U.S. Fish & Wildlife Service

Chincoteague and Wallops Island National Wildlife Refuges

Final Comprehensive Conservation Plan and Environmental Impact Statement

August 2015

Front cover:

Sunrise at Chincoteague National Wildlife Refuge
Steve Hillebrand/USFWS

This blue goose, designed by J.N. "Ding" Darling, has become the symbol of the National Wildlife Refuge System.

The U.S. Fish and Wildlife Service (Service) is the principal Federal agency responsible for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The Service manages the National Wildlife Refuge System comprised of over 150 million acres including over 555 national wildlife refuges and thousands of waterfowl production areas. The Service also operates 70 national fish hatcheries and 81 ecological services field stations. The agency enforces Federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Wildlife and Sportfish Restoration Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

Comprehensive Conservation Plans (CCPs) provide long-term guidance for management decisions on a refuge and set forth goals, objectives, and strategies needed to accomplish refuge purposes. CCPs also identify the Service's best estimate of future needs. These plans detail program levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. CCPs do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

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Refuge Vision Statement

Our vision statement for the refuges is a synthesis of the refuges' purposes, the National Wildlife Refuge System mission and goals, and other biological, legal, and social concerns in which the refuge has a role. It is intended to be an expression of what the refuge will be like in the future in terms of natural resources and visitor experience. Our vision for the refuge, developed to help provide the core component of management strategies hereafter, is as follows:

> *Chincoteague and Wallops Island National Wildlife Refuges encompass extraordinary and ever-changing lands at the edge of the sea, a place where unique habitats and wildlife flourish. In partnership with others, the refuges are a vital part of a larger system of protected lands and waters on the Delmarva Peninsula critical to migratory birds. People from around the world can visit the refuges to learn, recreate, refresh themselves, be inspired by wildlife and wild lands, and renew their connection with nature.*

Chincoteague and Wallops Island National Wildlife Refuges

Final Comprehensive Conservation Plan and Environmental Impact Statement

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Type of Action: Administrative – Development of a Comprehensive Conservation Plan

Lead Agency: U.S. Department of the Interior, Fish and Wildlife Service

Location: Chincoteague National Wildlife Refuge
Wallops Island National Wildlife Refuge
Chincoteague, Virginia

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This Final Comprehensive Conservation Plan and Environmental Impact Statement analyzes three alternatives to managing the 14,032-acre Chincoteague National Wildlife Refuge and 373-acre Wallops Island National Wildlife Refuge over the next 15 years. This document also contains 18 appendices that provide additional information supporting our analysis. Following is a brief overview of each alternative:

Alternative A is the status quo and current management alternative as required by the National Environmental Policy Act. This alternative continues current management strategies as established by the Master Plan approved in 1992, and is referred to as our "No Action" alternative.

Alternative B would continue established habitat and wildlife management strategies but focus them in light of the new goals and vision established by the Comprehensive Conservation Plan. This alternative balances habitat management, public use and access, and administration of the refuge. Alternative B is our preferred alternative, and the action that we recommend for final selection.

Alternative C would direct staffing and funding towards maximizing habitat and wildlife management strategies. As a result of prioritizing habitat and wildlife management, public use activities and access may be reduced.

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**Appendices A through O are not included in print copy. Available online or on CD-ROM.*

Chapter 1

USFWS

American Oystercatcher

Introduction, Purpose and Need, and Planning Background

1.1 Introduction
1.2 Regional Context and Project Area
1.3 Purpose and Need for Action
1.4 Refuge Purposes
1.5 National Wildlife Refuge System Mission
1.6 Ecological Integrity
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1.14 Issues and Opportunities
1.15 Decision to be Made

Chapter 1: Introduction, Purpose and Need, and Planning Background

1.1 Introduction

The U.S. Fish and Wildlife Service (USFWS, we, our) developed this Comprehensive Conservation Plan (CCP) and final Environmental Impact Statement (EIS) for Chincoteague National Wildlife Refuge (NWR) and Wallops Island NWR, collectively referred to as "the refuge." The refuge is part of the National Wildlife Refuge System (Refuge System), a national network of lands managed for the conservation of fish, wildlife, and plants. This document meets the requirements of a CCP, as required by the Refuge System Administration Act of 1966 as amended by the Refuge System Improvement Act of 1997 (Improvement Act), while simultaneously following the accepted format and incorporating supplemental documentation for an EIS required by the National Environmental Policy Act (NEPA) of 1969. As a result of integrating the document to meet the requirements for both a CCP and an EIS, certain areas of the suggested EIS format have been expanded to include the core of the CCP, such as the inclusion of goals, objectives, and strategies in the description of alternatives in chapter 2 and the expansion of certain sections of chapter 1.

This chapter achieves the following:

- defines our planning analysis area;
- explains the purpose and need for preparing this CCP/EIS;
- documents the mission, policies, mandates, and relevant plans that affect the development of the CCP;
- describes the refuge, including its purposes and habitats;
- identifies refuge operational plans that complement the CCP;
- presents the vision and goals that will direct refuge management; and
- identifies issues and opportunities for consideration in the alternatives.

1.2 Regional Context and Project Area

The refuge is located on a system of barrier islands off the eastern shore of the Delmarva Peninsula, a large peninsula on the east coast comprised of most of Delaware and portions of Virginia and Maryland (see Figure 1-1). The refuge primarily lies in Accomack County, Virginia. However, the planning area for the CCP/EIS also includes portions of Wicomico, Worcester, and Somerset Counties, Maryland, and Northampton County, Virginia (the Southern Delmarva Peninsula).

Figure 1-1. Overview Map of Chincoteague and Wallops Island NWRs Planning Area

1.3 Purpose and Need for Action

1.3.1 Need

Since we released the previous refuge management document, the Master Plan: Chincoteague National Wildlife Refuge (1993) and its corresponding EIS (1992), both natural processes and human uses have contributed to drastic changes to the refuge's environment. Climate change, sea level rise, and natural processes have altered, and will continue to alter, the coastal environment. Over the past 20 years, national directives from Congress and USFWS for managing uses and planning for units of the Refuge System have become more comprehensive and attuned to the essential features of natural systems. We designed this CCP/EIS to address management and protection of valuable natural resources into the future, a future where continued change is even more likely to occur.

Public visitation, which has stayed consistent over the past decade with approximately 1.25 million visits annually, is important to raising awareness and appreciation of the refuge and to generating revenue that supports public and wildlife services. Such high visitation provides a need to implement management strategies and direction to minimize human disruption to the natural environment.

Our development of this final CCP/EIS addresses three major needs. First, the Improvement Act (1997) requires that all national wildlife refuges have a CCP to help fulfill the mission of the Refuge System.

Second, the refuge currently has an outdated master plan. Since 1993, environmental factors affecting the coastal landscape of the refuge result in a need to revisit our vision statement, goals, objectives, and strategies to successfully manage the refuge now and into the future. Developing this CCP/EIS provides us with an opportunity to solicit public and partner involvement throughout the planning process that will inform the framework and direction with which to manage the refuge.

Third, our management practices should be consistent with current mandates. This new CCP will ensure the refuge conforms to all relevant current laws and policies.

