public education signs and published articles in the Station newspaper, and by creating more beach on Cedar Point for use as nesting habitat.	VIII-28	FY23 (update every 3 years)	O&MN	1	under EPR# 0428A29481
VIII	VIII.7	The first step in understanding the status of listed wildlife is accomplished by continuing specific biological surveys to identify and document all species with special protection status. The newly acquired Grayson parcel, for example, must be surveyed to document presence or absence of rare species prior to an construction or habitat changes on the parcel.	VIII-29	Annual	O&MN	1	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060
VIII	VIII.8	Continue comprehensive survey efforts to monitor known listed or candidate species.	VIII-29	Annual	O&MN	1A	FY24 (for new Grayson parcel), then in FY26, both under EPR# 0428A29060

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VIII	VIII.9	Locate newly listed or candidate species and/or taxa that have not yet been adequately researched (primarily invertebrates).	VIII-29	Annual	O&MN	1	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060
VIII	VIII.10	NR, in collaboration with Air Operations and the Center for Conservation Biology out of the College of William and Mary, is conducting a project to trap Bald Eagles and place GPS transmitters on them to track their movements.	VIII-30	FY23-FY24	O&MN	1	under EPR#0428AJCS08
VIII	VIII.11	Annual aerial survey for Bald Eagle nests performed by NR Program. Investigate all NAS property and flight corridors for nesting eagles. Continue this survey, as it is mission critical to closely monitor those birds that nest in close proximity to the Base.	VIII-30	Annual	O&MN	1	under EPR# 0428AJCS10
VIII	VIII.12	In general, mist-netting should be repeated at PAX and WOLF at least every five years in order to reevaluate occurrence of all listed, candidate and proposed bat species.	VIII-31	FY24 (every 5 years)	O&MN	1	under EPR#0428AJCS05
VIII	VIII.13	NR staff should continue stationary acoustic bat surveys (in-house) and include analysis of these recordings in the next bat survey contract.	VIII-31	Annual	O&MN	2	Combine with Projects VI.2 (monitoring FIDS) under EPR# 0428A20975 and VIII.31 (terrapin surveys) under EPR#0428A20675
VIII	VIII.14	In order to determine relative population status of the Northeastern Beach Tiger Beetle at PAX, future survey efforts should focus on repeated adult surveys (at least 2-3 days) during peak adult flight period.	VIII-32	Annual	O&MN	1	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060
VIII	VIII.15	To assess the occurrence, distribution, and quality of Monarch Butterfly habitat as well as determine the extent of Monarch Butterfly presence withing the identified habitat, surveys should occur during the active flying season.	VIII-32	FY23-FY25	O&MN	1	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VIII	VIII.21	All known occurrences of rare elements should be re-inventoried at least once in five years – unless changing conditions suggest declines, then more frequent monitoring is warranted.	VIII-35	Every 5 years	O&MN	1A	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060
VIII	VIII.16	NR should conduct additional plant species management on these sites as needed, and consider establishing additional pollinator areas in the future.	VIII-32	FY26 (every 3 years)	O&MN	1	under EPR#0428APOLL1
VIII	VIII.17	Monitor known populations or occurrences of state-listed species to determine changes in abundance.	VIII-33	Annual	O&MN	1	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060
VIII	VIII.18	Update management plans and programs to mitigate any negative impacts to rare species (such as human disturbance, beach erosion, vegetative succession, grounds maintenance, etc.).	VIII-33	As necessary	O&MN	1	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060
VIII	VIII.19	Produce educational materials and develop educational programs to inform Station personnel and the general public on rare species issues.	VIII-34	FY23 (every 3 years)	O&MN	1	Combined with Project VIII.6 above (Least Tern materials) under EPR# 0428A29481
VIII	VIII.20	Species with a rank designation of S1 (highly state rare), a few S2 (state rare), and some SU (state status uncertain) warrant strict in situ conservation with frequent monitoring and active programs to protect the biological communities that support these species. Species with a rank of S3, other S2, and SU (of the subset found to be somewhat abundant) warrant study and tracking, but not absolute protection of every occurrence.	VIII-35	Annual	O&MN	1A	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VIII	VIII.25	Rabies and Lyme disease are both true hazards to human and other mammal health. As the mammals that harbor these threats are present throughout the Station, it is possible for anyone aboard the Station to become exposed to them. The existing education program continues to disseminate basic information on rabies, Lyme disease, tularemia, and West Nile virus (as well as other wildlife-related health hazards) to all Station personnel.	VIII-45	FY23 (every 3 years after)	O&MN	3	Combined with Project VIII.6 above (Least Tern materials) under EPR# 0428A29481
VIII	VIII.22	Census populations of S1 and S2 species should be taken to determine changes in abundance and the effects of current disturbances (mowing, right-of-way management, etc.); prevent direct destruction of these plants; and identify and implement the appropriate cultural practices that would favor expansion of these populations – particularly by developing mowing schedules that would favor successful fruit and seed production.	VIII-35	Bi-Annual/Continual	O&MN	1A	Combined with Project VIII.8 (listed species surveys) under EPR# 0428A29060
VIII	VIII.23	Encroachment of invasive species that would negatively impact rare plant populations should be prevented.	VIII-36	Annual	O&MN	1	Combined with Project V.5 (control invasives) under EPR# 0428A29259
VIII	VIII.24	With assistance from summer interns, NR Program staff will conduct twice weekly [deer] dispersal efforts during the period of 15 May to 31 August.	VIII-41	Annual	O&MN	1	under EPR# 0428AJRS30
VIII	VIII.26	In order to determine deer travel routes adjacent to roadways and within the airfield as a whole, the trapping and radio-tagging effort to monitor deer movements should be continued.	VIII-46	FY23-FY26	O&MN	1	under EPR#0428AJRS20

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
VIII	VIII.27	More quantitative information is needed on small mammals, reptiles, amphibians, and invertebrates to determine and plan for their basic habitat needs.	VIII-46	multiple years, with cycled repetition	O&MN	3	Combined with Project VIII.31 (terrapin surveys) under EPR# 0428A20466, and EPR#0428A20675, and Project VI.2 (monitor FIDS) under EPR#0428A02975
VIII	VIII.28	A Great Blue Heron nest survey is conducted at Bloodsworth Island each year to gauge the viability of the breeding population there. This effort is explicitly requested by the regional USFWS when performing annual INRMP metrics reviews, and should be continued indefinitely.	VIII-49	Annual	O&MN	1	under EPR#0428AJCS11
VIII	VIII.29	A herpetological survey, known locally as the "Frog Log", should be continued and expanded on NAS. Additionally, the Station should be an active participant in the Maryland Amphibian and Reptile Atlas (MARA) project – a 5-year (last conducted 2010-2014) effort to map the distribution of "herps" in the State of Maryland.	VIII-49	Annual	O&MN	2	Combined with Project VIII.24 (large mammal surveys) under EPR#0428AJRS30
VIII	VIII.30	Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) nest monitoring project should be continued indefinitely.	VIII-49	Annual	O&MN	1	under EPR# 0428A20466 and EPR# 0428A20675
IX	IX.1	Reinstate the hunter survey for planning purposes as well as monitoring progress towards the outdoor recreation goals and objectives.	IX-15	FY23 (update every 4-5 years)	O&MN or Fish & Wildlife	3	Combined with Project VII.2 (user surveys) under EPR#042AJCS12

Chapter	#	Project	Page #	Scheduled Implementation	Funding Source	Budget Priority	Cost Estimate
IX	IX.2	Consider the addition of a hunting simulation range (e.g., a five-stand sporting clays range) to provide a blend of recreational benefit and hands-on hunter safety training and practice.	IX-16	As necessary	NAF or Fish & Wildlife	3	
IX	IX.3	Implement plans for observation platforms and nature trails in the areas of Chapel Cove and Fort Point. This effort can include: A) Chapel Cove - observation deck, mulch trail and signage, visitor brochures, and handicap access; and B) Fort Point Cove - small parking lot and a 150-foot boardwalk to the observation deck.	IX-16	FY23-25	Ag Outlease, NAF or O&MN	3	Combined with Project X.1 (accessible nature) under EPR#0428AWWPO1
IX	IX.4	Expand efforts to maintain scenic vistas. This may be facilitated by clearly identifying them with discreet signs and incorporating them into the driving tour (see Project X-2).	IX-19	As necessary	NAF, Fish & Wildlife, or Natl. Public Lands Day	3	
IX	IX.5	Establish an archery range as a recreational opportunity.	IX-19	As necessary	NAF or Fish & Wildlife	3	
IX	IX.6	In light of the population influx associated with base realignment, design and conduct visitor surveys, as well as visitor mapping and other visitor analysis techniques, in order to identify levels of use, areas of use, and participants' preferences for outdoor recreation opportunities. Evaluate information collected in order to assess the feasibility of implementing recreational desires in a manner that is cost-effective, sensitive to the Station's mission, and compatible with other natural resources goals and objectives.	IX-20	FY23 (update every 4-5 years)	NAF or Natl. Public Lands Day	3	Combined with Project VII.2 (user surveys) under EPR#0428AJCS12
X	X.1	Establish handicap-accessible Watchable Wildlife programs at PAX and WOLF (with Public Affairs providing maps and brochures).	X-4	FY23-25	Ag Outlease, NAF or O&MN	1	under EPR#0428AWWP01
X	X.2	Expand the PAX and WOLF driving tours, which highlight the abundant natural and cultural resources on the Station	X-4	As necessary	O&MN	3	Combined with Project VIII.6 (least tern materials) under EPR#0428A29481

Table B-3. Completed Projects

Chapter	Completed Project Description	Location	Timeframe	Comments
All	Revise INRMP to incorporate new GIS information, policy updates, updated project details, etc.	PAX and WOLF	FY09-12	Completed and delivered; future updates/revisions should be conducted in-house
III	Identify, locate and map all nuisance or invasive plant species at all Station properties.	all properties	FY03-10	Completed and delivered; repeat effort every 5-10 years (depending on infestation level)
V	Implement shoreline protection measures for significant problem areas as they occur.	multiple properties	FY05-FY12	Designed shoreline work inside Chesapeake Basin (no funding for construction yet); repair both sidewalls and top decking of Chesapeake Basin; repair seawall/shoreline east of West Basin; repair Point No Point and Bay Forest theodolite shorelines
V	Update mapped wetlands resource data in the Station GIS so that project planners have more reliable constraint information when sighting projects.	WOLF	FY10-12	Field work completed; GIS data-capture and report pending
V	Conversion of airfield clear zone to native warm-season grasses	PAX	FY06-12	Will continue to treat invasive species (as they arise) via chemical treatment or prescribed burning
VI	Study on noise levels and the degree of attenuation by current forest resources; provide report	PAX	FY07-11	Studies completed; report forthcoming
VI	Complete and incorporate the Installation Wildland Fire and Prescribed Burn Management Plan into the INRMP.	PAX and WOLF	FY10-12	Completed and delivered; referenced in revised INRMP
VII	Repair Chesapeake Bay fishing pier after tropical storm damage (replace decking and rails).	PAX	FY09	Completed
VII	Repair Chesapeake Bay fishing pier after tropical storm damage (replace lighting).	PAX	FY09	Completed

Chapter	Completed Project Description	Location	Timeframe	Comments
VII	Non-game aquatic species surveys/assessments (to include rare species); provide management plan	PAX	FY07-09	Completed and delivered
VII	Assess stream barriers at WOLF, such as culverts and dams that inhibit fish access to upstream spawning areas, and compare information gathered to that found in the 1996 impediments report. This work has already been completed for NAS PAX.	PAX and WOLF	FY07-12	Completed; repeat efforts every 5-7 years
VII	Map known stream blockages in Maps and Floor Plans.	PAX and WOLF	FY07-12	Completed; repeat efforts every 5-7 years
VII	Modify or remove, possibly in cooperation with the Maryland Department of Natural Resources' Fisheries Division, any existing structures or blockages to fish movements.	PAX and WOLF	FY07-12	Completed; repeat efforts every 5-7 years
VII	Conduct baseline inventories for non-game aquatic species at PAX and WOLF.	PAX and WOLF	FY19-20	Completed; repeat efforts every 5-7 years
VII	Conduct specific surveys for aquatic threatened and endangered species at NAS PAX.	PAX	FY07-08	Completed; repeat efforts every 5-7 years and conduct similar surveys at WOLF
VIII	Create biodiversity data base application in order to record and report on species occurrences	all properties	FY06-08	Completed and delivered
VIII	Created rare species database application in order to record, report on, and manage occurrences of rare species	all properties	FY06-08	Completed and delivered
VIII	A draft BASH management plan should be finalized and fully implemented.	PAX and WOLF	FY12	Plan completed; Final BASH management plan has been provided to Air Operations for primary implementation.
VIII	The Complex should develop a system to monitor and report all local bird strike hazards.	PAX and WOLF	FY12	Completed with signing of Station BASH Plan
X	Improve permit (hunting and fishing) sales procedure, ideally implementing web-based sales.	all properties	FY09-11	Completed and delivered; use permit sales funds for updates to system as needed

Chapter	Completed Project Description	Location	Timeframe	Comments
X	Provide signage identifying locations of and directions to cultural and natural resources features that provide recreational opportunities.	PAX and WOLF	FY99-03	Completed and delivered
X	Provide interpretive signage identifying unique natural and cultural resources features.	PAX and WOLF	FY99-03	Completed and installed

APPENDIX C

BIODIVERSITY DATABASE FOR NAS PATUXENT RIVER COMPLEX

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Table C-1. NAS Avian Species.

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	**PAX[1]**		**WOLF[1]**		**SOL[1]**		**BIR[1]**			**Global**	**State**	**Federal**	**State**			
Scientific name	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**		**Rank**	**Rank**	**Status**	**Status**			
Common Loon		X		X		X		X	C3	G5				X	O	Open water
Gavia immer																
Red-throated Loon		X		X					U	G5				X	O	Open water
Gavia stellata																
Red-necked Grebe		X				X			R6	G5					O	Open water
Podiceps grisegena																
Horned Grebe		X		X		X		X	C	G5				X	O	Open water
Podiceps auritus																
Eared Grebe		X		X					V	G5					M	Open water
Podiceps nigricollis																
Pied-billed Grebe		X		X		X			U, ~B	G5	S2S3B			X	R	Open water
Podilymbus podiceps																
Wilson's Storm-petrel		X							R2	G5					S	Open water
Oceanites oceanicus																
Northern Gannet		X						X	U3	G5					M	Open water
Morus bassanus																
American White Pelican		X							U2	G4					M	Open water
Pelecanus erythrorhynchos																
Brown Pelican		X		X		X		X	U1	G4	S1B			X	S	Open water
Pelecanus occidentalis																
Great Cormorant		X		X		X			U	G5				X	O	Open water
Phalacrocorax carbo																
Double-crested Cormorant		X		X		X		X	C21	G5					S	Open water
Phalacrocorax auritus																
Least Bittern	PO		PO					X	R, B	G4G5	S2S3B		I	X	S	Dense freshwater marshes w/ reeds
Ixobrychus exilis																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
American Bittern		X	PR					X	R1	G5	S1B		T	X	S	Marshes
Botaurus lentiginosus																
Black-crowned Night Heron		X						X	U10, ~B	G5	S3B, S2N			X	S	Marshes
Nycticorax nycticorax																
Yellow-crowned Night Heron		X	PR			X		X	R9	G5	S3B			X	S	Tidal mudflats, marshes, river margins, rocky shores
Nyctanassa violacea																
Green Heron		X		X		X		X	C, B	G5					R	Wooded wetlands, lakesides
Butorides striatus																
Tricolored Heron		X	PR					X	R15, ~B	G5	S3B			X	S	Marshes
Egretta tricolor																
Little Blue Heron		X	PR					X	U12, ~B	G5	S3B			X	S	Marshes
Egretta caerulea																
Cattle Egret		X						X	U	G5					S	Open fields
Bubulcus ibis																
Snowy Egret		X		X		X		X	U1, ~B	G5	S3B			X	S	Marshes
Egretta thula																
Great Egret		X		X		X		X	U4, B	G5	S3S4B				S	Marshes
Casmerodius albus																
Great Blue Heron		X		X		X		X	C350, B	G5					R	Marshes, wooded wetlands
Ardea herodias																
Glossy Ibis		X						X	R27, ~B	G5	S3B			X	S	Marshes
Plegadis falcinellus																
White Ibis		X	UN					X	V1	G5				X	M	Marshes, swamps, mangroves
Eudocimus albus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Tundra Swan		X		X		X		X	U	G5				X	O	Marshes, open water
Cygnus columbianus																
Mute Swan		X		X		X		X	R6, B	G5					O	Marshes
Cygnus olor																
Snow Goose		X						X	R2	G5				X	O	Marshes
Chen caerulescens																
Canada Goose		X		X		X		X	C2, B	G5				X	R	Throughout
Branta canadensis																
Brant		X						X	R2	G5				X	O	Marshes
Branta bernicla																
Mallard		X		X		X		X	U7, B	G5				X	R	Marshes, ponds
Anas platyrhynchos																
American Black Duck		X		X		X		X	U19, B	G5				X	O	Marshes
Anas rubripes																
Gadwall		X		X				X	U	G5	S2B			X	O	Marshes
Mareca strepera																
Green-winged Teal		X		X				X	C62	G5				X	O	Marshes
Anas crecca																
American Wigeon		X							R1	G5				X	O	Marshes
Mareca americana																
Northern Pintail		X		X				X	R	G5				X	O	Marshes
Anas acuta																
Northern Shoveler		X							R1	G5				X	O	Marshes, open water
Spatula clypeata																
Blue-winged Teal		X		X				X	U15, ~B	G5	S1B			X	O	Marshes, ponds
Spatula discors																
Ruddy Duck		X		X		X			C	G5					O	Open water
Oxyura jamaicensis																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Wood Duck		X		X		X			C, B	G5				X	R	Wooded wetlands
Aix sponsa																
Canvasback		X		X		X		X	C	G5				X	O	Marshes, open water
Aythya valisineria																
Redhead		X		X				X	R6	G5				X	O	Marshes
Aythya americana																
Ring-necked Duck		X							U	G5				X	O	Marshes
Aythya collaris																
Greater Scaup		X		X		X			C	G5				X	O	Open water
Aythya marila																
Lesser Scaup		X		X		X			C	G5				X	O	Open water
Aythya affinis																
Common Eider		X							R2	G5				X	O	Open water
Somateria mollissima																
Black Scoter		X		X		X		X	U	G5				X	O	Open water
Melanitta nigra																
White-winged Scoter		X				X		X	U	G5				X	O	Open water
Melanitta deglandi																
Surf Scoter		X		X		X		X	U	G5				X	O	Open water
Melanitta perspicillata																
Harlequin Duck		X							R5	G4				X	O	Open water
Histrionicus histrionicus																
Long-tailed Duck		X		X		X		X	Ab	G5				X	O	Open water
Clangula hyemalis																
Barrow's Goldeneye		X							V2	G5				X	O	Open water
Bucephala islandica																
Common Goldeneye		X		X		X		X	Ab	G5				X	O	Open water
Bucephala clangula																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Bufflehead		X		X		X		X	Ab75	G5				X	O	Open water
Bucephala albeola																
Common Merganser		X		X				X	C	G5	S2B			X	O	Open water
Mergus merganser																
Red-breasted Merganser		X		X		X			U	G5				X	O	Open water
Mergus serrator																
Hooded Merganser		X		X		X			U	G5	S3B			X	O	Open water
Lophodytes cucullatus																
King Rail		X							R1, B	G5	S2B			X	R	Freshwater or brackish marshes
Rallus elegans																
Clapper Rail		X		X		X		X	U, B	G5				X	R	Salt marshes
Rallus crepitans																
Virginia Rail		X		X		X		X	U, B	G5				X	R	Freshwater or brackish marshes
Rallus limicola																
Sora		X		X				X	U	G5	S2B				R	Freshwater or brackish marshes
Porzana carolina																
Eastern Black Rail	UN		UN						R	G3	S1	T	E	X	?	Marshes, swamps, wet meadows
Laterallus j. jamaicensis																
Common Gallinule		X	PO						R2, B	G5	S2S3B		I		O	Freshwater marshes
Gallinula galeata																
American Coot		X	PR			X			R4	G5	S1B				M	Freshwater marshes, wetlands
Fulica americana																
Sandhill Crane		X	UN						R1	G5					?	Sandy beaches, dunes
Antigone canadensis																
American Oystercatcher		X	UN					X	R2	G5	S3B			X	?	Coastal beaches and mudflats
Haematopus palliatus																
American Avocet		X	UN						R	G5					?	Shallow ponds, marshes, lakeshores
Recurvirostra americana																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Piping Plover		X	UN						R4	G3	S1B	LT	E	X	?	Sandy beaches, dunes
Charadrius melodus																
Semipalmated Plover		X		X				X	U	G5					S	Beaches, lakeshores, tidal flats
Charadrius semipalmatus																
Killdeer		X		X		X			C, B	G5					R	Open ground, usually gravel
Charadrius vociferus																
Black-bellied Plover		X						X	U	G5				X	R	Sandy beaches, open fields
Pluvialis squatarola																
American Golden-Plover		X							V3	G5					?	Open fields
Pluvialis dominica																
Whimbrel		X						X	R2	G5				X	S	Beaches, mud flats, wet fields
Numenius phaeopus																
Willet		X		X				X	U9, B	G5				X	S	Wet fields, marshes, beaches
Tringa semipalmata																
Greater Yellowlegs		X		X				X	C	G5				X	M	Coastal mud flats, marshes
Tringa melanoleuca																
Lesser Yellowlegs		X		X				X	U	G5				X	S	Open woodlands, sheltered tundra
Tringa flavipes																
Solitary Sandpiper		X		X		X			U	G5				X	S	Shallow backwaters, pools, small estuaries, maybe rain puddles
Tringa solitaria																
Spotted Sandpiper		X		X		X			C	G5	S3S4B				S	Sheltered streams, ponds. marshes
Actitis macularius																
Wilson's Phalarope		X							V	G5					?	Grassy borders of shallow lakes,marshes, reservoirs
Phalaropus tricolor																
Red-necked Phalarope		X							V	G4G5					M	tundra
Phalaropus lobatus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Short-billed Dowitcher		X							R1	G5				X	M	Mud flats
Limnodromus griseus																
Long-billed Dowitcher	UN							X	U	G5					?	Mud flats
Limnodromus scolopaceus																
Wilson's Snipe		X		X					U	G5				X	O	Marshes and bogs
Gallinago delicata																
American Woodcock		X		X		X			U, B	G5				X	R	Moist woodlands and thickets
Scolopax minor																
Ruddy Turnstone		X		X				X	R3	G5				X	M	Coastal tundra
Arenaria interpres																
Purple Sandpiper		X	UN						R	G5				X	?	Rocky shores, jetties
Calidris maritima																
Rufa Red Knot		X						X	R	G4T2	S1M	T	T	X	M	Sandy beaches and mud flats
Calidris canutus rufa																
Dunlin		X						X	R1	G5				X	M	Wet habitats
Calidris alpina																
Sanderling		X		X		X			U	G5				X	M	Sandy beaches, along surf's edge
Calidris alba																
Semipalmated Sandpiper		X				X		X	U	G5				X	M	Wet habitats
Calidris pusilla																
Western Sandpiper		X				X			?	G5				X	M	Wet habitats
Calidris mauri																
Least Sandpiper		X		X		X		X	R4	G5					M	Wet habitats
Calidris minutilla																
White-rumped Sandpiper		X		X					V	G5					M	Wet habitats
Calidris fuscicollis																
Baird's Sandpiper		X							V	G5					M	Upper beaches, lakeshores, wet field
Calidris bairdii																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Pectoral Sandpiper		X							U	G5					R	Wet meadows, marshes, pond edges
Calidris melanotos																
Upland Sandpiper		X		X					U	G5	S1B		E	X	M	Shortgrass fields
Bartramia longicauda																
Buff-breasted Sandpiper		X							V2	G4				X	?	Shortgrass fields, wet rice fields
Tryngites subruficollis																
Laughing Gull		X		X		X		X	Ab, ~B	G5	S1B			X	S	Along coast, farm fields, parking lot, landfills
Leucophaeus atricilla																
Bonaparte's Gull		X		X		X		X	R11	G5				X	S	Along coast, farm fields, parking lot, landfills
Chroicocephalus philadelphia																
Black-headed Gull		X							R1	G5					?	Along coast, farm fields, parking lot, landfills
Chroicocephalus ridibundus																
Ring-billed Gull		X		X		X		X	Ab	G5					S	Along coast, farm fields, parking lot, landfills
Larus delawarensis																
Herring Gull		X		X		X		X	Ab5	G5					R	Along coast, farm fields, parking lot landfills
Larus argentatus																
Glaucous Gull		X							U	G5					?	Beaches
Larus hyperboreous																
Lesser Black-backed Gull		X							R2	G5				X	?	Along coast, farm fields, parking lot, landfills
Larus fuscus																
Great Black-backed Gull		X		X		X		X	C3	G5					R	Along coast, farm fields, parking lot, landfills
Larus marinus																
Common Tern		X				X		X	R15, ~B	G5	S1B		E	X	S	Along coasts, beaches
Sterna hirundo																
Roseate Tern	PO/ UN		UN						?	G4	SXB	LE	X	X	?	Along coast, beaches, saltwater marshes
Sterna dougallii																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Forster's Tern		X		X		X		X	U1	G5	S2B		I	X	S	Along coast, beaches, saltwater marshes
Sterna forsteri																
Gull-billed Tern	PO		PO						R	G5	S1B		E	X	?	Along coast, beaches, saltwater marshes
Gelochelidon nilotica																
Least Tern		X	PR						U, B	G4	S2B		T	X	S	Along coast, beaches, saltwater marshes
Sternula antillarum																
Black Tern		X							R4	G4G5					S	Along coast, beaches, saltwater marshes
Chlidonias niger																
Sandwich Tern		X	UN						U	G5	S1B				?	Along coast, beaches, saltwater marshes
Thalasseus sandvicensis																
Royal Tern		X		X		X		X	R5	G5	S1B		E	X	S	Along coast, beaches, saltwater marshes
Thalasseus maximus																
Caspian Tern		X							U	G5					S	Along coasts, beaches
Hydroprogne caspia																
Black Skimmer		X	PO						R4	G5	S1B		E	X	S	Along coasts, beaches
Rynchops niger																
Turkey Vulture		X		X		X		X	Ab1, B	G5					R	Throughout
Cathartes aura																
Black Vulture		X		X		X		X	C, B	G5					R	Throughout
Coragyps atratus																
Golden Eagle		X							R1	G5				X	?	Throughout
Aquila chrysaetos																
Bald Eagle		X		X		X		X	U2, B	G5	S3S4			X	R	Throughout
Haliaeetus leucocephalus																
Mississippi Kite		X							V	G5					?	Open woodlands, swamps
Ictinia mississippiensis																
Northern Harrier		X		X		X		X	C7, B	G5	S2B		I	X	O	Wetlands, open fields
Circus hudsonius																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Sharp-shinned Hawk		X		X		X			C	G5	S2S3B				R	Mixed woodlands
Accipiter striatus																
Cooper's Hawk		X		X		X			U, B	G5					R	Deciduous broken woodlands
Accipiter cooperii																
Northern Goshawk		X	PO						R2	G5	S1B		E		?	Conifer-dominated mixed woodlands
Accipiter gentilis																
Red-shouldered Hawk		X		X		X		X	C, B	G5					R	Moist, mixed woodlands
Buteo lineatus																
Broad-winged Hawk		X		X				X	U, B	G5				X	R	Forests
Buteo platypterus																
Red-tailed Hawk		X		X		X		X	C, B	G5					R	Woods with nearby open fields
Buteo jamaicensis																
Rough-legged Hawk		X							R5	G5					O	Open fields
Buteo lagopus																
Osprey		X		X		X		X	C30, B	G5					S	Throughout
Pandion haliaetus																
American Kestrel		X		X		X		X	C, B	G5					R	Open fields, telephone wires
Falco sparverius																
Merlin		X		X		X			R8	G5					O	Open woods, marshes
Falco columbarius																
American Peregrine Falcon		X		X		X		X	R8	G4T4	S2B		I	X	M	Open fields, bluffs
Falco peregrinus anatum																
Northern Bobwhite		X		X					Ab, B	G4G5				X	R	Open fields, young woodlands
Colinus virginianus																
Ring-necked Pheasant		X							R	G5					R	Open fields, woodland edges
Phasianus colchicus																
Wild Turkey		X		X					U, B	G5					R	Open forested areas
Meleagris gallopavo																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Rock Pigeon		X		X		X			Ab, B	G5					R	High window ledges, bridges, barns, parks, and fields
Columba livia																
Mourning Dove		X		X		X		X	Ab, B	G5				X	R	Grassy fields, farm fields, backyard feeders, town parks
Zenada macroura																
White-winged Dove		X							V1	G5					?	Riparian woodlands, deserts, citrus groves
Zenada asiatica																
Yellow-billed Cuckoo		X		X		X		X	C, B	G5					S	Open woodlands, orchards, stream-side willow and alder groves
Coccyzus americanus										G5						
Black-billed Cuckoo		X							U					X	S	Woodlands and along streams
Coccyzus erythropthalmus																
Barn Owl		X		X				X	U, B	G5	S2B		I		R	Farm buildings, cliffs, dark cavities
Tyto alba																
Short-eared Owl		X		X					U	G5	S1B		E	X	O	Near the ground, open country
Asio flammeus																
Long-eared Owl		X	PR						R4	G5	S1B			X	M	Thick woods, open fields, marshes
Asio otus																
Great Horned Owl		X		X		X		X	C, B	G5					R	Forests
Bubo virginianus																
Barred Owl		X							C, B	G5					R	Coniferous or mixed woods, upland woods
Strix varia																
Snowy Owl		X	PO						V	G4				X	M	Tundra
Bubo scandiacus																
Eastern Screech-Owl		X		X		X			C, B	G5					R	Woodlots, forests, swamps, orchard, suburban gardens
Megascops asio																
Northern Saw-whet Owl		X	PR						R2	G5	S1B				M	Dense coniferous or mixed forests, wooded swamps
Aegolius acadicus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Chuck-will's-widow		X		X					C, B	G5					S	Oak-pine woodlands
Antrostomus carolinensis																
Eastern Whip-poor-will		X	PR						U, B	G5	S3S4B			X	S	Open coniferous and mixed woodland
Antrostomus vociferus																
Common Nighthawk		X		X					U, B	G5	S2S3B			X	S	Open woodlands, suburbs, towns, on ground
Chordeiles minor																
Chimney Swift		X		X		X		X	C, B	G4				X	S	Chimneys, barns, hollow trees
Chaetura pelagica																
Ruby-throated Hummingbird		X		X		X		X	C, B	G5					S	Gardens and woodland edges
Archilochus colubris																
Belted Kingfisher		X		X		X		X	C, B	G5					S	Rivers, ponds, lakes, and estuaries
Megaceryle alcyon																
Red-bellied Woodpecker		X		X		X			C, B	G5					R	Open woodlands, parks
Melanerpes carolinus																
Northern Flicker		X		X		X			C, B	G5				X	R	Open woodlands, suburban areas, feed on ground
Colaptes auratus																
Red-headed Woodpecker		X		X		X			U, B	G5				X	S	Open woods, farmlands, backyards
Melanerpes erythrocephalus																
Yellow-bellied Sapsucker		X		X		X			U	G5	S1B				R	Mixed forests
Sphyrapicus varius																
Downy Woodpecker		X		X		X			C, B	G5					R	Suburbs, forests, orchards
Dryobates pubescens																
Hairy Woodpecker		X		X					C, B	G5					R	Open and dense forests
Dryobates villosus																
Pileated Woodpecker		X		X					U, B	G5					R	Dense, mature forests, or second-growth woodlands
Dryocopus pileatus																
Eastern Kingbird		X		X		X		X	C	G5				X	R	Woodland clearings, farms, orchards
Tyrannus tyrannus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Great Crested Flycatcher		X		X		X			C, B	G5				X	S	Open woods
Myiarchus crinitus																
Ash-throated Flycatcher		X							V1	G5					?	Deserts, chaparral, woodlands
Myiarchus cinerascens																
Olive-sided Flycatcher		X	PR						R1	G4	SHB		X	X	?	Coniferous forests, bogs
Contopus borealis																
Eastern Wood-Pewee		X		X				X	C, B	G5				X	S	Woodland areas, mature deciduous forests to urban shade trees
Contopus virens																
Eastern Phoebe		X		X		X			C, B	G5					S	Woodlands, farmlands, suburbs
Sayornis phoebe																
Least Flycatcher		X	PR						R1	G5	S3S4B				M	Open deciduous woods, orchards, parks
Empidonax minimus																
Acadian Flycatcher		X		X					C, B	G5				X	S	Deep shade of mature woodlands, swamps
Empidonax virescens																
Willow Flycatcher		X				X			R2	G5					S	Dry, bushy upland pastures, along streams, near hawthorns
Empidonax traillii																
Alder Flycatcher		X	PR						R1	G5	S2B		I		?	Bogs, ponds, birch and alder thicket
Empidonax alnorum																
Yellow-bellied Flycatcher		X							R1	G5					S	Bogs, swamps, damp coniferous woods
Empidonax flaviventris																
Horned Lark		X		X					U, B	G5					R	Dirt fields, gravel ridges, shores
Eremophila alpestris																
Tree Swallow		X		X		X		X	C2, B	G5					S	Wooded habitat near water, esp. with dead trees available
Tachycineta bicolor																
Purple Martin		X		X		X		X	C, B	G5					S	Where suitable nest sites exist
Progne subis																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Bank Swallow		X		X		X			U, B	G5	S3B			X	S	Steep river banks, gravel pits
Riparia riparia																
Northern Rough-winged Swallow		X		X		X			U, B	G5					S	Riverbanks, cliffs, culverts, and under bridges
Stelgidopteryx serripennis																
Cliff Swallow		X							R1	G5					M	Bridges, rural settlements, open country on cliffs
HIrundo pyrrhonota																
Barn Swallow		X		X		X		X	Ab4, B	G5					S	Farm buildings, under bridges, inside culverts
Hirundo rustica																
Blue Jay		X		X		X			Ab, B	G5					R	Suburbs, parks, woodlands
Cyanacitta cristata																
American Crow		X		X		X			Ab, B	G5					R	Throughout
Corvus brachyrhynchos																
Fish Crow		X		X		X		X	C4, B	G5				X	R	Estuarine marshes, along eastern river systems
Corvus ossifragus																
Tufted Titmouse		X		X		X			C, B	G5					R	Deciduous woodlands, parklands
Baeolophus bicolor																
Carolina Chickadee		X		X		X		X	C, B	G5				X	R	Open deciduous forests, woodland clearings and edges
Poecile carolinensis																
Brown Creeper		X		X		X			U, B	G5	S3B				O	Coniferous, mixed, or swampy forest
Certhia americana																
White-breasted Nuthatch		X		X		X			U, B	G5					O	Leafy trees
Sitta carolinensis																
Red-breasted Nuthatch		X		X		X			U	G5	S3B				O	Conifers
Sitta canadensis																
Brown-headed Nuthatch		X		X					U, B	G5				X	R2O	Pine woodlands
Sitta pusilla																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
House Wren		X		X		X		X	U, B	G5					S	Brush and shrub, orchards, parks farmyards
Troglodytes aedon																
Winter Wren		X		X		X			U	G5	S2B				O	Dense brush, along stream banks, moist coniferous woods
Troglodytes hiemalis																
Carolina Wren		X		X		X		X	C, B	G5					R	Underbrush of moist woodlands and swamps
Thryothorus ludovicianus																
Marsh Wren		X		X				X	C6, B	G5				X	R	Reedy marshes, cattail swamps
Cistothorus palustris																
Sedge Wren		X	PO					X	R1, ~B	G5	S1B		E	X	M	Wet, grassy meadows; shallow sedge marshes
Cistothorus platensis																
Golden-crowned Kinglet		X		X					U	G5	S3B				O	Coniferous woodlands
Regulus satrapa																
Ruby-crowned Kinglet		X		X					U	G5					O	Woodlands, thickets
Regulus calendula																
Blue-gray Gnatcatcher		X		X		X			C, B	G5					S	Woodlands, thickets, chaparral
Polioptila caerulea																
Eastern Bluebird		X		X		X			C, B	G5					R	Open woodlands, farmlands, orchard
Sialia sialis																
Wood Thrush		X		X					Ab, B	G4				X	R	Swamps, moist deciduous forests
Hylocichla mustelina																
Veery		X							C	G5					S	Dense, moist woodlands, stream-side thickets
Catharus fuscescens																
Swainson's Thrush		X		X					U	G5	SHB		X		S	Moist woods, swamps, thickets
Catharus ustulatus																
Gray-cheeked Thrush		X						X	U	G5					S	Coniferous or mixed woodlands
Catharus minimus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Bicknell's Thrush		X							?	G4				X	?	Mountain coniferous or mixed woodlands
Catharus bicknelli																
Hermit Thrush		X		X		X			R9	G5	S4B				R	Coniferous or mixed woodlands
Catharus guttatus																
American Robin		X		X		X			Ab, B	G5					R	Woodlands, swamps, parks, lawns
Turdus migratorius																
Loggerhead Shrike		X	PO						R2	G4	S1B		E	X	?	Open or brushy areas
Lanius ludovicianus																
Gray Catbird		X		X		X		X	C, B	G5				X	R	Low, dense thickets in deciduous woodlands and residential areas
Dumetella carolinensis																
Northern Mockingbird		X		X		X			C, B	G5					R	Rural thickets, woodland edges
Mimus polyglottos																
Brown Thrasher		X		X		X			C, B	G5				X	R	Hedgerows, brush, woodland edges
Toxostoma rufum																
American Pipit		X		X					R2	G5					M	Fields and beaches
Anthus rubescens																
Cedar Waxwing		X		X		X			C, B	G5					R	Open habitats
Bombycilla cedrorum																
European Starling		X		X		X		X	Ab, B	G5					R	Throughout
Sturnus vulgaris																
White-eyed Vireo		X		X		X			C, B	G5					S	Dense, moist thickets
Vireo griseus																
Yellow-throated Vireo		X				X			U, B	G5				X	S	Mixed woodlands
Vireo flavifrons																
Blue-headed Vireo		X							C	G5					S	Mixed woodlands
Vireo solitarius																
Red-eyed Vireo		X		X		X			C, B	G5					S	Woodlands
Vireo olivaceus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Warbling Vireo		X				X			U	G5					S	Open deciduous woods
Vireo gilvus																
Philadelphia Vireo	PO/UN								R	G5					?	Open woodlands, burned areas, streamside willows and alders
Vireo philadelphicus																
Prothonotary Warbler		X							U, B	G5				X	S	Low along streams or surrounded by stagnant water, cavity nester
Protonotaria citrea																
Blue-winged Warbler		X							U	G5				X	M	Brushy meadows, second-growth woodlands
Vermivora cyanoptera																
Golden-winged Warbler	PO		PO						R	G4	S2B		I	X	M	Overgrown pastures, briery wooded borders
Vermivora chrysoptera																
Tennessee Warbler		X							?	G5					?	Coniferous and mixed woodlands in summer, open woodlands in winter
Leiothlypis peregrina																
Orange-crowned Warbler		X							R1	G5					M	Open, brushy, woodlands, forest edges, thickets
Leiothlypis celata																
Nashville Warbler		X		X		X			R1	G5	S1B		T		M	Second-growth woodlands,
Leiothlypis ruficapilla																
Northern Parula		X		X		X			C, B	G5					S	Coniferous or mixed woodlands, esp. near water
Setophaga americana																
Black-and-White Warbler		X		X		X			C, B	G5				X	M	Mixed woodlands
Mniotilta varia																
Black-throated Blue Warbler		X		X		X		X	U	G5	S3S4B			X	S	Deciduous forests
Setophaga caerulescens																
Cerulean Warbler		X	PR						R	G4	S3B			X	M	Tall tree swamps, bottomlands, mixed woodlands near water
Setophaga cerulea																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Blackburnian Warbler		X	PR						R1	G5	S3B			X	M	Coniferous or mixed woodlands
Setophaga fusca																
Chestnut-sided Warbler		X							U	G5					M	Second-growth deciduous woodlands
Setophaga pensylvanica																
Cape May Warbler		X							U	G5				X	M	Black spruce forests
Setophaga tigrina																
Magnolia Warbler		X		X		X			U	G5	S3S4B				M	Moist coniferous forests
Setophaga magnolia																
Yellow-rumped Warbler		X		X		X			C	G5	S2B				M	Coniferous or mixed woodlands
Setophaga coronata																
Black-throated Green Warbler		X				X			U	G5					M	Coniferous or mixed woodlands
Setophaga virens																
Yellow-throated Warbler		X		X					U, B	G5					S	Live oak and pine woodlands
Setophaga dominica																
Prairie Warbler		X		X		X			C, B	G5				X	S	Open woodlands, scrublands, over-grown fields
Setophaga discolor																
Bay-breasted Warbler		X				X			U	G5					M	Open coniferous forests
Setophaga castanea																
Blackpoll Warbler		X		X		X			C	G5				X	M	Coniferous forests
Setophaga striata																
Pine Warbler		X		X		X			C, B	G5					S	Pine forests and mixed woodlands
Setophaga pinus																
Palm Warbler		X		X		X			U	G5					M	Brush at edge of spruce bogs
Setophaga palmarum																
Yellow Warbler		X		X		X		X	U, B	G5					S	Wet habitats, open woodlands
Setophaga petechia																
Mourning Warbler		X	PR						R1	G5	S1B		E		?	Dense undergrowth, thickets, moist woods
Geothylpis philadelphia																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Connecticut Warbler		X							R2	G4G5				X	M	Spruce bogs, moist woodlands
Oporornis agilis																
Kentucky Warbler		X							U, B	G5				X	S	Rich, moist woodlands
Geothylpis formosa																
Canada Warbler		X	PR						U	G5	S3B			X	M	Dense woodlands and brush
Cardellina canadensis																
Wilson's Warbler		X							R1	G5					M	Dense, moist woodlands, bogs, streamside tangles
Cardellina pusilla																
Hooded Warbler		X		X					U, B	G5					S	Swamps, moist woodlands
Setophaga citrina																
Worm-eating Warbler		X		X		X			U, B	G5				X	S	Dense undergrowth on wooded slope
Helmitheros vermivorum																
Swainson's Warbler	PO		PO						R	G4	S1B		E		?	Swamps, canebrakes, rhododendron
Limnothlypis swainsonii																
Ovenbird		X		X					C, B	G5					S	Mature forests
Seiurus aurocapilla																
Louisiana Waterthrush		X							U, B	G5				X	S	Along streams in dense woodlands less often near ponds
Parkesia motacilla																
Northern Waterthrush		X	PR			X			U	G5	S2B		I		M	Woodland swamps, bogs, and thicket s
Parkesia noveboracensis																
Common Yellowthroat		X		X		X		X	C1, B	G5					R	Grassy fields, shrubs, marshes
Geothlypsis trichas																
Yellow-breasted Chat		X		X		X		X	C, B	G5					S	Dense thickets and brush
Icteria virens																
American Redstart		X		X		X		X	C, B	G5					R	Second-growth woodlands
Setophaga ruticilla																
Rose-breasted Grosbeak		X							U	G5				X	M	Open, second-growth woodlands;
Pheucticus ludovicianus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
																dense trees along water courses
Northern Cardinal		X		X		X			C, B	G5					R	Woodland edges, swamps, stream-side thickets, gardens
Cardinalis cardinalis																
Blue Grosbeak		X		X		X			U, B	G5					S	overgrown fields, stream and, woodland edges, brushy roadsides
Guiraca caerulea																
Indigo Bunting		X		X		X			C, B	G5					S	Woodland clearings and borders, brushy pastures
Passerina cyanea																
Eastern Towhee		X		X		X			C, B	G5				X	S	Dense undergrowth, streamside thickets, open and wood edges
Pipilo erythrophthalmus																
Grasshopper Sparrow		X		X					C, B	G5				X	S	Pastures, grasslands, old fields
Ammodramus savannarum																
Henslow's Sparrow	PR		PR						R, ~B	G4	S2B		I	X	?	Wet shrubby fields, weedy meadows
Centronyx henslowii																
Saltmarsh Sparrow		X	PR						R, B	G2	S2B,S1N		I	X	M	Salt marshes, lakeshores, Spartina grass
Ammospiza caudacuta																
Nelson's Sparrow		X								G5				X	?	Dry, open grasslands, farmlands
Ammospiza nelsoni																
Seaside Sparrow		X						X	R4, B	G4				X	S	Grassy tidal marshes
Ammospiza maritima																
Vesper Sparrow		X	PR						U	G5	S4B				M	Dry, open grasslands, farmlands, forest clearings, brush
Pooecetes gramineus																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Savannah Sparrow		X		X		X			U	G5	S4				O	Open habitats, marshes, grasslands
Passerculus sandwichensis																
Song Sparrow		X		X		X		X	C, B	G5					R	Brushy areas, dense streamside thickets
Melospiza melodia																
Lark Sparrow		X	PO						V1	G5	SXB		X		?	Farmlands, Open woodlands,
Chondestes grammacus																
American Tree Sparrow		X							U	G5					O	Weedy fields, marshes, groves of small trees
Spizelloides arborea																
Field Sparrow		X		X		X		X	C, B	G5				X	R	Open, brushy woodlands, fields
Spizella pusilla																
Chipping Sparrow		X		X		X			C, B	G5					S	Grassy fields, woodland edges
Spizella passerina																
Clay-colored Sparrow		X							V2	G5					?	Brushy fields, groves, streamside thickets
Spizella pallida																
Dark-eyed Junco		X		X		X			Ab	G5	S3B				O	Woodland undergrowth, brush
Junco hyemalis																
White-throated Sparrow		X		X		X			C	G5					O	Woodland undergrowth, brush
Zonotrichia albicollis																
White-crowned Sparrow		X		X					C	G5					O	Open woodlands, brushy grasslands
Zonotrichia leucophrys																
Fox Sparrow		X		X		X			U	G5					O	Dense undergrowth in coniferous or mixed woodlands
Passerella iliaca																
Lincoln's Sparrow		X		X					R1	G5					?	Brushy bogs, thickets, hedgerows, brambles
Melospiza lincolnii																
Swamp Sparrow		X		X		X			C, B	G5					R	Tall vegetation, fresh and brackish marshes, swamps, streams
Melospiza georgiana																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Lapland Longspur		X							R3	G5					?	Grassy fields, grain stubble, shores
Calcarius lapponicus																
Snow Bunting		X							R8	G5					M	Sand dunes, beaches, grain stubble, roadsides
Plectrophenax nivalis																
Dickcissel		X	PO						R1	G5	S3B				?	Open weedy meadows, grainfields, prairies
Spiza americana																
Bobolink		X		X					U	G5	S3S4B			X	M	Hayfields, weedy meadows
Dolichonyx oryzivorus																
Eastern Meadowlark		X		X		X		X	U, B	G5					R	Slightly moist fields, meadows
Sturnella magna																
Red-winged Blackbird		X		X		X		X	C2, B	G5					R	Thick vegetation of freshwater marshes, dry fields
Agelaius phoeniceus																
Rusty Blackbird		X		X					R1	G4				X	O	Wet woodlands, swamps, open fields
Euphagus carolinus																
Brown-headed Cowbird		X		X		X			C, B	G5					R	Open woodlands, farmlands, suburbs
Molothrus ater																
Common Grackle		X		X		X			C, B	G5					R	Open fields, marshes, parks
Quiscalus quiscula																
Boat-tailed Grackle		X						X	R36	G5					S	Coastal saltwater marshes
Quiscalus major																
Orchard Oriole		X		X		X		X	U, B	G5					S	Suburban shade trees, orchards, streamside groves
Icterus spurius																
Baltimore Oriole		X				X			U, B	G5				X	S	Open woodlands, river groves
Icterus galbula																
Scarlet Tanager		X		X		X			C, B	G5				X	S	Deciduous forests
Piranga olivacea																