1.3.2 Purpose

We must evaluate and plan for the changing environmental conditions that the refuge currently faces; the natural environment, human uses, and management direction have all changed over the past 20 years. We designed the CCP to address management and protection of valuable natural resources into the future anticipating, to the extent possible, how climate change and other factors will affect our ability to achieve refuge purposes. We will plan for approaches that are ecologically sound and sustainable in light of physical and biological change; practical, viable, or economically realistic; and responsive to issues, concerns, and policies.

Thus, in accordance with the Refuge System Planning Policy (Service Manual 602 FW 3*), the purpose of this CCP is to provide the refuge manager with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreational uses.* Specifically this CCP is designed to provide a management plan that:

(1) achieves the refuge's purposes;

(2) fulfills the mission of the Refuge System;

(3) maintains and, where appropriate, restores the ecological integrity of the refuge and the Refuge System;

(4) helps achieve the goals of the National Wilderness Preservation System (NWPS);

(5) meets other mandates and the management goals set by the USFWS for the refuge; and

(6) addresses other significant issues and concerns.

Each of these six elements of the purpose of the CCP is discussed in the sections below. The refuge purposes are discussed in section 1.4; the Refuge System Mission is presented in section 1.5; ecological integrity is defined in section 1.6, the goals of the NWPS are discussed in section 1.7; and descriptions of other mandates relevant to the refuge are provided in section 1.8. The relationship between the refuge and Assateague Island National Seashore with regard to agency jurisdiction and responsibilities is discussed in section 1.14.6. In addition, all of these elements are succinctly addressed in the vision and goals that we established for the refuge as part of this CCP process and that are reported in section 1.13.

NEPA requires a thorough analysis of a *range of alternatives*, which are different ways to achieve the purpose of the CCP, and our vision and goals for the refuge. As illustrated in chapter 2, the purpose and need statement, along with our goals and vision for the refuge (discussed in section 1.13), are the key criteria in establishing this range of alternatives.

By addressing the CCP purposes stated above, this process will result in a management plan that:

- states clearly the desired future conditions of refuge habitat, wildlife, and visitor services;
- provides state agencies, refuge neighbors, visitors, and partners with a clear understanding of the reasons for refuge management actions;
- ensures that refuge management reflects the policies, legal mandates, and the mission of the USFWS and the Refuge System and the refuge purposes;
- ensures the compatibility of current and future public use;
- provides long-term continuity in refuge management; and
- provides justification for refuge staffing, facilities, operations and maintenance, and projected budget requests.

1.4 Refuge Purposes

This CCP addresses both Chincoteague and Wallops Island NWRs and, therefore, the statutory purpose of each refuge is described below. Section 1.13 describes the vision statement and goals for the CCP that we developed with our partners to achieve both the purposes of the refuge and of the CCP.

1.4.1 Chincoteague National Wildlife Refuge

The Secretary of the Department of the Interior (DOI) established Chincoteague NWR in 1943 under authority of the Migratory Bird Conservation Act "*…for use as an inviolate sanctuary or for any other management purpose, for migratory birds*" (16 U.S.C. § 715d), especially migrating and wintering waterfowl. Since that time, the objectives have been expanded to include the

protection and management of threatened and endangered species and other wildlife, and to provide for wildlife-oriented public use. Other refuge purposes, and their associated acquisition authorities, now also include:

- *"... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." 16 U.S.C. § 460k- "... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..."* 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended);

- *"... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."* 16 U.S.C. § 3901(b) (Emergency Wetlands Resources Act of 1986);

- *"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4)"... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..."* 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956); and,

- *"... for conservation purposes ..."* 7 U.S.C. § 2002 (Consolidated Farm and Rural Development Act).

1.4.2 Wallops Island National Wildlife Refuge

Wallops Island NWR was created on March 11, 1971, when 373 acres of land were transferred to the USFWS from the National Aeronautics and Space Administration (NASA) Wallops Flight Center. Formally, Wallops Island NWR was established *"... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds"* (16 U.S.C. § 715d) and *for "... particular value in carrying out the national migratory bird management program."* (16 U.S.C. § 667b).

1.5 National Wildlife Refuge System Mission

The Refuge System is the world's largest collection of lands set aside specifically for the conservation of wildlife and the protection of ecosystems. President Theodore Roosevelt established the first national wildlife refuge in 1903, and as of September 30, 2012, the Refuge System consisted of 560 national wildlife refuges, 209 Waterfowl Production Areas, and 50 Coordination Areas encompassing more than 150 million acres of lands and waters in all 50 states and several island territories. The Refuge System is home to more than 700 species of birds, 220 species of mammals, 250 reptile and amphibian species, and more than 1,000 species of fish, and it also provides critical habitat for more than 280 threatened and/or endangered plants and animals. Each year, more than 45 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education and interpretive activities on refuges.

In 1997, President Clinton signed into law the Refuge System Improvement Act (PL 105-57, Improvement Act), which established a unifying mission for the Refuge System:

"to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

The Improvement Act, which is discussed further in section 1.8.3, also established a new process for determining the compatibility of public uses on refuges, and requires us to prepare a CCP for each refuge and to focus on wildlife conservation.

1.6 Ecological Integrity

In order to fulfill the Refuge System mission, described above, the refuge staff is charged to maintain and, where appropriate, restore the ecological integrity of the refuge. Ecological integrity is the integration of biological integrity, natural biological diversity, and environmental health; and the replication of natural conditions.

Biological integrity is defined as biotic composition, structure, and functioning at the genetic, organism, and community levels consistent with natural conditions, including the natural biological processes that shape genomes, organisms, and communities.

Biological diversity is the variety of life, including the variety of living organisms, the genetic differences among them, and the communities in which they occur.

Environmental health is an abiotic composition, structure, and functioning of the environment consistent with natural conditions, including the natural abiotic processes that shape the environment.

The refuge visions and goals, which we developed partly to help fulfill the Refuge System mission for ecological integrity, are described in section 1.13.

1.7 National Wilderness Preservation System

The Wilderness Act of 1964 established the NWPS and a process for Federal agencies to recommend wilderness areas to Congress. Its purpose is:

"to secure for the American people of present and future generations the benefits of an enduring resource of wilderness…for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness" and "to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness" (16 U.S.C §1131. 2011).

Wilderness, as defined by the Wilderness Act, is untrammeled (free from man's control), undeveloped, and natural land, offering outstanding opportunities for solitude and primitive recreation. Essentially, the goals are to ensure that, despite increasing population and expanding settlement and mechanization, there are still areas of the United States where these factors are not present or felt.

The Refuge System contains 20 percent of America's NWPS, with 20 million acres of designated wilderness on 63 refuges. The Refuge System also protects 1.9 million acres of proposed

wilderness on 21 refuges. By law and policy, we are responsible for preserving the wilderness character of these designated and proposed wilderness areas.

In response to the Wilderness Act, the entirety of Assateague Island was reviewed to see which areas still possessed primeval characteristics. As a result, the central 6,500 acres of Assateague Island was proposed as wilderness in 1974, but has yet to receive designation. Until such a congressional decision is made, Chincoteague NWR currently manages the proposed area within its jurisdiction to preserve its wilderness character. In accordance with wilderness policy (610 FW 4), an evaluation of the current land status, Appendix A, provides a 2012 baseline assessment and describes the wilderness character monitoring program for the 1974 proposed Assateague Island wilderness.

As part of the 50th Anniversary of the Wilderness Act in 2014, USFWS chartered a Refuge System Wilderness Council to evaluate the 21 Proposed Wilderness Areas and Wilderness Study Areas within the Refuge System and to prepare a National Strategy to advance priority wilderness proposals to Congress for designation.

1.8 Other Mandates

In addition to the requirements discussed above in sections 1.4 through 1.7, there are other mandates that we must abide by in managing the refuge, including laws, policies for implementing those laws, and executive orders. Some of these are specific to USFWS and others are broader and apply to all Federal agencies. Some of these are summarized in this section.

For each of the USFWS mandates and polices, the USFWS Service Manual (Service Manual) (found at: *http://www.fws.gov/policy/manuals/*) contains the standing and continuing directives implementing our authorities, responsibilities, and activities, and we amend it as necessary. We publish special directives that affect the rights of citizens or the authorities of other agencies separately in the Code of Federal Regulations (CFR), and the Service Manual does not duplicate them.

1.8.1 U.S. Fish and Wildlife Service and its Mission

The USFWS, as part of DOI, administers the Refuge System to safeguard the nation's fish, wildlife, plants and their habitats.

The USFWS vision is to "…*continue to be a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals, and commitment to public service.*"

The USFWS mission is: "*Working with others, to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.*"

The USFWS is the primary Federal agency responsible for conserving, protecting, and enhancing America's fish and wildlife populations and their habitats. These include migratory birds, federally listed endangered or threatened species, inter-jurisdictional fish, wetlands, certain marine mammals, and national wildlife refuges. We also enforce Federal wildlife laws and international treaties on importing and exporting wildlife, manage and protect migratory bird populations, restore national fisheries, administer the Endangered Species Act (ESA), and restore native plant

habitats. The USFWS also assists states with their fish and wildlife programs and helps other countries develop conservation programs.

1.8.2 Refuge System Goals

Through the planning process, the USFWS has proposed specific management goals for the refuge, further defined in section 1.13. The Refuge System has developed a number of goals to help guide the development of CCPs and to improve its administration, management, and growth in a unified and consistent manner. These goals, as captured in the Service Manual (601 FW 1), are:

- Conserve a diversity of fish, wildlife, plants, and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, fish, and marine mammal populations that are strategically distributed and carefully managed to meet important life history needs of these species across their habitat ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation, photography, environmental education, and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, plants, and their habitats.

1.8.3 The Improvement Act (1997)

The Improvement Act amended the Refuge System Administrative Act of 1966 by codifying various USFWS policies and establishing a unifying mission, policy direction, and management standards. This law established several new mandates to make management of the Refuge System more cohesive and standardized and to ensure that the USFWS considers wildlife first when managing refuges. These mandates include a new process for determining the compatibility of public uses on refuges, a requirement to prepare a CCP for each refuge, and a requirement to focus on wildlife conservation.

The Improvement Act directs the Secretary of the DOI to ensure that the mission of the Refuge System and purposes of the individual refuges are carried out. It states that the national mission, coupled with the purpose(s) for which each refuge was established, will provide the principal management direction for each refuge, as noted in the purpose statement of this CCP/EIS. It also requires the Secretary to maintain the biological integrity, diversity, and environmental health of the Refuge System, which is also included in the purpose of this CCP/EIS.

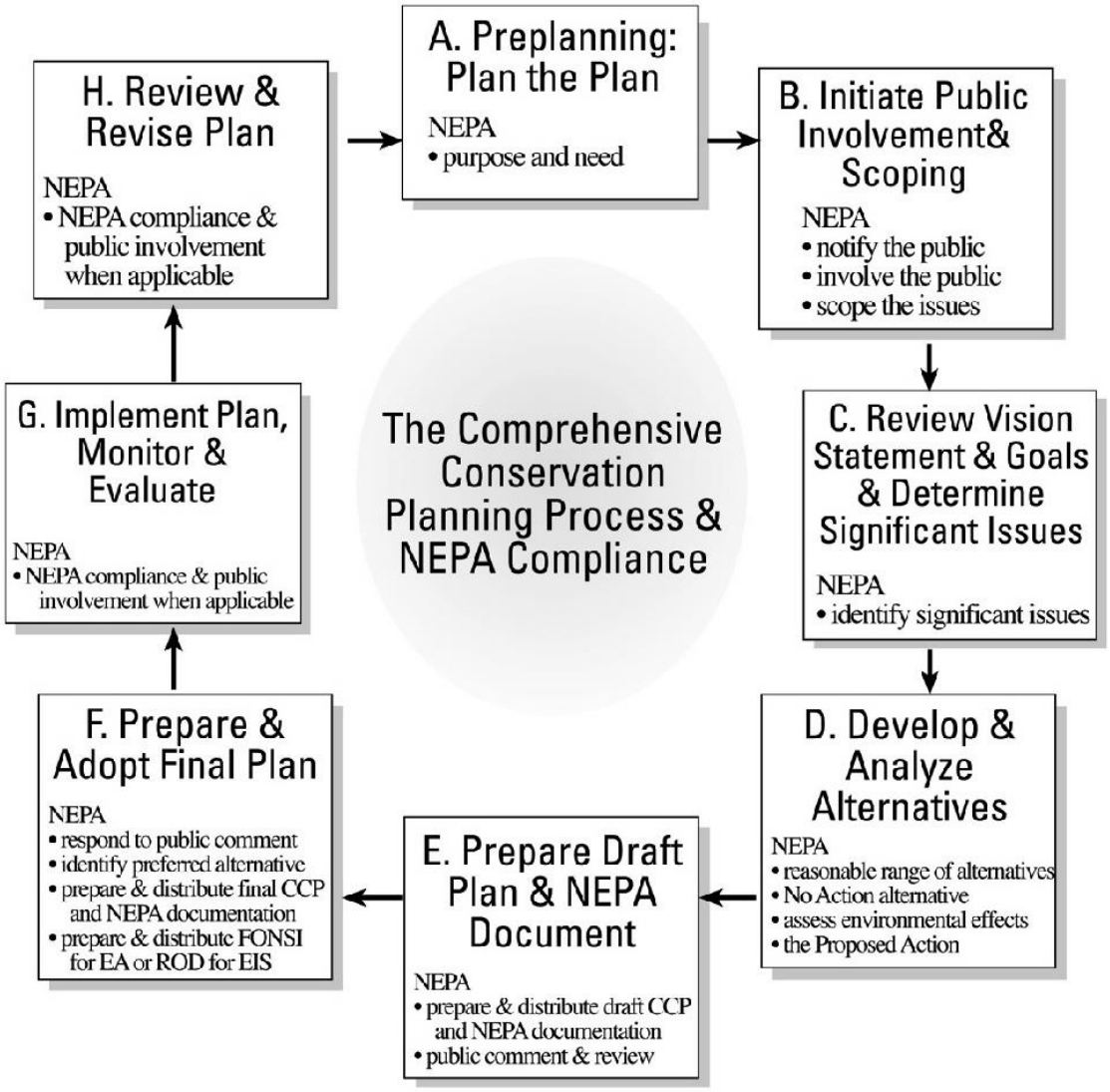
The Refuge System Planning Policy

The Refuge System Planning Policy (Service Manual 602 FW 1,2,3) establishes guidance, systematic direction, and minimum requirements for Refuge System planning, including CCPs, and stipulates a systematic decision-making process that fulfills those requirements. The purposes of this CCP that are listed in section 1.3.2 mirror those listed in the Service Manual, which states that we will manage all refuges in accordance with an approved CCP which, when implemented, will achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where

appropriate, restore the ecological integrity of each refuge and the Refuge System; help achieve the goals of the NWPS; and meet other mandates.