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				DOD PIF SOC[4]	Seasonality[5]	Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State			
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status			
Summer Tanager		X		X		X			U, B	G5					S	Pine-oak woods
Piranga rubra																
House Sparrow		X		X		X			Ab, B	G5					R	Throughout populated areas
Passer domesticus																
Pine Siskin		X		X					U	G5	S2B				O	Coniferous and mixed woods, forest,shrubs, and fields
Spinus pinus																
American Goldfinch		X		X		X			C, B	G5					R	Fields, open second-growth woodlands, thistles, sunflowers
Spinus tristis																
Red Crossbill		X							V	G5					M	Coniferous woods
Loxia curvirostra																
Common Redpoll	UN		PO						V	G5					?	Brushy, weedy areas, catkin bearing trees
Acanthis flammea																
Purple Finch		X	PR						U	G5	S3B, S3N				O	Coniferous or mixed woodlands, park areas, orchards
Haemorhous purpureus																
House Finch		X		X		X			C, Ab	G5					R	Dry lowlands
Haemorhous mexicanus																
Evening Grosbeak		X							R2	G5				X	O	Dry lowlands
Coccothraustes vespertinus																

[1] PR = Probably, PO = Possible, UN = Unlikely.
[2] Ac = Accidental, V = Vagrant, R = Rare, U = Uncommon, C = Common, Ab = Abundant, B = Breeding. When possible, # of sightings given for Ac, V and R.
[3] As of May 2023.
[4] These birds are on the DoD Partners in Flights Birds Species of Concern list for the NAS region. (Details and further SOC breakouts found at: http://www.dodpif.org/BCRMaps/RegionMap_30.htm?BCR=30
[5] R = Resident, M = Migrant, S = Summer, O = Overwinter.

Table C-2. NAS Mammal Species.

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
Opossum		X		X		X			Ab	G5				Wooded bottomlands interspersed with fields near water, adaptable to humans; densely forested areas, lowlands
Didelphis virginiana														
Cinereus Shrew		X		X					R1	G5				Diverse habitats; moist forests with ground cover; not found in Coastal Plain
Sorex cinereus														
Southeastern Shrew		X	PO						R1/U	G5	S3S4			Damp fields, thickets, lowland forests; moist situations
Sorex longirostris														
Eastern Pygmy Shrew	UN		UN						R/U	G5				Along ridges and slopes in deciduous forests with rocks, logs, and leaf litter
Sorex hoyi														
North American Least Shrew		X		X					C	G5				Open areas dominated with herbaceous vegetation, exp. grassy areas, marshes
Cryptotis parva														
Northern Short-tailed Shrew		X		X		X			C, Ab	G5				Most terrestrial environments (marshes, fields, forests); prefer leaf litter; damp woods with thick understory
Blarina brevicauda														
Southeastern Star-nosed Mole	PR		PR						U	G5T4	SU			Moist meadows, fields, swamps, woods; burrows near bogs and streams
Condylura cristata parva														
Eastern Mole		X		X		X			Ab	G5				Well drained sandy loam areas; grassy fields, meadows, lawns, gardens sandy soils/light loams
Scalopus aquaticus														
Southeastern Myotis		X	PO						U	G4				Buildings, trees during summer; caves winter; pref. near water for foraging
Myotis austroriparius														
Little Brown Bat		X		X		X			U	G3	S1	UR		Buildings, trees during summer; caves winter; pref. near water for foraging
Myotis lucifugus														

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
Eastern Small-footed Myotis	PO		PO						?	G4	S1		E	Crevices in rocks, buildings; near forested areas
Myotis leibii														
Northern Long-eared Bat	UN		UN						R	G1G2	S1	T	E	Crevices, holes, bark, caves, mines
Myotis septentrionalis														
Indiana Bat		X		X					R	G2	S1	E	E	Caves, loose bark, cavities, riparian areas, upland forests, ponds, fields
Myotis sodalis														
Silver-haired Bat		X		X					U	G3G4	SU			Crevices, holes, leaves; near water wooded areas near ponds/streams
Lasionycteris noctivagans														
Tricolored Bat		X		X					U	G2G3	S1	PE		Leaf clumps, caves, crevices; near buildings in summer
Perimyotis subflavus														
Big Brown Bat		X		X		X			C	G5				Favors buildings; some hollow trees, rock crevices, under loose bark
Eptesicus fuscus														
Eastern Red Bat		X		X		X			C	G3G4	S3S4			Trees and shrubs near permanent water; usually 4-10 ft high, south facing twigs
Lasiurus borealis														
Seminole Bat	UN		UN						?	G5				Wooded areas; trees
Lasiurus seminolus														
Hoary Bat		X		X					U	G3G4	S3S4			Forested areas, esp. coniferous forests by clearings and permanent water, in foliage; migratory
Lasiurus cinereus														
Evening Bat		X		X					U	G5				Hollow trees, bark crevices; some buildings and bridges
Nycticeius humeralis														
Raccoon		X		X		X		X	C	G5				Wetland habitats, moist upland habitats, suburban neighborhoods
Procyon lotor														

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
Long-tailed Weasel	PR			X					?	G5				Woodlands, brushy areas, and borders
Mustela frenata														
American Mink		X	PR						?					Most wetlands incl. marshes; lake, river, stream borders; drained ditches
Neogale vison										G5				
North American River Otter		X		X		X		X	U	G5				Coastal estuaries, river systems; any relatively undisturbed aquatic habitat
Lontra canadensis														
Striped Skunk		X		X		X		X	C	G5				Upland habitats; fields, forests, neighborhoods
Mephitis mephitis														
Coyote		X		X	PR		UN		U	G5	S4			Mixed forests, croplands, old fields
Canis latrans														
Red Fox		X		X		X		X	C	G5				Open habitats, interspersed croplands, woodlots, old fields
Vulpes vulpes														
Gray Fox		X		X		X			Ab	G5				Woodlands (early succession forests) timbered/rocky regions
Urocyon cinereoargenteus														
Harbor Seal	PO		UN					X	?	G5				Coastal waters: estuaries, river mouths
Phoca vitulina														
Harp Seal	PO		UN					X	?	G5				Coastal waters: estuaries, river mouths
Phoca groenlandicus														
Gray Seal	PO		UN						?	G5				Coastal waters: estuaries, river mouths
Halichoerus grypus														
Hooded Seal	PO		UN					X	?	G5				Coastal waters: estuaries, river mouths
Cystophora cristata														

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
Woodchuck / Groundhog		X		X		X		X	Ab	G5				Edge of forests bordering open land, brushy fence rows, stream banks, grassy fields
Marmota monax														
Eastern Chipmunk		X	PR						C	G5				Deciduous woodlands, forest edges, open bushy forests with crevices, rock piles; burrows, wooded hills, dry areas
Tamias striatus														
Eastern Gray Squirrel		X		X		X		X	Ab	G5				Mature hardwoods and conifers with nuts; brushy understory
Sciurus carolinensis														
Delmarva Fox Squirrel	UN		UN						U	G5T3	S1		I	Mature long leaf pine-oak forests, hollow trees, open understories; open deciduous woods
Sciurus niger cinereus														
North American Red Squirrel	PO		PO						U	G5				Coniferous, hardwood, mixed stands; prefers spruce and hemlock
Tamiasciurus hudsonicus														
Southern Flying Squirrel		X	PR			X			C	G5				Mature hardwood & coniferous forests with natural cavities
Glaucomys volans														
American Beaver		X		X		X			C	G5				Small, wooded streams, banks; forested areas with water courses
Castor canadensis														
Eastern Harvest Mouse	UN		UN						R18	G5	SH		X	Old fields, marshes, wet meadows; non forested land, esp. cultivated field
Reithrodontomys humulis														
White-footed mouse		X		X		X			C	G5				Hardwood forests, field margins, marshes, brushy fence rows, thickets
Peromyscus leucopus														
Marsh Rice Rat	PO		PO					X	Ab	G5				Marshes, marsh edges (fresh or brackish); partially amphibious
Oryzomys palustris														

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
Southern Bog Lemming	PO		PO						?	G5	S3			Bogs, meadows, canebrakes, marshes; anywhere moist with grasses/sedges; some woodland habitats
Synaptomys cooperi														
Southern Redback Vole	PR		PR						?	G5				Coniferous, deciduous, or mixed forest
Clethrionomys gapperi														
Meadow Vole		X		X		X			Ab	G5				Damp meadows, coastal brackish marshes, grassy fields, herbaceous ground cover
Microtus pennsylvanicus														
Pine Vole/Woodland Vole		X		X		X			C	G5				Woodland/old field habitats with well-drained soil, leaf litter; burrowers
Microtus pinetorum														
Common Muskrat		X		X		X		X	Ab1	G5				Most well vegetated brackish or fresh marshes, mounds of vegetation marshes lining Chesapeake Bay
Ondatra zibethicus														
Brown Rat		X	PR						?	G5				Proximity to humans, wherever can find food and shelter; water-loving, burrowing animals
Rattus norvegicus														
Roof Rat	PR		PR						U	G5				Shipping ports: attics, walls, ceilings; arboreal areas
Rattus rattus														
House Mouse		X		X		X			C	G5				Throughout populated areas; wide variety of habitat, both wild and urban
Mus musculus														
Meadow Jumping Mouse	PR		PR						U	G5				Weedy, grassy fields; thick vegetation near marshes, stream, ponds
Zapus hudsonius														

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
Eastern Cottontail		X		X		X		X	C	G5				Disturbed areas such as old fields, brushy edges; herbaceous/shrubby plants
Sylvilagus floridanus														
White-tailed Deer		X		X		X		X	Ab	G5				Natural communities, esp. broken areas of mixed young forests, old fields, and crop lands
Odocoileus virginianus														
West Indian Manatee	PO		UN					X	R	G2		LE		Coastal waters, estuaries, freshwater streams bordering (sub)tropical seas, warm water
Trichechus manatus														
True's Beaked Whale	PO		UN						R	G3	SNR			Deep waters off continental shelf
Mesoplodon mirus														
Gervai's Beaked Whale								X						Deep, tropical waters of the Atlantic Ocean
Mesoplodon europaeus														
Pygmy Sperm Whale	PO		UN					X	R	G4				Deep offshore waters, bottom dwellers
Kogia breviceps														
Dwarf Sperm Whale	PO		UN						R	G4				Deep offshore waters, bottom dwellers
Kogia sima														
Striped Dolphin	PO		UN					X	C	G5				Offshore waters, rarely within 12 miles of coastline
Stenella caeruleoalba														
Bottlenose Dolphin		X	PO		PO			X	?	G5				Inshore waters including sounds, river, creeks
Tursiops truncatus														
Short-beaked Common Dolphin	PO		UN		UN			X	?	G5				Pelagic waters
Delphinus delphis														

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
Atlantic White-sided Dolphin	PO		UN		UN			X	R	G5				Pelagic waters
Lagenorhyncus acutus														
Grampus or Risso Dolphin	PO		UN		UN		UN		R	G5				Pelagic waters
Grampus griseus														
Rough-toothed Dolphin								X						Tropical and warm temperate waters
Steno bredansis														
Common Blackfish/Long-finned Pilot Whale	PR		UN		UN		UN		U	G5				Oceanic, inshore when food resources abundant
Globicephala melas														
Short-finned Blackfish/Pilot Whale	PR		UN		UN			X	U	G5				Oceanic, inshore when food resources abundant
Globicephala macrorhyncha														
Harbor Porpoise	PO		UN		UN			X	U	G4G5				Inshore waters and shallow coastal bays
Phocoena phocoena														
Common Minke or Piked Whale	PR		UN		UN			X	U	G5				Coastal waters
Balaenoptera acutorostrata														
Fin Whale								X		G3G4	SZN	LE	E	Throughout the world's oceans
Balaenoptera physalus														
Humpback Whale	PR		UN		UN			X	U	G3	SZN	LE	E	Coastal waters
Megaptera novaeangliae														

Species	Area Seen at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global	State	Federal	State	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status	
North Atlantic/Black Right Whale	PR		UN		UN			X	U	G1	SZN	LE	E	Coastal waters
Eubalaena glacialis														

[1] PR = Probably, PO = Possible, UN = Unlikely.
[2] R = Rare, U = Uncommon, C = Common, Ab = Abundant. When possible, actual # of sightings given for R.
[3] As of May 2023.

Table C-3. NAS Reptile and Amphibian Species.

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL [1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes						
Common Eastern Snapping Turtle		X		X		X		X	C	G5	S5			Permanent body of freshwater, occasionally brackish water.
Chelydra s. serpentina														
Eastern Musk Turtle		X	PR		PO				U	G5	S5			Shallow, clear-water lakes, ponds, slow-moving water.
Sternotherus odoratus														
Eastern Mud Turtle		X		X		X		PO	C	G5	S5			Shallow water (fresh or brackish), ditches, small ponds, wet meadows, marshes.
Kinosternon s. subrubrum														
Spotted Turtle[1]		X		X	UN				U	G5	S3S4	UR		Marshy meadows, swamps, small ponds, ditches, other shallow waterbodies.
Clemmys guttata														
Eastern Box Turtle		X		X		X		X	C	G5T5				Terrestrial, areas to soak in mud or water, beneath logs or rotting vegetation.
Terrapene c. carolina														
Northern Diamondback Terrapin		X		X		PR		X	U	G4T4	S4			Coastal marshes, tidal flats, estuaries, salt or brackish water bodies.
Malaclemys t. terrapin														
Northern Red-bellied Cooter[2]		X		X		X			C	G5	S5			Ponds, rivers, relatively large bodies of fresh water.
Pseudemys rubriventris														
Eastern Painted Turtle		X		X		X			Ab	G5T5	S5			Muddy-bottomed ponds, marshes, ditches, backwater streams
Chrysemys p. picta														
Red-eared Slider		X		X	PO				U	G5T5	S5			Ponds, marshes, streams.
Trachemys scripta elegans														
Loggerhead Sea Turtle		X^		X^		PR		X	R	G3	S1B	LT	T	Open sea, Chesapeake Bay; does not nest at NAS.
Caretta caretta														

[1] DoD PARC Mission Sensitive Species
[2] DoD PARC Mission Sensitive Species

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL [1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes						
Atlantic/Kemp's Ridley Sea Turtle		X^	PO			PR		PR	R	G1	S1N	LE	E	Open sea, Chesapeake Bay; does not nest at NAS.
Lepidochelys kempii														
Atlantic Leatherback Sea Turtle	PO		UN		UN			PO	R	G2	S1N	LE	E	Open sea, Chesapeake Bay; does not nest at NAS.
Dermochelys coriacea														
Green Sea Turtle	PO		UN		UN			UN	R	G3	S1N	LT	T	Open sea, Chesapeake Bay; does not nest at NAS.
Chelonia mydas														
Hawksbill Sea Turtle	UN		UN		UN			UN	R	G3	SRN	LE	E	Open sea, Chesapeake Bay; does not nest at NAS.
Eretmochelys imbricata														
Eastern Spiny Softshell		X	UN		UN				Ac 1	G5	S1		I	Quiet bodies of water where sand and mud bars are available.
Apalone s. spinifera														
Eastern Fence Lizard		X		X		X			C	G5	S5			Rail fences, rotting logs/stumps, grasslands, forest edges , rocks.
Sceloporus undulatus														
Six-lined Racerunner		X		X		X		X	U	G5	S3			Open well-drained areas, fields, open woods, thicket margins
Aspidoscelis sexlineata														
Little Brown Skink		X		X	PO				U	G5	S5			Woodland floor, dry upland woodlands, stream and pond edges.
Scincella lateralis														
Common Five-lined Skink		X		X		X			U	G5	S5			Cut woodlots with rotting stumps/logs, old board piles,moist wooded areas.
Plestiodon fasciatus														
Broadhead Skink		X		X		X			C	G5	S4			Swamp forests, empty urban lots with debris. woodland areas, hollow trees.
Plestiodon laticeps														
Common Watersnake		X		X		X		X	C	G5	S5			Swamps,, ponds, quiet water areas, sometimes in swift waters.
Nerodia sipedon														
Dekay's Brownsnake		X	PR			X			U	G5	S5			Wetland margins, residential areas under debris.
Storeria dekayi														
Red-bellied Snake		X	PR		PO				U	G5	S5			Open woods, near sphagnum bogs, creek bottoms, leaf litter.
Storeria occipitomaculata														

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL [1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes						
Eastern Garter Snake		X		X		X			C	G5	S5			Meadows, marshes, woodlands, ditches, and around homes
Thamnophis s. sirtalis														
Plain-bellied Watersnake	UN		UN		UN			PO		G5	S2S3			Bald Cypress swamp, brackish to fresh coastal plains rivers
Nerodia erythrogaster														
Eastern Ribbon Snake		X	PR		PO				U	G5	S5			Seldom far from streams, ponds, or swamps
Thamnophis s. sauritus														
Smooth Earth Snake		X	PO			X			U	G5	S4			Abandoned fields, trails, and back roads near moist deciduous forests.
Virginia v. valeriae														
Eastern Hognose Snake		X		X		X			C	G5	S5			Sandy areas, grassy fields, forest edges.
Heterodon platirhinos														
Northern Ring-necked Snake		X	PR			X			U	G5T5	S5			Woodlands, cutover areas with logs, bark slabs in which to hide
Diadophis punctatus edwardsii														
Eastern Worm Snake		X		X		X			C	G5	S5			Under stones/ boards, in rotting logs, in partial to moist earth, brackish water.
Carphophis a. amoenus														
Rainbow Snake	UN		UN		UN				R	G4	S1		E	In/near water, cypress swamps, sandy fields burrowed in ground.
Farancia erytrogramma														
Northern Black Racer		X		X		X			C	G5	S5			Woodlands, cutover areas, old fields, marshes.
Coluber c. constrictor														
Northern Rough Greensnake		X		X		X		X	C	G5	S5			Dense vegetation overhanging a stream or lake.
Opheodrys a. aestivus														
Red Corn snake		X		X	PO				U	G5	S2			Wood lots, rodent burrows, abandoned buildings
Pantherophis guttatus														
Eastern Rat snake		X		X		X		PO	C	G4	S5			Timbered hillsides to flat farmland, floodplains, abandoned buildings.
Pantherophis alleghaniensis														
Eastern Kingsnake		X		X		X			C	G5	S4			Terrestrial, streambanks, hardwoods, wetlands, farmlands.
Lampropeltis getula														

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL [1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes						
Coastal Plains Milk snake		X	PR		PO				R2	?	?			Barns, fields, woodlands, river bottoms; under logs, boards, stones
Lampropeltis triangulum temporalis														
Northern Mole Kingsnake	PO		PR		UN				R	G5	S1			Thickets, sandy areas, woodlands, cultivated fields.
Lampropeltis rhombomaculata														
Northern Scarlet Snake	UN		UN		PO				R1	G5	S3			Under logs, bark; burrows - sandy loamy soil, pine forests.
Cemophora coccinea copei														
Northern Copperhead		X		X		X			U	G5	S5			Wooded hillsides, rocky areas, swamp edges.
Agkistrodon contortrix mokasen														
Marbled Salamander		X		X		X			C	G5	S5			Moist sandy areas to dry hillsides, damp forests.
Ambystoma opacum														
Spotted Salamander		X		X		X			C	G5	S5			Woodland ponds; beneath boards, stones, leaf litter; forest bottomland.
Ambystoma maculatum														
Red-spotted Newt	UN		UN		UN				R	G5	S5			Ponds, small lakes, marshes, ditches, semi-to permanent bodies of unpolluted water.
Notophthalmus v. viridescens														
Northern Dusky Salamander		X		X	UN				U	G5	S5			Brooks, edges of small woodland streams with debris to hide under.
Desmognathus f. fuscus														
Eastern Red-backed Salamander		X		X		X			R2	G5	S5			Terrestrial, forested areas
Plethodon cinereus														
Four-toed Salamander		X	PR		UN				R1	G5	S5			Sphagnum areas adjacent to woods, boggy woodland ponds.
Hemidactylium scutatum														
Eastern Mud Salamander	PO		PO		UN				R	G5	S2			Muddy areas of springs, along streams, swamps.
Pseudotriton m. montanus														
Northern Red Salamander		X		X	UN				R1	G5	?			Under moss, stones in forests; near slow-moving, cold springs.
Pseudotriton r. ruber														
Northern Two-lined Salamander		X	PR		UN				U	G5	S5			Wooded or open habitat with leaves, logs, rocks; brookside, water areas.
Eurycea bislineata														

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL [1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes						
Eastern Spadefoot		X		X	PO				R3	G5	S4			Sandy/loose soils, forested areas
Scaphiopus h. holbrookii														
American Toad		X		X		X			U	G5	S5			Backyards to mountains, shallow bodies of water near places to hide.
Anaxyrus americanus														
Fowler's Toad		X		X		X			C	G5	S5			Backyards to mountains, shallow bodies of water near places to hide.
Anaxyrus fowleri														
Northern Cricket Frog		X		X		X			C	G5	S5			Permanent bodies of shallow water with vegetated sides.
Acris c. crepitans														
Green Treefrog		X		X		X			C	G5	S5			Swamps, borders of lakes and streams, floating vegetation.
Hyla cinerea														
Cope's Gray Treefrog		X		X		X			C	G5	S5			Small trees or shrubs that are near/in a shallow body of water.
Hyla chrysoscelis														
Northern Spring Peeper		X		X		X			Ab	G5	S5			Brushy second-growth or cutover woodlots near small ponds.
Pseudacris c. crucifer														
Upland Chorus Frog		X		X	PO				C	G5	S5			Grass swales, moist woodlands, swamps, ponds.
Pseudacris triseriata feriarum														
Eastern Narrowmouth Toad		X		X	PO				R	G5	S2S3		E	Water body margins, under boards, logs, compost piles
Gastrophryne carolinensis														
American Bullfrog		X		X		X			C	G5	S5			Ponds, bogs, sluggish portions of streams, along edge with vegetation.
Lithobates catesbeiana														
Coastal Plains Leopard Frog	PR		PR		PO				?	?	?			Natural or artificial, permanent or semi-permanent water bodies.
Lithobates sphenocephalus utricularius														
Northern Green Frog		X		X		X			C	G4	S5			Shallow fresh water; springs, ditches, small streams.
Lithobates clamitans melanota														
Wood Frog		X		X		X			U	G5	S5			Moist wooded areas
Lithobates sylvatica														

Species	Area Seen or Heard at NAS								Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL [1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes	No	Yes						
Southern Leopard Frog		X		X		X			C	G5	S4			Shallow freshwater habitats, slightly brackish marshes
Lithobates sphenocephalus														
Pickerel Frog		X		X		X			R	G5	S5			Tea-colored waters, floodplain swamps, grass fields
Lithobates palustris														

[1] PR = Probably, PO = Possible, UN = Unlikely.
[2] Ac = Accidental, V = Vagrant, R = Rare, U = Uncommon, C = Common, Ab = Abundant. When possible, actual # of sightings given for V and R.
[3] As of May 2023.

Table C-4. NAS Fish Species.

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Bull Shark	PO		UN			PR			U	G5				Coastal embayments and estuaries
Carcharhinus leucas														
Sandbar Shark										G4				Muddy coastal waters and bays that are shallower than 18 meters
Carcharhinus plumbeus														
Spiny Dogfish										G2				From surface and shore to 180 meters
Squalus acanthias														
Cownose Ray		X		X		PR		X	C					Coastal, enters estuaries
Rhinoptera bonasus														
Sea Lamprey										G5				Along coast with some freshwater populations
Petromyzon marinus														
Clearnose Skate						X				GNR				Inshore waters
Raja eglanteria														
Little Skate						X				GNR				Sandy or gravelly bottoms in shallow water
Leucoraja erinacea														
Winter Skate						X				GNR				Sand and gravel bottoms
Leucoraja ocellata														
Least Brook Lamprey										G5				Clean, clear gravel riffles of small creek and rivers, spring-fed wetlands
Lampetra aepyptera														
Shortnose Sturgeon	PO		PO						U	G3	S1	LE	E	River mouths, tidal rivers, estuaries, and bays
Acipenser brevirostrum														
Atlantic Sturgeon		X	PO			PR			R1	G3	S1	E	C	Shallow waters of continental shelf
Acipenser oxyrhynchus														
Longnose Gar										G5	S4			Sluggish pools, backwaters, and oxbows of medium to large rivers, near vegetation.
Lepisosteus osseus														
Bowfin										G5	SNA			Swamps, pools, and backwater of lowland streams, near vegetation.
Amia calva														
American Eel		X	PR			X			C	G4				Permanent streams with continuous flow
Anguilla rostrata														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Blueback Herring	PR		PR			X			C	G3G4	S5			Current over rocky bottom
Alosa aestivalis														
Alewife		X	PR			X			C	G5				Open water over all bottom types
Alosa pseudoharengus														
Hickory Shad		X	PR			X			C	G4	S3			Open freshwater, large rivers
Alosa mediocris														
American Shad	PR		PR			X			C	G5				Open freshwater, large rivers
Alosa sapidissima														
Atlantic Menhaden		X		X		X		X	C	G5				Estuarine waters
Brevoortia tyrannus														
Gizzard Shad		X		X					U	G5				Deep, open water of medium to large rivers, maybe brackish waters
Dorosoma cepedianum														
Threadfin Shad										G5				Open water over sand, mud and debris, maybe in brackish water
Dorosoma petenense														
Bay Anchovy		X		X		X		X	C, Re	G5				Shallow bays and estuaries, brackish water, occurs to 36 meters
Anchoa mitchilli														
Eastern Mudminnow		X	UN						Ab	G5				Quiet streams, swamps, wetlands over sand, mud, and debris bottoms
Umbra pygmaea														
Grass/Redfin Pickerel										G5				Lakes, swamps, among vegetation in clear water
Esox americanus														
Chain Pickerel		X	UN						U	G5				Vegetated lakes, swamps, and back-waters
Esox niger														
Inshore Lizardfish		X	PO					X	R2	G5				Shallow bays and shore waters
Synodus foetens														
Goldfish										G5				Shallow, muddy pools, warm turbid or vegetated waters
Carassius auratus														
Common Carp		X	PO						C	G5				Manmade lakes, turbid, sluggish, debris filled streams
Cyprinus carpio														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Golden Shiner		X	PO						C	G5				Vegetated lakes, ponds. swamps
Notemigonus crysoleucas														
Creek Chub										G5				Rocky and sandy pools of headwaters, creeks, and small rivers
Semotilus atromaculatus														
Eastern Blacknose Dace										G5				Rocky runs and pools of headwaters, creeks and small rivers
Rhinichthys atratulus														
Eastern Silvery Minnow	PO		PO						U	G5				Pools and backwaters of low-gradient creeks and small to large rivers
Hybognathus regius														
Satinfin Shiner	PO		PO						U	G5				Rocky and sandy pools and runs of creeks and small-medium rivers
Cyprinella analostana														
Ironcolor Shiner		X	UN						U	G4	S1		E	Clear, vegetated, sand-bottomed pools and slow runs of creeks and sm. rivers
Notropis chalybaeus														
Swallowtail Shiner										G5				Sandy, sometimes rocky pools and runs
Notropis procne														
Spottail Shiner										G5				Sandy and rocky pools and runs of sm.to large rivers
Notropis hudsonius														
White Sucker										G5				Small, clear, cool creeks and small to medium rivers
Catostomus commersoni														
Eastern Creek Chubsucker										G5				Sand- and gravel-bottomed pools of clear headwaters, creeks;near vegetation.
Erimyzon oblongus														
Shorthead Redhorse										G5				Rocky pools, runs, and riffles in small to large rivers, lakes
Moxostoma macrolepidotum														
Channel Catfish		X	PO						C	G5				Deep pools and runs over sand or rocks
Ictalurus punctatus														
White Catfish		X	PO						C	G5	S4			Sluggish, mud-bottomed pools, open channels, lakes and impoundments
Ameiurus catus														
Yellow Bullhead		X								G5				Pools, backwaters, sluggish current over soft substrate in creeks
Ameiurus natalis														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Brown Bullhead		X		PO					C	G5				Pools, sluggish run over soft substrate in creeks and ponds and rivers
Ameiurus nebulosus														
Tadpole Madtom										G5				Rock-, mud-, or detritus-bottomed pools and backwaters
Noturus gyrinus														
Oyster Toadfish		X	PR			PR		X	C, Re					Largely inshore, among litter, rocky bottoms
Opsanus tau														
Red Hake	PO		PO						C	G5				Bottom-dwelling, near shore to at least 915 meters
Urophycis chuss														
Spotted Hake	PO		PO						C					Bottom-dwelling
Urophycis regia														
Atlantic Silverstripe Halfbeak	PR		PR						C					Bays and estuaries
Hyporhamphus unifasciatus														
Atlantic Needlefish		X		X				X	U	G5				Coastal waters, bays and estuaries
Strongylura marina														
Pirate Perch		X	PO						U	G5				Swamps, vegetated sloughs, ponds, and quiet pools of creeks
Aphredoderus sayanus														
Banded Killifish		X	PR						U	G5				Shallow, quiet margins of lakes, ponds and streams, over sand or mud, vegetation
Fundulus diaphanus														
Rainwater Killifish	PR			X					U	G5				Vegetated quiet water
Lucania parva														
Sheepshead Minnow		X		X		PR		X	C, Re	G5				Salt, brackish, and fresh water, near vegetation
Cyprinodon variegatus														
Mummichog		X		X		PR		X	C, Re	G5				Saltwater marshes, tidal creeks, sometimes in limited freshwater
Fundulus heteroclitus														
Striped Killifish		X		X		PR		X	U, Re	G5				Bays, estuaries, and coastal marshes
Fundulus majalis														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Spotfin Killifish								X	Re	G4	SU			Bays, estuaries, and coastal marshes
Fundulus luciae														
Mosquitofish		X	PO						U	G5				Standing to slow-flowing water, ponds with vegetation, sometimes brackish
Gambusia affinis														
Eastern Mosquitofish		X	PO						U	G5				Standing to slow-flowing water, ponds with vegetation, sometimes brackish
Gambusia holbrooki														
Rough Silverside	PR		PR						C					Along the shore, in bays and inlets
Membras martinica														
Inland Silverside	PR		PR						C	G5				Coastal fresh and tidal waters
Menidia beryllina														
Atlantic Silverside		X	PR			PR		X	C	G5				Along sandy seashores and mouths of inlets
Menidia menidia														
Fourspine Stickleback		X	PR						U	G5				Vegetated, quiet water areas
Apeltes quadracus														
Threespine Stickleback		X	PR						U	G5				Shallow vegetated areas, over mud or sand
Gasterosteus aculeatus														
Lined Seahorse	PO		PO						U					Seagrass beds in bays
Hippocampus erectus														
Dusky Pipefish		X	PR						C					Seagrass beds in bays and coastal lagoons
Syngnathus floridae														
Northern Pipefish		X		X					U	G5				Seagrass beds in bays and estuaries, enters freshwater
Syngnathus fuscus														
Slimy Sculpin	UN		UN							G5	SRF		T	Rocky riffles of cold streams
Cottus cognatus														
Striped Bass		X		X		X		X	C	G5				Marine, channels of medium to large rivers, lakes, impoundments
Morone saxatilis														
White Perch		X		X		X		X	C	G5				Brackish water, pools, quiet waters, over mud
Morone americana														
Black Sea Bass	PO		PO					X	C	G5				Around rock jetties, rocky bottoms in shallow water
Centropristis striata														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Flier		X	UN						U	G5	S2S3		I	Swamps, vegetated lakes, ponds, and pools of creeks, over mud
Centrarchus macropterus														
Black Crappie		X							U	G5				Lakes, ponds, pools of streams
Pomoxis nigromaculatus														
Mud Sunfish	PO		PO						U	G4G5	S3			Vegetated sloughs, lakes, over mud and detritus
Acantharchus pomotis														
Banded Sunfish										G5	S4			Heavily vegetated lakes, ponds, sand-or mud-bottomed pools
Enneacanthus obesus														
Bluespotted Sunfish										G5	S3S4			Vegetated ponds, lakes, sluggish sand-and mud-bottomed pools
Enneacanthus gloriosus														
Largemouth Bass		X		X					C	G5				Clear, vegetated ponds, swamps, and pools, over mud or impoundments
Micropterus salmoides														
Smallmouth Bass	UN		UN						U	G5				Clear, gravel-bottom runs and flowing pools
Micropterus dolomieu														
Bluegill		X		X					Ab	G5				Vegetated lakes, ponds, swamps, and pools of creeks and small-large rivers
Lepomis macrochirus														
Pumpkinseed		X	PR						C	G5				Vegetated lakes and ponds, quiet pools of small creeks and rivers-w/vegetation
Lepomis gibbosus														
Redbreast Sunfish		X	PR						U	G5				Rocky and sandy pools of creeks, rocky and vegetated lake margins
Lepomis auritus														
Yellow Perch	PO		PO			X			U	G5				Lakes, ponds, and pools of creeks, clear water near vegetation
Perca flavescens														
Glassy Darter	PO		PO							G4G5	S2		T	Sandy runs of creeks and small to medium rivers
Etheostoma vitreum														
Tesselated Darter										G5				Sandy and muddy pools of headwaters, creeks, and small to medium rivers
Etheostoma olmstedi														
Swamp Darter	PO		PO							G5	S3			Standing or slow-flowing water over mud, sometimes sand, near vegetation
Etheostoma fusiforme														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Bluefish		X		X		X		X	C	G5				Bays and estuaries
Pomatomus saltatrix														
Cobia	PR		PO			X			C					Coastal to open ocean, around buoys and other floating shelter
Rachycentron canadum														
Blue Runner	PO		PO						U					Open ocean
Caranx crysos														
Crevalle Jack	PO		PO						U	G5				Open ocean
Caranx hippos														
Lookdown	PO		PO						U	G5				Open water
Selene vomer														
Florida Pompano	PO		PO						U	G5				Coastal, bays and estuaries
Trachinotus carolinus														
Silver Perch	PR		PR						C	G5				Coastal areas, bays
Bairdiella chrysoura														
Atlantic Croaker		X		X		X		X	C	G5				Shallow coastal waters, common along beaches
Micropogonias undulatus														
Black Drum		X		X				X	C					Shallow coastal waters
Pogonias cromis														
Spot		X		X		X		X	C	G5				Coastal waters, bays and estuaries
Leiostomus xanthurus														
Red Drum		X		X		X			C	G5				Coastal waters, bays and estuaries
Sciaenops ocellatus														
Spotted Seatrout		X		X		PR		X	C	G5				Coastal waters
Cynoscion nebulosus														
Weakfish		X	PR					X	C					Coastal waters
Cynoscion regalis														
Striped Mullet	PR		PR						C	G5				Coastal waters, may enter brackish to fresh water
Mugil cephalus														
White Mullet	PO		PO						U	G5				Coastal, may enter fresh water
Mugil curema														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Northern Stargazer	PR		PR						C					Coastal waters
Astroscopus guttatus														
Striped Blenny		X		X				X	C	G5				Oyster beds and on hard bottoms, use deeper waters in winter
Chasmodes bosquianus														
Feather Blenny	PR		PR						C					Oyster reefs and rocky shores
Hypsoblennius hentz														
Naked Goby		X		X				X	C	G5				Estuaries and weedy, protected coastal water
Gobiosoma bosci														
Seaboard Goby	PR		PR						C	G5				Coastal areas to 50 meters
Gobiosoma ginsburgi														
Green Goby		X	PR						C					Muddy tidepools, nowhere common
Microgobius thalassinus														
Atlantic Bonito	PO		PO						U					Coastal waters, sometimes bays
Sarda sarda														
Little Tunny	PO		PO						U					Offshore, bays and reefs
Euthynnus alletteratus														
Butterfish	PO		PO						U	G5				Coastal waters
Peprilus triacanthus														
Harvestfish	PR		PR			PR			C	G5				Coastal waters
Peprilus alepidotus														
Northern Searobin		X	PR			PR		X	C	G5				Bays and estuaries
Prionotus carolinus														
Summer Flounder		X		X		X		X	C					Shallow coastal waters, bays
Paralichthys dentatus														
Windowpane	PO		PO			X			U	G5				Shore to 45 meters
Scopthalmus aquosus														
Winter Flounder	PR		PR			PR		X	C	G5				Coastal waters and bays
Pseudopleuronectes americanus														

Species	Area Found on NAS								Occurences[2]	Ranking and Status[3]				Habitat
Common Name	PAX[1]		WOLF[1]		SOL[1]		BIR[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific Name	No	Yes	No	Yes	No	Yes	No	Yes						
Hogchoker		X	PR			PR		X	C, Re	G5				Coastal waters to 75 meters, some in fresh waters
Trinectes maculatus														
Blackcheek Tonguefish	PO		PO						U	G5				Very common in shallow coastal waters and estuaries
Symphurus plagiusa														
Orange Filefish	PO		PO						U	G5				Coastal waters
Aluterus schoepfi														
Planehead Filefish														Open waters
Stephanolepis hispidus														
Northern Puffer		X	PR						C	G5				Bays, estuaries, protected coastal waters
Sphoeroides maculatus														
Striped Burrfish		X	PO						U	G5				Seagrass beds in bays
Chilomycterus schoepfi														
Northern Snakehead		X	PO						U	G5				Stagnant shallow ponds or swamps
Channa argua														
Atlantic Spadefish		X	PO					X	U	G5				Inshore and nearshore near reefs, wrecks, and buoys
Chaetodipterus faber														
Ladyfish		X	PO						U	G5				Brackish water lagoons and bays, mangrove swamps
Elops saurus														
Skilletfish		X		X		PR			U	G5				Oyster reefs and rocky areas
Gobiesox strumosus														
Spanish Mackerel						X				G5				Open waters
Scomberomorus maculatus														
King Mackerel						X				GNR				Open waters near the coast
Scomberomorus cavalla														

[1] PR = Probably, PO = Possible, UN = Unlikely.
[2] L = Accidental, V = Vagrant, R = Rare, U = Uncommon, C = Common, Ab = Abundant, Re = Resident. When possible, actual # of sightings given for R.
[3] As of May 2023.

Table C-5. NAS Butterfly and Moth Species.

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Silver-spotted Skipper		X	PR			X	C	G5				gardens, roadsides, meadows
Epargyreus clarus												
Long-tailed Skipper		X	PR				C	G5				agriculture fields, fields
Urbanus proteus												
Golden-banded Skipper							U	G4	SH		X	wet, grassy areas, along streams or ponds, sometimes near woods
Telegonus cellus												
Hoary Edge							C	G5				Open woodlands, brushy areas with oak and pine, areas with sandy soil
Achalarus lyciades												
Southern Cloudywing		X	PR				C	G5				open spaces, roadsides
Thorybes bathyllus												
Northern Cloudy Wing								G5				woodland - mixed, grassland/ herbaceous, woodland - hardwood, old field, shrubland, woodland – conifer, forested wetland, riparian
Thorybes pylades												
Confused Cloudywing								G4				woodland - hardwood, woodland - mixed, woodland – conifer, forested wetland, riparian
Thorybes confusis												
Hayhurst's Scallopwing								G5				woodland - hardwood, shrubland, woodland - mixed, suburban/orchard, cropland/hedgerow , grassland/herbaceous
Staphylus hayhurstii												
Dreamy Duskywing		X	PO				R1	G5				Suburban/orchard, Forest - hardwood, woodland - hardwood, woodland - conifer, forest - mixed, woodland – mixed, scrub-shrub wetland, riparian
Erynnis icelus												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Sleepy Duskywing								G5				woodland - hardwood, forest edge, woodland - mixed, forest - hardwood, forest - mixed, woodland - conifer, shrubland, old field, bog/fen
Erynnis brizo												
Juvenal's Duskywing		X	PR			X	C	G5				in and around wooded areas
Erynnis j. juvenalis												
Horace's Duskywing		X	PR			X	C	G5				open areas, open woody areas
Erynnis horatius												
Mottled Duskywing								G3	S1		E	woodland - mixed, shrubland, woodland - conifer, woodland - hardwood, grassland/herbaceous
Erynnis martialis												
Zarucco Duskywing								G5				woodland - conifer, grassland/herbaceous, suburban/orchard, shrubland, oldfield, woodland - hardwood, woodland - mixed
Erynnis zarucco												
Wild Indigo Duskywing								G5				grassland/herbaceous, cropland/ hedgerow, woodland - mixed, old field, woodland - conifer, suburban/orchard, woodland - hardwood, shrubland
Erynnis baptisiae												
Persius Duskywing							R	G5				woodland - hardwood, woodland - mixed, grassland/herbaceous, shrubland, woodland – conifer, scrub-shrub wetland, riparian, bog/fen
Erynnis persius												
Appalachian Grizzled Skipper								G5T1T2	S1		E	open areas near woods, barrens
Pyrgus wyandot												
Common Checkered Skipper		X	PO					G5				fields, grassland/herbaceous, cropland/hedgerow, suburban/ orchard, shrubland, riparian
Pyrgus communis												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Common Sootywing								G5				cropland/hedgerow, grassland herbaceous, suburban/orchard, old field
Pholisora catullus												
Swarthy Skipper								G5				grassland/herbaceous, woodland - conifer, woodland - mixed, suburban/orchard, old field, woodland - hardwood, riparian, scrub-shrub wetland, bog/fen, herbaceous wetland
Nastra lherminier												
Clouded Skipper		X	PO					G5				old field, suburban/orchard, woodland - conifer, grassland/herbaceous, riparian, herbaceous wetland
Lerema accius												
Common Least Skipper		X	PR			X		G5				Suburban/orchard, Woodland - Mixed, woodland - hardwood, grassland/herbaceous, woodland - conifer, cropland/hedgerow, bog/fen, herbaceous wetland, temporary pool, riparian, scrub-shrub wetland
Ancyloxypha numitor												
European Skipper								G5				grassland/herbaceous, suburban/orchard, old field, riparian, herbaceous wetland
Thymelicus lineola												
Fiery Skipper								G5				woodland - conifer, woodland - mixed, grassland/herbaceous, old field, shrubland, woodland - hardwood, suburban/orchard
Hylephila phyleus												
Leonard's Skipper								G4	S2			shrubland, woodland - mixed, old field, sand/dune, grassland/ herbaceous, woodland - conifer
Hesperia leonardus												
Cobweb Skipper								G4	S3			woodland - conifer, grassland/herbaceous, woodland - mixed, woodland - hardwood, shrubland
Hesperia metea												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Dotted Skipper							R	G3G4				woodland - conifer, grassland/herbaceous, woodland - mixed, old field, sand/dune, shrubland
Hesperia attalus slossonae												
Indian Skipper								G5	S3			woodland - hardwood, woodland - mixed, old field, grassland/herbaceous, shrubland, woodland - conifer
Hesperia sassacus												
Peck's Skipper								G5				suburban/orchard, grassland/ herbaceous, old field, shrubland, herbaceous wetland, riparian
Polites peckius												
Tawny-edged Skipper								G5				Old field, grassland/herbaceous, suburban/orchard; herbaceous, wetland, riparian
Polites themistocles												
Cross Line Skipper								G5				Shrubland, old field, Woodland - Mixed, grassland/herbaceous, woodland - hardwood
Polites origenes												
Long Dash							U	G5	S3			Open, moist areas such as meadows, marshes, water edge, and prairie
Polites mystic												
Whirlabout							R	G5				grassland/herbaceous, old field, woodland - conifer, sand/dune, suburban/ orchard
Polites vibex												
Southern Broken Dash		X	PO				U	G5				riparian, herbaceous wetland, forested wetland, suburban/orchard
Polites otho												
Northern Broken Dash		X	PO				U	G5				Woodland - Hardwood, Woodland - Conifer, Shrubland, Suburban/orchard, Grassland/ herbaceous, Woodland - Mixed, Old field
Polites egeremet												
Little Glassywing		X	UN				R1	G5				woodland - conifer, woodland - mixed, woodland - hardwood, shrubland, old field, herbaceous wetland
Pompeius verna												
Sachem		X	PR			X	C	G5				Shrubland, Suburban/ orchard, Old field, Woodland - Mixed, Woodland - Conifer, Sand/dune, Cropland/ hedgerow, Woodland - Hardwood, Grassland/ herbaceous; Riparian
Atalopedes campestris												
Delaware Skipper								UR	UR			
Atrytone logan												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Rare Skipper							R	G2G3	S1		T	
Problema bulenta												
Mulberry Wing								G4	S4			
Poanes m. massasoit												
Chermock's Mulberry Wing							R	G4T1	S1		E	
Poanes massasoit chermocki												
Hobomok Skipper								G5				
Lon hobomok												
Zabulon Skipper		X	PR				C	G5				forest edge
Lon zabulon												
Aaron's Skipper								G4				
Poanes a. aaroni												
Broad-winged Skipper		X	PO				U	G5				
Poanes viator												
Palatka Skipper								G3				
Euphyes pilatka												
Dion Skipper/Sedge Skipper							U	G5	S3			
Euphyes dion												
Black Dash								G4				
Euphyes conspicuus												
Two-spotted Skipper								G4	S1		E	
Euphyes bimacula												
Dun Skipper								G5				
Euphyes vestris												
Dusted Skipper		X						UR	UR			
Atrytonopsis hianna												
Pepper and Salt Skipper							U	G5	S2		I	
Amblyscirtes hegon												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Roadside Skipper								G5				
Amblyscirtes vialis												
Eufala Skipper							R	G5				
Lerodea eufala												
Twin-spot Skipper							R	G4				
Oligoria maculata												
Brazilian Skipper							R	G5				
Calpodes ethlius												
Salt Marsh Skipper								G5				
Panoquina panoquin												
Ocola Skipper								G5				
Panaquina ocola												
Pipevine Swallowtail								G5				
Battus p. philenor												
Zebra Swallowtail		X	PO				R1	G5				
Eurytides marcellus												
Black Swallowtail		X	PR			X	C	G5				open spaces, meadows, roadsides
Papilio polyxenes												
Giant Swallowtail								G5	S2		I	
Papilio cresphontes												
Eastern Tiger Swallowtail		X	PR			X	C	G5				fields, meadows, roadsides
Papilio glaucus												
Spicebush Swallowtail		X	PO				U	G5				fields
Papilio (Pterourus) troilus												
Palamedes Swallowtail							U	G5	SU			
Papilio palamedes												
Checkered White		X	UN				R1	G5				fields
Pontia protodice												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
West Virginia White							U	UR	UR			
Pieris virginiensis												
Cabbage White		X		X		X	C	G5				cultivated areas, open clearings
Pieris (Artogera) rapae												
Great Southern White							R	G5				
Ascia monuste												
Olympia Marble							U	G4G5	S2		I	
Euchloe olympia												
Falcate Orangetip		X	UN				U	G5				rich deciduous woodlands
Anthocharis midea												
Clouded or Common Sulphur		X	PR			X	C	G5				muddy roads, meadows, fields
Colias philodice												
Orange Sulphur / Alfalfa		X	PR			X	C	G5				open fields with clover and Ericaceae
Colias eurytheme												
Pink-edged Sulphur							R	G5	S1			
Colias interior												
Dog Face							R	G5				
Zerene cesonia												
Cloudless Sulphur		X						G5				
Phoebis sennae eubule												
Barred Yellow							R	G5				
Eurema daira												
Little Sulphur												
Eurema lisa												
Sleepy Orange								G5				
Abaeis nicippe												
Harvester								G5				
Feniseca t. tarquinius												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
American Copper								G5				
Lycaena phlaeas americana												
Bronze Copper								G5				
Tharsalea hyllus												
Bog Copper							U	G4G5	S1		E	
Lycaena epixanthe												
Great Purple Hairstreak								G5	S1S2			
Atlides halesus												
Coral Hairstreak								G5				
Satyrium titus							R					
Acadian Hairstreak								G5				
Satyrium acadica												
Edward's Hairstreak							R	G4	S1		E	
Satyrium edwardsii												
Banded Hairstreak								G5				
Satyrium calanus falacer												
Hickory Hairstreak							U	G4	S1		E	
Satyrium caryaevorum												
King's Hairstreak							R	G3G4	S1		T	
Satyrium kingi												
Striped Hairstreak								G5				
Satyrium liparops strigosum												
Red-banded Hairstreak		X	PO			X	U	G5				forest edge
Calycopis cecrops												
Olive Hairstreak								G5				
Mitoura g. grynea												
Hessel's Hairstreak							R	G3G4	SH		X	
Mitoura hesseli												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Brown Elfin		X	PR				C	G5				brushy areas, edge of woods
Callophrys augustinus												
Frosted Elfin		X	PO				R1	G2G3	S1		E	
Callophrys irus												
Henry's Elfin		X	PO				U	G5				open woody areas, brushy areas
Callophrys henrici												
Pine Elfin		X	UN				R1	G5				open pine woods areas
Callophrys niphon												
Northern Hairstreak								G4T4	S1S2		E	
Fixsenia ontario												
White-M Hairstreak	PR							G5				
Parrhasius m-album												
Gray Hairstreak		X	PR			X	C	G5				agriculture fields, meadows, gardens
Strymon melinus												
Early Hairstreak							U	G2G3	S1		E	
Erora laeta												
Eastern Tailed-Blue		X		X		X	Ab	G5				open areas, mud puddles, fields
Cupido comyntas												
Spring Azure		X		X		X	C	G4G5				brushy areas, open, deciduous woods
Celastrina ladon												
Edward's Azure												
Celastrina violacea												
Dusky Azure							R	GU	SH		E	
Celastrina ebenina												
Appalachian Blue							U	G4	S3S4			
Celastrina neglectamajor												
Summer Azure								G5				
Celastrina neglecta												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Silvery Blue							U	G5	S2		I	
Glaucopsyche lygdamus												
Little Metalmark							R	G4				
Calephelis virginiensis												
Northern Metalmark							U	G3G4	S2		T	
Calephelis borealis												
American Snout		X	PO				U	G5				
Libytheana carinenta												
Gulf Fritillary							R	G5				
Agraulis vanillae nigrior												
Variegated Fritillary								G5				
Euptoieta claudia												
Diana Fritillary							R	G2				
Speyeria diana												
Great Spangled Fritillary								G5				
Argynnis cybele												
Aphrodite Fritillary								G5				
Argynnis aphrodite												
Regal Fritillary							R	G3	SH		E	
Argynnis idalia												
Atlantis Fritillary								G5	S1		T	
Argynnis atlantis												
Silver-bordered Fritillary							U	G5	S3			
Boloria selene myrina												
Meadow Fritillary								G5				
Boloria bellona toddi												
Silvery Checkerspot								UR	UR			
Chlosyne nycteis												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Harris' Checkerspot							R	G4	S2		T	
Chlosyne harrisii												
Northern Crescent							U	G5				
Phyciodes cocyta												
Pearl Crescent		X		X		X	Ab	G5				open areas, meadows, roadsides
Phyciodes tharos												
Tawny Crescent							R	G4T1	SH		X	
Phyciodes batesii												
Baltimore Checkerspot								G4	S3			
Euphydryas p. phaeton												
Question Mark		X	PR			X	C	G5				Fields
Polygonia interrogationis												
Eastern Comma								G5				
Polygonia comma												
Gray Comma							R	UR	UR			
Polygonia progne												
Compton Tortoise Shell								G5	S1		E	
Nymphalis vaualbum												
Mourning Cloak		X	PR			X	C	G5				open country, woodlands
Nymphalis antiopa												
Milbert's Tortoise Shell							R	G5				
Nymphalis milberti												
American Lady		X	PR				C	G5				
Vanessa virginiensis												
Painted Lady		X	PO			X	C	G5				open and brightly lighted areas
Vanessa cardui												
Red Admiral		X		X			R1	G5				
Vanessa atalanta												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Common Buckeye		X	PR			X	C	G5				field
Junonia (Precis lavinia) coenia												
White Admiral/Red Spotted Admiral							U	G5				
Limenitis arthemis												
Red-spotted Purple		X	PR			X	C	G5				open, scrubby woods, and woods edge
Limenitis arthemis astyanax												
Viceroy		X	PO				R2	G5				
Limenitis archippus												
Hackberry Emperor								G5				
Asterocampa c. celtis												
Tawny Emperor								G5				
Asterocampa c. clyton												
Northern Pearly Eye								G5				
Lethe anthedon												
Appalachian Eyed Brown		X	PO				R1	G4				
Lethe appalachia												
Gemmed Satyr							R	G4				
Cyllopsis gemma												
Little Sulphur		X						G5				
Eurema lisa												
Carolina Satyr							U	G5	S1S3			
Hermeuptychia sosybius												
Mitchell's Satyr							R	G1G2	SR	LE		
Neonympha mitchellii												
Little Wood Satyr		X	PO				U	G5				forest edge
Megisto cymela												
Southern Wood Nymph		X	PO				U					
Cercyonis p. pegala												

Species	Area Sighted at NAS						Occurrence[2]	Ranking and Status[3]				Habitat
Common name	PAX[1]		WOLF[1]		SOL[1]			Global Rank	State Rank	Federal Status	State Status	
Scientific name	No	Yes	No	Yes	No	Yes						
Common Wood Nymph		X	PR			X	C	G5				fields
Cercyonis pegala alope												
Monarch		X	PR		PR		U	G4		C1		fields
Danaus plexippus												
MOTHS												
Regal Moth		X	PR				U					
Citheronia regalis												
Luna Moth		X	PR				U					
Actias luna												

[1] PR = Probably, PO = Possible, UN = Unlikely.
[2] R = Rare, U = Uncommon, C = Common, Ab = Abundant.
When possible, actual # of sightings given for R.
[3] As of May 2023.

Table C-6. NAS Dragonfly and Damselfly Species.

Species	Area Sighted at NAS						Occurrence[2]	Ranking/Status[3]			
Common name	PAX[1]		WOLF[1]		SOL[1]			Global	State	Federal	State
Scientific name	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status
DRAGONFLIES											
Gray Petaltail		X	PO				R2	G4	S3		
Tachopteryx thoreyi											
Black-shouldered Spinyleg		X	PR				C	G5			
Dromogomphus spinosus											
Lancet Clubtail		X	PO				C	G5			
Phanogomphus exilis											
Common Green Darner		X	PR			X	C	G5			
Anax junius											
Swamp Darner		X	PR				U	G5			
Epiaeschna heros											
Harlequin Darner		X	PO				R1	G5	S3S4		
Gomphaeschna furcillata											
Cyrano Darner		X	PO				R1	G5	S3S4		
Nasiaeschna pentacantha											
Arrowhead Spiketail		X	PO				R1	G4	S2		
Cordulegaster obliqua											
Common Baskettail		X	PO				U	G5			
Epitheca cynosura											
Four-spotted Pennant		X	PO				U	G5	S3S4		
Brachymesia gravida											
Calico/Elisa's Pennant		X	PR				C	G5			
Celithemis elisa											
Halloween Pennant		X	PR				C	G5			
Celithemis eponina											
Banded Pennant		X	PR				C	G5	S3		
Celithemis fasciata											

Species	Area Sighted at NAS						Occurrence[2]	Ranking/Status[3]			
Common name	PAX[1]		WOLF[1]		SOL[1]			Global	State	Federal	State
Scientific name	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status
Eastern Pondhawk		X	PR			X	C	G5			
Erythemis simplicollis											
Seaside Dragonlet		X	PR			X	Ab	G5			
Erythrodiplax berenice											
Golden-winged Skimmer		X	PR			X	Ab	G5	S3		
Libellula auripennis											
Bar-winged Skimmer		X	PO				U	G5	S3		
Libellula axilena											
Spangled Skimmer		X	PR				C	G5			
Libellula cyanea											
Corporal Skimmer		X	PR				C				
Libellula exusta deplanata											
Yellow-sided Skimmer		X	PO				U	G5	S2S3		
Libellula flavida											
Slaty Skimmer		X	PR				C	G5			
Libellula incesta											
Widow Skimmer		X	PO				U	G5			
Libellula luctousa											
Common Whitetail		X	PR			X	Ab	G5			
Libellula lydia											
Painted Skimmer		X	PO				U	G5			
Libellula semifasciata											
Great Blue Skimmer		X	PO				U	G5			
Libellula vibrans											
Blue Dasher/Blue Pirate		X	PR			X	Ab	G5			
Pachydiplax longipennis											
Spot-winged Glider		X	PO				U	G5			
Pantala hymenea											
Eastern Amberwing		X	PR				U	G5			
Perithemis tenera											

Species	Area Sighted at NAS						Occurrence[2]	Ranking/Status[3]			
Common name	PAX[1]		WOLF[1]		SOL[1]			Global	State	Federal	State
Scientific name	No	Yes	No	Yes	No	Yes		Rank	Rank	Status	Status
Autum Meadowhawk		X	PO				U	G5			
Sympetrum vicinum											
Violet-masked Glider/Carolina Saddlebags		X	PO				U	G5			
Tramea carolina											
Black-mantled Glider/Black Saddlebags		X		X			U	G5			
Tramea lacerata											
DAMSELFLIES											
Ebony Jewelwing		X	PR				C	G5			
Calopteryx maculata											
Common/Southern Spreadwing		X	PO				R1	G5			
Lestes disjunctus australis											
Eastern Red Damsel		X	PO				U	G5	S3S4		
Amphiagrion saucium											
Variable Dancer		X	PR				C	G5			
Argia fumipennis											
Familiar Bluet		X	PR			X	C	G5			
Enallagma civile											
Slender Bluet		X	PO				U	G5	S3		
Enallagma traviatum											
Citrine Forktail		X	PO				U	G5			
Ischnura hastata											
Fragile Forktail		X	PR			X	C	G5			
Ischnura posita											
Eastern Forktail		X	PO				R2	G5			
Ischnura verticalis											

[1] PR = Probably, PO = Possible, UN = Unlikely.
[2] R = Rare, U = Uncommon, C = Common, Ab = Abundant. When possible, actual # of sightings given for R.
[3] As of May 2023.

Table C-7. NAS Beetle Species.

Species	Area Sighted at NAS				Occurrence[2]	Ranking and Status[3]			
Common name	PAX[1]		WOLF[1]			Global	State	Federal	State
Scientific name	No	Yes	No	Yes		Rank	Rank	Status	Status
Northeastern Beach Tiger Beetle		X	UN		V	G3G4T2	S1	LT	E
Habroscelimorpha d. dorsalis									
Hairy-necked Tiger Beetle		X		X	U	G5			
Cicindela hirticollis									
Margined Tiger Beetle		X	PO		R6	G5			
Cicindela marginata									
Punctured Tiger Beetle		X	PR		U	G5			
Cicindela punctata									
Eastern Red-bellied Tiger Beetle		X	PO		R3	G5			
Cicindela rufiventris									
Bronze Tiger Beetle		X		X	U	G5			
Cicindela repanda									
Six-spotted Tiger Beetle		X	PO		R1	G5			
Cicindela sexguttata									
One-spotted Tiger Beetle		X	PO		R1	G4G5	S3		
Cylindera unipunctata									
Spotted Cucumber Beetle/ Southern Corn Rootworm		X	PO		R1	G5			
Diabrotica undecimpunctata howardi									
Horned Passalus/Bess-beetle		X	PO		R1				
Odontotaenius disjunctus									

[1] PR = Probable, PO = Possible, UN = Unlikely.
[2] V = Vagrant, R = Rare, U = Uncommon. When possible, actual # of sightings given for V and R.
[3] As of May 2023.

Table C-8. NAS Plant Species.