The policy establishes an eight-step planning process that facilitates compliance with NEPA (Figure 1-2). Each of the individual steps is described in detail in the Service Manual and CCP training materials (Service Manual 602 FW 3). By preparing this CCP, we are implementing the Planning Policy as directed by the Service Manual.

Figure 1-2. Steps in the Comprehensive Conservation Planning Process and its relationship to the National Environmental Policy Act of 1969 (Service Manual 602 FW 1,2,3)



Additional guidance published in *Planning for Climate Change on the National Wildlife Refuge System* (USFWS 2014) states that all CCPs should identify climate change as an issue affecting resources on and around refuges. CCPs should call for actions, plans, studies, monitoring, modeling, outreach, or related efforts toward climate change adaptation, mitigation, and engagement. In accordance to this guidance and based on the best available peer-reviewed science currently available, refuge managers and planners should explicitly plan for 1 – 1.5m global sea level rise by the year 2100. In addition to being scientifically defensible, this approach will ensure consistency among Refuge System planning documents and public outreach efforts.

Maintaining Biological Integrity, Diversity, and Environmental Health (BIDEH) Policy

The BIDEH policy (Service Manual 601 FW 1) provides guidance on maintaining or restoring the BIDEH of the Refuge System, including the protection of a broad spectrum of fish, wildlife, and habitat resources in refuge ecosystems, as reflected in the purpose of this CCP. It provides refuge managers with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and restore lost or severely degraded environmental components. The policy also provides guidance for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem.

Appropriate Refuge Uses Policy

Federal law and USFWS policy provide the direction and planning framework for protecting the Refuge System from inappropriate, incompatible, or harmful human activities and ensuring that visitors can enjoy its lands and waters, as noted in the purpose statement of this CCP. This policy provides a national framework for determining appropriate refuge uses in an effort to prevent or eliminate those uses that should not occur in the Refuge System. It describes the initial decision process the refuge manager follows when first considering whether or not to allow a proposed use on a refuge.

Compatibility Policy

The Improvement Act identifies six wildlife-dependent public uses as appropriate on national wildlife refuges. These uses—hunting, fishing, wildlife observation, photography, environmental education, and interpretation—will receive priority consideration on refuges and in CCPs. The Act also declares that all existing or proposed refuge uses must be found "compatible" with the refuge's purpose and consistent with public safety, as affirmatively determined by the refuge manager. Each use is evaluated for its potential impact on refuge resources and its ability to not materially interfere with or detract from the fulfillment of the Refuge System's mission or the refuge's purpose.

Findings of appropriateness and compatibility determinations (CDs) are required for all refuge uses, excluding management actions, per the Improvement Act (1997). These statements evaluate an activity's appropriateness and compatibility with refuge purposes and, in the case of the CDs, outline measures to ensure compatibility that must be followed if the use is to be allowed. The refuge manager may allow or deny any use, even one that is compatible, based on other considerations such as public safety, conflicts with other laws or policy, or available funding. This policy and its regulations, including a description of the process and requirements for conducting compatibility reviews, can be viewed online at: *http://www.fws.gov/policy/603fw2.html*.

1.8.4 The Endangered Species Act

Mandated under section 4(f) of the ESA of 1973, three Recovery Plans are in effect to protect and enhance threatened and endangered species that are residents of Chincoteague and/or Wallops Island NWRs:

- *Recovery Plan for U.S. Populations of Loggerhead Turtle (Caretta caretta)* (National Marine Fisheries Service (NMFS) and USFWS 1993). http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_loggerhead_atlantic.pdf

- *Recovery Plan for Seabeach Amaranth (Amarantus pumilus) (*USFWS 1996b*).* http://www.cals.ncsu.edu/plantbiology/ncsc/rare/Recovery_Amaranthus.pdf

- *Atlantic Coast Piping Plover (Chadradius melodus) Recovery Plan (*USFWS 1996c*).* http://www.fws.gov/northeast/pipingplover/pdf/entire_plan.pdf

A fourth recovery plan, for Delmarva fox squirrel, is still in effect. However, the species has recently been proposed for delisting since the draft CCP/EIS was released. The red knot was proposed for listing as a federally threatened species in September 2013 during development of the draft CCP/EIS, and was listed as threatened in December 2014. Current refuge management with respect to these federally listed species has been guided by these Recovery Plans and numerous ESA Section 7/Biological Opinions for refuge projects. For more detailed descriptions of these recovery plans and documents, see Appendix B, Appendix F, and Appendix O.

1.8.5 Other Federal Mandates

Although USFWS and Refuge System laws and policies, along with the purpose of each refuge, provide the foundation for managing the refuge, other Federal laws and executive orders affect how we manage refuges. These are addressed in chapter 4, Environmental Consequences, which evaluates the compliance of the alternatives with these mandates. These include, but are not limited to, the following laws (as amended): the National Historic Preservation Act (NHPA) of 1966, the Clean Air Act of 1970, the Clean Water Act of 1977, the Coastal Zone Management Act (CZMA) of 1972, and the Migratory Bird Treaty Act (MBTA) of 1918.

The following Executive Orders (EOs) are also applicable and addressed in chapter 4: EO 1988, Floodplain Management; EO 11990, Protection of Wetlands; and EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Finally, we designed this CCP/EIS to comply with NEPA and the Council on Environmental Quality regulations for implementing NEPA (40 CFR, 1500-1508). Other laws and executive orders can be found on the USFWS Laws Digest Web site at: *http://www.fws.gov/laws/Lawsdigest.cfm*; the laws listed here and others are also listed in Appendix C.

1.9 Significant Concerns

Interest in the future management of the refuge is widespread. The concerns and interests of citizens, local and state officials, and non-governmental organizations are diverse. We have heard from businesses and full-time and part-time residents from the town of Chincoteague and neighboring communities; hunters and harvesters of waterfowl, fish, and shellfish, and upland game species; visitors who come to observe birds, the Chincoteague ponies, monarch butterflies, and other wildlife, or who seek solitude and respite in the natural world; beachgoers, horseback riders, and other non-wildlife-dependent recreation users; and State agencies and other programs

and organizations concerned about the role and contributions the refuge can play in a larger network of natural areas across the Delmarva Peninsula, the mid-Atlantic region, and the migratory bird flyway of the Atlantic coast.