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name / ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Red Maple	Aceraceae	X	X		X	G5		
Acer rubrum L.								
Silver Maple	Aceraceae	X			X	G5		
Acer saccharinum L.								
Sugar Maple	Aceraceae	X				G5		
Acer saccharum Marsh.								
European Sweetflag	Acoraceae	X				G4		
Acorus calamus								
Yucca, Adam's Needle	Agavaceae	X				G5		
Yucca filamentosa								
American/Broadleaf Water Plantain	Alismataceae	X				G5		
Alisma subcordatum Raf.								
Common Arrow-head, Wapato	Alismataceae	X				G5		
Sagittaria latifolia								
Red-root Amaranth /Pigweed	Amaranthaceae			X		G5		
Amaranthus retroflexus								
Tidalmarsh Amaranth/Waterhemp Pigweed	Amaranthaceae	X		X		G5		
Amaranthus cannabinus (L.) Sauer								
Slim Amaranth, Smooth Pigweed	Amaranthaceae	X				G5		
Amaranthus hybridus L.								
Triangle Orache	Amaranthaceae			X				
Atriplex prostrata								
Slender Glasswort	Amaranthaceae			X				
Salicornia europaea								
Virginia Glasswort	Amaranthaceae			X		G5		
Salicornia depressa								
Dwarf/Shiny/Winged Sumac	Anacardiaceae	X		X	X	G5		
Rhus copallinum L.								
Smooth sumac	Anacardiaceae				X	G5		
Rhus glabra								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Eastern Poison Ivy	Anacardiaceae	X	X	X	X	G5		
Rhus or *Toxicodendron radicans* L.								
Staghorn Sumac	Anacardiaceae	X				G5		
Rhus typhina L.								
Pawpaw	Annonaceae	X				G5		
Asimina triloba (L.) Dunal								
Spotted Water Hemlock	Apiaceae	X				G5T5		
Cicuta maculata L.								
Queen Anne's Lace/Wild carrot	Apiaceae	X						
Daucus carota L.								
Buttercup Pennywort/Floating Marsh-pennywort	Apiaceae	X				G5		
*Hydrocotyle ranunculoide*s								
Whorled Pennywort	Apiaceae	X				G5		
Hydrocotyle verticillata								
Eastern Grasswort/Lilaeopsis	Apiaceae	X				G5		
Lilaeopsis chinensis (L.) Kuntze								
Atlantic Mock Bishopweed	Apiaceae	X				G5		
Ptilimnium capillaceum cf. (Michx.) Raf.								
Canadian Blacksnakeroot	Apiaceae	X				G5		
Sanicula canadensis L.								
Indian/Dogbane Hemp	Apocynaceae	X		X	X	G5		
Apocynum cannabinum L.								
Largeleaf Periwinkle	Apocynaceae	X						
Vinca major L.								
Periwinkle	Apocynaceae			X		GNR		
Vinca minor								
American Holly	Aquifoliaceae	X	X	X	X	G5T5		
Ilex opaca var. *opaca*								
Common Winterberry Holly	Aquifoliaceae	X				G5		
Ilex verticillata (L.) Gray								
Goldenclub	Araceae	X				G5		
Orontium aquaticum L.								
Green Arrow Arum	Araceae	X				G5		
Peltandra virginica (L.) Schott								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Hercules Club/Devil's Walkingstick	Araliaceae	X				G5		
Aralia spinosa L.								
English ivy	Araliaceae				X	GNR		
Hedera helix								
Sandvine, Honeyvine	Asclepiadaceae	X				G5		
Cynanchum laeve								
Clasping/Blunt-leaved Milkweed	Asclepiadaceae	X				G5		
Asclepias amplexicaulis Sm.								
Swamp Milkweed	Asclepiadaceae	X				G5		
Asclepias incarnata ssp. *pulchra*								
Common Milkweed	Asclepiadaceae	X				G5		
Asclepias syriaca L.								
Butterfly Weed	Asclepiadaceae	X				G5		
Ebony Spleenwort L.								
Whorled Milkweed	Asclepiadaceae		X			G5	S3	
Asclepias verticillata L.								
Angular-fruit Milkvine	Asclepiadaceae		X			G5T5	S2	
Matelea gonocarpos (Walt.) Shinners								
Ebony Spleenwort	Aspleniaceae	X	X			G5		
Asplenium platyneuron (L.) B.S.P.								
Common Yarrow	Asteraceae	X				G5		
Achillea millefolium L.								
Annual Ragweed	Asteraceae	X	X			G5		
Ambrosia artemisifolia L.								
Woman's Tobacco	Asteraceae	X				G5		
Antennaria plantaginifolia								
Corn Chamomile	Asteraceae	X						
Anthemis arvensis L.								
Mugwort, Common Wormwood	Asteraceae	X	X					
Artemisia vulgaris L.								
Bushy Aster, Rice Button Aster	Asteraceae	X				T4		
Aster dumosus L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Tall White Aster	Asteraceae	X	X			G5		
Doellingeria umbellata								
Calico/Starved Aster	Asteraceae	X						
Symphyotrichum lateriflorum						G5		
Stiff Aster	Asteraceae	X						
Aster linariifolius L.								
Late Purple Aster	Asteraceae		X			G5		
Symphyotrichum patens								
White Old-field/White Heath Aster	Asteraceae	X	X			G5		
Symphyotrichum pilosum								
Small-head Aster	Asteraceae		X			G4		
Aster racemosus Ell.								
Annual Saltmarsh Aster	Asteraceae			X		G5		
Symphyotrichum subulatum								
Large or Perennial Salt-marsh Aster	Asteraceae	X		X		G5		
Symphyotrichum tenuifolium.								
Clasping Heart-leaved Aster/ Wavyleaf Aster	Asteraceae	X				G5		
Aster undulatus L.								
Groundsel Tree, Eastern Baccharis	Asteraceae	X		X	X	G5		
Baccharis halimifolia L.								
Bearded/Tickseed Beggarticks	Asteraceae	X	X			G5		
Bidens aristosa								
Spotted Knapweed	Asteraceae				X			
Centaurea stoebe								
Oxeye Daisy	Asteraceae	X						
Chrysanthemum leucanthemum L.								
Maryland Goldenaster	Asteraceae	X				G5		
Chrysopsis mariana (L.) Ell.								
Tall Thistel	Asteraceae				X			
Cirsium altissimum								
Chicory	Asteraceae	X						
Cichorium intybus L.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Canadian/Creeping Thistle	Asteraceae	X				G5		
Cirsium arvense (L.) Scop.								
Field Thistle	Asteraceae	X				G5		
Cirsium discolor (Muhl. ex Willd.) Spreng.								
Canadian Horseweed	Asteraceae	X		X		G5		
Conyza canadensis (L.) Cronq.								
Golden-tickseed	Asteraceae		X			G5		
Coreopsis tinctoria Nutt.								
Carolina Elephant's Foot	Asteraceae	X				G5		
Elephantopus carolinianus Raeusch.								
Tabaccoweed	Asteraceae	X				G5	S1S2	E
Elephantopus tomentosus L.								
Prairie/Daisy Fleabane	Asteraceae	X	X			G5		
Erigeron strigosus Muhl. ex Willd.								
Lesser Snakeroot	Asteraceae	X				G5		
Ageratina aromatica.								
Dog-fennel	Asteraceae	X		X		G5		
Eupatorium capillifolium (Lam.) Small								
Blue Mistflower/Boneset	Asteraceae	X				G5		
Eupatorium coelestinum L.								
Eastern Joe-pye Thoroughwort	Asteraceae	X				G5		
Eupatorium dubium Willd. ex Poir.								
Hyssopleaf Thouroughwort	Asteraceae		X			G5		
Eupatorium hyssopifolium L.								
Common Boneset	Asteraceae	X				G5		
Eupatorium perfoliatum L.								
Rough Boneset	Asteraceae	X	X			G5		
Eupatorium pilosum Walt.								
Roundleaf Thoroughwort	Asteraceae	X	X			G5		
Eupatorium rotundifolium L.								
Late-flowering Thoroughwort	Asteraceae	X				G5		
Eupatorium serotinum Michx.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Flattop Goldentop	Asteraceae	X	X			G5		
Euthamia gramnifolia (L.) Nutt.								
Slender Goldentop	Asteraceae		X			G5		
Euthamia tenuifolia (Pursh) Nutt.								
Sweet Everlasting	Asteraceae	X				G5		
Pseudognaphalium obtusifolium								
Common Sunflower	Asteraceae	X				G5		
Helianthus annuus L.								
Beaked/Hairy Hawkweed	Asteraceae	X	X			G5		
Hieracium gronovii L.								
Panicled Hawkweed	Asteraceae	X				G5		
Hieracium paniculatum L.								
Hairy Cat's-ear	Asteraceae	X	X			G5		
Hypochaeris radicata L.								
Marsh Elder, Jesuit's Bark	Asteraceae	X		X		G5		
Iva frutescens L.								
Virginia Dwarf Dandelion	Asteraceae	X	X			G5		
Krigia virginica (L.) Willd.								
Wild/Canada Lettuce	Asteraceae	X				G5		
Lactuca canadensis L.								
Gayfeather, Grass-leaved Blazing Star	Asteraceae	X				G5		
Liatris pilosa								
Climbing Hempweed	Asteraceae	X				G5		
Mikania scandens (L.) Willd.								
Sweetscent or Shrubby Camphorweed	Asteraceae	X		X		G5		
Pluchea odorata (L.) Cass.								
Black-eyed Susan	Asteraceae	X				G5T5		
Rudbeckia hirta L.								
Small's Ragwort	Asteraceae	X	X			G5		
Senecio anonymus Wood								
Toothed Whitetop Aster	Asteraceae	X				G5		
Sericocarpus asteroides (L.) B.S.P.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Tall Goldenrod	Asteraceae	X				G5		
Solidago altissima L.								
White Goldenrod, Silver-rod	Asteraceae	X				G5		
Solidago bicolor L.								
Slender/Erect/Showy Goldenrod	Asteraceae	X			X	G5		
Solidago erecta								
Early Goldenrod	Asteraceae	X	X			G5T5		
Solidago juncea Ait.								
Gray Goldenrod	Asteraceae	X	X			G5		
Solidago nemoralis Ait.								
Wrinkle-leaf or Roughleaf Goldenrod	Asteraceae	X				G5		
Solidago rugosa P. Mill.								
Seaside Goldenrod	Asteraceae		X	X		G5		
Solidago sempervirens L.								
Coastal Plain Flattop Goldenrod or Slender Fragrant Goldenrod	Asteraceae	X	X			G5		
Euthamia caroliniana								
Common Dandelion	Asteraceae	X	X			G5		
Taraxacum officinale G.H. Weber ex Wiggers								
Yellow Crowbeard	Asteraceae	X				G5		
Verbesina occidentalis (L.) Walt.								
New York Ironweed	Asteraceae	X				G5		
Vernonia noveboracensis (L.) Michx.								
Beach Cocklebur	Asteraceae	X						
Xanthium echinatum Murr.								
Rough cocklebur	Asteraceae			X		G5		
Xanthium strumarium								
Puerto Rico or Slender sea-purslane	Aizoaceae			X		G5	S1	E
Sesuvium maritima								
Orange Jewelweed	Balsaminaceae	X	X	X		G5		
Impatiens capensis Meerb.								
Julian's Berberis	Berberidaceae	X						
Berberis julianiae Schneid.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name / ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Nandina	Berberidaceae				X	GNR		
Nandina domestica								
Mayapple	Berberidaceae	X		X		G5		
Podophylum peltatum L.								
Smooth/Common Alder	Betulaceae	X	X					
Alnus serrulata (Ait.) Willd.						G5		
American Hornbeam, Musclewood	Betulaceae	X						
Carpinus caroliniana Walt.								
Trumpet Creeper	Bignoniaceae	X	X		X	G5		
Campsis radicans (L.) Seem. ex Bureau								
Netted Chainfern	Blechnaceae	X				G5		
Woodwardia areolata (L.) T. Moore								
Virginia Chainfern	Blechnaceae	X				G5		
Woodwardia virginica (L.) Sm.								
Mouseear Cress or Wall-cress	Brassicaceae	X				G5		
Arabidopsis thaliana (L.) Heyuh.								
Early Yellowrocket	Brassicaceae	X						
Barbarea verna (P. Mill.) Aschers.								
Garden Yellowrocket	Brassicaceae	X						
Barbarea vulgaris R. Br.								
Brown Sarson	Brassicaceae	X						
Brassica campestris L.								
American Searocket	Brassicaceae	X		X		G5		
Cakile edentula (Bigelow) Hook.								
Hairy Bittercress	Brassicaceae	X						
Cardamine hirsuta L.								
Cutleaf Toothwort	Brassicaceae	X				G5		
Dentaria laciniata Muhl. ex Willd.								
Field Pennycress, Thickleaf Pepperweed	Brassicaceae	X						
Lepidium campestre (L.) Ait. f.						G5		
Virginia Pepperweed	Brassicaceae	X						
Lepidium virginicum L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Jointed Charlock, Wild Radish	Brassicaceae	X				G5		
Raphanus raphanistrum L.								
Hedgemustard	Brassicaceae	X						
Sisymbrium officinale (L.) Scop.								
Twoheaded Water-starwort	Callitrichaceae	X				G5		
Callitriche heterophylla Pursh								
Pond Water-starwort	Callitrichaceae	X	X					
Callitriche stagnalis Scop.								
Cardinalflower	Campanulaceae	X				G5		
Lobelia cardinalis L.								
Indian-tobacco	Campanulaceae	X				G5		
Lobelia inflata L.								
Nuttall's Lobelia	Campanulaceae	X				G4G5		
Lobelia nuttallii Schult.								
Downy Lobelia	Campanulaceae	X				G5		
Lobelia puberula Michx.								
Clasping Venus' Looking-glass	Campanulaceae	X				G5		
Triodanis perfoliata (L.) Nieuwl.								
Glossy Abelia	Caprifoliaceae	X						
Abelia grandiflora (Andre) Rehder								
Sweet Breath of Spring	Caprifoliaceae	X						
Lonicera fragrantissima Lindl. & Paxton								
Fly Honeysuckle	Caprifoliaceae	X						
Lonicera involucrata Banks ex Spreng.								
Japanese Honeysuckle	Caprifoliaceae	X	X	X	X	GNR		
Lonicera japonica Thunb.								
Amur Honeysuckle	Caprifoliaceae	X						
Lonicera maackii (Rupr.) Maxim.								
Trumpet Honeysuckle	Caprifoliaceae		X			G5		
Lonicera sempervirens L.								
Bush Honeysuckle	Caprifoliaceae	X			X	GNR		
Lonicera tatarica L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Common Elderberry	Caprifoliaceae	X				G5		
Sambucus nigra								
Arrowwood	Caprifoliaceae	X						
Viburnum dentatum L. var. *lucidem* Ait.								
Nannyberry	Caprifoliaceae	X				G5	S1	
Viburnum lentago L.								
Possumnaw Viburnum	Caprifoliaceae	X				G5		
Viburnum nudum L.								
Black Haw	Caprifoliaceae	X				G5		
Viburnum prunifolium L.								
Thyme-leaved Sandwort	Caryophyllaceae		X					
Arenaria serpyllifolia L.								
Sticky Chickweed	Caryophyllaceae	X						
Cerastium viscosum L.								
Mouse-eared Chickweed	Caryophyllaceae	X						
Cerastium glomeratum								
Deptford pink	Caryophyllaceae	X			X			
Dianthus armeria L.								
White Campion	Caryophyllaceae	X						
Lychnis alba L.								
Bladder Campion	Caryophyllaceae	X						
Silene latifolia Poir								
Maiden's Tears	Caryophyllaceae	X						
Silene vulgaris (Moench) Garcke								
Cornspurry	Caryophyllaceae		X					
Spergula arvensis L.								
Salt Sandspurry	Caryophyllaceae	X				G5		
Spergularia marina (L.) Griseb.								
Chickweed	Caryophyllaceae	X						
Stellaria media (L.) Vill.								
American Strawberry Bush	Celastraceae	X				G5		
Euonymus americana L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Scientific Name								
Coon's Tail or Common Hornwort	Ceratophyllaceae	X				G5		
Ceratophyllum demersum L.								
Halberd-leaf Orache	Chenopodiaceae			X				
Atriplex patula L.								
Spear Saltbrush	Chenopodiaceae	X						
Atriplex patula L.								
Lamb's Quarters, Pigweed	Chenopodiaceae	X		X		G5		
Chenopodium album L.								
Mexican Tea, Wormseed	Chenopodiaceae	X			X			
Chenopodium ambrosioides L.								
Pitseed Goosefoot	Chenopodiaceae		X	X		G5		
Chenopodium berlandieri Moq.								
Sampshire, Slender Glasswort	Chenopodiaceae	X		X		G5		
Salicornia maritima								
Prickly saltwort or Russian Thistle	Chenopodiaceae			X				
Salsola kali								
Largepod Pinweed	Cistaceae	X	X					
Lechea intermedia cf. Leggett ex Britt.								
Beach Pinweed	Cistaceae	X				G5	S3	
Lechea maritima Leggett ex B.S.P.								
Illinois Pinweed	Cistaceae	X				G5		
Lechea racemulosa Michx.								
Sweet Pepperbush	Clethraceae	X				G5		
Clethra alnifolia L.								
Lesser Canadian St. Johnswort	Clusiaceae	X				G5		
Hypericum canadense L.								
Orange-grass, Pineweed	Clusiaceae	X	X			G5		
Hypericum gentianoides (L.) B.S.P.								
Claspingleaf St. Johnswort	Clusiaceae	X	X			G4	S3	
Hypericum gymnanthum Engelm. & Gray								
Dwarf St. Johnswort	Clusiaceae	X				G5		
Hypericum mutilum L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Common St. Johnswort	Clusiaceae	X	X					
Hypericum perforatum L.								
Spotted St. Johnswort	Clusiaceae	X	G5			G5		
Hypericum punctatum Lam.								
Virginia Marsh St. Johnswort	Clusiaceae	X	G5			G5		
Hypericum or *Triadenum virginicum* (L.) Raf.								
Greater Marsh St. Johnswort	Clusiaceae	X	G5			G5		
Triadenum walteri (J.G. Gmel.) Gleason								
St. Andrew's Cross	Clusiaceae	X				G5		
Ascyrum hypericoides (L.)								
Hedge Bindweed	Convolvulaceae	X	X	X		G5		
Calystegia sepium (L.) R. Br.								
Field Bindweed	Convolvulaceae	X						
Convolvulus arvensis L.								
Hoary Bindweed	Convolvulaceae	X						
Convolvulus incanus Vahl.								
Small Red Morning-glory	Convolvulaceae	X						
Ipomoea coccinea L.								
Ivy-leaved Morning-glory	Convolvulaceae	X						
Ipomoea hederacea Jacq.								
Small White Morning-glory or Whitestar	Convolvulaceae	X				G5		
Ipomoea lacunosa L.								
Swamp Dogwood	Cornaceae				X	G5T5		
Cornus amomum								
Flowering Dogwood	Cornaceae	X	X		X	G5		
Cornus florida L.								
Stiff Dogwood	Cornaceae	X				G5		
Cornus stricta Lam.								
Creeping Cucumber	Cucurbitaceae	X	X			G5		
Melothria pendula L.								
Eastern Red Cedar	Cupressaceae	X	X	X	X	G5		
Juniperus virginiana L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Bald cypress	Cupressaceae				X	G5		
Taxodium distichum								
Compact Dodder	Cuscutaceae	X						
Cuscuta compacta Juss. ex Choisy								
Big-seed Alfalfa Dodder	Cuscutaceae	X		X		G5T5	S12?	
Cuscuta indecora Choisy								
Five-angled/Field Dodder	Cuscutaceae	X				G5		
Cuscuta pentagona Engelm.								
Dodder	Cuscutaceae	X						
Cuscuta sp.								
Threadleaf Beakseed or Dense-tuft Hairsedge	Cyperaceae	X						
Bulbostylis capillaris (L.) Kunth ex C.B. Clarke								
Cosmopolitan Bulrush	Cyperaceae			X				
Bolboschoenus maritimus								
Whitetinge Sedge or Bellow-beaked Sedge	Cyperaceae	X				G5		
Carex albicans Willd. ex Spreng.								
Yellowfruit Sedge	Cyperaceae	X	X			G5		
Carex annectens (Bickn.) Bickn.								
Prickly Bog Sedge	Cyperaceae	X				G5		
Carex atlantica Bailey								
Shortbeak Sedge	Cyperaceae	X	X			G5		
Carex brevior (Dewey) Mack. ex Lunell								
Silvery Sedge	Cyperaceae	X				G5		
Carex canascens L.								
Longhair Sedge	Cyperaceae	X				G5		
Carex comosa Boott								
Hirsute Sedge	Cyperaceae	X	X			G5	S3	
Carex complanata Torr. & Hook.								
Fringed Sedge	Cyperaceae	X				G5		
Carex crinita Lam.								
White Edge Sedge	Cyperaceae	X				G5		
Carex debilis Michx.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Separated Sedge	Cyperaceae		X					
Carex divisa Huds.								
Long-bract Sedge	Cyperaceae	X						
Carex extensa Gooden.								
Fuzzy-wuzzy Sedge or Hisute Sedge	Cyperaceae	X				G5		
Carex hirsutella Mack.								
Greater Bladder Sedge	Cyperaceae	X				G5		
Carex intumescens Rudge								
Bristly-stalked Sedge	Cyperaceae	X				G5		
Carex leptalea Wahlenb.								
Shallow Sedge	Cyperaceae	X						
Carex lurida Wahlenb.								
Muhlenberg's Sedge	Cyperaceae	X				G5		
Carex muhlenbergii Schkuhr ex Willd.								
Weak Stellate Sedge	Cyperaceae	X				G5		
Carex seorsa Howe								
Awl-fruit Sedge	Cyperaceae		X			G5		
Carex stipata Muhl. ex Willd.								
Upright Sedge	Cyperaceae	X				G5		
Carex stricta Lam.								
Bent Sedge	Cyperaceae	X				G4G5	S3	
Carex styloflexa Buckl.								
Fox Sedge	Cyperaceae	X				G5		
Carex vulpinoidea Michx.								
Tapertip Flatsedge	Cyperaceae	X				G5		
Cyperus acuminatus Torr. & Hook. ex Torr.								
Globe Flatsedge	Cyperaceae	X	X			G5		
Cyperus echinatus (L.) Wood								
Redroot Flatsedge	Cyperaceae	X				G5		
Cyperus erythrorhizos Muhl.								
Chufa Flatsedge	Cyperaceae	X		X		G5		
Cyperus esculentus L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Fern Flatsedge	Cyperaceae	X				G5		
Cyperus filicinus Vahl								
Yellow Flatsedge	Cyperaceae	X				G5		
Cyperus flavescens L.								
Gray's Flatsedge	Cyperaceae	X				G5		
Cyperus grayi Torr.								
Manyflower Flatsedge	Cyperaceae	X				G5	SU	
Cyperus lancastriensis Porter ex Gray								
Asian Flatsedge	Cyperaceae	X						
Cyperus amuricus Maxim								
Fragrant Flatsedge	Cyperaceae	X				G5		
Cyperus odoratus L.								
Umbrella Sedge	Cyperaceae	X				G5	SU	
Cyperus ovularis (Michx.) Torr.								
Marsh Flatsedge	Cyperaceae		X			G5		
Cyperus pseudovegetus Steud.								
Pine Barren Flatsedge	Cyperaceae	X				G5		
Cyperus retrorsus Chapm.								
Strawcolored Sedge	Cyperaceae	X				G5		
Cyperus strigosus L.								
Needle Spikerush	Cyperaceae	X				G5		
Eleocharis acicularis (L.) R. & S.								
White Spikerush	Cyperaceae				X	G4G5		
Eleocharis albida								
Englemann's Spikerush	Cyperaceae	X				G4G5	S4	S3
Eleocharis engelmannii Steud.								
Yellow Spikerush	Cyperaceae	X				G5		
Eleocharis flavescens cf. (Poir.) Urban								
Ovate Spikerush	Cyperaceae	X	X			G5		
Eleocharis ovata (Roth) R. & S.								
Common Spikerush	Cyperaceae	X				G5		
Eleocharis palustris (L.) R. & S.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Slender Spikerush	Cyperaceae	X				G5		
Eleocharis tenuis (Willd.) Schult.								
Twisted Spikerush	Cyperaceae	X				G5	S3	
Eleocharis tortilis (Link) Schult.								
Cone-cup Spikerush	Cyperaceae	X	X			G5		
Eleocharis tuberculosa (Michx.) R. & S.								
Slender Fimbry	Cyperaceae	X				G5		
Fimbristylis autumnalis (L.) R. & S.								
Marsh Fimbry	Cyperaceae	X	X	X		G5		
Fimbristylis castanea (Michx.) Vahl								
Hairy Umbrella-sedge	Cyperaceae	X				G4G5		
Fuirena squarrosa Michx.								
Brownish Beaksedge	Cyperaceae		X			G5		
Rhynchospora capitellata (Michx.) Vahl								
Globe Beakrush	Cyperaceae	X				G5?T5?	S1	E
Rhynchospora globularis (Chapm.) Small								
Clustered Beaksedge/Beakrush	Cyperaceae	X				G5	S3	
Rhynchospora glomerata (L.) Vahl								
Common Threesquare	Cyperaceae	X	X			G5		
Schoenoplectus pungens (Vahl) Palla								
Softstem Bulrush	Cyperaceae	X				G5		
Schoenoplectus validus (Vahl) A. & D. Love								
Bulrush or American Threesquare	Cyperaceae	X				G5		
Scirpus americanus Pers.								
Woolgrass or Cottongrass Bulrush	Cyperaceae	X				G5		
Scirpus cyperinus (L.) Kunth.								
Saltmarsh bulrush	Cyperaceae			X		G5		
Scriptus martimus								
Leafy Bulrush	Cyperaceae	X				G5		
Scirpus polyphyllus Vahl								
Chairmaker's Bulrush	Cyperaceae	X				G5		
Schoenoplectus pungens								
Weakstalk Bulrush	Cyperaceae	X				G4		
Scirpus purshianus Fern.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Saltmarsh/Sturdy Bulrush	Cyperaceae	X	X	X		G5		
Bolboschoenus robustus (Pursh) Soják								
Bulrush	Cyperaceae	X						
Scirpus sp.								
Fewflower Nutrush	Cyperaceae	X				G5		
Scleria pauciflora Muhl. ex Willd.								
Alpine Ladyfern	Dryopteridaceae	X				G4		
Athyrium alpestre (Hoppe) Milde								
Common Ladyfern	Dryopteridaceae	X				G5		
Athyrium filix-femina (L.) Roth								
Spinulose Wood Fern	Dryopteridaceae		X			G5		
Dryopteris carthusiana								
Ostrich Fern	Dryopteridaceae	X				G5	S2S3	
Matteuccia struthiopteris (L.) Todaro								
Sensitive Fern	Dryopteridaceae	X				G5		
Onoclea sensiblis L.								
Christmas Fern	Dryopteridaceae	X				G5		
Polystichum acrostichoides (Michx.) Schott								
Common Persimmon	Ebenaceae	X	X			G5		
Diospyros virginiana L.								
Russian Olive	Elaeagnaceae	X						
Elaeagnus angustifolia L.								
Autumn Olive	Elaeagnaceae	X						
Elaeagnus umbellata Thunb.								
Field Horsetail	Equisetaceae	X				G5		
Equisetum arvense L.								
American Fly Honeysuckle	Ericaceae	X						
Lonicera canadensis Bartr. ex Marsh.								
Spotted Wintergreen	Ericaceae	X	X			G5		
Chimaphila maculata (L.) Pursh								
Deciduous Swamp-fetterbush	Ericaceae	X				G5		
Eubotrys racemosa (L.) Nutt.								
Black Huckleberry	Ericaceae		X			G5		
Gaylussacia baccata (Wangenh) K. Koch								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Blue/Tall Huckleberry	Ericaceae		X			G5		
Gaylussacia frondosa (L.) T. & G. ex Torr.								
Mountain Laurel	Ericaceae	X				G5		
Kalmia latifolia L.								
Fetterbush	Ericaceae	X				G5		
Leucothoe racemosa (L.) Gray								
Maleberry	Ericaceae	X	X			5G		
Lyonia ligustrina (L.) DC.								
Indian Pipe	Ericaceae	X				G5		
Monotropa uniflora L.								
Dwarf Azalea	Ericaceae		X			G4G5		
Rhododendron atlanticum (Ashe) Rehd.								
Catawba Rosebay	Ericaceae	X				G5		
Rhododendron catawbiense Michx.								
Pinkster Flower, Pink Azalea	Ericaceae	X				G5		
Rhododendron periclymenoides (Michx.) Shinners								
Swamp Azalea	Ericaceae	X				G5		
Rhododendron viscosum (L.) Torr.								
Black Highbush Blueberry	Ericaceae	X	X			G5		
Vaccinium fuscatum Ait.								
Highbush Blueberry	Ericaceae		X			G5		
Vaccinium corymbosum L.								
Southern Low Blueberry	Ericaceae	X				G5		
Vaccinium pallidum Ait.								
Deerberry	Ericaceae	X	X			G5		
Vaccinium stamineum L.								
Slender Three-seeded Mercury	Euphorbiaceae	X				G5		
Acalypha gracilens Gray								
Common Three-seeded Mercury	Euphorbiaceae	X				G5		
Acalypha rhomboidea Raf.								
Virginia Three-seed Mercury	Euphorbiaceae	X				G5		
Acalypha virginica L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Seaside Spurge	Euphorbiaceae			X		G5		
Euphorbia polygonifolia L.								
Flowering Spurge	Euphorbiaceae	X				G5		
Euphorbia corollata L.								
Spotted Sandmat	Euphorbiaceae	X				G5		
Euphorbia maculata L.								
Eyebane	Euphorbiaceae	X				G5		
Euphorbia nutans Lag.								
Seaside Spurge/Sandmat	Euphorbiaceae	X		X		G5		
Euphorbia polygonifolia L.								
Spurge	Euphorbiaceae	X						
Euphorbia sp.								
Milk-purslane or Spotted Spurge	Euphorbiaceae	X				G5		
Euphorbia maculata								
Groundnut	Fabaceae	X				G5		
Apios americana Medik.								
Eastern Redbud	Fabaceae	X			X	G5		
Cercis canadensis L.								
Sleepingplant or Patridge-pea	Fabaceae	X				G5		
Chamaecrista fasciculata (Michx.) Greene								
Hoary Tick Trefoil	Fabaceae	X	X			G5		
Desmodium canescens (L.) DC.								
Hairy Small-leaf Trefoil	Fabaceae	X				G5		
Desmodium cilare (Muhl. ex Willd.) DC.								
Dillenius' Trefoil	Fabaceae	X				G5		
Desmodium glabellum (Michx.) DC.								
Panicleleaf Trefoil	Fabaceae	X						
Desmodium paniculatum (L.) DC.								
Prostrate Trefoil	Fabaceae	X				G5		
Desmodium rotundifolium DC.								
Downy Milkpea	Fabaceae		X			G5	S3	
Galactia volubilis (L.) Britt.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name / ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Singletary Peavine or**Single-tary** Pea	Fabaceae	X						
Lathyrus hirsutus L.								
Perennial Pea	Fabaceae	X						
Lathyrus latifolius L.								
Shrubby Lespedeza	Fabaceae	X						
Lespedeza bicolor Turcz.								
Roundhead Lespedeza	Fabaceae	X				G5		
Lespedeza capitata Michx.								
Bush Clover, Chinese Lespedeza	Fabaceae	X	X					
Lespedeza cuneata (Dum.-Cours.) G. Don								
Sericea lespedeza	Fabaceae				X	GNR		
Lespedeza cuniata								
Intermediate Lespedeza or *Lespedeza violacea*	Fabaceae	X	X			G5		
Lespedeza intermedia (Wats.) Britton								
Bush Lespedeza	Fabaceae	X						
Lespedeza japonica L.H. Bailey								
Lespedeza	Fabaceae	X						
Lespedeza nuttallii Darl.								
Trailing Bush Clover	Fabaceae	X	X					
Lespedeza procumbens Michx.						G5		
Creeping Bush Clover	Fabaceae	X						
Lespedeza repens (L.) W. Bart.								
Korean Bush Clover	Fabaceae	X						
Lespedeza stipulacea Maxim.								
Japanese Bush Clover	Fabaceae	X	X		X	GNR		
Kummerowia striata								
Thunberg's Lespedeza	Fabaceae	X						
Lespedeza thunbergia (DC.) Nakai								
Slender Lespedeza	Fabaceae	X	X					
Lespedeza virginica (L.) Britt.								
White Sweetclover	Fabaceae	X						
Melilotus alba Medikus								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Yellow Sweetclover	Fabaceae	X						
Melilotus officinalis (L.) Lam.								
Kudzu	Fabaceae	X			X	GNR		
Pueraria lobata (Willd.) Ohwi								
Black Locust	Fabaceae	X	X	X	X	G5		
Robinia psuedoacacia L.								
Crownvetch	Fabaceae				X	GNR		
Securigera varia								
Trailing Wild Bean	Fabaceae	X		X				
Strophostyles helvola (L.) Ell.								
Perennial Wooly Bean	Fabaceae	X						
Strophostyles umbellata (Muhl. ex Willd.) Britt.								
Sidebeak Pencilflower	Fabaceae	X						
Stylosanthes biflora (L.) B.S.P.								
Red Clover	Fabaceae	X						
Trifolium pratense L.								
Low Hop Clover	Fabaceae	X						
Trifolium procumbens L.								
White Clover	Fabaceae	X						
Trifolium repens L.								
Common Vetch	Fabaceae		X					
Vicia angustifolia L.								
Garden Vetch	Fabaceae	X						
Vicia sativa L.								
Japanese Chestnut	Fagaceae	X						
Castanea crenata cf. Sieb. & Zucc.								
American Chestnut	Fagaceae	X	X			G4	S2/S3	
Castanea dentata (Marsh.) Borkh								
American Beech	Fagaceae	X	X					
Fagus grandifolia Ehrh.								
Sawtooth Oak	Fagaceae		X					
Quercus acutissima Carruthers								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
White Oak	Fagaceae	X	X		X			
Quercus alba L.								
Scarlet Oak	Fagaceae	X						
Quercus coccinea Muenchh.								
Southern Red Oak	Fagaceae	X						
Quercus falcata Michx.								
Southern Red Oak hybrid	Fagaceae	X						
Quercus falcata hybrid								
Shingle Oak	Fagaceae	X						
Quercus imbricaria Michx.								
Hybrid Oak	Fagaceae		X					
Quercus x *leana* Nutt.								
Bur/Mossy-cup Oak	Fagaceae				X			
Quercus macrocarpa								
Blackjack Oak	Fagaceae	X						
Quercus marilandica Muenchh.								
Swamp Chestnut Oak	Fagaceae	X	X					
Quercus michauxii Nutt.								
Water Oak	Fagaceae	X						
Quercus nigra L.								
Pin Oak	Fagaceae	X						
Quercus palustris Muenchh.								
Willow Oak	Fagaceae	X			X			
Quercus phellos L.								
Chestnut Oak	Fagaceae	X						
Quercus prinus L.								
Northern Red Oak	Fagaceae	X						
Quercus rubra L.								
Shumard's Oak	Fagaceae	X	X			G5	S2	T
Quercus shumardii Buckl.								
Post Oak	Fagaceae	X						
Quercus stellata Wangenh.								
Black Oak	Fagaceae	X	X					
Quercus velutina Lam.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Twining Screwstem	Gentianaceae	X				G5	S3	
Bartonia paniculata (Michx.) Muhl.								
Spike-century	Gentianaceae			X				
Centaurium spicata								
Harvestbells	Gentianaceae		X					
Gentiana saponaria L.								
Marsh Pink	Gentianaceae	X		X				
Sabatia stellaris								
Slender Marsh Pink	Gentianaceae			X		G5	S1	E
Sabatia campanulata or stellaris								
Crane's Bill	Geraniaceae	X						
Geranium carolinianum L.								
Cut-leaf Geranium	Geraniaceae		X					
Geranium dissectum L.								
Virginia Sweetspire	Grossulariaceae	X						
Itea virginica L.								
Eurasian Watermilfoil	Haloragidaceae	X						
Myriophyllum spicatum L.								
Whorled Watermilfoil	Haloragidaceae	X				G5	SU	
Myriophyllum verticullatum L.								
Sweetgum	Hamamelidaceae	X	X		X			
Liquidambar styraciflua L.								
Canadian Waterweed	Hydrocharitaceae	X						
Elodea canadensis Michx.								
Wild Celery	Hydrocharitaceae	X						
Vallisneria americana Michx.								
Narrowleaf Blue-eyed Grass	Iridaceae	X						
Sisyrinchium angustifolium P. Mill.								
Strict Blue-eyed Grass	Iridaceae		X					
Sisyrinchium montanum Greene								
Bitternut Hickory	Juglandaceae	X						
Carya cordiformis (Wangenh.) K. Koch								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
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Pignut Hickory	Juglandaceae	X						
Carya glabra (P. Mill.) Sweet								
Shagbark Hickory	Juglandaceae	X						
Carya ovata (P. Mill.) K. Koch								
Sand Hickory	Juglandaceae	X						
Carya pallida (Ashe) Engl. & Graebn.								
Mockernut Hickory	Juglandaceae	X						
Carya tomentosa (Lam. ex Poir.) Nutt.								
Black Walnut	Juglandaceae	X						
Juglans nigra L.								
Tapertip Rush	Juncaceae	X	X					
Juncus acuminatus Michx.								
Bog Rush	Juncaceae	X	X					
Juncus biflorus Ell.								
Whiteroot Rush	Juncaceae	X	X			G4G5	SU	
Juncus brachycarpus Engelm.								
Toadrush	Juncaceae	X	X					
Juncus bufonius L.								
Leathery Rush	Juncaceae	X						
Juncus coriaceous Mack.								
Weak Rush	Juncaceae	X	X					
Juncus debilis Gray								
Forked Rush	Juncaceae	X						
Juncus dichotomus cf. Ell.								
Dudley's rush	Juncaceae			X				
Juncus dudleyi Wiegand								
Common Rush	Juncaceae	X	X					
Juncus effusus L.								
Elliott's Rush	Juncaceae		X			G4G5	SU	?
Juncus elliottii Chapman								
Saltmeadow Rush, Black Grass	Juncaceae		X					
Juncus gerardii Loisel.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Grassleaf Rush	Juncaceae	X	X					
Juncus marginatus Rostk.								
Needlegrass Rush	Juncaceae	X	X	X				
Juncus roemerianus Scheele								
Needlepod Rush	Juncaceae	X	X					
Juncus scirpoides Lam.								
Lopsided Rush	Juncaceae	X						
Juncus secundus Beauv. ex Poir.								
Slender Rush	Juncaceae	X	X					
Juncus tenius Willd.								
Bulbous Woodrush	Juncaceae	X						
Luzula bulbosa (Wood) Smyth & Smyth								
Giant Yellow Hyssop	Lamiaceae	X						
Agastache nepetoides (L.) Kuntze								
Henbit Deadnettle	Lamiaceae	X						
Lamium amplexicaule L.								
American Water Horehound	Lamiaceae		X					
Lycopus americanus Muhl. ex W. Bart.								
Virginia Water Horehound	Lamiaceae	X						
Lycopus virginicus L.								
Common Selfheal	Lamiaceae	X						
Prunella vulgaris L.								
Narrowleaf Mountainmint	Lamiaceae	X	X					
Pycnanthemum tenuifolium Schrad.								
Lyreleaf Sage	Lamiaceae		X					
Salvia lyrata L.								
Basil-thyme	Lamiaceae	X	X					
Satureja calamintha (L.) Scheele								
Helmet Flower, Hyssop Skullcap	Lamiaceae	X	X					
Scutellaria integrifolia L.								
American germander	Lamiaceae			X				
Teucrium canadense L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Forked Blue-curls	Lamiaceae	X						
Trichostema dichotomum L.								
Northern Spicebush	Lauraceae	X						
Lindera benzoin (L.) Blume								
Sassafras	Lauraceae	X			X	G5		
Sassafras albidum (Nutt.) Nees								
Duckweeds	Lemnaceae	X						
Lemna spp.								
Bladderwort	Lentibulariaceae	X				G5	S1	E
Utricularia biflora Lam.								
Humped Bladderwort	Lentibulariaceae	X						
Utricularia gibba L.								
Meadow Onion	Liliaceae	X						
Allium canadense								
Field Garlic	Liliaceae	X		X	X	X		
Allium vineale L.								
Asparagus	Liliaceae	X		X	X			
Asparagus officinalis L.								
Day Lily	Liliaceae	X						
Hemerocallis fulva (L.) L.								
Daffodil	Liliaceae	X						
Narcissus pseudonarcissus L.								
Sleepydick	Liliaceae		X					
Ornithogalum umbellatum L.								
False Solomon's Seal	Liliaceae	X						
Smilacina racemosa L. Desf.								
Sandplain Flax, Bicknell's Yellow Flax	Linaceae	X				G4	S2	T
Linum intercursum Bickn.								
Stiff Yellow Flax	Linaceae	X	X					
Linum medium (Planch.) Britt.								
Ridged Yellow Flax	Linaceae	X						
Linum striatum Walt.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Juniper Leaf	Loganaceae	X						
Polypremum procumbens L.								
Southern Bog Clubmoss	Lycopodiaceae	X						
Lycopodium adpressum (Chapman) Lloyd & Underwood								
Southern Ground Cedar	Lycopodiaceae	X						
Lycopodium digitatum Dill. ex A. Braun								
Ground Pine	Lycopodiaceae	X						
Lycopodium obscurum L.								
Swamp Loosestrife	Lythraceae	X						
Decodon verticillatus (L.) Ell.								
Tulip/Yellow Poplar	Magnoliaceae	X	X		X			
Liriodendron tulipifera L.								
Sweetbay Magnolia	Magnoliaceae	X						
Magnolia virginiana L.								
Velvetleaf	Malvaceae	X						
Abutilon theophrasti Medik.								
Marsh Mallow	Malvaceae		X					
Althaea officinalis L.								
Marsh Hibiscus	Malvaceae	X		X				
Hibiscus moscheutos L.								
Rose Mallow	Malvaceae	X		X				
Hibiscus palustris L.								
Seashore Mallow	Malvaceae	X		X				
Kosteletzkya virginica (L.) K. Presl ex Gray								
Prickly Mallow	Malvaceae	X						
Sida spinosa L.								
Maryland Meadow Beauty	Melastomataceae	X						
Rhexia mariana L.								
Nash's Meadow-pitcher	Melastomataceae	X						
Rhexia nashii Small								
Pinesap, False Beechdrop	Monotropaceae	X						
Monotropa hypopithys L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Paper Mulberry	Moraceae	X	X		X			
Broussonetia papyrifera (L.) L'Her. ex Vent.								
Osage Orange	Moraceae		X					
Maclura pomifera (Raf.) Schneid.								
White Mulberry	Moraceae	X	X		X			
Morus alba L.								
Black Mulberry	Moraceae	X						
Morus nigra L.								
Red Mulberry	Moraceae	X	X					
Morus rubra L.								
Waxmyrtle	Myricaceae	X	X	X				
Myrica cerifera L.								
Bayberry	Myricaceae	X						
Myrica pensylvanica Mirbel								
Bushy Ponweed, Southern Waternymph	Najadaceae	X						
Najas guadalupensis (Spreng.) Magnus								
American White Waterlily	Nymphaeaceae	X						
Nymphaea odorata Ait.								
Yellow Pond Lily	Nymphaeaceae	X						
Nuphar lutea (L.) Sm.								
Blackgum, Black Tupelo	Nyssaceae		X		X			
Nyssa sylvatica Marsh.								
Fringe-tree	Oleaceae	X						
Chionanthus virginicus L.								
Green Ash	Oleaceae	X			X			
Fraxinus pennsylvanica Marsh.								
Pumpkin Ash	Oleaceae	X			X	G4	S2S3	
Fraxinus profunda (Bush) Bush								
Japanese Privet	Oleaceae				X	GNR		
Ligustrum japonicum								
California Privet	Oleaceae	X						
Ligustrum ovalifolium Hassk.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Chinese privet	Oleaceae				X	GNR		
Ligustrum sinese								
Broadleaf Enchanter's Nightshade	Onagraceae	X						
Circaea quadrisulcata (Maxim.) Franch. & Savigny								
Common Water-purslane	Onagraceae	X						
Ludwigia palustris (L.) Ell.								
Common Evening-primrose	Onagraceae	X						
Oenothera biennis L.								
Northern Evening-primrose	Onagraceae	X						
Oenothera parviflora L.								
Sparse-lobed Grapefern	Ophioglossaceae	X						
Botrychium biternatum (Sav.) Underwood								
Lace-frond Grapefern	Ophioglossaceae	X						
Botrychium dissectum Spreng.								
Rattlesnake Fern	Ophioglossaceae	X						
Botrychium virginianum (L.) Sw.								
Adder's-tongue	Ophioglossaceae	X						
Ophioglossum vulgatum L.								
Stemless Lady's Slipper	Orchidaceae	X						
Cypripedium acaule Ait.								
Club Spur Orchid	Orchidaceae	X						
Habenaria clavellata (Michx.) Spreng.								
Green Adder's Mouth	Orchidaceae	X						
Malaxis uniflora Michx.								
Nodding Ladies' Tresses	Orchidaceae		X					
Spiranthes cernua (L.) L.C. Rich.								
Cranefly Orchid	Orchidaceae	X						
Tipularia discolor (Pursh) Nutt.								
Cinnamon Fern	Osmundaceae	X						
Osmunda cinnamomea L.								
Royal Fern	Osmundaceae	X						
Osmunda regalis L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Southern Yellow Woodsorrel	Oxalidaceae	X						
Oxalis dillenii Jacq.								
Great Yellow Woodsorrel	Oxalidaceae	X						
Oxalis grandis Small								
Yellow Hornpoppy	Papaveraceae	X						
Glaucium flavum Crantz								
Purple Passionflower	Passifloraceae	X				G5	SU	
Passiflora incarnata L.								
Pokeweed	Phytolaccaceae	X		X	X	G5		
Phytolacca americana L.								
Longleaf Pine	Pinaceae	X						
Pinus palustris P. Mill.								
Eastern White Pine	Pinaceae				X	G5		
Pinus strobus								
Loblolly Pine	Pinaceae	X	X	X	X			
Pinus taeda L.								
Virginia or Scrub Pine	Pinaceae	X	X		X			
Pinus virginiana P. Mill.								
Eastern hemlock	Pinaceae				X	G5		
Tsuga canadensis								
Large-bracted Plantain	Plantaginaceae	X						
Plantago 93enicula Michx.								
Narrow-leaf Plantain	Plantaginaceae	X						
Plantago lanceolata L.								
Virginia Plantain	Plantaginaceae	X	X					
Plantago virginica L.								
Wooly Plantain	Plantaginaceae	X	X					
Plantago patagonica Jacq.								
American Sycamore	Platanaceae	X			X			
Platanus occidentalis L.								
Carolina Sealavender	Plumbaginaceae		X	X				
Limonium carolinianum								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Sealavender	Plumbaginaceae	X		X				
Limonium vulgare (Walter) Britton								
Velvet Bent-grass	Poaceae	X						
Agrostis canina L.								
Elliott's Bentgrass	Poaceae		X					
Agrostis elliottiana J.A. Schultes								
Winter Bentgrass	Poaceae	X	X					
Agrostis hyemalis (Walt.) B.S.P.								
Upland Bentgrass	Poaceae	X	X					
Agrostis perennans (Walt.) Tuckerman								
Bentgrass	Poaceae	X						
Agrostis sp.								
Creeping Bentgrass	Poaceae	X						
Agrostis stolonifera L.								
Silver Hairgrass	Poaceae		X					
Aira caryophyllea L.								
Annual Silver Hairgrass	Poaceae	X						
Aira elegans Willd. Ex Kunth								
Carolina Foxtail	Poaceae		X					
Alopecurus carolinianus Walt.								
Water Foxtail	Poaceae		X					
Alopecurus geniculatus L.								
Meadow Foxtail	Poaceae	X						
Alopecurus pratensis L.								
European Beachgrass	Poaceae	X						
Ammophilia arenaria (L.) Link								
American Beachgrass	Poaceae	X						
Ammophilia breviligulata Fern.								
Splitbeard Bluestem	Poaceae	X						
Andropogon ternarius Michx.								
Broomsedge Bluestem, Tall Anemone	Poaceae	X			X	G5		
Andropogon virginicus L.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Curtiss' Threeawn	Poaceae	X				G5T5	SU	
Aristida curtissii (Gray ex S. Wats. & Coult.) Nash								
Churchmouse Threeawn	Poaceae	X	X					
Aristida dichotoma Michx.								
Slimspike Threeawn	Poaceae	X	X					
Aristida longespica Poir.								
Prairie Threeawn	Poaceae	X						
Aristida oligantha Michx.								
Giant Cane	Poaceae	X				G5	S2	
Arundinaria gigantea (Walt.) Muhl.								
Soft Brome	Poaceae	X	X					
Bromus hordeaceus L.								
Bald Brome	Poaceae	X						
Bromus racemosus L.								
Ripgut Brome	Poaceae	X						
Bromus rigidus Roth								
Reedgrasses	Poaceae	X						
Calamagrostis spp.								
Dune sandbur	Poaceae			X				
Cenchurus tribuloides								
Slender Wood-oats	Poaceae	X	X					
Chasmanthium laxum (L.) Yates								
Tumble Windmill Grass	Poaceae	X						
Chloris 95eniculate9595 Nutt.								
Small Woodreed Grass	Poaceae	X						
Cinna arundinacea L.								
Bermuda Grass	Poaceae	X			X	GNR		
Cynodon dactylon (L.) Pers.								
Orchard Grass	Poaceae	X						
Dactylis glomerata L.								
Poverty Danthonia	Poaceae	X	X					
Danthonia spicata (L.) Beauv. Ex R. & S.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Wavy Hairgrass	Poaceae		X					
Deschampsia flexuosa (L.) Trin.								
Variable Panicgrass	Poaceae	X						
Dichanthelium commutatum (Schult.) Gould								
Broadleaf Rosette Grass	Poaceae	X						
Dichanthelium latifolium (L.) Gould & C.A. Clark								
Hairy Crabgrass	Poaceae	X						
Digitaria sanguinalis (L.) Scop.								
Inland Saltgrass	Poaceae	X		X				
Distichlis spicata (L.) Greene								
Barnyard Grass	Poaceae	X						
Echinochloa crus-galli (L.) Beauv.								
Coast Cockspur Grass	Poaceae	X						
Echinochloa walteri (Pursh) Heller								
Virginia Wildrye	Poaceae	X	X					
Elymus virginicus L.								
Lace Grass	Poaceae	X						
Eragrostis capillaris (L.) Nees								
Weeping Lovegrass	Poaceae	X						
Eragrostis curvula (Schrad.) Nees								
Tufted/Carolina Lovegrass	Poaceae	X						
Eragrostis 96eniculate96 (Michx.) Nees								
Lovegrass	Poaceae	X						
Eragrostis sp.								
Purple Lovegrass	Poaceae	X						
Eragrostis spectabilis (Pursh) Steud.								
Bent-awn Plumegrass	Poaceae		X			G5	S3S4	
Erianthus contortus Ell.								
Meadow Ryegrass	Poaceae	X	X					
Festuca elatior L. p.p.								
Rat-tail Fescue	Poaceae	X						
Festuca myuros L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name / ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Sheep Fescue	Poaceae		X					
Festuca ovina L.								
Ryegrass	Poaceae	X						
Festuca pratensis Huds.								
Atlantic Mannagrass	Poaceae	X						
Glyceria 97enicu (Muhl.) Trin.								
Fowl Mannagrass	Poaceae	X						
Glyceria striata (Lam.) Hitchc.								
Little Barley	Poaceae	X	X					
Hordeum pusillum Nutt.								
Common Barley	Poaceae	X						
Hordeum vulgare L.								
Whitegrass	Poaceae	X						
Leersia virginica Willd.								
Fall Witchgrass	Poaceae	X						
Leptoloma cognatum (Schult.) Chase								
Saltpond Grass, Bearded Sprangletop	Poaceae	X				G5	SU	
Leptochloa fusca (L.) Kunth ssp. *Fascicularis* (Lam.) N. Snow								
Perennial Ryegrass	Poaceae	X	X					
Lolium perenne L.								
Japanese stiltgrass	Poaceae				X	GNR		
Microstegium vimineum								
Silver grass	Poaceae							
Miscanthus sp.					X	GNR		
Nimblewill Muhly	Poaceae	X						
Muhlenbergia schreberi J.F. Gmel.								
Needleleaf Rosette Grass/Bristling Panicgrass	Poaceae	X				G4G5	SU	
Panicum aciculare Desv. Ex Poir.								
Bitter Panicgrass	Poaceae		X					
Panicum amarulum Hitchc. & Chase								
Bitter Panicgrass	Poaceae	X	X	X				
Panicum amarum Ell.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Bosc's Panicgrass	Poaceae	X						
Panicum boscii Poir.								
Witchgrass	Poaceae	X						
Panicum capillare L.								
Deertongue Panicgrass	Poaceae	X						
Panicum clandestinum L.								
Starved Panicgrass	Poaceae	X						
Panicum depauperatum Muhl.								
Fall Panicgrass	Poaceae	X						
Panicum dichotomiflorum Michx.								
Cypress Panicgrass	Poaceae	X	X					
Panicum dichotomum L.								
Western Panicgrass	Poaceae	X	X					
Panicum lanuginosum Ell.								
Broadleaf Rosette Grass	Poaceae	X						
Panicum latifolium L.								
Broomcorn Millet	Poaceae	X						
Panicum miliaceum L.								
Philadelphia Panicgrass	Poaceae	X						
Panicum philadelphicum Bernh. Ex Trin.								
Roundseed Panicgrass	Poaceae	X	X					
Panicum polyanthes Schult.								
Redtop Panicgrass	Poaceae	X						
Panicum rigidulum Bosc ex Nees.								
Velvet Panicgrass	Poaceae	X						
Panicum scoparium Lam.								
Roundseed Panicgrass	Poaceae	X	X					
Panicum sphaerocarpon Ell.								
Warty Panicgrass	Poaceae	X						
Panicum verrucosum Muhl.								
White-hair Rosette Grass	Poaceae	X	X					
Panicum villosissimum Nash								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Switchgrass	Poaceae	X		X	X	G5		
Panicum virgatum L.								
Dallisgrass	Poaceae	X			X	GNR		
Paspalum dilatatum Poir.								
Field Paspalum	Poaceae	X	X					
Paspalum 99enic Michx.								
Thin Paspalum	Poaceae	X						
Paspalum setaceum Michx.								
Timothy	Poaceae		X					
Phleum pratense L.								
Common Reed	Poaceae			X	X	G5		
Phragmites australis								
Common Reed	Poaceae	X	X					
Phragmites australis (Cav.) Trin. Ex Steud.								
Annual Bluegrass	Poaceae	X		X				
Poa annua L.								
Bulbous Bluegrass	Poaceae	X	X					
Poa bulbosa L.								
Canada Bluegrass	Poaceae		X					
Poa compressa cf L.								
Kentucky Bluegrass	Poaceae	X		X				
Poa pratensis L.								
Little Bluestem	Poaceae	X						
Schizachyrium scoparium (Michx.) Nash								
Cereal Rye	Poaceae	X						
Secale cereale L.								
Japanese Bristle Grass	Poaceae	X						
Setaria faberi Herrm.								
Yellow Bristlegrass	Poaceae	X	X					
Setaria eniculate auct. Non (Willd.) Beauv.								
Giant Bristlegrass	Poaceae	X						
Setaria magna Griseb.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Marsh Brittlegrass	Poaceae			X				
Setaria parviflora								
Green Bristlegrass	Poaceae	X						
Setaria viridisl (L.) Beauv.								
Smooth Cordgrass	Poaceae	X		X	X			
Spartina alterniflora Loisel.								
Big Cordgrass	Poaceae	X		X				
Spartina cynosuroides (L.) Roth								
Saltmeadow Cordgrass	Poaceae	X		X				
Spartina patens (Ait.) Muhl.								
Swamp Wedgescale	Poaceae	X				G4	S2	T
Sphenopholis pensylvanica (L.) A.S. Hitchc.								
Poverty Dropseed	Poaceae	X						
Sporobolus vaginiflorus (Torr. Ex Gray) Wood								
Sorghums	Poaceae	X						
Sorghum spp.								
Purple Sandgrass	Poaceae	X						
Triplasis purpurea (Walt.) Chapman								
Sixweeks Fescue	Poaceae	X	X					
Vulpia octoflora (Walt.) Rydb.								
Annual Wild Rice	Poaceae	X						
Zizania aquatica L.								
Curtiss' Milkwort	Polygalaceae	X						
Polygala curtissii Gray								
Maryland Milkwort	Polygalaceae	X	X					
Polygala mariana P. Mill.								
Purple Milkwort	Polygalaceae	X						
Polygala sanguinea L.								
Milkworts	Polygalaceae	X						
Polygala spp.								
Buckwheat	Polygonaceae	X						
Fagopyrum esculentum Moench								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Buckwheat	Polygonaceae	X						
Fagopyrum sagittatum Gilib.								
Halberdleaf Tearthumb	Polygonaceae	X						
Polygonum arifolium L.								
Oriental Ladysthumb	Polygonaceae	X						
Polygonum caespitosum Blume								
Seabeach Knotweed	Polygonaceae	X		X		G3	S1	E
Polygonum glaucum Nutt.								
Swamp Smartweed	Polygonaceae	X	X			G5	SU	
Polygonum hydropiperoides Michx.								
Opelousas Smartweed	Polygonaceae		X					
Polygonum opelousanum Ridell ex Stone								
Pennsylvania Smartweed	Polygonaceae	X						
Polygonum pensylvanicum L.								
Mile-a-minute Weed, Asiatic Tearthumb	Polygonaceae	X			X	GNR		
Polygonum perfoliatum L.								
Spotted Ladysthumb	Polygonaceae	X						
Polygonum persicaria L.								
Dotted Smartweed	Polygonaceae	X						
Polygonum puntatum Ell.								
Climbing False Buckwheat	Polygonaceae	X						
Polygonum scandens L.								
Jumpseed	Polygonaceae	X						
Polygonum virginianum L.								
Japanese Knotweed	Polygonaceae				X	GNR		
Reynoutria japonica								
Field Sorrel	Polygonaceae	X						
Rumex acetosella L.								
Swamp Dock	Polygonaceae	X		X		G5	S1	E
Rumex verticillatus.								
Dock	Polygonaceae	X			X			
Rumex sp.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Pickerelweed	Pontederiaceae	X						
Pontederia cordata L.								
Waterthread Pondweed	Potamogetonaceae	X						
Potamogeton diversifolius Raf.								
Ribbonleaf Pondweed	Potamogetonaceae	X						
Potamogeton epihydrus Raf.								
Sago Pondweed	Potamogetonaceae	X						
Potamogeton pectinatus L.								
Redhead Grass	Potamogetonaceae	X						
Potamogeton perfoliatus L.								
Scarlet Pimpernel	Primulaceae	X						
Anagallis arvensis L.								
Whorled Loosestrife	Primulaceae		X					
Lysimachia quadrifolia L.								
Seaside Brookweed	Primulaceae	X						
Samolus parviflorus Raf.								
Common/Tall Buttercup	Ranunculaceae	X	X					
Ranunculus acris L.								
Cursed Crowfoot	Ranunculaceae	X						
Ranunculus scleratus L.								
Tall Meadow-rue	Ranunculaceae	X						
Thalictrum pubescens Pursh								
Beaked Agrimony	Rosaceae	X						
Agrimonia rostellata Wallr.								
Serviceberry	Rosaceae	X						
Amelanchier canandensis (L.) Medik.								
Slender Parsley Piert	Rosaceae		X					
Aphanes microcarpa (Boiss. & Reut.) Rothm.								
Red Chokeberry	Rosaceae	X						
Aronia arbutifolia (L.) Pers.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name / ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Purple Chokeberry	Rosaceae	X						
Aronia prunifolia (Marsh.) Rehd.								
Strawberry	Rosaceae	X						
Fragaria vesca L.								
White Avens	Rosaceae	X						
Geum canadense Jacq.								
Dwarf Cinquefoil	Rosaceae	X						
Potentilla canadensis L.								
Common Cinquefoil	Rosaceae	X	X					
Potentilla simplex Michx.								
Beach Plum	Rosaceae	X				G4	S1	E
Prunus maritima Marsh.								
Wild/Black Cherry	Rosaceae	X	X	X	X			
Prunus serotina Ehrh.								
Common Chokecherry	Rosaceae	X						
Prunus virginiana L.								
Bradford pear	Rosaceae				X	GNR		
Pyrus calleryana								
Dog Rose	Rosaceae				X	GNR		
Rosa canina								
Multiflora Rose	Rosaceae	X			X	GNR		
Rosa multiflora Thunb. ex Murr.								
Swamp Rose	Rosaceae	X						
Rosa palustris Marsh.								
Rugosa Rose	Rosaceae	X						
Rosa rugosa Thunb.								
Blanchard's Dewberry	Rosaceae	X						
Rubus arundelanus Blanch.								
Himalayan Blackberry	Rosaceae		X					
Rubus discolor cf Weihe & Nees								
Southern Dewberry	Rosaceae	X	X					
Rubus enslenii Tratt.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Northern Dewberry	Rosaceae	X						
Rubus flagellaris Willd.								
Wineberry	Rosaceae	X			X	G5		
Rubus phoenicolasius Maxim.								
Red Raspberry	Rosaceae	X						
Rubus strigosus Michx.								
Blackberry	Rosaceae			X				
Rubus spp.								
Buttonbush	Rubiaceae	X						
Cephalanthus occidentalis L.								
Poorjoe, Buttonweed	Rubiaceae	X						
Diodia teres Walt.								
Virginia Buttonweed	Rubiaceae		X					
Diodia virginiana L.								
Licorice Bedstraw	Rubiaceae	X						
Galium circaezans Michx.								
Bluntleaf Bedstraw	Rubiaceae	X						
Galium obtusum Bigelow								
Piedmont Bedstraw	Rubiaceae	X						
Galium pedemontatum (Bellardi) All.								
Stickywilly	Rubiaceae	X						
Galium vaillantii DC.								
Venus' Pride	Rubiaceae	X						
Hedyotis purpurea (L.) Torr. & Gray								
Bluets	Rubiaceae	X						
Houstonia caerulea L.								
Large Houstonia	Rubiaceae	X						
Houstonia purpurea L.								
Tiny Bluet	Rubiaceae	X						
Houstonia pussilla Schoepf								
Partridgeberry	Rubiaceae	X						
Mitchella repens L.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Blue Fieldmadder	Rubiaceae	X	X					
Sherardia arvensis L.								
Widgeongrass	Ruppiaceae	X	X	X				
Ruppia maritima L.								
Handy Orange	Rutaceae	X						
Poncirus trifoliata (L.) Raf.								
White poplar	Salicaceae				X	G5		
Populus alba								
Weeping Willow	Salicaceae	X						
Salix babylonica auct. non L.								
Black Willow	Salicaceae	X			X	G5		
Salix nigra Marsh.								
Willow	Salicaceae	X						
Salix sp.								
Lizard's Tail	Saururaceae	X						
Saururus cernuus L.								
Saltmarsh false-foxglove	Scrophulariaceae			X	X			
Agalinis maritima (Raf.) Raf								
Saltmarsh white false-foxglove	Scrophulariaceae			X				
Agalinis maritima forma alba								
Purple False Foxglove	Scrophulariaceae	X						
Agalinis purpurea (L.) Pennell								
Clammy Hedge Hyssop	Scrophulariaceae	X	X					
Gratiola neglecta Torr.								
Shaggy Hedge Hyssop	Scrophulariaceae	X						
Gratiola pilosa Michx.								
Roundfruit Hedge Hyssop	Scrophulariaceae	X						
Gratiola virginiana L.								
Mudworts	Scrophulariaceae	X						
Limosella spp.								
Canada Toadflax	Scrophulariaceae	X	X					
Linaria canadensis (L.) Chaz.								

Species Common Name *Scientific Name*	FAMILY	Area Found at NAS				Ranking and Status[1]		
		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Yellowseed False Pimpernel	Scrophulariaceae	X						
Lindernia anagallidea (Michx.) Pennell								
Tall-white Beard-tongue	Scrophulariaceae	X	X					
Penstemon digitalis Nutt. ex Sims								
Maryland Figwort	Scrophulariaceae	X						
Scrophularia marilandica L.								
Moth Mullein	Scrophulariaceae	X						
Verbascum blattaria L.								
Common Mullein	Scrophulariaceae	X						
Verbascum thapsus L.								
Corn Speedwell	Scrophulariaceae		X					
Veronica arvensis L.								
Purslane Speedwell	Scrophulariaceae	X	X					
Veronica peregrina L.								
Tree-of-Heaven	Simaroubaceae	X			X			
Ailanthus altissima (P. Mill.) Swingle								
Common/Roundleaf Greenbrier	Smilacaceae	X			X	G5		
Smilax rotundifolia L.								
Redberry Greenbrier	Smilacaceae	X						
Smilax walteri Pursh								
Jimsonweed	Solanaceae	X						
Datura stramonium L.								
Longleaf Groundcherry	Solanaceae	X						
Physalis longifolia Nutt.								
Horse Nettle	Solanaceae	X						
Solanum carolinense L.								
Black/Common Nightshade	Solanaceae	X						
Solanum nigrum L.								
American Bur-reed	Sparganiaceae	X						
Sparganium americanum Nutt.								
Branched Bur-reed	Sparganiaceae	X				G4G5	S3	
Sparganium androcladum (Engelm.) Morong								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		PAX	WOLF	BIR	SOL[1]	Global Rank	State Rank	State Status
Baldcypress	Taxodiaceae	X						
Taxodium distichum (L.) L.C. Rich								
New York Fern	Thelypteridaceae	X						
Thelypteris noveboracensis (L.) Nieuwl.								
Eastern Marsh Fern	Thelypteridaceae	X						
Thelypteris palustris Schott								
Narrow-leaved Cattail	Typhaceae	X	X					
Typha angustifolia L.								
Cattail	Typhaceae	X						
Typha latifolia L.								
Common Hackberry	Ulmaceae	X	X	X	X			
Celtis occidentalis L.								
Slippery elm	Ulmaceae				X	G5		
Ulmus rubra								
False Nettle	Urticaceae	X						
Boehmeria cylindrica (L.) Sw.								
Lewiston Cornsalad	Valerianaceae		X					
Valerianella locusta (L.) Lat.								
Lewiston Cornsalad	Valerianaceae	X						
Valerianella olitoria (L.) Pollich								
Swamp Verbena	Verbenaceae	X						
Verbena hastata L.								
Narrowleaf Vervain	Verbenaceae		X					
Verbena simplex cf Lehm.								
Hoary Verbena	Verbenaceae		X					
Verbena stricta Vent.								
Marsh Blue Violet	Violaceae	X						
Viola cucullata Ait.								
Field Pansy	Violaceae	X						
Viola kitaibeliana auct. non J.A. Schultes								
Bog White Violet	Violaceae	X						
Viola lanceolata L.								

Species	FAMILY	Area Found at NAS				Ranking and Status[1]		
Common Name ***Scientific Name***		**PAX**	**WOLF**	**BIR**	**SOL[1]**	**Global Rank**	**State Rank**	**State Status**
Meadow Violet, Common Blue Violet	Violaceae	X						
Viola papilionacea Pursh p.p.								
Birdfoot Violet	Violaceae		X					
Viola pedata L.								
Primrose-leaved/Common Violet	Violaceae	X						
Viola primulifolia L.								
Violet	Violaceae	X						
Viola sagittata Ait.								
Porcelain-berry	Vitaceae	X						
Ampelopsis brevipedunculata (Maxim.) Trautv.								
Virginia Creeper	Vitaceae	X	X		X	G5		
Parthenocissus quinquefolia L. Planch.								
Summer Grape	Vitaceae	X						
Vitis aestivalis Michx.								
Fox Grape	Vitaceae	X						
Vitis labrusca L.								
Slender Yellow-eyed Grass	Xyridaceae	X						
Xyris torta Sm.								
Horned Pondweed	Zannichelliaceae	X	X	X				
Zannichellia palustris L.								
Eelgrass	Zosteraceae	X		X				
Zostera marina L.								

[1] As of May 2023.

Table C-9. Herbarium Report Results at PAX and WOLF

FAMILY	SPECIES		PAX or WOLF?
	Scientific Name	**Common Name**	
Aceraceae	*Acer rubrum L.*	Red maple	Both
Alismataceae	*Alisma subcordata Raf.*	common water plantain	PAX
Alismataceae	*Sagittaria latifolia Willd.*	broad-leaved plantain	PAX
Amaranthaceae	*Amaranthus hybridus L.*	pigweed	PAX
Amaryllidaceae	*Narcissus pseudonarcissus L.*		PAX
Anacardiaceae	*Rhus copallina L.*		PAX
Anacardiaceae	*Rhus copallinum L.*		PAX
Anacardiaceae	*Rhus typhina L.*		PAX
Anonaceae	*Asimina triloba Dunal*	Pawpaw	PAX
Apiaceae	*Cicuta maculata L.*	water hemlock	PAX
Apiaceae	*Daucus carota L.*	Queen Anne's-lace	PAX
Apiaceae	*Hydrocotyle ranunculoides L. f.*	floating water pennywort	PAX
Apiaceae	*Hydrocotyle verticillata Thunb.*		PAX
Apiaceae	*Lilaeopsis chinensis (L.) Kuntze.*		PAX
Apiaceae	*Oxypolis rigidior (L.) Raf.*	cowbane	PAX
Apiaceae	*Ptilimnium capillaceum (Michx.) Raf.*		PAX
Apiaceae	*Sanicula canadensis L.*	black snakeroot	PAX
Apiaceae	*Sanicula* sp.		WOLF
Apocynaceae	*Apocynum cannabinum L.*	dogbane hemp	PAX
Apocynaceae	*Vinca major L.*	large periwinkle	PAX
Aquifoliaceae	*Ilex opaca Ait.*		PAX
Aquifoliaceae	*Ilex verticillata (L.) Gray*		PAX
Araceae	*Orontium aquaticum L.*	golden club	PAX
Araliaceae	*Aralia spinosa L.*	Hercule's-club	PAX
Araliaceae	*Hedera helix L.*	English ivy	PAX
Asclepiadaceae	*Ampelamus albidus (Nutt.) Britt.*	sandvine	PAX
Asclepiadaceae	*Asclepias amplexicaulis J. E. Smith*	clasping milkweed	PAX
Asclepiadaceae	*Asclepias incarnata L.*	swamp milkweed	PAX
Asclepiadaceae	*Asclepias syriaca L.*	common milkweed	PAX
Asclepiadaceae	*Asclepias tuberosa L.*	butterfly-weed	PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Asclepiadaceae	*Asclepias verticillata L.*	whorled milkweed	WOLF
Asclepiadaceae	*Matelea gonocarpa (Walter) Shinners*		WOLF
Aspleniaceae	*Asplenium platyneuron (L.) Oakes*	ebony spleenwort	Both
Aspleniaceae	*Athyrium filix-femina (L.) Roth*	Lady-fern	PAX
Aspleniaceae	*Dryopteris spinulosa (O. F. Mull) Watt.*	=D.carthusiana(Villars)HPFuchs	WOLF
Aspleniaceae	*Polystichum acrostichoides (Michx.) Schott*	Christmas fern	PAX
Aspleniaceae	*Thelypteris noveboracensis (L.) Nieuwl.*	New York fern	PAX
Aspleniaceae	*Thelypteris palustris Schott*	marsh-fern	PAX
Asteraceae	*Artemisia vulgaris L.*	wormwood	Both
Asteraceae	*Aster lanceolatus Willd.*	tall white aster	Both
Asteraceae	*Aster pilosus Willd.*	white heath aster	Both
Asteraceae	*Bidens polylepis S. F. Blake*	Ozark tickseed-sunflower	Both
Asteraceae	*Erigeron strigosus Muhl.*	daisy fleabane	Both
Asteraceae	*Eupatorium pilosum Walter*	Ragged eupatorium	Both
Asteraceae	*Eupatorium rotundifolium L.*	round-leaved thoroughwort	Both
Asteraceae	*Euthamia graminifolia (L.) Nutt.*	grass-leaved goldenrod	Both
Asteraceae	*Euthamia tenuifolia (Pursh) Nutt.*		Both
Asteraceae	*Gnaphalium obtusifolium L.*	cudweed	Both
Asteraceae	*Gnaphalium purpureum L.*	purple cudweed	Both
Asteraceae	*Hieracium gronovii L.*	hairy hawkweed	Both
Asteraceae	*Hypochaeris radicata L.*	cat's ear	Both
Asteraceae	*Krigia virginica (L.) Willd.*	dwarf dandelion	Both
Asteraceae	*Senecio anonymus A. Wood*	Small's ragwort	Both
Asteraceae	*Solidago juncea Ait.*	early goldenrod	Both
Asteraceae	*Solidago nemoralis Ait.*		Both
Asteraceae	*Solidago sempervirens L.*		Both
Asteraceae	*Achillea millefolium L.*	yarrow	PAX
Asteraceae	*Antennaria plantaginifolia (L.) Richardson var. ambigens (Green) Cronq.*		PAX
Asteraceae	*Anthemis arvensis L.*	corn chamomile	PAX
Asteraceae	*Aster dumosus L.*		PAX
Asteraceae	*Aster lateriflorus (L.) Britt.*	calico aster	PAX
Asteraceae	*Aster linariifolius L.*		PAX
Asteraceae	*Aster patens Ait.*		WOLF

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Asteraceae	*Aster racemosus Elliott*	small white aster	WOLF
Asteraceae	*Aster* sp.		PAX
Asteraceae	*Aster tenuifolius L.*		PAX
Asteraceae	*Aster undulatus L.*	wavy-leaved aster	PAX
Asteraceae	*Baccharis halimifolia L.*		PAX
Asteraceae	*Bidens aristosa (Michx.) Britton*		PAX
Asteraceae	*Centaurea* sp.		PAX
Asteraceae	*Chondrilla juncea L.*	skeleton weed	PAX
Asteraceae	*Chrysanthemum leucanthemum L.*	ox-eye daisy	PAX
Asteraceae	*Chrysopsis mariana (L.) Ell.*		PAX
Asteraceae	*Cichorium intybus L.*	chicory	PAX
Asteraceae	*Cirsium arvense (L.) Scop.*	Canada thistle	PAX
Asteraceae	*Cirsium discolor (Muhl.) Spreng.*	field thistle	PAX
Asteraceae	*Cirsium* sp.		WOLF
Asteraceae	*Conyza canadensis (L.) Cronq.*	horseweed	PAX
Asteraceae	*Coreopsis tinctoria Nutt.*		WOLF
Asteraceae	*Cornus* sp.		PAX
Asteraceae	*Crepis* sp.		WOLF
Asteraceae	*Eclipta prostrata (L.) L.*	yerba de tajo	PAX
Asteraceae	*Elephantopus carolinianus Willd.*	elephant's foot	PAX
Asteraceae	*Elephantopus tomentosus L.*		PAX
Asteraceae	*Eupatorium album L var. subvenosum A. Gray*		PAX
Asteraceae	*Eupatorium album L. var. album L.*		PAX
Asteraceae	*Eupatorium aromaticum L.*		PAX
Asteraceae	*Eupatorium capillifolium (Lam.) Small*	dog fennel	PAX
Asteraceae	*Eupatorium coelestinum L.*	mistflower	PAX
Asteraceae	*Eupatorium dubium Willd. ex Poir.*		PAX
Asteraceae	*Eupatorium fistulosum Barratt*	hollow-stemmed Joe-pye-weed	PAX
Asteraceae	*Eupatorium hyssopifolium L.*	hyssop-leaved thoroughwort	WOLF
Asteraceae	*Eupatorium perfoliatum L.*	boneset	PAX
Asteraceae	*Eupatorium serotinum Michx.*	late-flowering thoroughwort	PAX
Asteraceae	*Gnaphalium* sp.		PAX
Asteraceae	*Helianthus annuus L.*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Asteraceae	*Hieracium paniculatum L.*		PAX
Asteraceae	*Iva frutescens L.*		PAX
Asteraceae	*Lactuca canadensis L.*	wild lettuce	PAX
Asteraceae	*Liatris graminifolia (Walt.) Willd.*		PAX
Asteraceae	*Mikania scandens (L.) Willd.*	climbing hempweed	PAX
Asteraceae	*Pluchea odorata (L.) Cass.*		PAX
Asteraceae	*Pluchea purpurescens (Sw.) DC.*		PAX
Asteraceae	*Rudbeckia hirta L.*	black-eye Susan	PAX
Asteraceae	*Sericocarpus asteroides (L.) BSP.*	= Aster paternus Cronq.	PAX
Asteraceae	*Solidago altissima L.*		PAX
Asteraceae	*Solidago bicolor L.*		PAX
Asteraceae	*Solidago erecta Pursh*		PAX
Asteraceae	*Solidago rugosa Mill.*	wrinkle-leaf goldenrod	PAX
Asteraceae	*Solidago* sp.		PAX
Asteraceae	*Tragopogon* sp.		PAX
Asteraceae	*Verbesina occidentalis (L.) Walt.*	southern flatseed-sunflower	PAX
Asteraceae	*Vernonia noveboracensis Willd.*	New York ironweed	PAX
Asteraceae	*Vernonia* sp.		PAX
Asteraceae	*Xanthium echinatum Murray*		PAX
Balsaminaceae	*Impatiens* sp.		PAX
Berberiaceae	*Berberis julianae Schneid*		PAX
Berberidaceae	*Podophyllum peltatum L.*	mayapple	PAX
Betulaceae	*Alnus serrulata (Ait.) Willd.*		PAX
Betulaceae	*Carpinus caroliniana Walt. virginiana (Marsh.) Fern.*		PAX
Bignoniaceae	*Campsis radicans (L.) Seem.*	Tecooma radicans (L.) Jus	PAX
Blechnaceae	*Woodwardia virginica (L.) J. E. Smith*	Virginia chain-fern	Both
Blechnaceae	*Woodwardia areolata (L.) Moore*	Netted chain-fern	PAX
Boraginaceae	*Myosotis discolor Pers.*		PAX
Brassicaceae	*Arabidopsis thaliana (L.) Heynh.*	Mouse-ear cress	PAX
Brassicaceae	*Barbarea verna (Mill.) Asch.*	early winter cress	PAX
Brassicaceae	*Barbarea vulgaris R. Br.*	common winter cress	PAX
Brassicaceae	*Brassica rapa L.*	field mustard	PAX
Brassicaceae	*Brassica* sp.		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Brassicaceae	*Cakile edentula (Bigel.) Hook.*		PAX
Brassicaceae	*Cardamine concatenata (Michx.) O. Schwarz.*	cut-leaved toothwort	PAX
Brassicaceae	*Cardamine hirsuta L.*	hairy bittercress	PAX
Brassicaceae	*Draba verna L.*	whitlow mustard	PAX
Brassicaceae	*Lepidium campestre (L.) R. Br.*	field cress	PAX
Brassicaceae	*Lepidium virginicum L.*	wild peppercress	PAX
Brassicaceae	*Raphanus raphanistrum L.*		PAX
Brassicaceae	*Sisymbrium officinale (L.) Scop. var. leiocarpum DC.*		PAX
Cactaceae	*Opuntia humifusa Raf.*	O. vulgaris Mill.	PAX
Caesalpiniaceae	*Cassia fasciculata Michx.*	=Chamaecrista f.(Michx.)Greene	PAX
Caesalpiniaceae	*Chamaecrista fasciculata (Michx.) Greene*	large-flowered partridge-pea	PAX
Caesalpiniaceae	*Chamaecrista nictitans (L.) Moench.*	wild sensitive plant	WOLF
Callitrichaceae	*Callitriche stagnalis Scop.*		Both
Callitrichaceae	*Callitriche heterophylla Pursh*	large water starwort	PAX
Campanulaceae	*Triodanis perfoliata (L.) Nieuwl.*	Venus'-looking-glass	PAX
Caprifoliaceae	*Lonicera japonica Thunb.*		Both
Caprifoliaceae	*Lonicera maackii Maxim*	Amur honeysuckle	Both
Caprifoliaceae	*Lonicera fragrantissima Lindl. & PAXton*		PAX
Caprifoliaceae	*Lonicera sempervirens L.*		WOLF
Caprifoliaceae	*Lonicera* sp.		PAX
Caprifoliaceae	*Lonicera tatarica L.*		PAX
Caprifoliaceae	*Sambucus canadensis L.*		PAX
Caprifoliaceae	*Viburnum convert to #2624 dentatum L. var. lucidum Aiton*		PAX
Caprifoliaceae	*Viburnum dentatum L.*		PAX
Caprifoliaceae	*Viburnum nudum L.*		PAX
Caprifoliaceae	*Viburnum prunifolium L.*		PAX
Caryophyllaceae	*Arenaria serpyllifolia L.*	sandwort	Both
Caryophyllaceae	*Arenaraia* sp.		PAX
Caryophyllaceae	*Cerastium semidecandrum L.*		PAX
Caryophyllaceae	*Cerastium* sp.		PAX
Caryophyllaceae	*Cerastium viscosum L.*	mouse-eared chickweed	PAX
Caryophyllaceae	*Cerastium vulgatum L.*	common mouse-eared chickweed	WOLF
Caryophyllaceae	*Dianthus armeria L.*	Deptford pink	PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Caryophyllaceae	*Holosteum umbellatum L.*		PAX
Caryophyllaceae	*Lychnis alba Mill.*		PAX
Caryophyllaceae	*Lychnis* sp.		PAX
Caryophyllaceae	*Silene vulgaris (Moench) Garcke.*		PAX
Caryophyllaceae	*Spergula arvensis L.*		WOLF
Caryophyllaceae	*Spergularia marina (L.) Griseb.*		PAX
Caryophyllaceae	*Stellaria graminea L.*		PAX
Celastraceae	*Euonymus americanus L.*		PAX
Chenopodiaceae	*Atriplex hastata L.*		WOLF
Chenopodiaceae	*Atriplex patula L.*	Spearscale	PAX
Chenopodiaceae	*Chenopodium ambrosioides L.*		PAX
Chenopodiaceae	*Chenopodium berlanderi Moq.*		WOLF
Chenopodiaceae	*Salicornia europaea L.*		PAX
Cistaceae	*Lechea intermedia (Britton and Hollick in Britton, Sterns & Poggenb.) Legg. In Britton*		Both
Cistaceae	*Lechea maritima Leggett*		PAX
Cistaceae	*Lechea racemulosa Michx.*	pinweed	PAX
Cistaceae	*Lechea* sp.		WOLF
Clusiaceae	*Hypericum canadense L.*		Both
Clusiaceae	*Hypericum gentianoides (L.) BSP.*		Both
Clusiaceae	*Hypericum perforatum L.*	common St. John's wort	Both
Clusiaceae	*Hypericum* sp.		Both
Clusiaceae	*Hypericum gymnanthum Engelm. & Gray*		WOLF
Clusiaceae	*Hypericum mutilum L.*	dwarf St. John's wort	PAX
Clusiaceae	*Hypericum punctatum Lam.*	spotted St. John's wort	PAX
Clusiaceae	*Hypericum stragulum P. Adams & Robson*		PAX
Clusiaceae	*Hypericum virginicum L.*		PAX
Clusiaceae	*Triadenum virginicum (L.) Raf.*		PAX
Clusiaceae	*Triadenum walteri (S. G. Gmelin) Gleason*		PAX
Commelinaceae	*Commelina communis L.*	Asiatic dayflower	PAX
Convolvulaceae	*Calystegia sepium (L.) R. Br.*	hedge bindweed	Both
Convolvulaceae	*Convolvulus arvensis L.*		PAX
Convolvulaceae	*Convolvulus incanus auct non Vahl*		PAX
Convolvulaceae	*Convolvulus sp.*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Convolvulaceae	*Ipomoea coccinea L.*		PAX
Convolvulaceae	*Ipomoea hederacea Jacq.*	ivy-leaved morning glory	PAX
Convolvulaceae	*Ipomoea lacunosa L.*	small-flowered morning glory	PAX
Cornaceae	*Cornus florida L.*		PAX
Cornaceae	*Nyssa sylvatica Marsh.*	blackgum	WOLF
Cucurbitaceae	*Melothria pendula L.*		Both
Cupressaceae	*Thuja occidentalis L.*		PAX
Cuscutaceae	*Cuscuta compacta Juss.*		PAX
Cuscutaceae	*Cuscuta indecora Choisy*	ornamental-not dodder	PAX
Cuscutaceae	*Cuscuta pentagona Engelm.*	=C. arvensis Beyrich	PAX
Cyperaceae	*Carex abscondita Mack.*		Both
Cyperaceae	*Carex annectens Bicknell*		Both
Cyperaceae	*Carex complanata Torr. & Hook.*		Both
Cyperaceae	*Carex swanii (Fern.) Mack.*	Swan's sedge	Both
Cyperaceae	*Cyperus echinatus (L.) Wood*	Globe-flatsedge	Both
Cyperaceae	*Eleocharis ovata (Roth) Roemer & Schultes*	blunt spikerush	Both
Cyperaceae	*Eleocharis tuberculosa (Michx.) R & S.*		Both
Cyperaceae	*Fimbristylis castanea (Michx.) Vahl*		Both
Cyperaceae	*Rhynchospora capitellata (Michx.) Vahl*		Both
Cyperaceae	*Schoenoplectus pungens (Vahl) Palla*		Both
Cyperaceae	*Scirpus robustus Pursh*		Both
Cyperaceae	*Bulbostylis capillaris (L.) C. B. Clarke*		PAX
Cyperaceae	*Carex albicans Willd. ex Spreng.*		PAX
Cyperaceae	*Carex atlantica L. H. Bailey*		PAX
Cyperaceae	*Carex atlantica L. H. Bailey var. capillacea (L. H. Bailey) Cronq.*		PAX
Cyperaceae	*Carex blanda Dewey*		PAX
Cyperaceae	*Carex canescens L.*		PAX
Cyperaceae	*Carex comosa Boott*		PAX
Cyperaceae	*Carex crinita Lamarck*	tasselled sedge	PAX
Cyperaceae	*Carex debilis Michx.*		PAX
Cyperaceae	*Carex digitalis Willd.*		PAX
Cyperaceae	*Carex divisa Huds.*		WOLF
Cyperaceae	*Carex extensa Gooden*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Cyperaceae	*Carex glaucodea Tuck.*		PAX
Cyperaceae	*Carex hirsutella Mack.*		PAX
Cyperaceae	*Carex intumescens Rudge*		PAX
Cyperaceae	*Carex leptalea Wahl.*		PAX
Cyperaceae	*Carex longii Mack.*		PAX
Cyperaceae	*Carex lurida Wahl.*	yellow-green sedge	PAX
Cyperaceae	*Carex muhlenbergii Schkuhr*		PAX
Cyperaceae	*Carex muhlenbergii Schkuhr enervis Boott*		PAX
Cyperaceae	*Carex scoparia Schkuhr*		PAX
Cyperaceae	*Carex seorsa E. C. Howe*		PAX
Cyperaceae	*Carex* sp.		WOLF
Cyperaceae	*Carex stipata Muhl.*		WOLF
Cyperaceae	*Carex tonsa (Fern.) Bicknell*		PAX
Cyperaceae	*Carex vulpinoidea Michx.*	foxtail sedge	PAX
Cyperaceae	*Carex willdenowii Schkuhr*		PAX
Cyperaceae	*Cyperus acuminatus Torr. & Hook.*		PAX
Cyperaceae	*Cyperus erythrorhizos Muhl.*		PAX
Cyperaceae	*Cyperus esculentus L.*		PAX
Cyperaceae	*Cyperus filicinus Vahl*		PAX
Cyperaceae	*Cyperus flavescens L.*		PAX
Cyperaceae	*Cyperus grayi Torr.*		PAX
Cyperaceae	*Cyperus iria L.*		PAX
Cyperaceae	*Cyperus lancastriensis Porter*		PAX
Cyperaceae	*Cyperus microiria Steudel.*		PAX
Cyperaceae	*Cyperus odoratus L.*		PAX
Cyperaceae	*Cyperus pseudovegetus Steud.*		WOLF
Cyperaceae	*Cyperus retrorsus Chapm.*	retrose sedge	PAX
Cyperaceae	*Cyperus* sp.		PAX
Cyperaceae	*Cyperus strigosus L.*	straw-colored umbrella sedge	PAX
Cyperaceae	*Dulichium arundinaceum (L.) Britt.*		PAX
Cyperaceae	*Eleocharis acicularis (L.) R. & S.*		PAX
Cyperaceae	*Eleocharis engelmanni Steud.*		PAX
Cyperaceae	*Eleocharis flavescens (Poiret) Urban*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Cyperaceae	*Eleocharis palustris (L.) Roem. & Schult.*		PAX
Cyperaceae	*Eleocharis tenuis (Willd.) Schultes*		PAX
Cyperaceae	*Eleocharis tortilis (Link) Schultes*		PAX
Cyperaceae	*Fimbristylis annua (All.) Roemer & Schultes*		PAX
Cyperaceae	*Fimbristylis autumnalis (L.) R. & S.*		PAX
Cyperaceae	*Fuirena squarrosa Michx.*		PAX
Cyperaceae	*Rhynchospora globularis Chapm. recognita Gale*		PAX
Cyperaceae	*Rhynchospora glomerata (L.) Vahl*		PAX
Cyperaceae	*Schoenoplectus validus (Vahl) A. & D. Love*		PAX
Cyperaceae	*Scirpus americanus Pers.*		PAX
Cyperaceae	*Scirpus cyperinus (L.) Kunth*		PAX
Cyperaceae	*Scirpus polyphyllus Vahl*		PAX
Cyperaceae	*Scirpus pungens Vahl*		PAX
Cyperaceae	*Scirpus purshianus Fern.*		PAX
Cyperaceae	*Scirpus validus Vahl*		PAX
Ebenaceae	*Diospyros virginiana L.*		PAX
Elaeagnaceae	*Elaeagnus* sp.		PAX
Elaeagnaceae	*Elaeagnus umbellata Thunb.*		PAX
Equisetaceae	*Equisetum arvense L.*	common horse tail	PAX
Ericaceae	*Eubotrys racemosa (L.) Nutt.*	deciduous swamp-fetterbush	Both
Ericaceae	*Gaylussacia baccata (Wang.) K. Koch*	black huckleberry	Both
Ericaceae	*Gaylussacia frondosa (L.) T. & G.*		Both
Ericaceae	*Lyonia ligustrina (L.) DC.*		Both
Ericaceae	*Rhododendron viscosum (L.) Torr.*		Both
Ericaceae	*Vaccinium corymbosum L.*		Both
Ericaceae	*Vaccinium pallidum Ait.*	V. vacillans Kalm	Both
Ericaceae	*Vaccinium stamineum L.*	deerberry	Both
Ericaceae	*Chimaphila maculata (L.) Pursh.*	spotted wintergreen	PAX
Ericaceae	*Clethra alnifolia L.*	coastal pepperbush	PAX
Ericaceae	*Kalmia latifolia L.*		PAX
Ericaceae	*Monotropa hypopitys L. rubra (Torr.) Farw.*	M. hypopitys L.	PAX
Ericaceae	*Monotropa uniflora L.*	Indian-pipe	PAX
Ericaceae	*Rhododendron atlanticum (Ashe) Rehder*		WOLF

FAMILY	SPECIES		PAX or WOLF?
	Scientific Name	**Common Name**	
Ericaceae	*Rhododendron periclymenoides (Michx.) Shinn.*	Pinkster-flower	PAX
Euphorbiaceae	*Acalypha gracilens A. Gray*	slender three-seeded mercury	PAX
Euphorbiaceae	*Acalypha rhomboidea Raf.*	common three-seeded mercury	PAX
Euphorbiaceae	*Acalypha* sp.		PAX
Euphorbiaceae	*Acalypha virginica L.*		PAX
Euphorbiaceae	*Euphorbia corollata L.*	flowering spurge	PAX
Euphorbiaceae	*Euphorbia maculata L.*	milk purslane	PAX
Euphorbiaceae	*Euphorbia marginata Pursh*		PAX
Euphorbiaceae	*Euphorbia nutans Lagasca*	Eyebane	PAX
Euphorbiaceae	*Euphorbia polygonifolia L.*		PAX
Euphorbiaceae	*Euphorbia* sp.		PAX
Euphorbiaceae	*Euphorbia supina Raf.*	E. maculata of Gray's	PAX
Fabaceae	*Desmodium canescens (L.) DC.*	hoary tick trefoil	Both
Fabaceae	*Lespedeza cuneata (Dum.-Cours.) G. Don*	Chinese lespedeza	Both
Fabaceae	*Lespedeza intermedia (Wats.) Britton*	=L. frutescens (L.) Britt	Both
Fabaceae	*Lespedeza procumbens Michx.*		Both
Fabaceae	*Lespedeza striata (Thunb.) H. & A.*	Japanese clover	Both
Fabaceae	*Lespedeza virginica L.*		Both
Fabaceae	*Vicia angustifolia Reichard*	common vetch	Both
Fabaceae	*Albizzia julibrissin Durazzini*	Mimosa-tree	PAX
Fabaceae	*Amorpha fruticosa L.*		PAX
Fabaceae	*Apios americana Medikus*	groundnut	PAX
Fabaceae	*Cercis canadensis L.*		PAX
Fabaceae	*Desmodium ciliare DC.*	=D.obtusum (Muhl.) DC.	PAX
Fabaceae	*Desmodium glabellum (Michx.) DC*	Smooth tick-trefoil	PAX
Fabaceae	*Desmodium marilandicum (L.) DC.*	Maryland tick trefoil	WOLF
Fabaceae	*Desmodium paniculatum (L.) DC.*	panicled tick trefoil	PAX
Fabaceae	*Desmodium rotundifolium (Michx.) DC.*		PAX
Fabaceae	*Galactia volubilis (L.) Britton*		WOLF
Fabaceae	*Lathyrus hirsutus L.*		PAX
Fabaceae	*Lespedeza bicolor Turcz.*		PAX
Fabaceae	*Lespedeza capitata Michx.*		PAX
Fabaceae	*Lespedeza japonica Bailey*		PAX

FAMILY	SPECIES		PAX or WOLF?
	Scientific Name	**Common Name**	
Fabaceae	*Lespedeza nuttallii Darl.*		PAX
Fabaceae	*Lespedeza repens (L.) Bart.*		PAX
Fabaceae	*Lespedeza stipulacea Maxim.*		PAX
Fabaceae	*Lespedeza thunbergii Nakai*		PAX
Fabaceae	*Melilotus alba Desr.*	white sweetclover	PAX
Fabaceae	*Melilotus officinalis (L.) Pallas*	yellow sweet clover	PAX
Fabaceae	*Pueraria lobata (Willd.) Ohwi*		PAX
Fabaceae	*Robinia pseudoacacia L.*		PAX
Fabaceae	*Strophostyles helvola (L.) Ell.*	trailing wild bean	PAX
Fabaceae	*Strophostyles umbellata (Muhl.) Britton*		PAX
Fabaceae	*Stylosanthes biflora (L.) BSP. biflora*		PAX
Fabaceae	*Trifolium arvense L.*	rabbit-foot clover	PAX
Fabaceae	*Trifolium pratense L.*	red clover	PAX
Fabaceae	*Trifolium procumbens L.*	low hop clover	PAX
Fabaceae	*Trifolium repens L.*	white clover	PAX
Fabaceae	*Vicia sativa L.*		PAX
Fagaceae	*Castanea dentata (Marsh.) Borkh.*		Both
Fagaceae	*Quercus coccinea Muenchh.*	Scarlet oak	Both
Fagaceae	*Quercus michauxii Nutt.*	Swamp chestnut oak	Both
Fagaceae	*Quercus pagoda Raf.*		Both
Fagaceae	*Quercus prinus L.*	chestnut oak	Both
Fagaceae	*Quercus* sp.		Both
Fagaceae	*Castanea crenata Sieb. & Zucc.*		PAX
Fagaceae	*Fagus grandifolia Ehrh.*		WOLF
Fagaceae	*Quercus acutissima Carruth.*		WOLF
Fagaceae	*Quercus alba L.*	White oak	PAX
Fagaceae	*Quercus falcata Michx.*	Southern red oak	PAX
Fagaceae	*Quercus imbricaria Michx.*	Shingle oak	PAX
Fagaceae	*Quercus marilandica Muenchh.*	Blackjack oak	PAX
Fagaceae	*Quercus montana Willd.*	Chestnut oak	PAX
Fagaceae	*Quercus nigra L.*	Water oak	PAX
Fagaceae	*Quercus palustris DuRoi*	Pin oak	PAX
Fagaceae	*Quercus phellos L.*	Willow oak	PAX

FAMILY	SPECIES		PAX or WOLF?
	Scientific Name	**Common Name**	
Fagaceae	*Quercus rubra L.*	Northern red oak	PAX
Fagaceae	*Quercus stellata Wang.*	Post oak	PAX
Fagaceae	*Quercus velutina Lam.*	black oak	PAX
Fagaceae	*Quercus x heterophylla Michx.*		PAX
Fagaceae	*Quercus x leana Nutt.*		WOLF
Gentianaceae	*Gentiana saponaria L.*		WOLF
Gentianaceae	*Sabatia angularis (L.) Pursh*	rose pink	PAX
Geraniaceae	*Geranium carolinianum L.*	Carolina cranesbill	PAX
Geraniaceae	*Geranium dissectum L.*		WOLF
Geraniaceae	*Geranium molle L.*		PAX
Geraniaceae	*Geranium* sp.		PAX
Haloragaceae	*Myriophyllum pinnatum BSP*		PAX
Haloragaceae	*Myriophyllum verticillatum L.*		PAX
Hamamelidaceae	*Liquidambar styraciflua L.*		PAX
Hydrocharitaceae	*Vallisneria americana Michx.*	water celery	PAX
Iridaceae	*Sisyrinchium angustifolium Mill.*	blue-eyed grass	Both
Iridaceae	*Sisyrinchium montanum Greene*		WOLF
Juglandaceae	*Carya glabra (Mill.) Sweet*		PAX
Juglandaceae	*Carya ovalis (Wang.) Sarg.*	pignut hickory	PAX
Juglandaceae	*Carya pallida (Ashe) Engl.& Graebn.*		PAX
Juglandaceae	*Carya tomentosa (Lam.) Nutt.*		PAX
Juncaceae	*Juncus acuminatus Michx.*		Both
Juncaceae	*Juncus biflorus Ell.*		Both
Juncaceae	*Juncus brachycarpus Engelm.*		Both
Juncaceae	*Juncus bufonius L.*		Both
Juncaceae	*Juncus debilis Gray*		Both
Juncaceae	*Juncus effusus L.*	soft rush	Both
Juncaceae	*Juncus roemerianus Scheele*		Both
Juncaceae	*Juncus scirpoides Lam.*		Both
Juncaceae	*Juncus secundus Beauv.*		Both
Juncaceae	*Juncus tenuis Willd.*	path rush	Both
Juncaceae	*Juncus coriaceus Mack.*		PAX
Juncaceae	*Juncus dichotomus Ell.*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Juncaceae	*Juncus gerardii Loisel.*		WOLF
Juncaceae	*Juncus marginatus Rostk.*		PAX
Juncaceae	*Juncus subcaudatus (Engelm.) Conv. & Blake*		PAX
Juncaceae	*Luzula bulbosa (A.W. Wood) Rydb.*		PAX
Juncaceae	*Luzula multiflora (Retz..) Lej.*		PAX
Lamiaceae	*Pycnanthemum tenuifolium Schrader*	narrow-leaved mountain-mint	Both
Lamiaceae	*Satureja calamintha (L.) Scheele*	basil thyme	Both
Lamiaceae	*Scutellaria integrifolia L.*	large skullcap	Both
Lamiaceae	*Agastache nepetoides (L.) Kuntze*	giant yellow hyssop	PAX
Lamiaceae	*Lamium amplexicaule L.*	henbit	PAX
Lamiaceae	*Lamium purpureum L.*	purple dead nettle	PAX
Lamiaceae	*Lycopus americanus Muhl.*	Cut-leaved waterhorehound	WOLF
Lamiaceae	*Lycopus* sp.		PAX
Lamiaceae	*Lycopus uniflorus Michx.*	northern bugleweed	PAX
Lamiaceae	*Lycopus virginicus L.*	Virginia bugleweed	PAX
Lamiaceae	*Mentha* sp.		PAX
Lamiaceae	*Prunella vulgaris L.*		PAX
Lamiaceae	*Salvia lyrata L.*	lyre-leaved sage	WOLF
Lamiaceae	*Trichostema dichotomum L.*	blue curls	PAX
Lamiaceae	*Vitex agnus-castus L.*		PAX
Lauraceae	*Lindera benzoin Blume*		PAX
Lauraceae	*Sassafras albidum (Nutt.) Nees*	sassafras	PAX
Lemnaceae	*Lemna* sp.		PAX
Lentibulariaceae	*Utricularia biflora Lam.*		PAX
Lentibulariaceae	*Utricularia gibba L.*		PAX
Lentibulariaceae	*Utricularia* sp.		PAX
Liliaceae	*Allium vineale L.*	field garlic	PAX
Liliaceae	*Asparagus officinalis L.*	asparagus	PAX
Liliaceae	*Hemerocallis fulva (L.) L.*	common day lily	PAX
Liliaceae	*Muscari botryoides (L.) Mill.*		PAX
Liliaceae	*Muscari* sp.		PAX
Liliaceae	*Ornithogalum umbellatum L.*	star-of-Bethlehem	WOLF
Liliaceae	*Smilacina racemosa (L.) Desf.*	false Solomon's-seal	PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Liliaceae	*Smilax hispida Muhl.*		PAX
Liliaceae	*Smilax walteri Pursh*		PAX
Liliaceae	*Yucca filamentosa L.*		PAX
Linaceae	*Linum medium (Planch.) Trel. var. texanum (Planch.) Fern.*	stiff yellow flax	Both
Linaceae	*Linum intercursum Bickn.*	sandplain flax	PAX
Linaceae	*Linum* sp.		PAX
Linaceae	*Linum striatum Walt.*	ridged yellow flax	PAX
Lobeliaceae	*Lobelia cardinalis L.*	cardinal flower	PAX
Lobeliaceae	*Lobelia inflata L.*	Indian tobacco	PAX
Lobeliaceae	*Lobelia nuttallii R. & S.*		PAX
Lobeliaceae	*Lobelia puberula Michx.*	downy lobelia	PAX
Loganiaceae	*Polypremum procumbens L.*	low logan	PAX
Lycopodiaceae	*Lycopodium adpressum (Chapm.) Ly\loyd & Underw*		PAX
Lycopodiaceae	*Lycopodium digitatum Dillen*	Southern ground-cedar	PAX
Lycopodiaceae	*Lycopodium obscurum L.*	tree clubmoss	PAX
Lythraceae	*Decodon verticillatus (L.) Ell.*	swamp loosestrife	PAX
Magnoliaceae	*Liriodendron tulipifera L.*	Tuilptree	PAX
Magnoliaceae	*Magnolia* sp.		PAX
Magnoliaceae	*Magnolia virginiana L.*		PAX
Malvaceae	*Abutilon theophrasti Medikus*	velvetleaf	PAX
Malvaceae	*Hibiscus palustris L.*		PAX
Malvaceae	*Kosteletzkya virginica (L.) Presl.*		PAX
Malvaceae	*Sida spinosa L.*	prickly mallow	PAX
Melastomatceae	*Rhexia mariana L.*	Maryland meadow beauty	Both
Melastomatceae	*Rhexia nashii Small*		PAX
Menispermaceae	*Menispermum canadense L.*		PAX
Mimosaceae	*Amelanchier arborea (Michx. F.) Fern.*		Both
Moraceae	*Broussonetia papyrifera (L.) Vent.*		Both
Moraceae	*Morus rubra L.*		Both
Moraceae	*Maclura pomifera (Raf.) Schneid.*		WOLF
Moraceae	*Morus alba L.*		WOLF
Moraceae	*Morus* sp.		WOLF
Myricaceae	*Myrica cerifera L.*		Both

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Myricaceae	*Myrica* sp.		WOLF
Najadaceae	*Zannichellia palustris L.*		PAX
Nymphaeaceae	*Nymphaea odorata Ait.*		PAX
Oleaceae	*Chionanthus virginicus L.*		PAX
Oleaceae	*Fraxinus pennsylvanica Marsh.*		PAX
Oleaceae	*Fraxinus profunda (Bush) Bush*		PAX
Oleaceae	*Ligustrum obtusifolium Sieb. & Zucc.*	privet	PAX
Oleaceae	*Ligustrum ovalifolium Hassk.*		PAX
Oleaceae	*Ligustrum* sp.		PAX
Oleaceae	*Osmanthus ilicifolius Mouillef.*		PAX
Onagraceae	*Circaea lutetiana L.*	enchanter's nightshade	PAX
Onagraceae	*Ludwigia palustris (L.) Ell. americana (DC.) Fern. & Grisc.*	water purslane	PAX
Onagraceae	*Oenothera parviflora L.*		PAX
Onocleaceae	*Matteuccia struthiopteris (L.) Todaro*		PAX
Onocleaceae	*Onoclea sensibilis L.*	sensitive fern	PAX
Ophioglossaceae	*Botrychium biternatum Savigny in Lam.*		PAX
Ophioglossaceae	*Botrychium dissectum Spreng.*	cutleaved grapefern	PAX
Ophioglossaceae	*Botrychium virginianum (L.) Sw.*	rattlesnake fern	PAX
Ophioglossaceae	*Ophioglossum vulgatum L.*		PAX
Orchidaceae	*Cypripedium acaule Ait.*	pink lady's slipper	PAX
Orchidaceae	*Habenaria clavellata (Michx.) Spreng.*		PAX
Orchidaceae	*Malaxis unifolia (Michx.) B. S. P.*		PAX
Orchidaceae	*Spiranthes cernua (L.) Richard*		WOLF
Orchidaceae	*Spiranthes vernalis Engelm. & Gray*		WOLF
Osmundaceae	*Osmunda cinnamomea L.*	cinnamon fern	PAX
Osmundaceae	*Osmunda regalis L.*		PAX
Oxalidaceae	*Oxalis dillenii Jacq.*	Southern yellow wood-sorrel	Both
Oxalidaceae	*Oxalis grandis Small*		PAX
Papaveraceae	*Glaucium flavum Crantz.*		PAX
Passifloraceae	*Passiflora incarnata L.*	purple passion flower	PAX
Phytolaccaceae	*Phytolacca americana L.*	pokeweed	PAX
Pinaceae	*Juniperus virginiana L.*	eastern red cedar	Both
Pinaceae	*Pinus* sp.		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Pinaceae	*Pinus taeda L.*	Loblolly pine	PAX
Pinaceae	*Pinus virginiana Mill.*	Virginia pine	PAX
Pinaceae	*Taxodium distichum (L.) Richard*	Bald cypress	PAX
Plantaginaceae	*Plantago virginica L.*	hoary plantain	Both
Plantaginaceae	*Plantago aristata Michx.*	bracted plantain	PAX
Plantaginaceae	*Plantago lanceolata L.*	English plantain	PAX
Plantaginaceae	*Plantago patagonica Jacq.*		PAX
Plumbaginaceae	*Limonium nashii Small*		WOLF
Poaceae	*Agrostis elliottiana Schult.*		Both
Poaceae	*Agrostis hyemalis (Walt.) BSP.*		Both
Poaceae	*Agrostis perennans (Walt.) Tuckerm.*		Both
Poaceae	*Aira caryophyllea L.*		Both
Poaceae	*Aristida dichotoma Michx.*		Both
Poaceae	*Aristida longispica Poir.*		Both
Poaceae	*Bromus hordeaceus L.*		Both
Poaceae	*Bromus* sp.		Both
Poaceae	*Chasmanthium laxum (L.) Yates*		Both
Poaceae	*Danthonia spicata (L.) F. Beauv.*	povertygrass	Both
Poaceae	*Elymus virginicus L.*		Both
Poaceae	*Festuca elatior L.*		Both
Poaceae	*Hordeum pusillum Nutt.*		Both
Poaceae	*Lolium perenne L.*		Both
Poaceae	*Panicum clandestinum L.*		Both
Poaceae	*Panicum dichotomum L.*		Both
Poaceae	*Panicum lanuginosum Ell.*		Both
Poaceae	*Panicum polyanthes Schult.*		Both
Poaceae	*Panicum* sp.		Both
Poaceae	*Panicum sphaerocarpon Ell.*		Both
Poaceae	*Panicum villosissimum Nash*		Both
Poaceae	*Paspalum laeve Michx.*		Both
Poaceae	*Poa annua L.*		Both
Poaceae	*Poa bulbosa L.*	Bulbous bluegrass	Both
Poaceae	*Poa pratensis L.*		Both