Based on input we received and our professional judgment in incorporating the best available scientific and technical information, we have identified several key concerns which this CCP will address. They are:

- Climate change/sea level rise
- Regional conservation
- Balance between public use and habitat and wildlife conservation
- Public access to the refuge, in particular to the recreational beach, and impact on visitor experience and the local economy
- Public safety and community resilience to storm damage and flooding

We identified the first two concerns based on the policies and initiatives of the USFWS and the DOI, as well as feedback from other resource management agencies. The next two concerns were the most consistently and strongly voiced themes from public comments received during scoping. The last concern arose primarily during the public comment period with release of the draft CCP/EIS.

These concerns are summarized below, and also addressed in the alternatives we developed that are described in chapter 2 and as part of the existing conditions discussed in chapter 3.

1.9.1 Climate Change/Sea Level Rise

Climate change and sea level rise are a growing concern for the refuge and the nation. Rising air and water temperatures, intense precipitation events, drought, sea level rise, strong coastal storms, and intense wind events are all concerns identified by the scientific community for the mid-Atlantic region. Since the current Master Plan was signed, our awareness and understanding of the impacts of climate change and sea level rise on barrier islands has increased.

Recent repeated coastal flooding and overwash caused by nor'easters and tropical hurricanes have resulted in damage to beach access and parking. Impacts on habitat and wildlife have been either beneficial or negative depending upon the timing and severity of the weather event. We are committed to working with partners to continue research and assessment of future climate change impacts on the Delmarva Peninsula. The effects of climate change and sea level rise at the refuge are discussed in more detail in section 1.14.7 and with regard to its effect on the existing conditions, in section 3.2.5.

1.9.2 Regional Conservation

We are committed to a landscape-level approach to conserve, manage, and restore refuge lands and waters, as well as to facilitate such conservation actions beyond our boundaries. We recognize the conservation importance of the southern Delmarva Peninsula and the regional challenges it faces, including those related to climate change and land use. We are committed to working with partners to examine opportunities to address these challenges, such as improving connectivity between protected lands and providing lands for multiple recreational activities to support the tourism economy, while also providing ecological, educational, and other benefits. Regional conservation is a significant concern and is discussed further in section 1.14.5 and with regard to the existing environment, in section 3.9.5.

1.9.3 Balance Between Public Use and Habitat and Wildlife Conservation

We received many comments requesting that the refuge maintain a balance between people and nature, or recreation and wildlife management. Federal land management agencies often allow multiple uses to occur on their lands, and some agencies, like national forests and the Bureau of Land Management (BLM) have a multiple-use mandate and structure. However, statutory and policy framework of the Refuge System clearly defines that wildlife and wildlife conservation must come first on refuge lands and waters. Many of our policies and goals aim to achieve this balance, through allowing for public uses that are deemed appropriate and compatible for each refuge. A balanced approach that upholds that wildlife comes first is reflected throughout the discussion of visitor service issues and concerns in section 1.14.6.

1.9.4 Public Access to the Refuge, in Particular to the Recreational Beach, and Impact on Visitor Experience and the Local Economy

Access to the refuge, in particular to the recreational beach, was the most commonly cited issue by the public. We are committed to preserving access to the refuge, including by personal vehicle, and to continuing to provide a recreational beach. We considered impacts on visitor experience and the local economy throughout this CCP/EIS. Access issues are discussed in section 1.14.6 and in the affected environment chapter in section 3.5.2 and 3.6.2.

1.9.5 Public Safety and Community Resilience to Storm Damage and Flooding

A number of comments were received during the public comment period that community resiliency and potential catastrophic flooding in the town of Chincoteague should be primarily considered in any action (or inaction) taken by the refuge, especially as pertaining to dunes, breaches, and emergency repairs. In response to coastal resiliency for all alternatives considered, as stated on page 2-10 of the Draft CCP/EIS, "*the refuge would work with the town of Chincoteague to explore potential impacts and identify protective methods to address hazard mitigation, in coordination with others, such as Accomack County, Commonwealth of Virginia, NPS, National Aeronautics and Space Administration (NASA), Federal Emergency Management Agency (FEMA), and USACE. The refuge would also work with partners to explore how best to advance the study, information exchange, and project resources for adaptive management practices that sustain the resiliency of this unique barrier island system including but not limited to Assateague, Wallops, Assawoman, and Metompkin islands in the face of dynamic coastal processes and climate change.*"

1.10 Other Relevant Plans and Initiatives

USFWS manages and administers the Chincoteague NWR and Wallops Island NWR as part of the Refuge System. In addition to the purposes, mandates, and policies that are discussed relative to the purpose of this CCP, as discussed in sections 1.3 through 1.9 above, a variety of international, national, state, regional, and local plans and initiatives affect the context and setting of refuge and therefore, the CCP. These plans and initiatives are related to conservation, public use, climate change, and land use. They are listed below and described in more detail in Appendix B.

1.10.1 International and National Conservation Plans and Initiatives

The plans and initiatives listed below, in chronological order, provide guidance for the CCP/EIS development and for development of refuge management policies, goals, and objectives with

regard to the significance of the refuge's natural environment and considerations for its protection and management.

- *North American Breeding Bird Survey* (BBS; 1966-present). https://www.pwrc.usgs.gov/BBS/index.cfm?CFID=9765136&CFTOKEN=20581228
- *North American Waterfowl Management Plan* (NAWMP; 1986, 2004, and 2012). http://nawmprevision.org/sites/default/files/NAWMP-Plan-EN-may23.pdf
- *Partners in Flight: Mid-Atlantic Coastal Plain Bird Conservation Plan (PIF; Watts, 1999).* http://www.partnersinflight.org/bcps/plan/pl_44_10.pdf
- *Regional Wetland Concept Plan, Northeast Region* (USFWS; 1990). http://digitalmedia.fws.gov/utils/getfile/collection/document/id/1378/filename/1379.pdf
- *North American Bird Conservation Initiative* (NABCI, 1998). http://www.nabci-us.org/
- *U.S. Shorebird Conservation and North Atlantic Regional Shorebird Plans*
    - The USSCP is available online at: http://www.shorebirdplan.org/wp-content/uploads/2013/01/USShorebirdPlan2Ed.pdf (Brown et al. 2001).
    - The North Atlantic Regional Shorebird Plan can be viewed online at: http://www.fws.gov/shorebirdplan/RegionalShorebird/downloads/NATLAN4.pdf (Clark & Niles 2000).
- *North American Waterbird Conservation Plan* (NAWCP; Version 1, 2002). http://www.nawcp.org/pubs/ContinentalPlan.cfm (Kushlan et al. 2002).
- *Birds of Conservation Concern (BCC).* http://digitalmedia.fws.gov/cdm/ref/collection/document/id/1404
- *New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Implementation Plan.* http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf (Steinkamp 2008).
- *A Blueprint for the Future of Migratory Birds: A Strategic Plan 2004-2014.* http://library.fws.gov/Bird_Publications/blueprint04-14.pdf
- *Conserving the Future: Wildlife Refuges and the Next Generation* (USFWS 2011). http://americaswildlife.org/wp-content/uploads/2012/01/Final-Document-Conserving-the-Future.pdf
- *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines (2012).* http://www.fws.gov/windenergy/docs/WEG_final.pdf

1.10.2 National Public Use Plans and Initiatives

- *America's Great Outdoors: A Promise to Future Generations* (AGO; 2011). http://americasgreatoutdoors.gov/files/2011/02/AGO-Report-With-All-Appendices-3-1-11.pdf/
- Let's Move! And Let's Move Outside. http://www.letsmove.gov/
- Youth in the Great Outdoors. https://youthgo.gov/
- Connecting People with Nature. http://www.fws.gov/northeast/cpwn/index.html

1.10.3 Climate Change and Sea Level Rise Studies

USFWS is concerned with the potential effects of climate change on Assateague Island and the Virginia Eastern Shore, and the potential impact on refuge facilities, infrastructure, and access. We, therefore, consider climate change to be a key consideration for this CCP/EIS. These concerns are further described in section 1.14, Issues and Opportunities.

The most relevant climate change plans are the following:

- *Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change* (USFWS 2009). http://www.fws.gov/home/climatechange/pdf/CCStrategicPlan.pdf.
- *The National Fish, Wildlife and Plants Climate Adaptation Strategy* (2012). http://www.wildlifeadaptationstrategy.gov/pdf/NFWPCAS-Final.pdf.
- *Planning for Climate Change on the National Wildlife Refuge System* (USFWS 2014). http://www.fws.gov/refuges/vision/pdfs/PlanningforClimateChangeontheNWRS.pdf.

The relevant work on climate change for the refuge includes the following studies and plans, presented in chronological order:

- *Refuges at Risk: the Threat of Global Warming* (Schlyer 2006). http://www.defenders.org/publications/refuges_at_risk_2006.pdf.
- *The Virginia Climate Change Action Plan* (Governor's Commission on Climate Change 2008). http://www.sealevelrisevirginia.net/docs/homepage/CCC_Final_Report-Final_12152008.pdf.
- *Sea Level Rise and Coastal Habitats in the Chesapeake Bay Region, Sea Level Affecting Marshes Model (SLAMM)*[1] (Glick 2008). http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/SeaLevelRiseandCoastalHabitats_ChesapeakeRegion.ashx.
- *A Case Study on Chesapeake Bay and Assateague Island* (EPA, NPS, USFWS 2009). http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/SeaLevelRiseandCoastalHabitats_ChesapeakeRegion.pdf?dmc=1&ts=20130325T1459161406
- *Application of the SLAMM 5.0.2 in the Lower Delmarva Peninsula* (Nieves 2009). http://www.slammview.org/slammview2/reports/LDP_ChincoteagueFinal.pdf.
- *National Parks in Peril: The Threats of Climate Change Disruption* (Saunders 2009). http://rockymountainclimate.org/website%20pictures/National-Parks-In-Peril-final.pdf.
- *Marshes on the Move. A Manager's Guide to Understanding and Using Model Results Depicting Potential Impacts of Sea level Rise on Coastal wetlands.* (TNC and NOAA 2011). http://coast.noaa.gov/digitalcoast/sites/default/files/files/1366313090/marshes_on_the_move.pdf.
- *Global Sea Level Rise Scenarios for the US National Climate Assessment.* (Parris et al. 2012). http://scenarios.globalchange.gov/sites/default/files/NOAA_SLR_r3_0.pdf.

[1] SLAMM is one of the models used to study the impact of coastal processes, such as sea level rise, on an area and simulate the dominant processes and forecast long-term effects. SLAMM takes into account five processes that determine the impact of sea level rise impact on wetlands: inundation (the rise of water levels and the salt boundary); erosion; overwash (beach migration and transport of sediments); saturation (migration of coastal swamps and fresh marshes onto adjacent uplands due to the water table responding to rising sea level); and accretion (vertical rise due to buildup of organic and inorganic matter).

- *Recurrent Flooding Study for Tidewater Virginia*. (Mitchell et al. 2013). http://ccrm.vims.edu/recurrent_flooding/Recurrent_Flooding_Study_web.pdf.
- *Intergovernmental Panel on Climate Change. Contribution of Working Groups I, II, and III to the Fifth Assessment Report, Climate Change 2014.* http://www.ipcc.ch/report/ar5/syr/.
- *Climate Change Impacts in the United States: The Third National Climate Assessment.* http://nca2014.globalchange.gov/report.

1.10.4 State, Regional, and Local Plans

- *Virginia's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plan* (Virginia Department of Game and Inland Fisheries 2005). http://www.bewildvirginia.org/wildlifeplan/.
- *State Comprehensive Outdoor Recreation Plan* (Virginia Department of Conservation & Recreation 2007). http://www.dcr.virginia.gov/recreational_planning/vop.shtml.
- *Accomack County Comprehensive Plan* (County of Accomack 2008). http://www.co.accomack.va.us/Planning/2008_comprehensive_plan_update.html.
- *Town of Chincoteague Comprehensive Plan* (Town of Chincoteague 2010). http://www.chincoteague-va.gov/pdf/ComprehensivePlan201001.04.10.pdf.

1.11 Description of the Refuge

This section provides the history and description of the two refuges that are the subject of this CCP/EIS.

1.11.1 Chincoteague National Wildlife Refuge

Chincoteague NWR includes approximately 14,000 acres of beach, dune, marsh, and forest habitats. Federal title to refuge land extends to the mean low water line. Actual acreage is difficult to measure due to land erosion and accretion. Under common law, title to accreted lands inures to the uplands owner.

Originally, Chincoteague NWR encompassed 8,808 acres acquired under the Migratory Bird Conservation Act (MBCA) (1929). This land was located primarily on the southern end of Assateague Island, which lies in Accomack County, Virginia, but also included Jerico and Hebron Islands, two small marshes adjacent to the island but located in Worcester County, Maryland. These islands are now managed by the National Park Service (NPS). The northern end of Assateague Island lies in Maryland and is managed by the NPS (Assateague Island National Seashore) and the Maryland Department of Natural Resources (Maryland Assateague State Park). Assateague Island National Seashore was designated in 1965 with provisions for the southern end of Assateague Island to remain a refuge under the management of the USFWS. (More details on the relationship between the refuge and Assateague Island National Seashore with regard to agency jurisdiction and responsibilities is discussed in section 1.14.6). Since the refuge's creation, the USFWS has acquired additional lands using the Migratory Bird Conservation Fund (MBCF) or the Land and Water Conservation Fund (LWCF). Today, Chincoteague NWR encompasses approximately 14,032 acres, of which all but 418 acres (as previously mentioned) are located in Accomack County, Virginia. In addition to the Virginia part of Assateague Island, Chincoteague NWR includes all 427 acres of Morris Island (located between Chincoteague and Assateague Islands), 546 acres of the northern end of Chincoteague Island (known as Wildcat Marsh), all 1,434 acres of Assawoman Island, 174 acres of the northern end of Metompkin Island, and 1,412 acres in fee title and 600 acres in easements on Cedar Island. Portions of Assawoman and Metompkin Islands were acquired most recently, in 1990. Acreage given is based on realty transaction accounts; the actual acreage changes with land accretion, erosion, and other factors.