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Poaceae	*Vulpia myuros (L.) C. Gmelin*	rat-tail fescue	Both
Poaceae	*Vulpia octoflora (Walt.) Rydb.*		Both
Poaceae	*Agrostis canina L.*	Velvet Bent-grass	PAX
Poaceae	*Agrostis capillaris L.*		WOLF
Poaceae	*Agrostis* sp.		PAX
Poaceae	*Agrostis stolonifera L.*		PAX
Poaceae	*Aira elegans Willd.*		PAX
Poaceae	*Aira elegantissima Schur.*		WOLF
Poaceae	*Alopecurus carolinianus Walt.*		WOLF
Poaceae	*Alopecurus geniculatus L.*		WOLF
Poaceae	*Alopecurus pratensis L.*		PAX
Poaceae	*Ammophila breviligulata Fernald*		PAX
Poaceae	*Andropogon ternarius Michx.*		PAX
Poaceae	*Andropogon virginicus L.*		PAX
Poaceae	*Aristida curtissii (A. Gray) Nash*		PAX
Poaceae	*Aristida oligantha Michx.*		PAX
Poaceae	*Avena fatua L.*	Wild oats	PAX
Poaceae	*Bromus rigidus Roth*		PAX
Poaceae	*Bromus wildenowii Kunth*		PAX
Poaceae	*Calamagrostis cinnoides (Muhl.) Barton*		PAX
Poaceae	*Cenchrus longispinus (Hackel) Fern*		PAX
Poaceae	*Chloris verticillata Nutt.*		PAX
Poaceae	*Cinna arundinacea L.*	Common woodreed	PAX
Poaceae	*Cynodon dactylon (L.) Pers.*		PAX
Poaceae	*Dactylis glomerata L.*	orchardgrass	PAX
Poaceae	*Danthonia compressa Austin*		PAX
Poaceae	*Deschampsia flexuosa (L.) Trin.*		WOLF
Poaceae	*Dichanthelium commutatum (Schult.) Gould*		PAX
Poaceae	*Dichanthelium latifolium (L.) Harvill*		PAX
Poaceae	*Digitaria sanguinalis (L.) Scop.*		PAX
Poaceae	*Distichlis spicata (L.) Greene*		PAX
Poaceae	*Echinochloa crusgalli (L.) Beauv.*		PAX
Poaceae	*Echinochloa walteri (Pursh) Keller*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Poaceae	*Eragrostis capillaris (L.) Nees*		PAX
Poaceae	*Eragrostis curvula (Schrad.) Nees*		PAX
Poaceae	*Eragrostis intermedia A. Hitchc.*		PAX
Poaceae	*Eragrostis pectinacea (Michx.) Nees*		PAX
Poaceae	*Eragrostis* sp.		PAX
Poaceae	*Eragrostis spectabilis (Pursh) Steud.*		PAX
Poaceae	*Erianthus contortus Baldw.*		WOLF
Poaceae	*Festuca myuros L.*		PAX
Poaceae	*Festuca ovina L.*		WOLF
Poaceae	*Festuca pratensis Huds.*		PAX
Poaceae	*Festuca* sp.		WOLF
Poaceae	*Glyceria obtusa (Muhl.) Trin.*		PAX
Poaceae	*Glyceria striata (Lam.) Hitchc.*		PAX
Poaceae	*Hordeum vulgare L.*		PAX
Poaceae	*Leersia virginica Willd.*		PAX
Poaceae	*Leptoloma cognatum (Schult.) Chase*		PAX
Poaceae	*Lolium temulentum L.*		PAX
Poaceae	*Muhlenbergia schreberi Gmel.*		PAX
Poaceae	*Panicum aciculare Desv.*		PAX
Poaceae	*Panicum amarulum A. Hitchc. & Chase*		WOLF
Poaceae	*Panicum amarum Hitchc. & Chase*		PAX
Poaceae	*Panicum boscii Poir.*	Bosc's panic grass	PAX
Poaceae	*Panicum capillare L.*		PAX
Poaceae	*Panicum depauperatum Muhl.*		PAX
Poaceae	*Panicum dichotomiflorum Muhl.*		PAX
Poaceae	*Panicum latifolium L.*		PAX
Poaceae	*Panicum lucidum Ashe*		PAX
Poaceae	*Panicum philadelphicum Bernh.*		PAX
Poaceae	*Panicum rigidulum Nees*	Redtop panic grass	PAX
Poaceae	*Panicum scoparium Lam.*	Velvety panic grass	PAX
Poaceae	*Panicum verrucosum Muhl.*		PAX
Poaceae	*Panicum virgatum L.*		PAX
Poaceae	*Paspalum dilatatum Poir.*	Dallis-grass	PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Poaceae	*Paspalum setaceum Michx.*		PAX
Poaceae	*Paspalum* sp.		PAX
Poaceae	*Phleum pratense L.*	Timothy	WOLF
Poaceae	*Phragmites australis (Gav.) Trin.*		PAX
Poaceae	*Poa compressa L.*		WOLF
Poaceae	*Poa* sp.		PAX
Poaceae	*Schizachyrium scoparium (Michx.) Nash.*	little bluestem	PAX
Poaceae	*Setaria geniculata (Lam.) P. Beauv.*		WOLF
Poaceae	*Setaria glauca (L.) P. Beauv.*	Yellow foxtail	PAX
Poaceae	*Setaria italica (L.) Beauv.*		PAX
Poaceae	*Setaria magna Griseb.*		PAX
Poaceae	*Setaria* sp.		PAX
Poaceae	*Setaria viridis (L.) Beauv.*		PAX
Poaceae	*Sorghum halepense (L.) Pers.*		PAX
Poaceae	*Spartina alterniflora Loisel.*		PAX
Poaceae	*Spartina patens (Ait.) Muhl.*		PAX
Poaceae	*Sphenopholis obtusata (Michx.) Scribn.*		WOLF
Poaceae	*Sphenopholis pensylvanica (L.) A. Hitchoc*		PAX
Poaceae	*Sporobolus vaginiflorus (Torr.) Wood*		PAX
Poaceae	*Triplasis purpurea (Walt.) Chapm.*		PAX
Poaceae	*Triticum aestivum L.*		PAX
Poaceae	*Triticum durum Desf.*		PAX
Polemoniaceae	*Polemonium* sp.		PAX
Polygalaceae	*Polygala mariana Mill.*	Maryland milkwort	Both
Polygalaceae	*Polygala curtissii Gray*		PAX
Polygalaceae	*Polygala sanguinea L.*		PAX
Polygalaceae	*Polygala* sp.		PAX
Polygonaceae	*Polygonum opelousanum Riddell*		Both
Polygonaceae	*Fagopyrum esculentum Moench*		PAX
Polygonaceae	*Polygonum arenastrum Boreau*		PAX
Polygonaceae	*Polygonum arifolium L.*	halbred-leaved tearthumb	PAX
Polygonaceae	*Polygonum cespitosum Blume longisetum (De Bruyn) Steward*	smartweed	PAX
Polygonaceae	*Polygonum hydropiper L.*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Polygonaceae	*Polygonum hydropiperoides Michx.*		PAX
Polygonaceae	*Polygonum pensylvanicum L.*		PAX
Polygonaceae	*Polygonum punctatum Ell.*	water smartweed	PAX
Polygonaceae	*Polygonum scandens L.*		PAX
Polygonaceae	*Polygonum* sp.		PAX
Polygonaceae	*Polygonum virginianum L.*	jumpseed	PAX
Polygonaceae	*Rumex acetosella L.*	sheep sorrel	PAX
Polygonaceae	*Rumex crispus L.*		WOLF
Polygonaceae	*Rumex floridanus Meissner*	swamp dock	PAX
Polygonaceae	*Rumex* sp.		PAX
Polypodiaceae	*Athyrium alpestre (Hoppe.) Farw.*		PAX
Potamogetonaceae	*Ruppia maritima L.*		Both
Potamogetonaceae	*Potamogeton diversifolius Raf.*		PAX
Potamogetonaceae	*Potamogeton epihydrus Raf. nuttallii (Schlecht. & Cham.) Fern.*		PAX
Primulaceae	*Anagallis arvensis L.*	scarlet pimpernel	PAX
Primulaceae	*Lysimachia quadrifolia L.*	whorled loosestrife	WOLF
Primulaceae	*Samolus parviflorus Raf.*	brookweed	PAX
Ranunculaceae	*Ranunculus bulbosus L.*	bulbous buttercup	Both
Ranunculaceae	*Ranunculus* sp.		Both
Ranunculaceae	*Ranunculus abortivus L.*	kidney-leaved buttercup	PAX
Ranunculaceae	*Ranunculus acris L.*		WOLF
Ranunculaceae	*Ranunculus sceleratus L.*	cursed crowfoot	PAX
Ranunculaceae	*Thalictrum pubescens Pursh*		PAX
Roasaceae	*Potentilla simplex Michx.*		Both
Rosaceae	*Amelanchier* sp.		Both
Rosaceae	*Potentilla* sp.		Both
Rosaceae	*Prunus serotina Ehrh.*	black cherry	Both
Rosaceae	*Rosa canina L.*		Both
Rosaceae	*Rosa palustris Marsh.*		Both
Rosaceae	*Rubus enslenii Tratt.*	Southern dewberry	Both
Rosaceae	*Rubus pensylvanicus Poiret*	Pennsylvania blackberry	Both
Rosaceae	*Rubus* sp.		Both
Rosaceae	*Agrimonia rostellata Wallr.*		PAX

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Rosaceae	*Amelanchier canadensis L.*	Canadian serviceberry	PAX
Rosaceae	*Aphanes microcarpa (Boiss. & Reuter) Rothm.*		WOLF
Rosaceae	*Aronia arbutifolia (L.) Ell.*		PAX
Rosaceae	*Cottoneaster* sp.		PAX
Rosaceae	*Fragaria vesca L.*		PAX
Rosaceae	*Fragaria virginiana Duchesne*	wild strawberry	PAX
Rosaceae	*Geum canadense Jacq.*		PAX
Rosaceae	*Potentilla canadensis L.*	common cinqfoil	PAX
Rosaceae	*Pyrus communis L.*		PAX
Rosaceae	*Rosa multiflora Thunb.*		PAX
Rosaceae	*Rosa rugosa Thunb.*		PAX
Rosaceae	*Rosa* sp.		PAX
Rosaceae	*Rubus allegheniensis Porter*		PAX
Rosaceae	*Rubus arundelanus Blanch.*		PAX
Rosaceae	*Rubus discolor Weihe & Nees*		WOLF
Rosaceae	*Rubus phoenicolasius Maxim.*		PAX
Rubiaceae	*Diodia* sp.		Both
Rubiaceae	*Galium tinctorium L.*		Both
Rubiaceae	*Sherardia arvensis L.*		Both
Rubiaceae	*Cephalanthus occidentalis L.*		PAX
Rubiaceae	*Diodia teres Walt.*	Poorjoe	PAX
Rubiaceae	*Diodia virginiana L.*		WOLF
Rubiaceae	*Galium aparine L.*	cleavers	PAX
Rubiaceae	*Galium circaezans Michx.*		PAX
Rubiaceae	*Galium obtusum Bigelow*	blunt-leaf bedstraw	PAX
Rubiaceae	*Galium pedemontanum All.*		PAX
Rubiaceae	*Hedyotis purpurea (L.) T. & G.*	laarge houstonia	PAX
Rubiaceae	*Houstonia caerulea L.*		PAX
Rubiaceae	*Houstonia purpurea L.*		PAX
Rubiaceae	*Houstonia pusilla Schoepf*		PAX
Rubiaceae	*Mitchella repens L.*	partridgeberry	WOLF
Rutaceae	*Poncirus trifoliata Raf.*		PAX
Salicaceae	*Salix nigra Marsh.*		Both

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Salicaceae	*Salix* sp.		Both
Saururaceae	*Saururus cernuus L.*	lizard's-tail	PAX
Saxifragaceae	*Itea virginica L.*		PAX
Scrophulariaceae	*Gratiola neglecta Torr.*	G. virginiana of Gary's m	Both
Scrophulariaceae	*Linaria canadensis (L.) Dumort.*	blue toadflax	Both
Scrophulariaceae	*Penstemon digitalis (Sweet) Nutt.*	white beardtongue	Both
Scrophulariaceae	*Veronica arvensis L.*	corn speedwell	Both
Scrophulariaceae	*Veronica peregrina L.*	purslane speedwell	Both
Scrophulariaceae	*Agalinis purpurea (L.) Pennell*	purple false-foxglove	PAX
Scrophulariaceae	*Gratiola pilosa Michx.*	Hedge-hyssop	PAX
Scrophulariaceae	*Gratiola virginiana L.*		PAX
Scrophulariaceae	*Kickxia elatine (L.) Dumort.*	Linaria elatine (L.) Mill	PAX
Scrophulariaceae	*Lindernia anagallidea (Michx.) Pennell*	Hysanthes anagallidea (Mi	PAX
Scrophulariaceae	*Lindernia dubia (L.) Pennell*	false pimpernel	PAX
Scrophulariaceae	*Melampyrum lineare Lam. ssp. latifolium (Muhl.) Beauv.*		PAX
Scrophulariaceae	*Scrophularia marilandica L.*	carpenter's square	PAX
Scrophulariaceae	*Verbascum blattaria L.*	moth mullein	PAX
Scrophulariaceae	*Verbascum thapsus L.*	common mullein	PAX
Selaginellaceae	*Selaginella apoda (L.) Fern.*		PAX
Simarubaceae	*Ailanthus altissima (Mill.) Swingle*		PAX
Solanaceae	*Solanum nigrum L.*	American black nightshade	Both
Solanaceae	*Datura stramonium L.*	jimsonweed	PAX
Solanaceae	*Solanum carolinense L.*	horse-netle	PAX
Solaniaceae	*Physalis longifolia Nutt.*	smooth ground cherry	PAX
Sparganiaceae	*Sparganium americanum Nutt.*		PAX
Sparganiaceae	*Sparganium androcladum (Engelm.) Morong*		PAX
Typhaceae	*Typha angustifolia L.*	Narrow-leaf cattail	PAX
Ulmaceae	*Celtis occidentalis L.*		Both
Ulmaceae	*Ulmus rubra Muhl.*	Slippery elm	PAX
Ulmaceae	*Ulmus* sp.		PAX
Unknown	*Unknown*		PAX
Urticaceae	*Boehmeria cylindrica (L.) Sw.*	false nettle	PAX
Valerianaceae	*Valerianella locusta (L.) Betcke.*	European corn-salad	Both

FAMILY	SPECIES		
	Scientific Name	**Common Name**	**PAX or WOLF?**
Valerianaceae	*Valerianella* sp.		PAX
Verbeneaceae	*Verbena hastata L.*	common vervain	PAX
Verbeneaceae	*Verbena simplex Lehm.*	narrow-leaved vervain	WOLF
Verbeneaceae	*Verbena stricta Vent.*		WOLF
Violaceae	*Viola rafinesquii Greene*	field pansy	Both
Violaceae	*Viola blanda Willd.*		PAX
Violaceae	*Viola cucullata Ait.*	blue marsh violet	PAX
Violaceae	*Viola lanceolata L.*	Lance-leaved violet	WOLF
Violaceae	*Viola pedata L.*		WOLF
Violaceae	*Viola primulifolia L.*	primrose-leaved violet	PAX
Violaceae	*Viola sagittata Ait.*		PAX
Violaceae	*Viola sororia Willd.*		PAX
Vitaceae	*Ampelopsis brevipedunculata (Maxim.) Trautv.*	porcelainberry	PAX
Vitaceae	*Ampelopsis brevipedunculata (Maxim.) Trautv. elegans Bailey*	porcelainberry	PAX
Vitaceae	*Parthenocissus quinquefolia (L.) Planch.*	Virginia creeper	PAX
Vitaceae	*Parthenocissus* sp.		PAX
Vitaceae	*Vitis aestivalis Michx.*		PAX
Vitaceae	*Vitis labrusca L.*		PAX
Vitaceae	*Vitis vulpina L.*	V. cordifolia Michx.	PAX
Xyridaceae	*Xyris torta Sm. In Rees*		PAX

APPENDIX D

CLIMATE ADAPTATION PLAN FOR NAVAL AIR STATION PATUXENT RIVER COMPLEX INRMPs

1 Overview

1.1 Background

In accordance with the Department of Defense Manual (DoDM) 4715.03, updated in 2018, the Navy is required to consider climate change impacts in the development of Integrated Natural Resource Management Plans (INRMPs) and, when not in conflict with mission objectives, to take steps to implement adaptive management to ensure the long-term sustainability of natural resources (DoD 2018). Department of Defense Directive (DoDD) 4715.21, *Climate Change Adaptation and Resilience*, defines climate adaptation as the process of "adjustment in natural or human systems in anticipation of or response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative effects" (DoD 2021).

In 2019, the Department of Defense (DoD) published guidance for natural resource managers to assist installations in implementing climate change policy. As such, the method applied to carry out the climate change adaptation planning process for the Naval Air Station Patuxent River Complex (NAS PAX) INRMPs can be found in DoD's *Climate Adaptation for DOD Natural Resource Managers: A Guide to Incorporating Climate Considerations into INRMPs* (2019) (hereafter referred to as the DoD Climate Adaptation Guide). NAS PAX includes Naval Air Station Patuxent River (PAX), Webster Outlying Field (WOLF), Naval Recreation Center (NRC) Solomons and Bloodsworth Island Range (BIR).

As part of the climate change adaptation process, climate related vulnerabilities, risks, and impacts are assessed to determine natural resource goals and management strategies that support adaptation to climate changes. To ensure consistency and clarity in how the terms vulnerability, risk, and impact are used in this climate change adaptation plan, and to distinguish them from definitions used in the field of natural resource management, the definitions presented in the DoD Climate Adaptation Guide (2019) are provided below for reference:

- **Vulnerability:** The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.
- **Risk:** The product of the likelihood that an event will occur (probability) and the consequences (i.e., magnitude of impact) of that occurrence.
- **Impact:** The term "climate impacts" generally refers to the effects of climatic and extreme weather events on a given natural or human system.

1.2 Scope

The Office of the Chief of Naval Operations Manual (OPNAV) 5090.1, Environmental Readiness Manual, updated in 2014, identifies climate change as among a range of stressors on ecosystems. The Navy emphasizes regional coordination in the integration of climate change resilience and that ecosystems need to be managed in a way that allows for mitigation, adaptation, and long-term sustainability on a regional basis. Both positive and negative climate change impacts often result from a combination of physical processes that interact across multiple temporal and spatial scales. In the context of natural resources, complex ecological effects may occur at multiple scales that translate to direct or indirect risks to the installation's natural resources and to mission requirements.

Available regional models and assessments provide a necessary geographic scope to assess potential climate change impacts and adaptation strategies at NAS PAX (also referred to as the Complex throughout this appendix). Additionally, consideration of longer-term effects provides a strategic context for shorter-term operational and management planning. Throughout the climate change adaptation planning process, the Complex natural resources staff may engage a variety of internal and external stakeholders/partners to participate in evaluation of climate change conditions and adaptation strategy development.

2 Current Conditions

2.1 Northeast Regional Projections

The DoD Climate Adaptation Guide (2019) emphasizes that INRMPs should list or include by reference, installation-specific climate data and region-specific climate projections from the most current quadrennial U.S. Global Change Research Program (USGCRP) National Climate Assessment (NCA) Report. At the time of this INRMP update, the most current completed assessment is the fourth NCA (NCA4). The fifth assessment is currently underway, and completion is anticipated in 2023. Key Northeast Region climate concerns identified in the NCA4 include the following:

- **Temperature.** By 2050, average annual temperatures in the Northeast are expected to increase by 4.0°F under the lower emissions scenario and 5.1°F under the higher emission scenario relative to the near present (1975–2005), with several more days of extreme heat occurring throughout the region each year.
- **Precipitation.** The recent dominant trend in precipitation throughout the Northeast has been towards increases in rainfall intensity, with increases in intensity exceeding those in other regions of the contiguous United States. Further increases in rainfall intensity are expected, with increases in total precipitation expected during the winter and spring but with little change in the summer. Monthly precipitation in the Northeast is projected to be about 1 inch greater for December through April by end of century (2070–2100) under the higher emissions scenario.
- **Sea Level Rise.** Projections for the region suggest that sea level rise in the Northeast will be greater than the global average of approximately 0.12 inches (3 mm) per year. The worst-case and lowest-probability scenarios, however, project that sea levels in the region would rise upwards of 11 feet (3 m) on average by the end of the century (USGCRP 2018).

2.2 Recent Local Trends and Resources

In July 2008 the Maryland Commission on Climate Change (MCCC) Scientific and Technical Working Group produced a *Comprehensive Assessment of Climate Change Impacts in Maryland* as part of the Commission on Climate Change's *Plan of Action*. The assessment was revisited in October 2016 to modify projections of future climatic conditions in Maryland based on new research findings. Specifically, downscaled projections from model ensembles that were produced for the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report and the Third NCA (NCA3) were utilized in the review. Analysis of direct observations for the Northeast U.S., including Maryland, presented in the NCA3 were also evaluated. Low emissions and high emissions scenarios were considered in both the 2008 and 2016 assessments. Projections of changes in Maryland, such as changes in temperature and precipitation, continued to largely align with those presented in the MCCC 2008 impact assessment (MCCC 2016). The MCCC 2008 impact assessment, which remains the most current and comprehensive assessment, continues to serve as a valuable resource for climate change adaptation planning in Maryland. It is important to note that climate change projections continue to evolve. Projections must be frequently evaluated to ensure they reflect current conditions.

MCCC (2008) provides detailed descriptions of impacts to many natural resource features in Maryland, including water resources and aquatic ecosystems, human health, farms and forests, sea level rise and storms. Because the Complex is located in Maryland's Coastal Plain physiographic province, the most significant impacts to Maryland that are associated with projected sea-level rise will impact the Complex directly. The location and elevation of BIR, and the increased wave action on its entire perimeter, may significantly increase its vulnerability to relative sea level rise. The remaining climate trends are also expected to impact the Complex, including the projected increase in temperature and precipitation.

Numerous resources are available that can aid natural resource management staff in tracking local conditions and trends, to include but not limited to:

- Maryland Adaptation and Resiliency Working Group
- Maryland Annual Climate Change Reports by Department (Department of Natural Resources, Department of the Environment)
- Chesapeake Bay Program Strategies and Research, such as the Climate Resiliency Outcomes Management Strategy, Climate Change and the Chesapeake Bay State of Science Review and Recommendations, and the Submerged Aquatic Vegetation Outcome Strategy (2015-2025).
- National Centers for Coastal Ocean Science
- Chesapeake Bay Sentinel Site Cooperative
- State Wildlife Action Plan
- Virginia Institute of Marine Science – Chesapeake Bay Environmental Forecast System

Some of the most up to date climate change data at a local scale is available through the National Oceanic and Atmospheric Administration (NOAA) Centers for Environmental Information. NOAA's Centers for Environmental Information 2022 State Climate Summaries for Maryland highlights the following local trends:

- **Temperatures**. Temperatures in Maryland have risen about 2.5°F since the beginning of the 20th century. Historically unprecedented warming is projected during this century under a higher emissions pathway. Even under a lower emissions pathway, annual average temperatures are projected to most likely exceed historical record levels by the middle of this century. Heat waves are projected to be more intense, while cold waves are projected to be less intense.

- **Precipitation.** The frequency and intensity of extreme precipitation events are projected to increase. The annual number of 2-inch extreme precipitation events averaged 2.5 days from 2005–2020, compared to 1.8 days from 1950–2004. Total annual precipitation has been above the long-term average for the last 26 years**.** Annual average precipitation is also projected to increase, particularly in the winter and spring.

- **Sea level rise:** Tide-gauge records show that sea level in the Chesapeake Bay has been increasing at an average rate of 1.3 to 1.5 inches per decade over the past 100 years, 50% more than the global historical average observed over the same period. Large additional increases (in the likely range of 1 to 4 feet by 2100) are projected (Kunkel et al. 2022).

The Chesapeake Bay and its tributaries have a high vulnerability to sea level rise, as indicated by the NOAA projection described above. Differences in relative sea level rise among tide gauge stations indicate some small variation in sea level rise throughout the Chesapeake Bay, largely due to differences in vertical land motion (VLM) at the various sites (Boesch et al. 2018). VLM can be defined as the average long-term rate of change of the land surface in a geocentric reference frame. This rate of change is impacted by factors such as tectonic forces, extraction of groundwater and localized faulting (Miller et al. 2018).

Tidal amplitude trends also vary throughout the Chesapeake Bay, with current trends showing small increases in the major semi-diurnal tide amplitude in the upper portion of the Chesapeake Bay and decreases in the lower portion. In addition to sea-level rise, future tidal amplitude will depend on what future shoreline protection measures are implemented. With widespread armoring for example, tidal amplitude may increase. However, if low lying-lands are permitted to be inundated by sea-level rise, tidal range will likely decrease (Boesch et al. 2018**).**

To illustrate, a 2017 study applied two different shoreline management scenarios within a numerical model to investigate how sea level rise and coastline changes may impact tides in the Chesapeake Bay and Delaware Bay. In the first approach, named the *soft shoreline approach* (labeled SLR Soft), low-lying areas are flooded by sea level rise. In the second approach, named the *hard shoreline approach* (labeled SLR Hard), "a hypothetical sea wall is placed at the present coastline such that low-lying land is not allowed to flood" (Lee et al. 2017). See Figure 1 below.

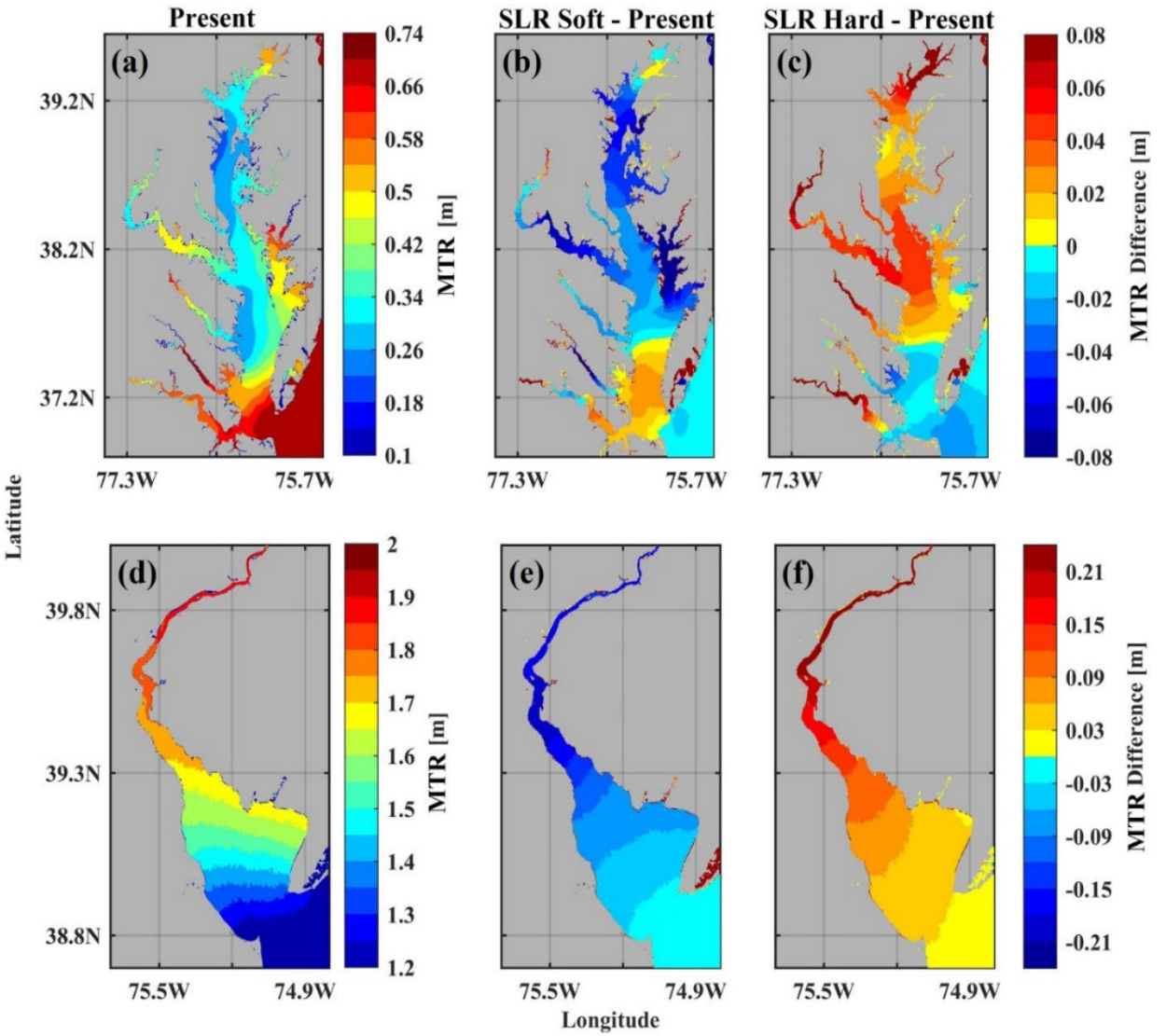

Figure 1. The mean tidal range (MTR) under the present sea level in (a) Chesapeake and (d) Delaware Bays. The tidal range difference between Runs "SLR Soft" and "Present" in (b) Chesapeake and (e) Delaware Bays. The tidal range difference between Runs "SLR Hard" and "Present" in (c) Chesapeake and (f) Delaware Bays (Lee et al. 2017).

In 2018, an expert group drawn from the Mid-Atlantic, with funding from the University of Maryland Center for Environmental Science, came to a consensus on sea level rise projections for Maryland coastal lands, estimating the "likely range (66% probability) of the relative rise of mean sea level expected in Maryland between 2000 and 2050 is 0.8 to 1.6 feet, with about a one-in-twenty chance it could exceed 2.0 feet and about a one-in-one hundred chance it could exceed 2.3 feet." (Boesch et al. 2018). Figure 2 below, derived from MD iMAP Data Catalog (DOIT), depicts potential inundation on Maryland's Eastern Shore at two feet of sea level rise. The DOIT map shows Bloodsworth Island fully inundated at 2 feet of sea level rise.

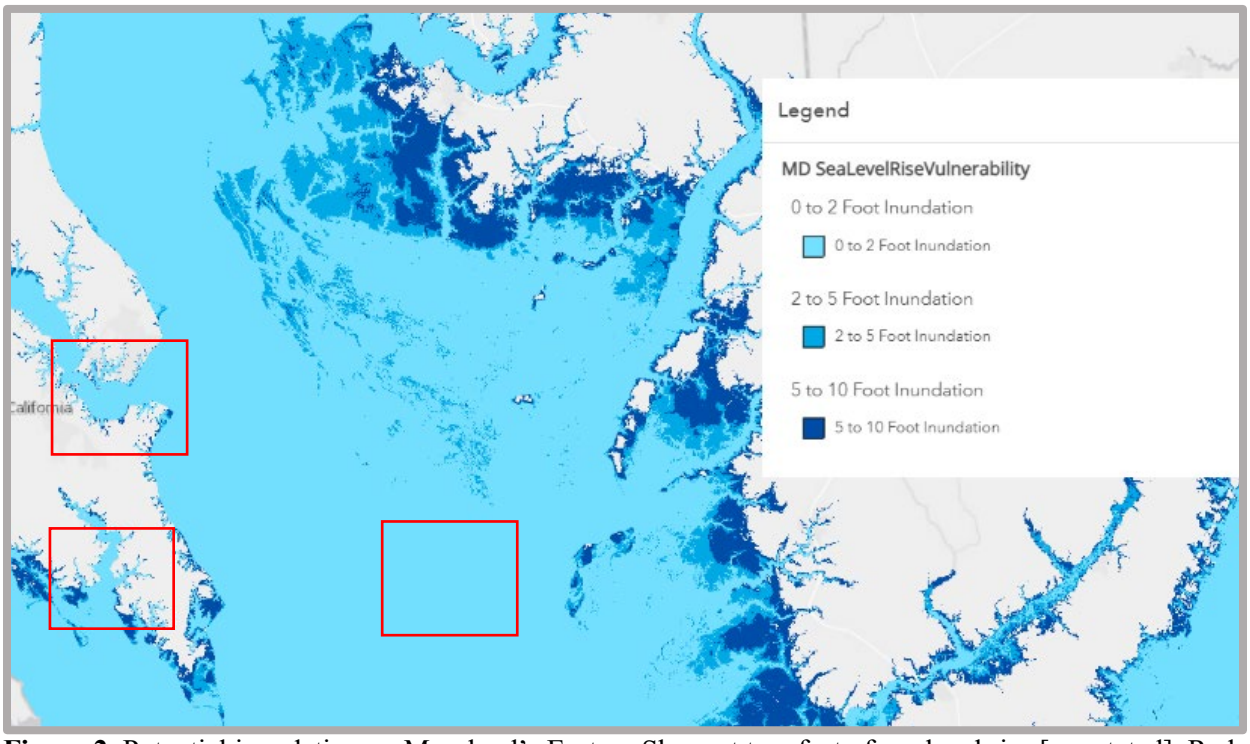

Figure 2. Potential inundation on Maryland's Eastern Shore at two feet of sea level rise [annotated]. Red boxes indicate approximate locations of NAS PAX properties addressed within this appendix.

Each year, the Virginia Institute of Marine Science (VIMS) updates recent-sea level trends and projections to the year 2050 at five localities from north to south within the Chesapeake Bay (VIMS, 2022a). The Solomons Island tidal station is the most relevant to the Complex. However, data for all five stations are included below for reference. The NOAA Sea Level Rise Viewer indicates that PAX and WOLF have a low level of vulnerability to sea level rise. NRC Solomons and BIR are categorized as having a "medium" level of vulnerability to sea level rise (NOAA 2022). However, a lack of mapping for BIR indicates a low level of confidence.

Table 1. Year-to-year sea level-rise trends in the Chespeake Bay by tide guage locality (VIMS 2022a)

	Rise Rate (mm/yr)	Acceleration (mm/y2)	Linear 2050 (m)	Quadratic 2050 (m)
Baltimore, MD	3.783	0.13	0.21	0.41
Annapolis, MD	4.21	0.186	0.23	0.52
Solomons Island, MD	4.956	0.147	0.28	0.5
Yorktown, VA	5.216	0.154	0.3	0.53
Norfolk, VA	5.401	0.122	0.31	0.49

The projection chart for Solomons Island tidal station presented in Figure 3 depecits sea-level trends from 1969-2050. Observed Monthly Mean Sea Level (MMSL) is depectied in light blue and a Quadratic Trend is in the darker orange color. QHI95 and QLo95 in dotted orange depict confidence intervals that include 95% of sea level observations recorded during each month at the tidal station. A linear trend is shown in green and a decadal signal is shown in dark blue. The decadal signal shows vairability in sea level due to short-term interactions (e.g., El Nino). The quadartic trend at Solomons Island tidal station, indicates that the rate of sea level rise is accelerating with time. Comparing the quadratic trend with the linear projections shows an exponential rise in sea level (VIMS 2022a).

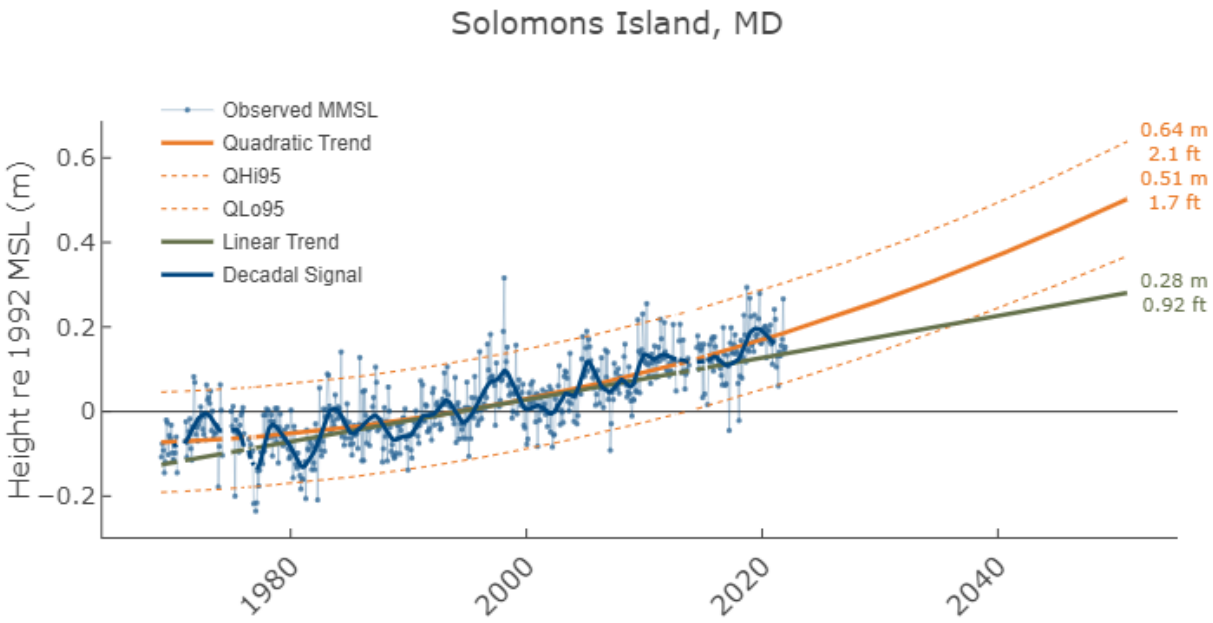

Figure 3. Projected trends (1969-2050) at Solomons Island (VIMS 2022a).

The Chesapeake Bay and its tributatires are also warming, with esturine Water Surface Temperature (WST) in the Chesapeake Bay increasing more rapidly than air temperatures. Factors other than climate change may also contribute to the rise in water temperatures, including coastal urbanization, stormwater runoff, and discharges from industrial sources (Ding & Elmore 2015).

Research indicates a seasonal pattern of warming within the Chesapeake Bay, with temperatures warming three to four times faster in summer than winter. Eighty to ninety percent (80%-90%) of warming is driven by atmospheric effects, with concentrated increases near the mouth of the Chesapeake Bay. Riverine temperature increases in the Chesapeake Bay appear to be limited to the heads of tidal tributaries. Understanding the the seasonal timing of warming can improve projections and support the assesment of water quality goals (Malmquist 2021).

To determine causes of Chesapeake Bay warming, research at VIMS conducted a reference run for 1985-2019 using a Watershed–Estuarine–Hydrodynamic model and Chesapeake Bay data. Sensitivity experiments were conducted, designed to isolate the drivers of temperature trends in the Bay (*Model Sensitivity Experiments*) (Hinson et al. 2021). The Figure 4 below illustrates research results on the drivers of temperature trends in the Chesapeake Bay.

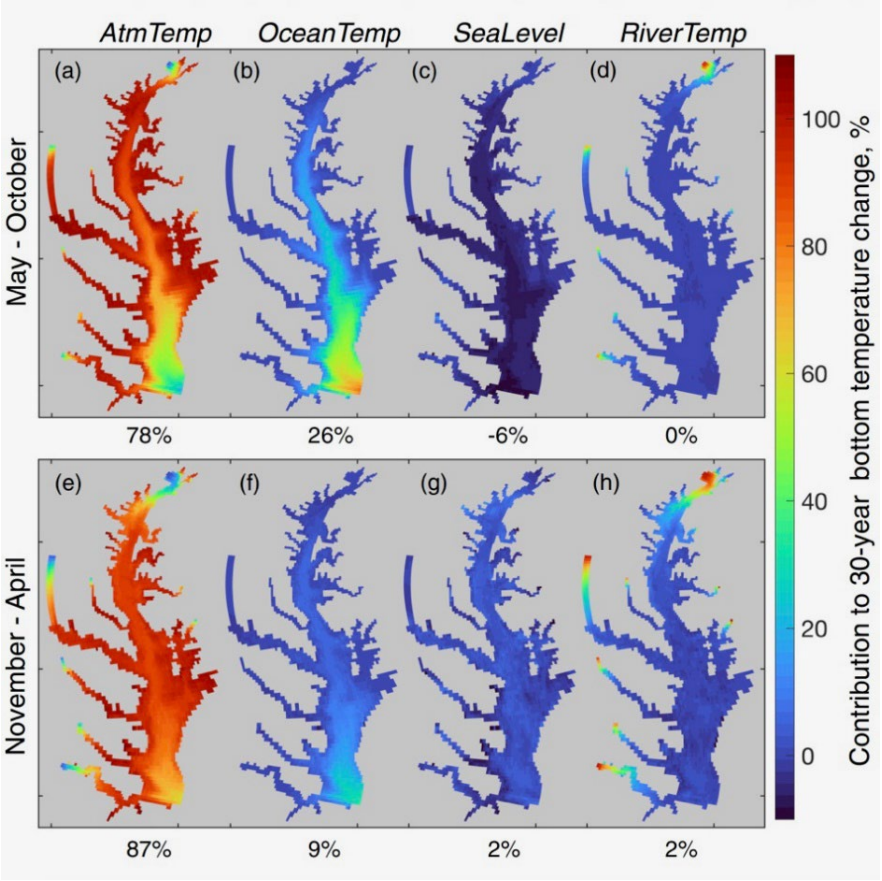

Figure 4. Percent contribution to the total change in main stem bottom temperatures from each sensitivity experiment for (a) May through October and (b) November through April. Average main stem percent contributions to total temperature change are denoted beneath each panel (Hinson et al. 2021).

To understand seasonal and short-term changes in temperatures throughout the Chesapeake Bay, VIMS has water quality monitoring stations established at select locations. Station LE2.3 is approximately 15 miles south of NAS PAX. Figure 5 contains two line-plots with temperature data from the LE2.3 station.

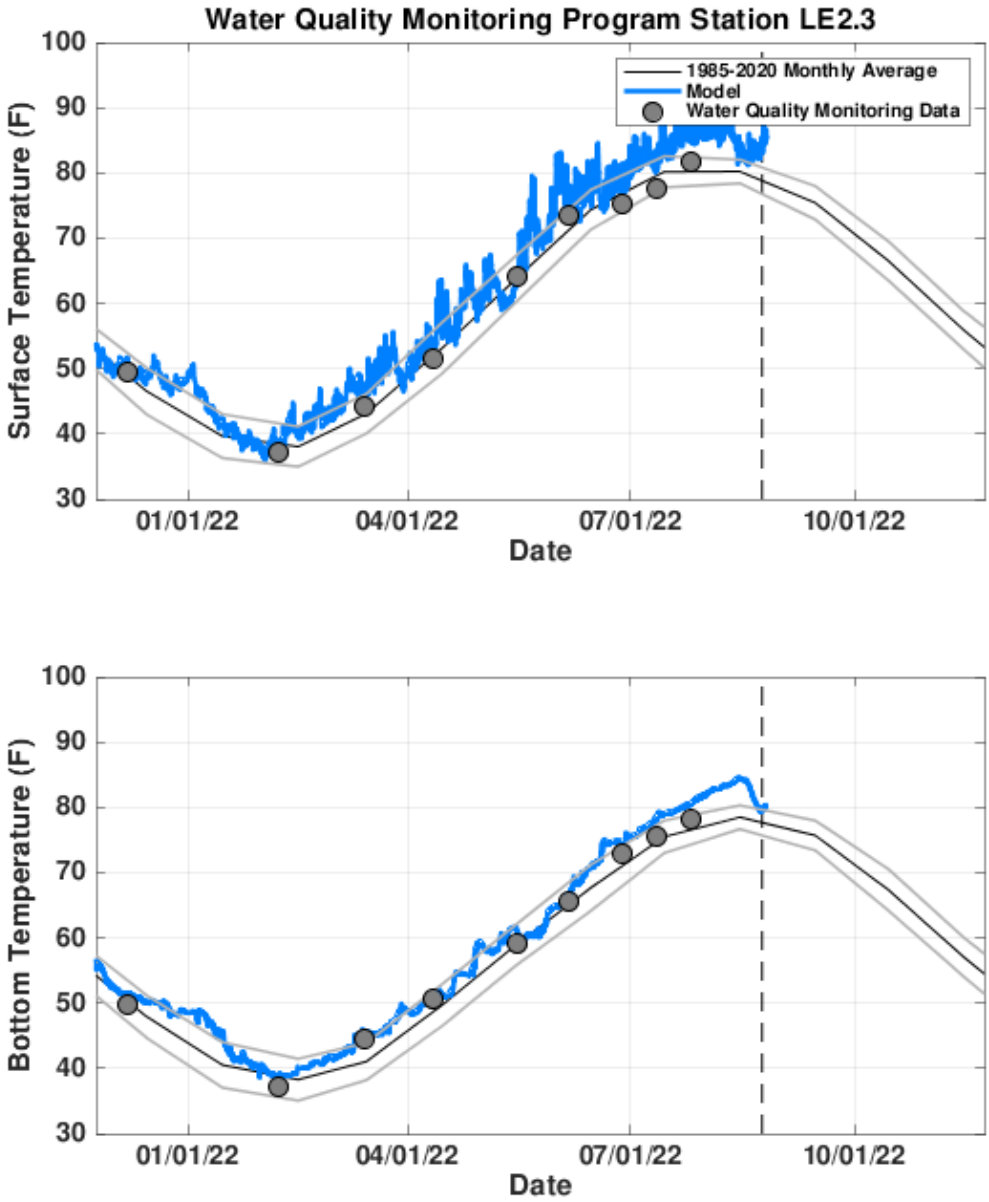

Figure 5. Overlaying the modeled temperature on top of long-term averages from observed data shows how the forecasted temperature compares to the historical average. Grey lines show one standard deviation above and below the average (VIMS 2022b).

The following figures depict local observations in climate phenomena in Maryland. Figure 6 below identifies observed warming trends in Maryland under a higher emissions scenario and a lower emissions scenario. Figure 7 illustrates the observed number of 2-inch precipitation events from

1900 to 2100. Figure 8 depicts total annual precipitation for Maryland from 1950 to 2020 and 1895 to 2020.

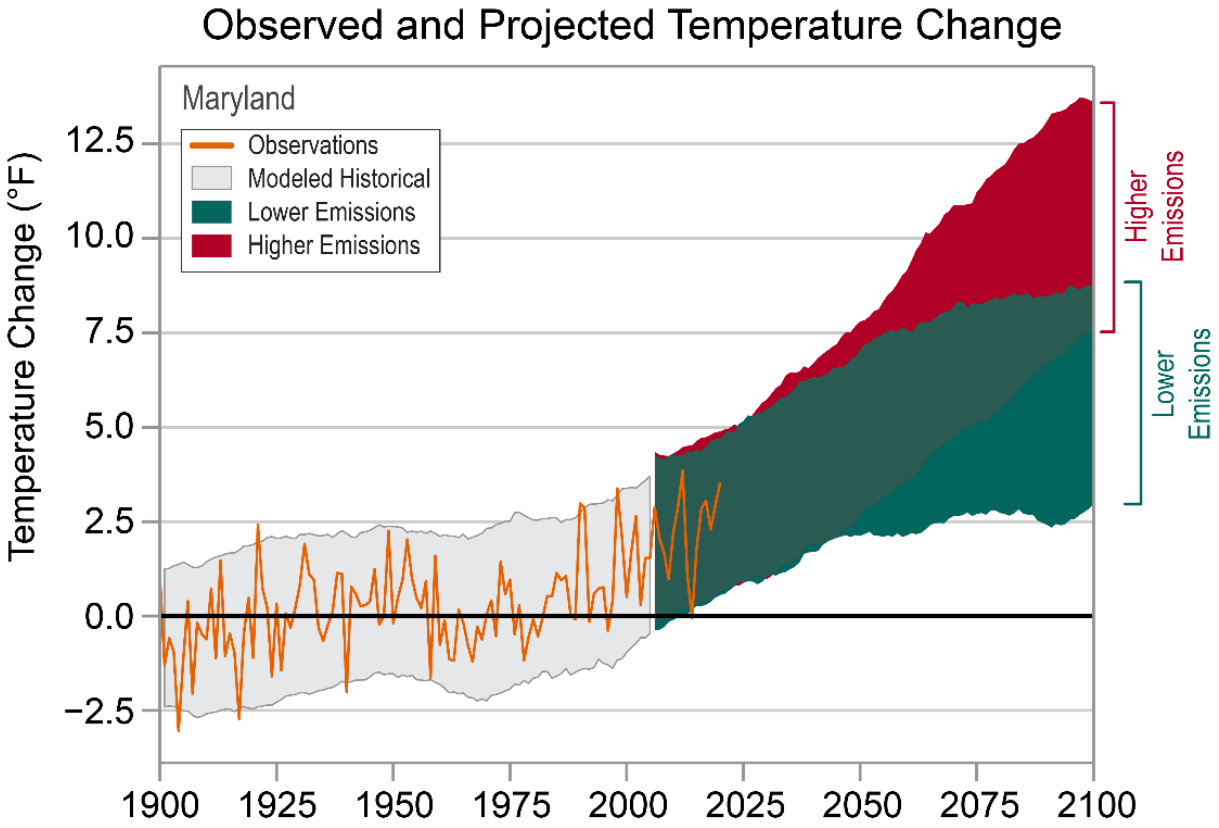

Figure 6. Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for Maryland. Observed data are for 1900–2020. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in Maryland (orange line) have risen about 2.5°F since the beginning of the 20th century. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during this century. Less warming is expected under a lower emissions future (the coldest end-of-century projections being about 2.5°F warmer than the historical average; green shading) and more warming under a higher emissions future (the hottest end-of-century projections being about 10°F warmer than the hottest year in the historical record; red shading). Sources: CISESS and NOAA NCEI (Kunkel et al. 2022).

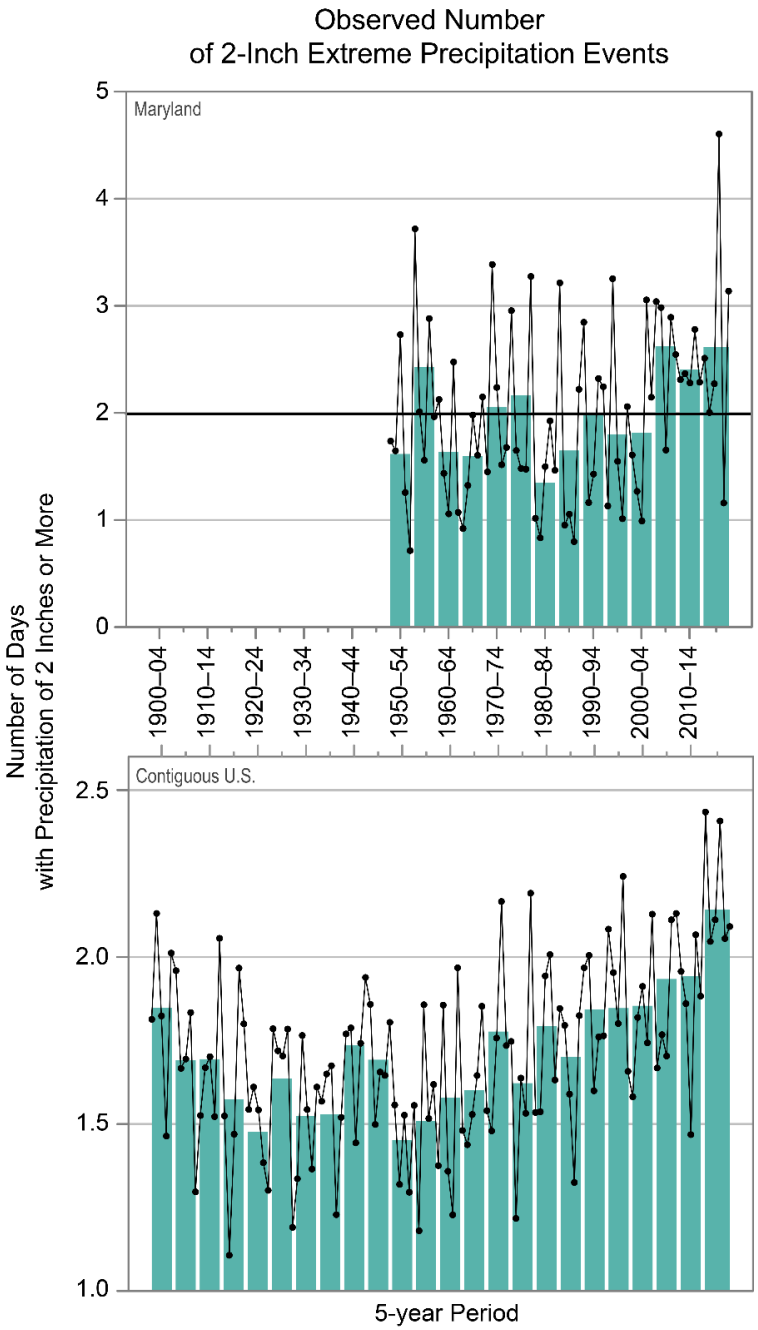

Figure 7: Observed annual number of 2-inch extreme precipitation events (days with precipitation of 2 inches or more) for Maryland from 1950 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average for Maryland of 2.0 days. A typical reporting station experiences about 2 events per year. Values for the contiguous United States (CONUS) are included to provide a longer and larger context. Long-term stations dating back to 1900 were not available for Maryland. The number of extreme precipitation events has been above average since 2005. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 11 long-term stations (Kunkel et al. 2022).

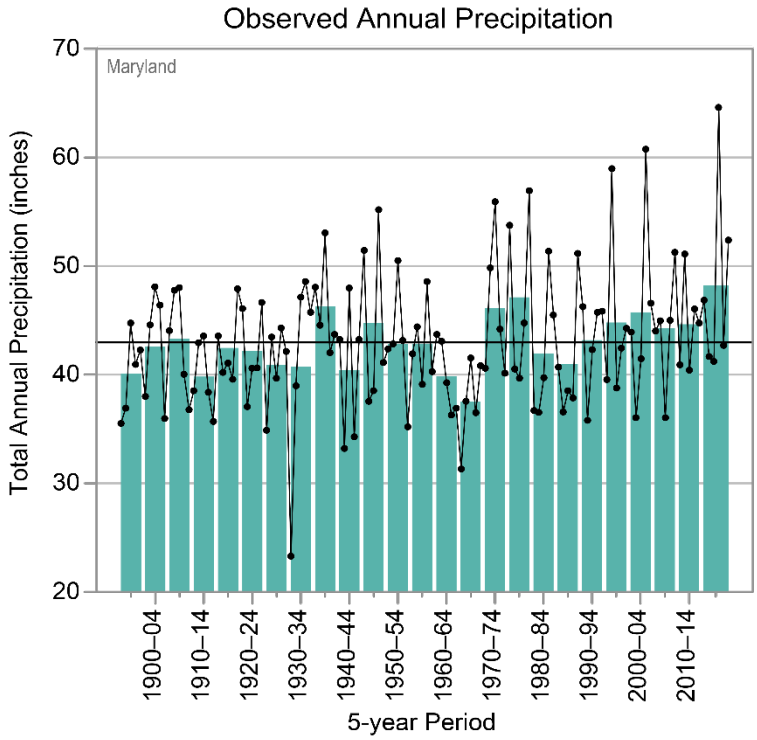

Figure 8. Total annual precipitation for Maryland from 1950 to 2020 and 1895 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black lines show the long-term (entire period) averages for Maryland (Kunkel et al. 2022).

Independently and through their interaction with each other, climate change phenomena can produce various primary and secondary climate threats with the potential to negatively impact natural resources at the Complex. Table 2 below depicts target natural resource features, climate change trends and associated resource vulnerabilities of concern for the Complex. Target natural resources are defined as "natural resource features that will be the focus of adaptation planning" (Stein et al. 2019).

Target resources that are the focus of adaptation planning for this INRMP were selected based on installation mission priorities and current regional and local climate change trends and projections. Future conditions may warrant the addition or subtraction of a target resource from the selection as changes in climate trends occur, such as an increasing trend toward a higher emission scenario which may alter projected impacts and risk.

Table 2.

Climate Vulnerabilities of Target Natural Resources at PAX/WOLF		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
Agricultural Parcels	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Changes in precipitation/temperature patterns may impact crop suitability for agricultural outleases. An increase of extreme precipitation events increases risk of damage to crops, soils, and infrastructure. • Distribution of weed species may shift due to climate change and elevated carbon dioxide concentrations. Competition from weeds and invasive plant species may increase. [g] • Beneficial and harmful insects, microbes, and other organisms present in agricultural ecosystems will also respond either positively or negatively, depending on the species, to climate change. • There is high agreement among models that summertime soil moisture will decrease in Maryland, which may increase water demand. [b] • Climate related shifts in RTE species ranges, breeding seasons, migrations, and other life-cycle events. New species protected under ESA. • *Current farm fields at NAS PAX River include Corn, Soybeans, Winter Wheat (*Triticum spp*.), Barley (*Hordeum spp*.), and Sorghum (*Sorghum spp*.).
Coastal/Tidal Ecosystems	Temperature Increase Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Submerged Aquatic Vegetation (SAV) distribution and abundance are sensitive to water quality and light availability. Increased rainfall and high-intensity storms will increase sediment and nutrient inputs and may lead to SAV erosion from increased wave action and storm surge. Increased water temperatures may lead to significant loss of eelgrass. [h] • Intertidal and shallow subtidal zones are vulnerable to inundation, erosion, and the potential for habitat conversion (e.g., vegetated to unvegetated, or intertidal to subtidal). Increased precipitation and storm intensity may result in long-term changes in salinity and dissolved oxygen conditions in

Climate Vulnerabilities of Target Natural Resources at PAX/WOLF		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
		estuarine waters, with the potential to negatively impact fish and shellfish (this occurred in the Chesapeake Bay in 2018 and 2019). [i] • Modification of wetland habitat characteristics such as inundation frequency, may impact the quality and accessibility of marsh habitat. [j] • Based on projections of marsh habitat loss in Chesapeake Bay, significant declines of many marsh species are predicted. Birds such as the rare Black Rail that relies solely on irregularly flooded high marsh could disappear from the Bay if breeding sites are submerged. [j] • Altered hydrologic and disturbance regimes are likely to favor invasive species. [e] • Plankton food webs - plankton must respond quickly to changes in their habitat – on time scales of days to weeks. The plankton are highly sensitive to climate changes (especially abundance, growth rates and type of species present). [k] • High peak flows and degraded streams may transmit more nutrients and sediments to the Chesapeake Bay and its tidal tributaries, contributing to water quality impairment in the estuaries. [b] • There are limits in the extent to which marshes can build elevation naturally through vegetation growth and sediment accretion. Rising waters will thus likely lead to wetland migration landward/upslope if land is available or migration. [l] • Upland migration of wetland may impact other land uses. [m]
Freshwater/Non-tidal Ecosystems	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Increased sedimentation and erosion. Altered hydrologic and disturbance regimes may benefit invasive species. [e] • Rapid increases in stream temperatures may limit habitat suitability for native fishes and other organisms. [b]

Climate Vulnerabilities of Target Natural Resources at PAX/WOLF		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
		• Wetland sensitivity to temperature and small changes in ground/surface water levels/elevation. [a, f] • Forested wetlands are sensitive to higher water levels leading to "drowning" and replacement with emergent herbaceous wetlands. While lower water levels result in wetlands being converted to upland vegetation. • Sea level rise may cause saltwater intrusion into non-tidal wetland systems. [c]
Floodplain	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Sea level rise and increases in precipitation likely to expand flood hazard/inundation risk. [d]
Forest	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Increased forest defoliation; loss of birds and other animal species; increased intensity of storms; expansion in the geographic range and population size of tree pests. [b]
Land Resources	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Increased coastal flooding and erosion, submergence of coastal marshes and other habitats. Interior stormwater runoff and stream flow will erode land in locations where the landscape has steep slopes (prevalent in the western portion of NAS PAX River.) adversely affecting the shoreline along the Chesapeake Bay and the Patuxent River.
Migratory Birds	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Climate-related shifts in migratory bird species ranges, breeding seasons, migrations, and other life-cycle events. • Disrupted interactions among interdependent species. • Coastal bird species are expected to shift distributions northward, as warmer temperatures cause shifts in food resources and nesting opportunities. [j] • Seabirds breeding on coasts may be unsuccessful in raising chicks if their hatch dates do not match patterns in the availability of food resources. [J] • Loss of water bird habitats due to reduction in mid-marsh availability due to sea level rise.

Climate Vulnerabilities of Target Natural Resources at PAX/WOLF		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
Native Ecosystems	Temperature Increase Increases in precipitation and rainfall Intensity Sea level rise	• Degraded integrity and resilience. Proliferation of non-native/invasive species • Most invasive species are expected to respond well to climate change. [o] • Degradation of water quality with intrusion of saltwater into freshwater systems.
Rare Threatened and Endangered (RTE) Species	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Climate-related changes may cause non-listed species to decline to the point where they may be eligible for protection under the Endangered Species Act. Shifts in species ranges, breeding seasons, migrations, and other life-cycle events. • If coastal habitats are lost, bird populations may decline. Based on projections of marsh habitat loss in Chesapeake Bay, significant declines of many marsh species are predicted.
Stormwater Treatment Quality	Increases in Precipitation and Rainfall Intensity	• Excessive precipitation can increase stormwater runoff and sediment yields, degrading water quality. [e]
Human Health	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Changes in habitat, population, and active season of ticks and mosquitos; warmer winters likely resulting in earlier insect emergence. [b]

[a] Moomaw et al. 2018. [b]MCCC 2008. [c] EPA 2022 [d] Kunkel et al. 2022. [e] Furniss et al. 2010. [f] Brekke et al. 2009. [g] Janowiak et al. 2016. [h] Moore & Orth 2008. [i] (Farr et al. 2021). [j] NABCI, U.S. Committee 2010. [k] Smith et al. 2008. [l] Osland et al. 2022. [m] Sudol et al. 2020. [o] MDNR, 2015.

Table 3.

Climate Vulnerabilities of Target Natural Resources at BIR		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
Coastal/Tidal Ecosystems	Temperature Increase Increases in Precipitation and Rainfall Intensity Seal Level Rise	• Submerged Aquatic Vegetation (SAV) distribution and abundance are sensitive to water quality and light availability. Increased rainfall and high-intensity storms will increase sediment and nutrient inputs and may lead to SAV erosion from increased wave action and storm surge. Increased water temperatures may lead to significant loss of eelgrass. [h] • Intertidal and shallow subtidal zones are vulnerable to inundation, erosion, and the potential for habitat conversion (e.g., vegetated to unvegetated, or intertidal to subtidal). Increased precipitation and storm intensity may result in long-term changes in salinity and dissolved oxygen conditions in estuarine waters, with the potential to negatively impact fish and shellfish (this occurred in the Chesapeake Bay in 2018 and 2019). [i] • Modification of wetland habitat characteristics such as inundation frequency, may impact the quality and accessibility of marsh habitat. [j] • Based on projections of marsh habitat loss in Chesapeake Bay, significant declines of many marsh species are predicted. Birds such as the rare Black Rail that relies solely on irregularly flooded high marsh could disappear from the Bay if breeding sites are submerged. [j] • Altered hydrologic and disturbance regimes are likely to favor invasive species. [e] • Plankton food webs - plankton must respond quickly to changes in their habitat – on time scales of days to weeks. The plankton are highly sensitive to climate changes (especially abundance, growth rates and type of species present). [k] • There are limits in the extent to which marshes can build elevation naturally through vegetation growth and sediment

Climate Vulnerabilities of Target Natural Resources at BIR		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
		accretion. Rising waters will thus likely lead to wetland migration landward/upslope if land is available or migration. [l] • Upland migration of wetland may impact other land uses. [m]
Land Resources	Increases in Precipitation and Rainfall Intensity Seal Level Rise	• Increased coastal flooding and erosion, submergence of coastal marshes and other habitats.
Migratory Birds	Increases in Precipitation and Rainfall Intensity Seal Level Rise	• Climate-related shifts in migratory bird species ranges, breeding seasons, migrations, and other life-cycle events. • Disrupted interactions among interdependent species. • Coastal bird species are expected to shift distributions northward, as warmer temperatures cause shifts in food resources and nesting opportunities. • Seabirds breeding on coasts may be unsuccessful in raising chicks if their hatch dates do not match patterns in the availability of food resources. [J]
Native Ecosystems	Temperature Increase Increases in precipitation and rainfall Intensity Sea level rise	• Degraded integrity and resilience. Proliferation of non-native/invasive species • Most invasive species are expected to respond well to climate change. [o]
Rare Threatened and Endangered (RTE) Species	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Climate-related changes may cause non-listed species to decline to the point where they may be eligible for protection under the Endangered Species Act. Shifts in species ranges, breeding seasons, migrations, and other life-cycle events. • If coastal habitats are lost, bird populations may decline. Based on projections of marsh habitat loss in Chesapeake Bay, significant declines of many marsh species are predicted.
Human Health	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Changes in habitat, population, and active season of ticks and mosquitos; warmer winters likely resulting in earlier insect emergence. [b]

[a] Moomaw et al. 2018. [b]MCCC 2008. [c] EPA 2022 [d] Kunkel et al. 2022. [e] Furniss et al. 2010. [f] Brekke et al. 2009. [h] Moore & Orth 2008. [i] (Farr et al. 2021). [j] NABCI, U.S. Committee 2010. [k] Smith et al. 2008. [l] Osland et al. 2022. [m] Sudol et al. 2020. [o] MDNR, 2015.

Table 4.

Climate Vulnerabilities of Target Natural Resources at NRC Solomons		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
Coastal/Tidal Ecosystems	Temperature Increase Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Submerged Aquatic Vegetation (SAV) distribution and abundance are sensitive to water quality and light availability. Increased rainfall and high-intensity storms will increase sediment and nutrient inputs and may lead to SAV erosion from increased wave action and storm surge. Increased water temperatures may lead to significant loss of eelgrass. [h] • Intertidal and shallow subtidal zones are vulnerable to inundation, erosion, and the potential for habitat conversion (e.g., vegetated to unvegetated, or intertidal to subtidal). Increased precipitation and storm intensity may result in long-term changes in salinity and dissolved oxygen conditions in estuarine waters, with the potential to negatively impact fish and shellfish (this occurred in the Chesapeake Bay in 2018 and 2019). [i] • Modification of wetland habitat characteristics such as inundation frequency, may impact the quality and accessibility of marsh habitat. [j] • Based on projections of marsh habitat loss in Chesapeake Bay, significant declines of many marsh species are predicted. Birds such as the rare Black Rail that relies solely on irregularly flooded high marsh could disappear from the Bay if breeding sites are submerged. [j] • Altered hydrologic and disturbance regimes are likely to favor invasive species. [e] • Plankton food webs - plankton must respond quickly to changes in their habitat – on time scales of days to weeks. The plankton are highly sensitive to climate changes (especially abundance, growth rates and type of species present). [k] • High peak flows and degraded streams may transmit more nutrients and sediments to the Chesapeake Bay and its tidal

Climate Vulnerabilities of Target Natural Resources at NRC Solomons		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
		tributaries, contributing to water quality impairment in the estuaries. [b] • There are limits in the extent to which marshes can build elevation naturally through vegetation growth and sediment accretion. Rising waters will thus likely lead to wetland migration landward/upslope if land is available or migration. [l] • Upland migration of wetland may impact other land uses. [m]
Freshwater/Non-tidal Ecosystems	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Increased sedimentation and erosion. Altered hydrologic and disturbance regimes may benefit invasive species. [e] • Rapid increases in stream temperatures may limit habitat suitability for native fishes and other organisms. [b] • Wetland sensitivity to temperature and small changes in ground/surface water levels/elevation. [a, f] • Forested wetlands are sensitive to higher water levels leading to "drowning" and replacement with emergent herbaceous wetlands. While lower water levels result in wetlands being converted to upland vegetation. • Sea level rise may introduce saltwater into non-tidal wetland. [c]
Floodplain	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Sea level rise and increases in precipitation likely to expand flood hazard/inundation risk. [d]
Forest	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Increased forest defoliation; loss of birds and other animal species; increased intensity of storms; expansion in the geographic range and population size of tree pests. [b]
Land Resources	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Increased coastal flooding and erosion, submergence of coastal marshes and other habitats. Interior stormwater runoff and stream flow will erode land in locations where the landscape has steep slopes (prevalent in the western portion of

Climate Vulnerabilities of Target Natural Resources at NRC Solomons		
Target Natural Resources	**Climate Change Trends**	**Climate Change Vulnerabilities**
		NAS PAX River.). Shoreline along the Chesapeake Bay and the Patuxent River.
Migratory Birds	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Climate-related shifts in migratory bird species ranges, breeding seasons, migrations, and other life-cycle events. • Disrupted interactions among interdependent species. • Coastal bird species are expected to shift distributions northward, as warmer temperatures cause shifts in food resources and nesting opportunities. [j] • Seabirds breeding on coasts may be unsuccessful in raising chicks if their hatch dates do not match patterns in the availability of food resources. [J]
Native Ecosystems	Temperature Increase Increases in precipitation and rainfall Intensity Sea level rise	• Degraded integrity and resilience. Proliferation of non-native/invasive species • Most invasive species are expected to respond well to climate change. [o]
Rare Threatened and Endangered (RTE) Species	Increases in Precipitation and Rainfall Intensity Sea Level Rise	• Climate-related changes may cause non-listed species to decline to the point where they may be eligible for protection under the Endangered Species Act. Shifts in species ranges, breeding seasons, migrations, and other life-cycle events. • If coastal habitats are lost, bird populations may decline. Based on projections of marsh habitat loss in Chesapeake Bay, significant declines of many marsh species are predicted.
Stormwater Treatment Quality	Increases in Precipitation and Rainfall Intensity	• Excessive precipitation can increase stormwater runoff and sediment yields, degrading water quality. [e]
Human Health	Temperature Increase Increases in Precipitation and Rainfall Intensity	• Changes in habitat, population, and active season of ticks and mosquitos; warmer winters likely resulting in earlier insect emergence. [b]

[a] Moomaw et al. 2018. [b]MCCC 2008. [c] EPA 2022 [d] Kunkel et al. 2022. [e] Furniss et al. 2010. [f] Brekke et al. 2009. [h] Moore & Orth 2008. [i] (Farr et al. 2021). [j] NABCI, U.S. Committee 2010. [k] Smith et al. 2008. [l] Osland et al. 2022. [m] Sudol et al. 2020. [o] MDNR, 2015.

3 Mission Sustainability and Environmental Management Strategy

3.1 Climate Risks to Mission Assets

Climate impacts on natural resources may compromise the ability of the installation to implement its mission. Key climate risks to mission assets posed by climate vulnerabilities to NAS PAX natural resources are identified in Table 5.

Table 5.

Climate Risks to PAX/WOLF Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk[1]**	**Scope**
Decline in agricultural parcel productivity and crop suitability	**Economics.** Decline in economic values of leases, natural resources conservation measures included in outlease provisions **Regulatory:** BASH, compatibility with the mission and long-term ecosystem management goals **Training and Operations.** Aircraft training/operations	Low	Agricultural parcels, airfield environments
Coastal/Tidal Ecosystem Degradation	**Regulatory:** Contains habitats that serves several federally listed RTE species, including Leatherback Sea Turtle (*Dermochelys coriacea*), Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Atlantic Loggerhead Sea Turtle (*Caretta caretta*), Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*), Piping Plover (*Charadrius melodus*), Humpback Whale (*Megaptera novaeangliae*), North Atlantic Right Whale (*Eubalaena glacialis*), West Indian Manatee (*Trichechus manatus*) and Shortnose Sturgeon (*Acipenser brevirostrum*). The Maryland State Wildlife Action Plan (SWAP) ranked the **Piping Plover** as highly vulnerable to climate change and the **Northeaster Beach Tiger Beetle** as extremely vulnerable to climate change.	High	Coastal/Estuarine

Climate Risks to PAX/WOLF Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk[1]**	**Scope**
	Climate changes may impact both estimation of post-project restoration, recovery rates and targets for any future actions (e.g., coastal structures, bridges or culverts in tidal streams/rivers) requiring consultations on Essential Fish Habitat (EFH). EFH for **Summer Flounder (***Paralichthys dentatus***)**: Native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH is Habitat Area of Particular Concern (HAPC). Though the effect of climate change on Summer Flounder on the Northeast U.S. Shelf is estimated to be neutral at this time, NOAA indicates a high level of uncertainty (<66% certainty in expert scores) and a very high climate exposure.[2] Rising waters may lead to wetland inundation or migration landward/upslope if land is available or migration. A decrease in coastal wetlands can threaten protection and restoration efforts. **Infrastructure/Assets:** Changing conditions may affect key hydrological processes sustaining wetlands. Potential loss of protective benefits to facilities and other military assets through reducing their exposure to flooding		
Coastal and interior erosion	**Training and Operations:** Potential for reduction of land use as training areas and more generally potential for disruption of training and operations. Suitability of training sites may change. It may also be difficult to distinguish climate-related effects from military training and base operations resulting in adverse effects (e.g.,	Very High	Stream systems and in locations where the landscape has steep slopes (prevalent in the western portion of NAS PAX.). Shoreline along the

Climate Risks to PAX/WOLF Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk[1]**	**Scope**
	increased mitigation requirements) on mission sustainment. **Infrastructure/Assets:** Potential for damage to or loss of infrastructure/assets.		Chesapeake Bay and the Patuxent River. Atlantic Test Range, Chesapeake Test Range, Theodolite Stations.
Freshwater/non-tidal ecosystem degradation	**Regulatory**: Higher regulatory compliance costs due to ecosystem degradation. **Infrastructure/Assets:** Changing conditions may affect key hydrological processes sustaining wetlands. Potential loss of protective benefits to facilities and other military assets through reducing their exposure to flooding.	Medium	Freshwater non-tidal stream systems, ponds, and wetlands
Degradation of forests	**Regulatory:** Higher regulatory compliance costs and restrictions due to declines in protected species or habitats.	Low	Current forest canopy
Decline in native ecosystem integrity/resilience	**Training and Operations:** Training objectives and essential aspects of training could be compromised by the structural changes in ecosystems such as the proliferation of new or non-native species and dense undergrowth (sight lines, barriers to vehicular and ground movements). Ecosystem recovery can take longer, potentially reducing the carrying capacity of the land for training.	Medium	Complex-wide

Climate Risks to PAX/WOLF Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk[1]**	**Scope**
Expanded flood hazard	**Infrastructure/Assets:** Increased extreme precipitation events, and storm surge pose a risk to existing structures and other military assets in and near the floodplain.	High	FEMA labeled floodplain as well as all waterbodies on property. Areas of concern include the Atlantic Test Range, Chesapeake Test Range, Theodolite Stations
Loss of stormwater quality	**Regulatory:** Runoff, erosion and sedimentation that result from heavy precipitation may increase regulatory pressure associated with installation's NPDES permit.	Medium	Complex-wide
Climate-related shifts in migratory bird species ranges, breeding seasons, migrations, and other life cycles	**Training and Operations:** limitations on or shifts in the timing of training, bird hazards can pose increased risks to runways and military flight operations. **Regulatory:** Increased risk of accidental take. Conservation challenges.	Medium	Complex-wide
Increased vector-borne disease transmission	**Human Assets:** Increased population and/or active season of ticks and mosquitos may provide more opportunity for human exposure to illness such as Lyme disease and West Nile virus.	Medium	Complex-wide
Increased species decline	**Regulatory:** Declines in populations of listed or at-risk species might result in access restrictions, which in turn could reduce the military's capacity to test and train. Higher regulatory compliance costs and restrictions due to declines in protected species or habitats. New species protected under ESA.	Medium	Complex-wide

[1]Relative risk this vulnerability poses to the installation's ability to meet its military mission requirements (e.g., Negligible, Low, Medium, High, Extreme).
[2]NOAA 2022.

Climate impacts on natural resources may compromise the ability of the installation to implement its mission. Key climate risks to mission assets posed by climate vulnerabilities to BIR natural resources are identified in Table 6.

Table 6.

Climate Risks to BIR Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk[1]**	**Scope**
Coastal/Tidal Ecosystem Degradation	**Regulatory:** Contains habitats that serves several federally listed RTE species, including the Rufas Red Knot (*Calidris canutus rufa)*, the Leatherback (*Dermochelys coriacea*) and Kemp's Ridley (*Lepidochelys kempii*), the Atlantic Loggerhead (Caretta caretta), The Atlantic Hwksbill Sea Turtle (*Eretmochelys imbricata)* The Humpback Whale (*Megaptera novaeangliae*), North Atlantic Right Whale (*Eubalaena glacialis*), the West Indian Manatee (*Trichechus manatus*), Shortnose Sturgeon (*Acipenser brevirostrum),* Atlantic Sturgeon (*Acipenser oxyrhinchus).* Climate changes may impact both estimation of post-project restoration, recovery rates and targets for any future actions (e.g., coastal structures, bridges or culverts in tidal streams/rivers) requiring consultations on Essential Fish Habitat (EFH). EFH for **Summer Flounder (***Paralichthys dentatus***)**: Native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH is Habitat Area of Particular Concern (HAPC). Though the effect of climate change on Summer Flounder on the Northeast U.S. Shelf is estimated to be neutral at this time, NOAA indicates a high level of uncertainty	High	Coastal/Estuarine

Climate Risks to BIR Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk[1]**	**Scope**
	(<66% certainty in expert scores) and a very high climate exposure. [2] Rising waters may lead to wetland inundation or migration landward/upslope if land is available or migration. A decrease in coastal wetlands can threaten protection and restoration efforts.		
Coastal and interior erosion	**Training and Operations:** Potential for reduced physical availability of training areas and disrupted training and operations. Suitability of training sites may change. It may also be difficult to distinguish climate-related effects from military training and base operations resulting in adverse effects (e.g., increased mitigation requirements) on mission sustainment. **Infrastructure/Assets:** Potential for damage to or loss of infrastructure/assets.	Extreme	BIR freshwater and upland habitat is mostly gone. Current high-risk areas include the west and northwest shores of Bloodsworth Island. Helicoptor landing areas at Hog Island.
Decline in native ecosystem integrity/resilience	**Regulatory:** Potential decrease in habitat for RTE species. **Training and Operations:** Training objectives and essential aspects of training could be compromised by the structural changes in ecosystems such as the proliferation of new or non-native species and dense undergrowth Ecosystem recovery can take longer, potentially reducing the carrying capacity of the land for training.	Medium	Basewide

Climate Risks to BIR Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk[1]**	**Scope**
Climate-related shifts in migratory bird species ranges, breeding seasons, migrations, and other life cycles	**Training and Operations:** limitations on or shifts in the timing of training, bird hazards can pose increased risks to runways and military flight operations. **Regulatory:** Increased risk of accidental take. Conservation challenges.	Medium	Colonial nesting birds at BIR - pelicans, gulls, cormorants nesting at what's left of Adams Island
Increased vector-borne disease transmission	**Human Assets:** Increased population and/or active season of ticks and mosquitos may provide more opportunity for human exposure to illness such as Lyme disease and West Nile virus.	Low	Basewide
Increased species decline	**Regulatory:** Declines in populations of listed or at-risk species might result in access restrictions, which in turn could reduce the military's capacity to test and train. Higher regulatory compliance costs and restrictions due to declines in protected species or habitats. New species protected under ESA.	Medium	Basewide

[1]Relative risk this vulnerability poses to the installation's ability to meet its military mission requirements (e.g., Negligible, Low, Medium, High, Extreme).[2] NOAA 2022

Climate impacts on natural resources may compromise the ability of the installation to implement its mission. Key climate risks to mission assets posed by climate vulnerabilities to NRC SOL natural resources are identified in Table 7.

Table 7.

Climate Risks to NRC Solomons Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk [1]**	**Scope**
Coastal/Tidal Ecosystem Degradation	**Regulatory:** Contains habitats that serves several federally listed RTE species, including the Leatherback (*Dermochelys coriacea*) and Kemp's Ridley (*Lepidochelys kempii*), the Atlantic Loggerhead (*Caretta caretta*), Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*), the Piping Plover (*Charadrius melodus*), the Humpback Whale (*Megaptera novaeangliae*), North Atlantic Right Whale (*Eubalaena glacialis*), the West Indian Manatee (*Trichechus manatus*) and the Shortnose Sturgeon (*Acipenser brevirostrum*). Climate changes may impact both estimation of post-project restoration, recovery rates and targets for any future actions (e.g., coastal structures, bridges or culverts in tidal streams/rivers) requiring consultations on Essential Fish Habitat (EFH). EFH for **Summer Flounder (***Paralichthys dentatus***)**: Native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH is Habitat Area of Particular Concern (HAPC). Though the effect of climate change on Summer Flounder on the Northeast U.S. Shelf is estimated to be neutral at this time, NOAA indicates a high level of uncertainty (<66% certainty in expert scores) and a very high climate exposure. [2]	High	Coastal/Estuarine

Climate Risks to NRC Solomons Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk [1]**	**Scope**
	Rising waters may lead to wetland inundation or migration landward/upslope if land is available or migration. A decrease in coastal wetlands can threaten protection and restoration efforts. **Infrastructure/Assets:** Changing conditions may affect key hydrological processes sustaining wetlands. Potential loss of protective benefits to facilities and other military assets through reducing their exposure to flooding		
Coastal and interior erosion	**Infrastructure/Assets:** Potential for damage to or loss of infrastructure/assets.	Extreme	Stream systems and in locations where the landscape has steep slopes. Shoreline along the Chesapeake Bay and the Patuxent River.
Freshwater/non-tidal ecosystem degradation	**Regulatory**: Higher regulatory compliance costs due to ecosystem degradation. **Infrastructure/Assets:** Changing conditions may affect key hydrological processes sustaining wetlands. Potential loss of protective benefits to facilities and other military assets through reducing their exposure to flooding.	Medium	Freshwater non-tidal stream systems, ponds, and wetlands
Degradation of forests	**Regulatory:** Higher regulatory compliance costs and restrictions due to declines in protected species or habitats.	Low	Current forest canopy

Climate Risks to NRC Solomons Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk [1]**	**Scope**
Decline in native ecosystem integrity/resilience	**Operation and Activities:** Structural changes in ecosystems such as the proliferation of new or non-native species and dense undergrowth could disrupt current activities. Ecosystem recovery can take longer, potentially reducing the carrying capacity of the land for recreational activities.	Low	Basewide. Natural vegetative communities are very limited at NRC Solomons; improved lands with mowed lawns, ornamental trees and shrubs are the dominant vegetative cover.
Expanded flood hazard	**Infrastructure/Assets:** Increased extreme precipitation events, and storm surge pose a risk to existing structures and other military assets in and near the floodplain.	High	FEMA labeled floodplain as well as all waterbodies on property.
Loss of stormwater quality	**Regulatory:** Runoff, erosion and sedimentation that result from heavy precipitation may increase regulatory pressure associated with installation's NPDES permit.	Medium	Basewide
Climate-related shifts in migratory bird species ranges, breeding seasons, migrations, and other life cycles	**Regulatory:** Increased risk of accidental take. Conservation challenges.	Medium	Basewide

Climate Risks to NRC Solomons Mission Assets from Climate Vulnerabilities to Installation Natural Resources			
Vulnerabilities of Target Natural Resources	**Risks to Installation Mission Requirements**	**Degree of Risk [1]**	**Scope**
Increased vector-borne disease transmission	**Human Assets:** Increased population and/or active season of ticks and mosquitos may provide more opportunity for human exposure to illness such as Lyme disease and West Nile virus.	Medium	Basewide
Increased species decline	**Regulatory:** Declines in populations of listed or at-risk species might result in access restrictions, which in turn could limit access to recreational areas. Higher regulatory compliance costs and restrictions due to declines in protected species or habitats. New species protected under ESA.	Medium	Basewide

[1]Relative risk this vulnerability poses to the installation's ability to meet its military mission requirements (e.g., Negligible, Low, Medium, High, Extreme).[2] NOAA 2022

3.2 Risk Assessments

Figure 9 illustrates climate change risk levels for target natural resource vulnerabilities at PAX/WOLF, considering both likelihood of occurrence and consequences. Assignment of risk is based on a qualitative assessment of available literature.