We have created and manage approximately 2,600 acres of fresh and brackish-water impoundments on Chincoteague NWR for migrating and wintering waterfowl and other migratory birds. Chincoteague NWR also provides and manages habitat for American black ducks, as part of a long-term effort, in compliance with NAWMP, to reverse significant drops in this species' populations. These efforts also benefit other wildlife, especially shore and wading birds.

Wildlife management strategies at Chincoteague NWR continue to provide quality habitat for migrating and wintering waterfowl which also benefits a greater variety of wildlife, such as wading birds, shorebirds, and neotropical migrants. The refuge supports breeding populations of the endangered Delmarva Peninsula fox squirrel and the threatened piping plover. The American bald eagle (delisted or removed from the Federal List of Endangered and Threatened Wildlife and Plants in 2007) regularly nests on the refuge, and the American peregrine falcon (delisted in

1999) is seen quite frequently during its annual autumn migration. The refuge's southern barrier islands are particularly important as spring stopover sites for migrating red knots between late April to early June, with numbers peaking in late May (Niles et al. 2010). Virginia hosts approximately 30 percent of the hemisphere's red knot rufa subspecies population, and Cedar and Metompkin Islands fall in the upper third of islands in terms of numbers of red knots counted during migration (The Nature Conservancy (TNC) 1996). Additionally, the Atlantic loggerhead sea turtle is a threatened species that nests occasionally on Chincoteague NWR. Refuge management programs are targeted to provide feeding and resting areas for birds in migration, and nesting and brood-rearing habitat for those birds that find Chincoteague NWR suitable for reproduction. To this end, Chincoteague NWR continues efforts toward acquiring land and water for increased conservation of migratory bird resources and to protect important wildlife habitat from the impacts of development.

Chincoteague NWR has been designated as part of a Globally Important Bird Area (IBA) by the American Bird Conservancy and the Audubon Society; one of the top 10 birding hotspots by the National Audubon Society; and a Site of International Importance within the Western Hemisphere Shorebird Reserve Network (WHSRN), a conservation partnership of stewards and landowners led by the Manomet Center for Conservation Sciences. This coastal barrier island/lagoon system has been designated a World Biosphere Reserve by the United Nations Educational, Scientific, and Cultural Organization in recognition of its great ecological value. Moreover, the DOI designated the area a National Natural Landmark in recognition of its outstanding natural values.

Chincoteague NWR is also an important recreational destination, particularly for people living in the Washington, DC, Baltimore, Philadelphia, and New York City areas. With approximately 1.2 to 1.4 million visits annually, Chincoteague NWR is one of the most visited refuges in the United States, providing visitors with the six wildlife-dependent recreation opportunities (hunting, fishing, wildlife observation and photography, environmental education and interpretation) designated as priority general public uses of the Refuge System by Congress, as well as other public uses that have been deemed appropriate and compatible. The majority of visits are to the recreational beach, which is managed by the NPS under an agreement with USFWS, and subject to a congressional mandate from 1965 when the Assateague Island National Seashore was designated. Visitation to Chincoteague NWR supports the tourism economy of the town of Chincoteague, which is the refuge's gateway community and is located on Chincoteague Island, and through which visitors must travel to access Chincoteague NWR.

Chincoteague NWR Management Units

The management units for Chincoteague NWR are organized by island, with habitats as sub units. Table 1-1 summarizes the management units by name, and then breaks down individual acreage for each sub unit by habitat. Habitats for each management unit, or group of units, are then described in more detail. The differences in habitat among the management units illustrate the need for different management. Figure 1-3 identifies the refuge management units.

Table 1-1. Management Units

Unit	Sub Unit by Habitat (acres)					Total Acreage
	Beach /Dune	Shrub/early successional	Forested Uplands	Impoundments	Salt Marsh	
Assateague Island	970	2,872	1,600	2,650	1,985	10,077
Wildcat Marsh	-	-	71	-	475	546
Morris Island	-	-	21	-	406	427
Assawoman Island	359	-	-	-	1,075	1,434
Metompkin Island	96	-	-	-	78	174
Cedar Island	402				1,610	2,012
Wallops Island NWR	-	57	121	-	195	373
Refuge Total	**1,827**	**2,929**	**1,813**	**2,650**	**5,824**	**15,043**

The areas assigned to each habitat type are approximate, based on a 1994 land cover map, and provide a rough idea of the proportion of each habitat type on the refuge. A dynamic environment and shoreline constantly modified by storm and extreme high tide means that the amount of beach/dune and salt marsh habitat varies from year to year and across seasons. Encroachment of shrubs and trees into impoundments further hinders the accurate estimation of cover types at any given point in time.

1.11.2 Wallops Island National Wildlife Refuge

Wallops Island NWR is located on the mainland, east of Wattsville in Accomack County, Virginia, immediately adjacent to Highway 175, which provides access to the town of Chincoteague and Chincoteague NWR. Wallops Island NWR is comprised mainly of salt marsh and woodlands and contains habitat for a variety of species, including upland and wetland dependent migratory birds. Wallops Island NWR is managed as a satellite refuge of Chincoteague NWR.

Wallops Island NWR is adjacent to the NASA Wallops Flight Facility. In 1971, the Bureau of Sport Fisheries and Wildlife, the precursor to the USFWS, entered into a noninterference, nonexclusive use agreement with the NASA Wallops Flight Facility to manage property (approximately 3,000 acres, "…of any and all lands and marsh…") of Wallops Island, Virginia. These lands were entered into the national data base of land under control (but not ownership) of the USFWS. For the next 35 years, this agreement was to be renewed every 5 years and administration and management of these lands were the responsibility of the Chincoteague NWR. These new lands under the nonexclusive use agreement assimilated the purpose(s) of Chincoteague NWR.

In 1975, NASA transferred 373 acres of upland and marsh that now comprise Wallops Island NWR to the USFWS for ownership. In 2006, the agreement between NASA and USFWS expired and NASA requested that the agreement not be renewed. Additionally, NASA asked the USFWS to remove the 3,000 acres it was managing from its national data base. This was done; however, the dialogue that took place between the NASA Wallops Flight Facility and the USFWS concerning the renewal of the use agreement produced a greater understanding of our individual agency missions and responsibilities. This led to extensive discussions concerning current and

Figure 1-3. Refuge Management Units

future challenges jointly faced by both our agencies in light of climate change and its corresponding sea level rise. It became readily apparent that the opportunities presented by working together as part of a larger collaborative effort would provide for a greater scientific understanding of our shared coastal environment, and that the advancements in the use of technologies for the study of these environments could be shared with others. On August 11, 2011, the NASA Wallops Flight Facility, the Marine Science Consortium, and USFWS entered into a "Nonreimbursable Space Act Agreement" for the purpose of: "Technical Collaboration for Data Collection and Studies Related to Climate Change, Habitat Shifts, Algorithm Development, Instrument Development, and Small Satellite Development". This new agreement will form the backbone of many future collaborative efforts.

Since its creation in 1971, Wallops Island NWR has been unstaffed, with little monitoring or management, except by A&N Electric Cooperative (and previously by Delmarva Power), utility companies with a power line right-of-way that removes tall growing trees, primarily the non-native autumn olive, and some brush species. Both the NPS and U.S. Department of Agriculture (USDA) Wildlife Services have storage facilities and maintenance areas on the refuge.