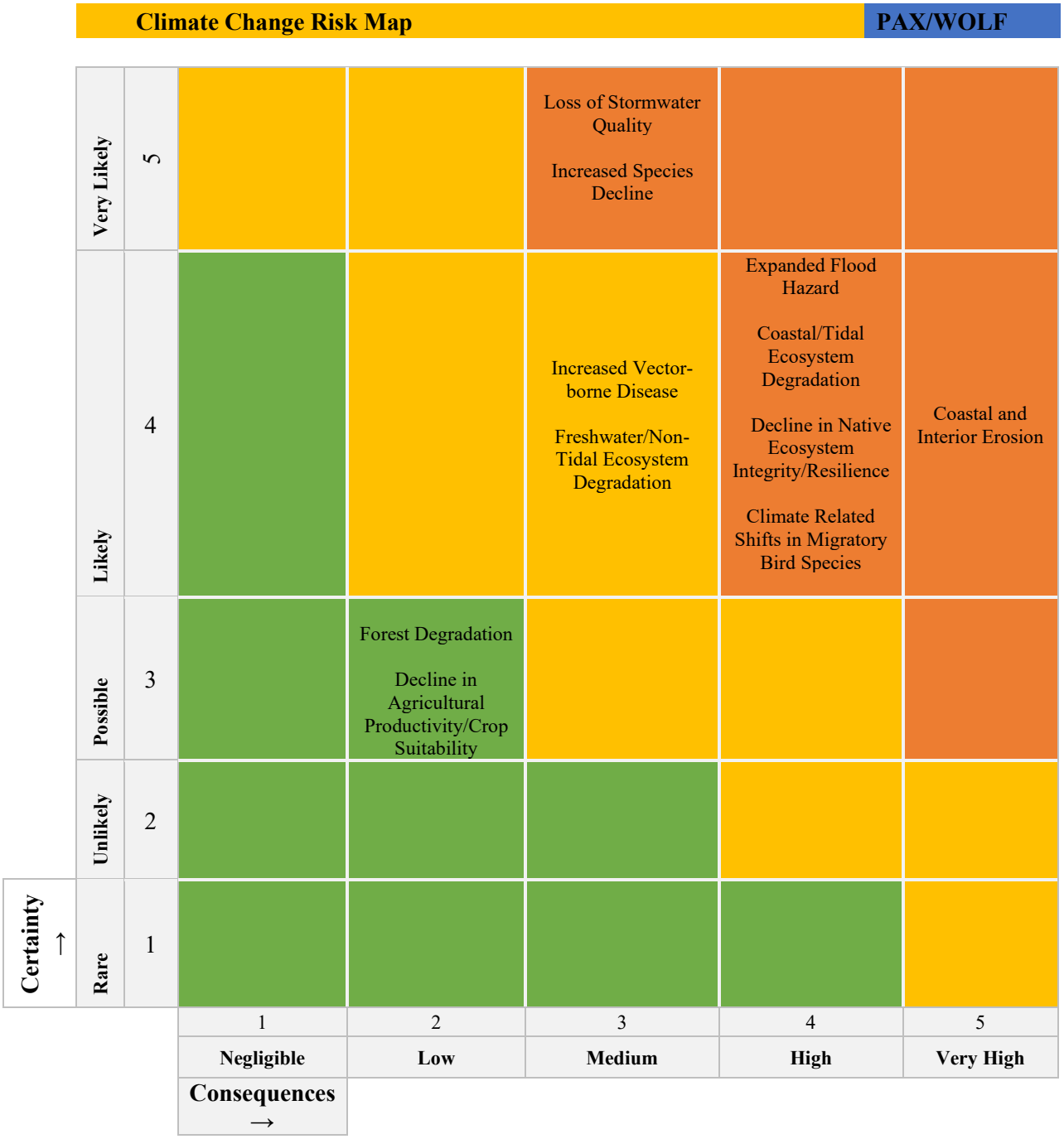

Figure 9. Climate change risk for target natural resource vulnerabilities at PAX/WOLF.

Figure 10 illustrates climate change risk levels for target natural resource vulnerabilities at BIR, considering both likelihood of occurrence and consequences. Assignment of risk is based on a qualitative assessment of available literature.

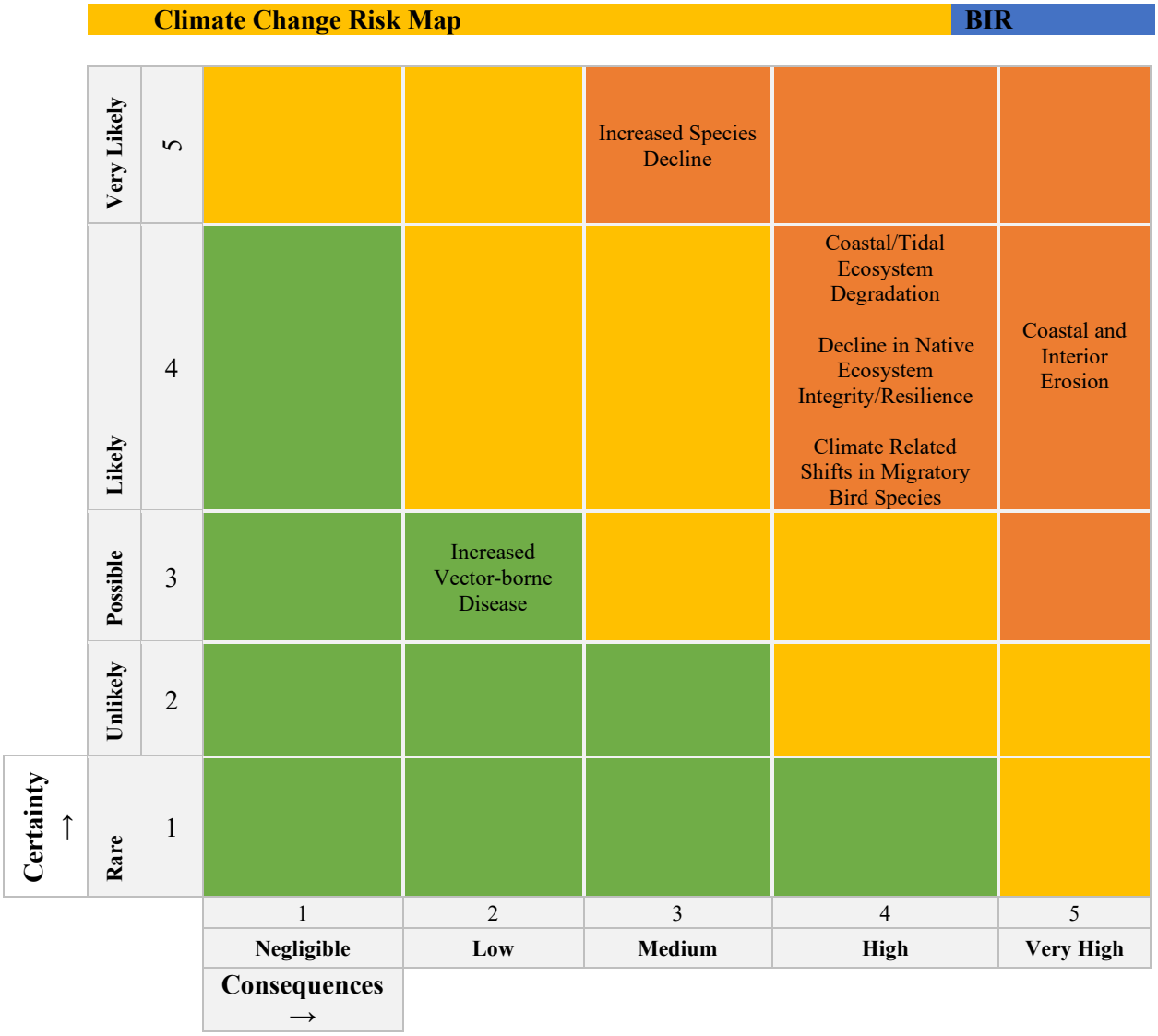

Figure 10. Climate change risk for target natural resource vulnerabilities at BIR.

Figure 11 illustrates climate change risk levels for target natural resource vulnerabilities at NRC Solomons, considering both likelihood of occurrence and consequences. Assignment of risk is based on a qualitative assessment of available literature.

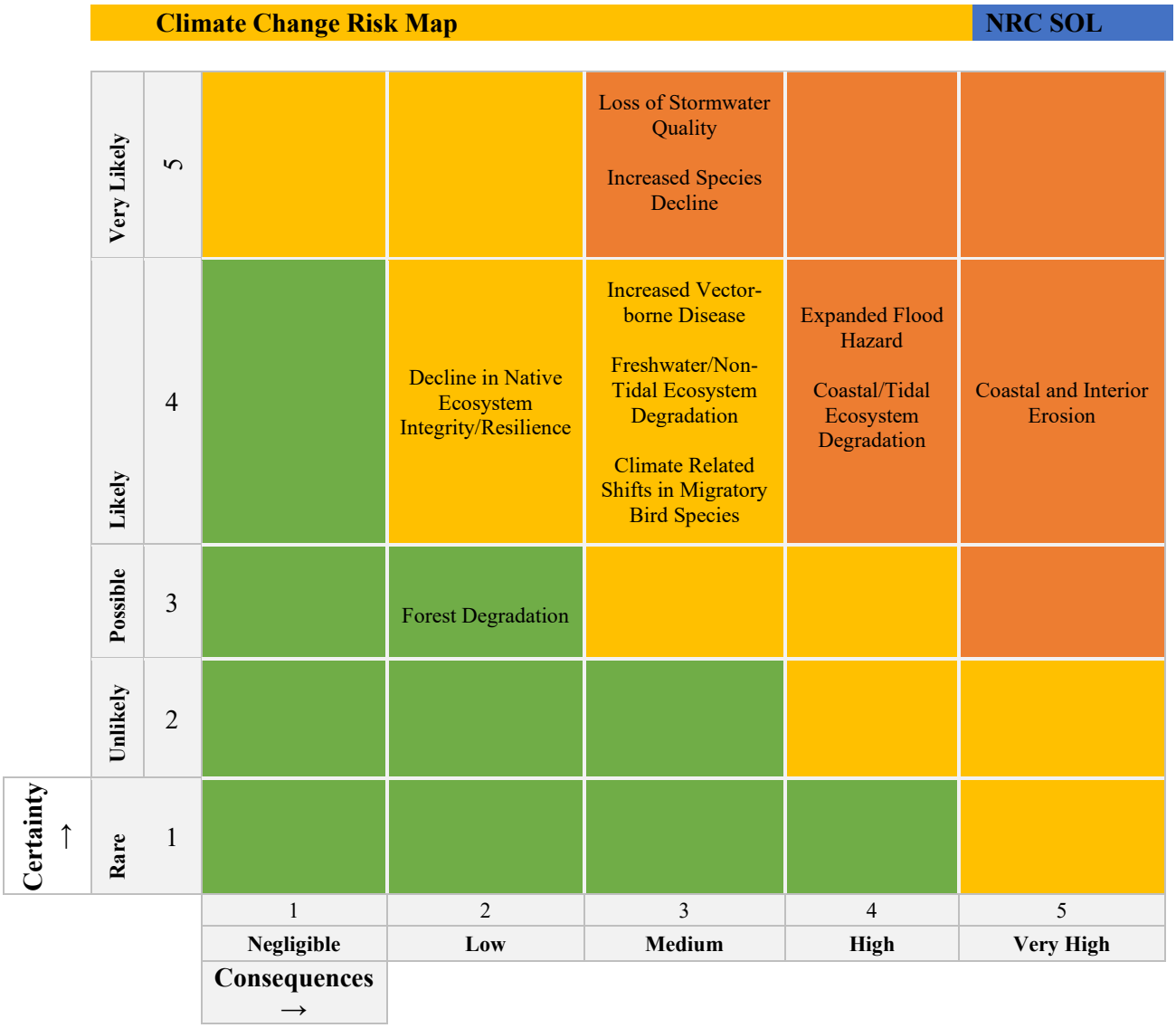

Figure 11. Climate change risk for target natural resource vulnerabilities at NRC Solomons.

4 Program Element Goals and Objectives

A review was conducted for the feasibility of existing natural resource goals and objectives under projected changes to climatic conditions. To integrate climate change adaptation into existing program elements, the evaluation focused on identifying needed refinements/adjustments to goals and objectives. However, it was determined that existing INRMP strategies can reduce climate vulnerabilities and risks and will remain relevant and appropriate for addressing projected climate changes. No modifications were made to INRMP goals and objectives for the Complex. Throughout the evaluation process, the following Best Management Practices (BMPs) to support climate change resilience were developed to assist in continual monitoring for resilience throughout Natural Resources Programs and are outlined in Section 4.1. In addition, when considering opportunities and/or when implementing activities/structures within the Complex, natural resource management staff will ask the following questions:

1. Will this opportunity/action exacerbate any existing climate related stressors and threats to the installation's natural resources?
2. Are conditions likely to remain suitable for this opportunity/action if current climate change trends continue (short-term suitability, long-term suitability)?
3. If climate change threats will likely impact the suitability of the opportunity/action, are there best management practices or adaptation strategies that can be implemented?
4. Is the opportunity/action mission critical?

4.1 Climate Change Resilience and Adaptation Practices

Climate change adaptation strategies/BMPs at PAX/WOLF that can assist natural resource management staff in risk reduction and achieving climate-informed goals and objectives, are detailed below:

Table 8.

Program	Climate Change Resilience and Adaptation Practices
All	**Applicable to Most Programs** a. Implement coordinated information management to monitor and identify changes in ecological baselines from the species to the ecosystem level. b. Identify and track key ecological variables that may indicate approaching change. c. Determine appropriate baseline and reference conditions to use in comparative analysis. For example, historical baselines versus observed changes. d. Refine monitoring protocols as more data on climate change impacts becomes available and climate change impacts are more thoroughly understood.
Wildlife Management	e. Identify and monitor climate-derived indicators of species responses to climate change (e.g., behavior [such as seeking shade or refuge, altered feeding times, changing site use], morphology, phenology). f. Where feasible, facilitate the adaptive capacity of climate-sensitive habitats and RT&E species. g. When setting restoration objectives and approaches, consider uncertainties associated with characteristics of future, potential novel ecosystems. h. When evaluating suitability of sites for restoration actions, consider vulnerability to climate change projections, and other related factors such as the space available for the target species to move/expand. g. Consider development of new or improved natural areas or restoration projects to enhance the resilience of natural systems. h. Protect refugia and movement corridors/stopover areas that may be important for climate induced movements. i. Consider development of new strategies to facilitate broad landscape connectivity for species movements where feasible.
Land Management	e. Establish a consistent process to monitor and evaluate the effectiveness of BMPs and to assess the sustainability and resilience of BMPs. f. Consider BMP sensitivities to climate change, capacity for modification to address climate changes, and the time horizon for adaptation. g. Implement treatments to maintain and improve soil infiltration and nutrient cycling. h. Reduce hydrological impacts from road and road-stream crossings. i. Ensure agricultural outlease plans address risks associated with climate change. j. Increase scouting for weed species and pests in agricultural parcels. k. Buffer against hydrologic variability in agricultural parcels (e.g., landscape features such as swales and buffer strips to increase infiltration after intense precipitation). l. Ensure adequate hedgerows/vegetative barriers in agricultural parcels to reduce storm exposure. m. Maintain and/or improve infrastructure to accommodate more intense precipitation events. n. Create/maintain pollinator habitat, and reduce herbicide and pesticide use in pollinator habitat. o. Control invasive plants to prevent crowding of native grasses in saline marshes. p. Protect connectivity of stream systems where habitats may be disconnected due to climate change induced changes in flow regimes. q. Minimize impacts from temperature increases by maintaining shaded riparian areas. r. Consider the addition of local sediment to saline marshes (through hydraulic pumping) to increase marsh surface elevation and facilitate health of plant species. s. Consider implementing shallow drainage (creating channels that lead to tidal creaks) to mitigate saline marsh erosion due to ponding. t. Protect and increase areas of natural wetland-upland transition zones or adjacent habitats that will facilitate migration of wetlands upstream. Where feasible, consider grading areas adjacent to wetlands. u. Consider development of nature-based features such as ecotone levees.

Program	Climate Change Resilience and Adaptation Practices
	v. Protect stream and wetland crossings from vehicular and foot traffic. If access is needed seasonally, consider use of temporary structures
Forest Management	e. Enhance Forest capacity to resist, tolerate, and adapt to a dynamic environment (e.g., maintain/enhance species and structural diversity). f. When possible, reduce threats to vulnerable forest stands (e.g., climate stressors such as insects and diseases, invasive plants, windstorms).
Fisheries Management	e. Where feasible, ensure that monitoring can reliably detect signs of climate change and differentiate these signals from restoration or degradation. f. Identify and monitor climate-derived indicators of ecosystem responses to climate change (primary productivity; emergent properties that may lead to novel or hybrid ecosystems (e.g., some historical characteristics continue but structure/composition are not within historical range of variability). g. When setting restoration objectives and approaches, consider uncertainties associated with characteristics of future, potential novel ecosystems. h. Consider climate change impacts to EFH in any future consultations, especially in design and estimation of restoration/recovery goals. i. Implement nature-based/living shoreline management for future shoreline protection projects where feasible. j. Evaluate projected temporal and spatial shifts in species distribution due to climate changes and address these projections through the development of relevant fisheries management objectives.
Outdoor Recreation Management	e. Monitor recreation areas for climate variables critical to current and/or future use and set trigger points to determine when a recreation site should be closed or restricted due to changing site conditions. f. Educate the public about changing site conditions and/or safety issues. g. Relocate or improve/modify at-risk existing infrastructure to better endure future climate conditions. h. Develop new recreation sites that are resilient to climate change impacts or create new recreation opportunities at existing sites.
Environmental Education	e. Ensure natural resources staff receive annual climate change adaptation training. Some examples of training resources include, but are not limited to: *National Military Fish and Wildlife Association Annual Training Workshop – Climate Change Working Group and Technical Sessions *U.S. Fish and Wildlife Service National Conservation Training Center *U.S. Forest Service Climate Change Resource Center *The Climate Change Response Network f. Incorporate into community outreach/environmental education, changing climate conditions, the benefits of native ecosystems (ie., native pollinators) and potential threats related to climate change.

Climate change adaptation strategies/BMPs at BIR that can assist natural resource management staff in risk reduction and achieving climate-informed goals and objectives, are detailed below:

Table 9.

Program	Climate Change Resilience and Adaptation Practices
Management of Rare Threatened and Endangered Species	e. Identify and monitor climate-derived indicators of species responses to climate change (e.g., behavior [such as seeking shade or refuge, altered feeding times, changing site use], morphology, phenology). f. Where feasible, facilitate the adaptive capacity of climate-sensitive habitats and RT&E species.
Fish and Wildlife Management	e. Identify and monitor climate-derived indicators of species responses to climate change (e.g., behavior [such as seeking shade or refuge, altered feeding times, changing site use], morphology, phenology). f. Where feasible, facilitate the adaptive capacity of climate-sensitive habitats and RT&E species. g. When setting restoration objectives and approaches, consider uncertainties associated with characteristics of future, potential novel ecosystems. h. When evaluating suitability of sites for restoration actions, consider vulnerability to climate change projections, and other related factors such as the space available for the target species to move/expand.
Migratory Bird Management **Bird/Animal Aircraft Strike Hazard** **Flight Operations Management**	e. Continue habitat enhancement for waterbirds and raptors. f. Increased monitoring for climate-related shifts in species ranges, breeding seasons, migrations, and other life cycles for migratory bird species with significant potential to impact training/flight operations.
Invasive Species Management	e. Conduct nuisance/invasive species survey to assess threats to listed species and to evaluate opportunities for revegetation with native species to improve climate resiliency in habitats.
Land Management **Wetlands Management**	e. Consider nature-based/living shoreline stabilization at BIR to conserve ecologically valuable aquatic habitats (EFH/SAV, habitat used for RTE species and tidal wetlands, especially if dominated by native species), and to provide greater resilience to climate changes.
Cultural Resource Management	e. Conduct climate change vulnerability assessments for cultural resource sites to include evaluating significance, climate impacts and exposure/sensitivity. Identify, evaluate and prioritize mitigation and/or adaptation options.

Climate change adaptation strategies/BMPs at NRC Solomons that can assist natural resource management staff in risk reduction and achieving climate-informed goals and objectives, are detailed below:

Table 10.

Program	Climate Change Resilience and Adaptation Practices
All	**Applicable to Most Programs** a. Implement coordinated information management to monitor and identify changes in ecological baselines from the species to the ecosystem level. b. Identify and track key ecological variables that may indicate approaching change. c. Determine appropriate baseline and reference conditions to use in comparative analysis. For example, historical baselines versus observed changes. d. Refine monitoring protocols as more data on climate change impacts becomes available and climate change impacts are more thoroughly understood.
Management of RTE Species **Forest Management** **Vegetative Management**	e. Identify and monitor climate-derived indicators of species responses to climate change (e.g., behavior [such as seeking shade or refuge, altered feeding times, changing site use], morphology, phenology). f. Where feasible, facilitate the adaptive capacity of climate-sensitive habitats and RT&E species. g. Consider development of new or improved natural areas or restoration projects to enhance the resilience of natural systems. h. Protect refugia and movement corridors/stopover areas that may be important for climate induced movements. i. Consider development of new strategies to facilitate broad landscape connectivity for species movements where feasible. j. Enhance forest capacity to resist, tolerate, and adapt to a dynamic environment (e.g., maintain/enhance species and structural diversity). k. When possible, reduce threats to vulnerable forest stands (e.g., climate stressors such as insects and diseases, invasive plants, windstorms).
Wetlands Management	e. Create/ensure adequate buffer vegetation. For example, as temperatures increase wetland buffer vegetation that provides shade may help to regulate water temperatures. f. Monitor and assess buffer vegetation health. g. Develop approach to distinguish accidental wetland disturbances from the effects of climate change.
Fish and Wildlife Management	e. Identify and monitor climate-derived indicators of species responses to climate change (e.g., behavior [such as seeking shade or refuge, altered feeding times, changing site use], morphology, phenology). f. Identify and monitor climate-derived indicators of ecosystem responses to climate change (primary productivity; emergent properties that may lead to novel or hybrid ecosystems (e.g., some historical characteristics continue but structure/composition are not within historical range of variability). g. Where feasible, facilitate the adaptive capacity of climate-sensitive habitats and RT&E species. h. When setting restoration objectives and approaches, consider uncertainties associated with characteristics of future, potential novel ecosystems. i. When evaluating suitability of sites for restoration actions, consider vulnerability to climate change projections, and other related factors such as the space available for the target species to move/expand. j. When setting restoration objectives and approaches, consider uncertainties associated with characteristics of future, potential novel ecosystems. k. Where feasible, ensure that monitoring can reliably detect signs of climate change and differentiate these signals from restoration or degradation. l. Consider climate change impacts to EFH in any future consultations, especially in design and estimation of restoration/recovery goals. m. Evaluate projected temporal and spatial shifts in fish species distribution due to climate changes and address these projections through the development of relevant fisheries management objectives.
Migratory Bird Management	e. Increase community outreach related to the unique migratory bird species; encourage and facilitate reporting to NR staff when encountered. f. Continue to enhance bird nesting habitat where feasible.

Program	Climate Change Resilience and Adaptation Practices
Land Management	e. Establish a consistent process to monitor and evaluate the effectiveness of BMPs and to assess the sustainability and resilience of BMPs. f. Consider BMP sensitivities to climate change, capacity for modification to address climate changes, and the time horizon for adaptation. g. Maintain and/or improve infrastructure to accommodate more intense precipitation events. h. Continue to implement nature-based/living shoreline erosion control projects.
Outdoor Recreation Management	e. Monitor recreation areas for climate variables critical to current and/or future use and set trigger points to determine when a recreation site should be closed or restricted due to changing site conditions. f. Educate the public about changing site conditions and/or safety issues. g. Relocate or improve/modify at-risk existing infrastructure to better endure future climate conditions. h. Develop new recreation sites that are resilient to climate change impacts or create new recreation opportunities at existing sites. i. Increase community outreach related to the unique migratory bird species; encourage and facilitate reporting to NR staff when encountered.
Cultural Resources	e. Conduct climate change vulnerability assessments for cultural resource sites to include evaluating significance, climate impacts and exposure/sensitivity. Identify, evaluate and prioritize mitigation and/or adaptation options.

5 Implementation

DoD (2019) emphasizes that climate change adaptation planning can necessitate consideration of a time horizon of a decade or more. The uncertainties associated with planning over long time horizons are compounded with climate change. It may therefore be beneficial for natural resource management staff to consider a phased approach to adaptation planning. In addition, collaborative partnerships with internal and external stakeholders can support the implementation of climate adaptation strategies by providing cooperative benefits such as exchange of expertise and cost share opportunities. Table 4 identifies key stakeholders associated with target natural resource throughout the Complex.

Table 10.

Target Resource	Key Stakeholders/Partners
Agricultural Parcels	NAVFAC, leasees, Naval Air Systems Command (NAVAIR), Naval Air Warfare Center (NAWC)
Coastal/Tidal Ecosystem	United States Army Corps of Engineers (USACE), NAVFAC, Maryland Department of the Environment (MDE), Chesapeake Bay Action Team (CBAT), Environmental Protection Agency (EPA), NOAA, US Fish and Wildlife Service (USFWS), Maryland Department of Natural Resources (MDNR)
Freshwater/Non-tidal Ecosystems	USACE, NAVFAC, MDE, CBAT, EPA, USACE, NAVFAC, NOAA, USFWS, MDNR
Floodplains	NAVFAC, USACE, MDE, CBAT, NAVAIR, NOAA, NAWC
Forest	USFWS, NAVFAC, MDNR, CBAT
Land Resources	NAVFAC, NAVAIR, NOAA, NAWC, USFWS, MDNR, MDE, USACE, other installation tenants, CBAT
Migratory Birds	NAVFAC, NAVAIR, NOAA, NAWC, USFWS, MDNR, DOD Partners In Flight (PIF), other installation tenants, CBAT
Native Ecosystems	NAVFAC, MDNR, USFWS, CBAT, DOD PARC, DOD PIF, NAVAIR,
RTE Species	NAVFAC, NOAA, USFWS, CBAT, MDNR, DOD PARC, DOD PIF
Water quality	MDE, EPA, USACE, NAVFAC, NOAA, USFWS, CBAT
Human health	Bureau of Medicine and Surgery (BUMED)/Defense Health Agency (DHA), St. Mary's County Health Department, NAVFAC, PPV Housing

5.1 Decision Support Tools

Climate change decision support tools refer to science-based tools that facilitate the evaluation of scenarios and planning options in the context of climate variability and change. Many federal partners have available tools that include interactive maps and printable data. Table 5 below includes a list of tools that may be useful in tracking and planning for climate changes at facilities within the NAS PAX River Complex. Tables 12-14, include federally listed RTE Species evaluated by MDNR for climate change vulnerability using the NatureServe Climate Change Vulnerability Index (CCVI), with the potential to occur throughout the Complex. Figure 12

illustrates the directional effects of climate change on fish and invertebrates on the northeast U.S. continental shelf. Figures 12-13 illustrates marsh migration projections at BIR using the NOAA Sea Level Rise map viewer.

Table 11.

Climate Change Decision Support Tools	Description
CDC Disease Mapviewer	Seasonal tracking of seven vector-borne diseases in the United States and territories: West Nile virus, St. Louis encephalitis, eastern equine encephalitis, western equine encephalitis, La Crosse encephalitis, Powassan virus, dengue fever (locally acquired), and dengue fever (imported).
EPA EnviroAtlas and the EnviroAtlas Change Analysis Tool (ECAT)	Users can explore the benefits people receive from ecosystem services. It includes interactive map displays that incorporate data from federal, state, community, and non-governmental organizations. Supplemental data layers include ecological, watershed, and political boundaries; conservation areas; EPA assessed and impaired waters; and other available national data sets. It includes interactive map displays that incorporate data from federal, state, community, and non-governmental organizations. ECAT enables the user to compare a selected variable between selected time periods.
EPA Locating and Selecting Scenarios Online (LASSO) Tool	LASSO guides the user step-by-step through the process of identifying and downloading climate change scenarios—or projections. At the end of the process, the user has the option to download maps, figures, and GIS-ready spatial data or use an interactive scatterplot widget to customize or change your choices.
EPA National Stormwater Calculator	Requires a computer running Microsoft© Windows operating system. Estimate the annual amount of rainwater and frequency of runoff from a specific site anywhere in the United States.
National Weather Service Advanced Hydrologic Prediction Service	Forecast products from the National Weather Service. The site displays information regarding the magnitude and uncertainty of the occurrence of floods or droughts, from hours to days and months in advance.

Climate Change Decision Support Tools	Description
NOAA's Sea Level Rise map viewer	NOAA's Sea Level Rise map viewer gives users a way to visualize community-level impacts from coastal flooding or sea level rise (up to 10 feet above average high tides). Photo simulations of how future flooding might impact local landmarks are also provided, as well as data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss and migration, and mapping confidence.
NatureServe Climate Change Vulnerability Index	An Excel workbook that allows the user to estimate plant or animal species' relative vulnerability to climate change. This tool uses natural history, distribution, and management with downscaled climate predictions. The user can store the results for multiple assessments.
USDA Climate Change Tree Atlas and Climate Change Bird Atlas.	Explore current and projected future distribution of 134 tree species and 147 bird species in the eastern United States.
US Forest Service Forest Vegetation Simulator (FVS)	FVS answers questions about how forest vegetation will change in response to natural succession, disturbances, and proposed management actions. Extensions to the base model are available to assess the effects of insects, disease, and fire.
USGS Fire Danger Viewer	In a joint effort between the USGS and the U.S. Forest Service, the Fire Danger Forecasting Project focuses on research and development of digital map products suited for monitoring and forecasting fire potential within the United States.
USGS Global Biodiversity Information Facility (GBIF) national data portal	Science Analytics and Synthesis Program (SAS) of the U.S. Geological Survey (USGS). Users can query species by name, range, state, county, or data record provider. GBIF displays search results in lists and in interactive map formats.
USGS Wildlife Health Information Sharing Partnership (WHISPers)	An event reporting system and web-based repository for sharing basic information about historic and ongoing wildlife mortality (death) and morbidity (illness) events in North America. The system is also a searchable archive of historic wildlife mortality and morbidity event data. The records in WHISPers can be searched by species, disease, location (to county level), and event start and end dates.

Table 12. Federally listed RTE Species evaluated by MDNR for climate change vulnerability using the NatureServe Climate Change Vulnerability Index (CCVI), with potential to occur at PAX/WOLF.

Common Name	Scientific Name	Climate Change Vulnerability Index (CCVI)
Piping Plover	*Charadrius melodus*	Highly Vulnerable
Atlantic Loggerhead Turtle	*Caretta caretta*	WWF Vulnerable
Atlantic Ridley/Kemp's Ridley	*Lepidochelys kempii*	WWF Vulnerable
Northeastern Beach Tiger Beetle	Cicindela dorsalis	Extremely Vulnerable
Atlantic Sturgeon	*Acipenser oxyrhynchus*	Presumed Stable

Table 13. Federally listed RTE Species evaluated by MDNR for Climate Change Vulnerability Using the CCVI, with potential to occur at BIR.

Common Name	Scientific Name	Climate Change Vulnerability Index (CCVI)
Shortnose Sturgeon	*Acipenser brevirostrum*	Moderately Vulnerable
Atlantic Sturgeon	*Acipenser oxyrhynchus*	Presumed Stable
Atlantic Loggerhead Turtle	*Caretta caretta*	Vulnerable WWF
Atlantic Ridley/Kemp's Ridley	*Lepidochelys kempii*	Vulnerable WWF

Table 14. Federally listed RTE Species at evaluated by MDNR for Climate Change Vulnerability Using the NatureServe Climate Change Vulnerability Index (CCVI), with potential to occur at NRC Solomons.

Common Name	Scientific Name	Climate Change Vulnerability Index (CCVI)
Shortnose Sturgeon	*Acipenser brevirostrum*	Moderately Vulnerable
Atlantic Sturgeon	*Acipenser oxyrhynchus*	Presumed Stable
Atlantic Ridley/Kemp's Ridley	*Lepidochelys kempii*	Vulnerable WWF
Atlantic Loggerhead Turtle	*Caretta caretta*	Vulnerable WWF

Source: Maryland State Wildlife Action Plan (2015-2025)

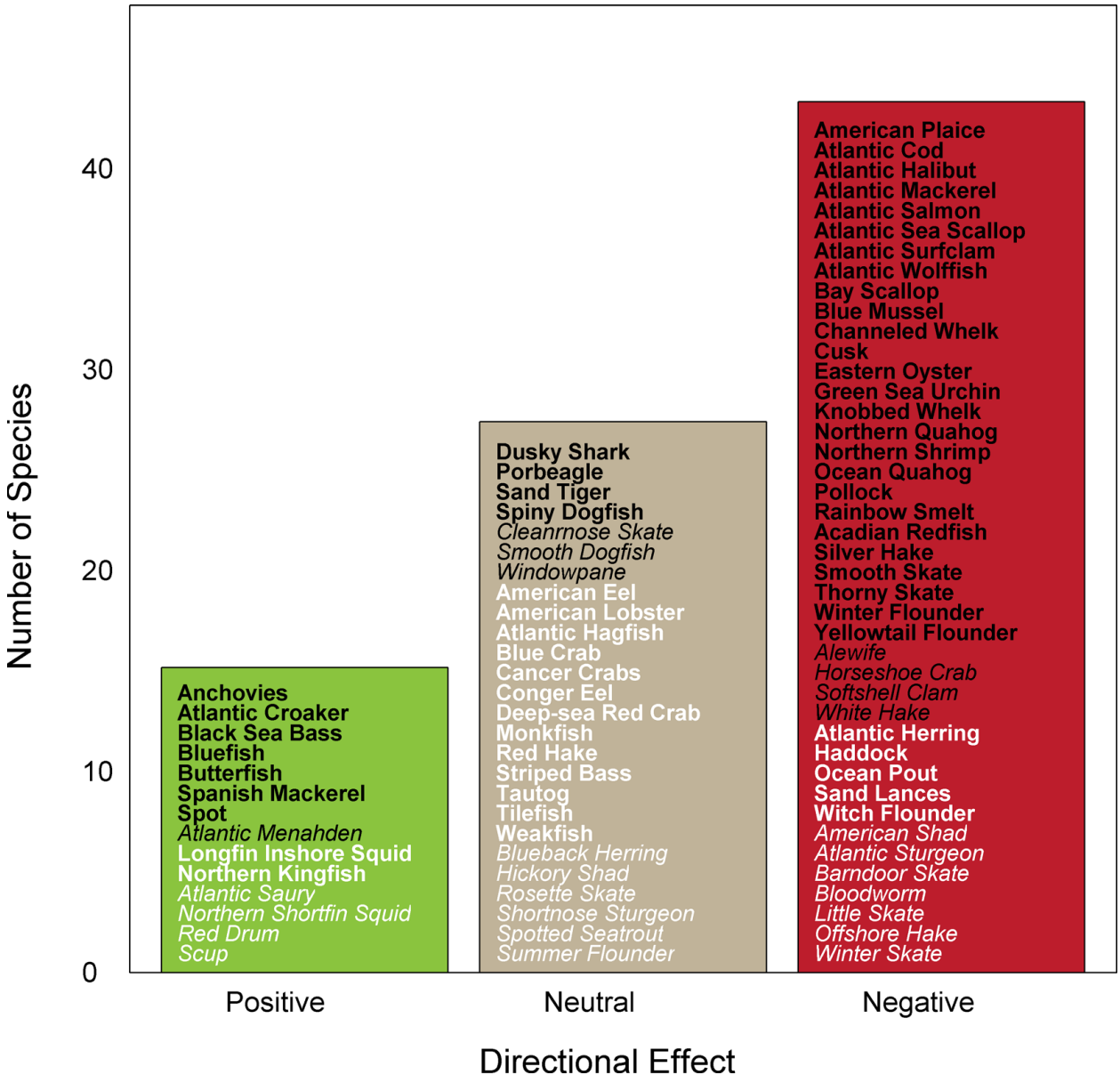

Figure 8. Directional effect of climate change. Colors represent expected negative (red), neutral (tan), and positive (green) effects. Certainty in score is denoted by text font and text color: very high certainty (>95%, black, bold font), high certainty (90–95%, black, italic font), moderate certainty (66–90%, white or gray, bold font), low certainty (<66%, white or gray, italic font) (Hare et al. 2016).

Near-term NOAA Marsh Migration Projection Maps

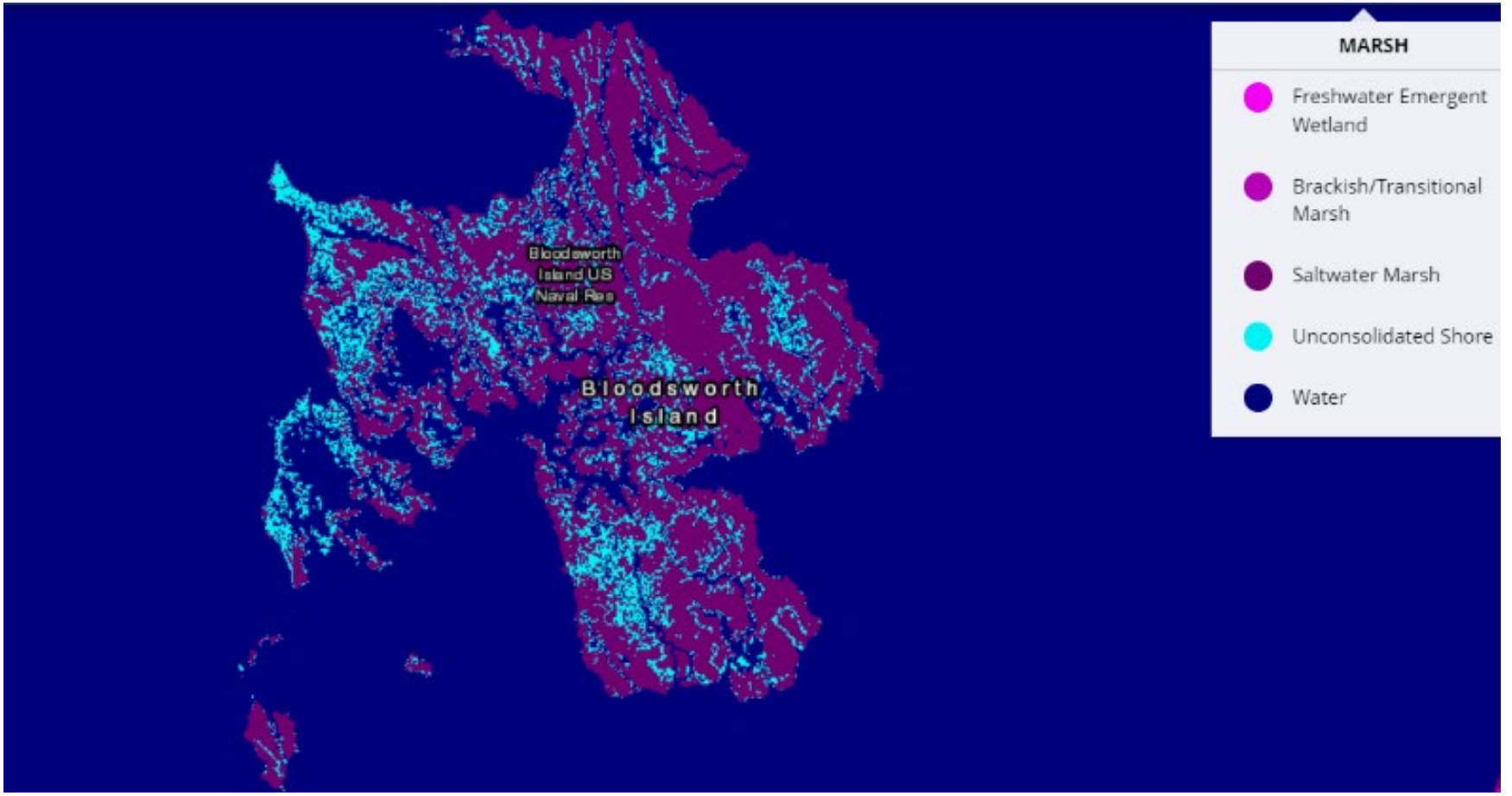

Figure 12. BIR marsh migration porjections at 1 foot (.3 meters) of sea level rise, without accreation. Assuming the intermediate-low scenario of warming, 1.0 feet of sea level rise will occur by approximately 2040.

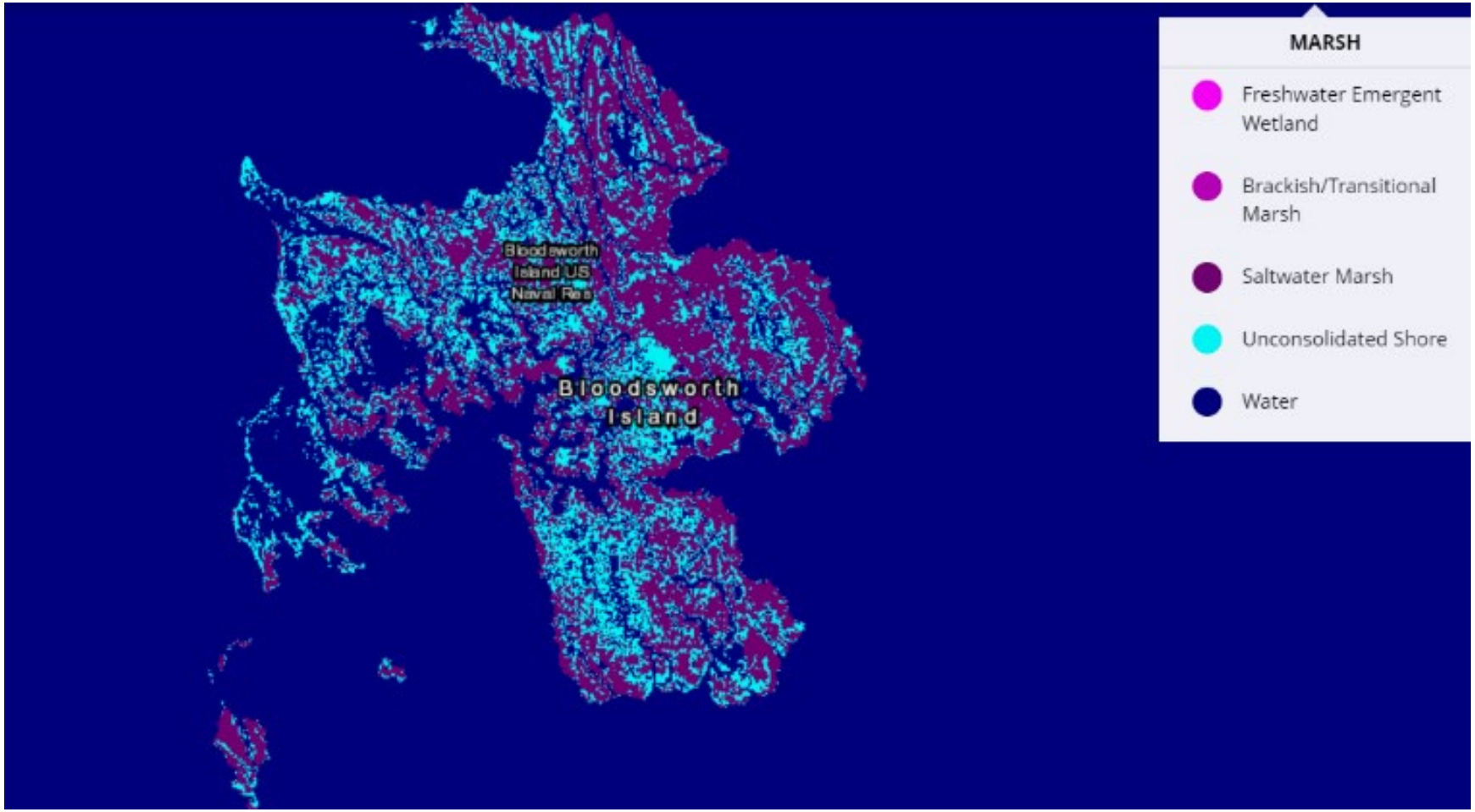

Figure 13. BIR marsh migration projection at 1.5 feet (.4 meters) of sea level rise, without accretion. Assuming the intermediate-low scenario of warming, 1.5 feet of sea level rise will occur by approximately 2060.

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