Wallops Island NWR is closed to the public except for white-tailed deer hunting. It was opened to public hunting in 2002 to reduce effects of overbrowsing by white-tailed deer, and to reduce the potential of deer collision with vehicles on the adjacent Highway 175 and aircraft at the neighboring NASA flight facility.

1.12 Refuge Operational Plans ("Step-down" Management Plans)

The Service Manual lists more than 25 step-down management plans that may be required on refuges to complement the CCP. Those plans contain specific strategies and implementation schedules for achieving refuge goals and objectives. Some plans require annual revisions; others require revision every 5 to 10 years. Some plans require additional NEPA analysis, public involvement, and Compatibility Determinations (CDs) before they can be implemented (602 FW 4).

This document incorporates by reference those step-down plans that were previously highlighted by the refuge as necessary for enhanced management. These plans are necessary to continue proper management of the refuge, and should be carried forth in the future.

The following step-down plans are complete or updated annually, and consequently are consistent with current management. We will revise them if necessary per the selected alternative after the CCP is complete.

1.12.1 Fire Management Plan

We completed the most recent Fire Management Plan for Chincoteague NWR in 2009; the plan is updated every 5 years and is currently being updated. The Fire Management Plan addresses wildland fire events with guidelines on the level of protection needed to ensure personal and public safety, and to protect facilities and resources. We have incorporated fire programs needed to mimic natural processes and manage habitats, and other pertinent portions of the fire management, into this CCP.

1.12.2 Prescribed Fire Plan

We require a Prescribed Fire Plan for each prescribed fire on the refuge, and such plans are to be updated every 2 to 5 years. Each plan lays out the management objectives for the prescribed fire, specific prescriptions to achieve the objectives, and contingency planning for managing the fire. We prepared the most recent prescribed fire plans for the refuge in 2009 for the Wash Flats and Fire Management Unit 2 (refuge impoundments), and the plan is currently being updated.

1.12.3 Annual Habitat Work Plans

For each NWR, we develop Annual Habitat Work Plans (AHWP) that review habitat management activities from the previous year, evaluate monitoring programs, and make recommendations for habitat management strategies and prescriptions for the upcoming year. The AHWP incorporates adaptive management practices by evaluating success of management programs on an annual basis. We prepared the most recent comprehensive AHWP for Chincoteague NWR in January 2006, followed by a streamlined version annually. Shorebird and Delmarva Peninsula fox squirrel reports are prepared annually and semi-annually, respectively. We incorporated the results summarized in the 2010 Shorebird and 2008 Delmarva Peninsula fox squirrel reports into this CCP. Likewise, we reviewed and incorporated information from the 2007-09 Impoundment (Water) Management Plan as appropriate.

1.12.4 Predator Management Plan

We manage mammalian and certain avian predators to minimize losses to federally listed species and other ground-nesting birds using an Annual Predator Management Program that we develop each year prior to the nesting season. The program evaluates the prior year's results and outlines methods for the upcoming year—protective enclosures, trapping, and shooting—to protect nesting species (USFWS 2012g). This annual plan is tied to the Final Environmental Assessment for the Management of Predation Losses to Native Bird Populations on the Barrier and Chesapeake Bay Islands and Coastal Areas of the Commonwealth of Virginia, prepared by the USDA Wildlife Service (USDA 2005).

1.12.5 Hunt Management Plans

We prepared the current Chincoteague and Wallops Island NWR Hunt Management Plans in September 2007 and April 2007, respectively. These plans outline population objectives, identify areas to be open for hunting, and describe how the hunts will be administered for big game (i.e., deer and sika) and migratory birds.

1.12.6 Annual Hunt Program

Each year, we develop the Annual Hunt Program, which is a written document detailing specifics of each year's hunt.

1.12.7 Inventory and Monitoring Plan

The 1993 Chincoteague NWR Wildlife Inventory Plan describes surveys and protocols to monitor population numbers and trends. The information obtained from these surveys and programs is used to guide management decisions. We are currently reviewing the plan for consistency with national and regional guidance; once the Habitat Management Plan (HMP) and CCP are finalized, the inventory and monitoring plan will be revised and finalized.

1.12.8 Pony Management Plan

Chincoteague NWR has resident horses known as Chincoteague ponies on Assateague Island that are owned and managed by the Chincoteague Volunteer Fire Company and that graze in two large designated areas on the refuge under a special use permit. In partnership with the Fire Company, we have drafted an Interim Chincoteague Pony Management Plan (2013; Appendix D), which replaces the 1990 plan. It outlines refuge and Fire Company responsibilities in managing the ponies (USFWS 2013c).

1.12.9 Plans to be Developed

We will develop the following plans after the CCP is finalized:

Habitat Management Plan (HMP)

We intend the HMP to be a dynamic working document that provides long-term vision, specific guidance, continuity, and consistency for managing habitat on the refuge. The document sets a direction for the next 15 years, with reviews every 5 years and the use of adaptive management to assess and modify management activities as research, monitoring and priorities may require. HMPs are often step-down plans from the CCP, but can also be prepared prior to, or in conjunction with, the CCP/EIS. We developed a draft HMP during the pre-planning phase of this CCP/EIS and incorporated its content, including wildlife habitat goals, objectives, and strategies, into this CCP/EIS. We will revise it as necessary to be consistent with the selected alternative and finalize it after the CCP is complete.

In 1992, we completed the Upland Habitat Management Plan for Chincoteague NWR, outlining goals, objectives, and management actions for 3,440 acres of forest and shrub habitats on Assateague Island (USFWS 1992b). Unfortunately, reductions in staff and changing priorities curtailed our implementation of the plan. We reviewed the plan during preparation of the draft HMP, and incorporated applicable portions into it.

The Virginia Ecological Services Field Office in Gloucester, Virginia, prepared several Biological Opinions which spell out terms, conditions, and conservation recommendations for various management activities on Chincoteague NWR. The most comprehensive and detailed one is the 2008 Biological Opinion (USFWS 2008b; Appendix F). It addresses the timing, location, and types of beach use permitted in areas that harbor piping plover, sea turtles, and seabeach amaranth. It also requires specific monitoring and protective measures (USFWS 2008b). Elements of the Biological Opinion were incorporated into the draft HMP. Biological Evaluations prepared by staff under Section 7 of the ESA (and concurred by USFWS Endangered Species Offices in Virginia and Maryland) also set management guidance for other activities in Delmarva Peninsula fox squirrel habitat.

Visitor Services Plan

This plan will be a step-down plan to the CCP and will build upon other management plans, namely the Hunt Management Plan (2007), to document approved recreational activities and identify the structure of the visitor services program. The plan will include visitor services data and research to evaluate and plan for visitor services programs, and will assist in the implementation of the CCP.

1.13 Refuge Vision and Goals

Our vision statement for the refuge is a synthesis of the refuge's purposes, the Refuge System mission and goals, and other biological, legal, and social concerns in which the refuge has a role. It is intended to be an expression of what the refuge will be like in the future in terms of natural resources and visitor experience. Our vision for the refuge, as developed for this CCP/EIS to help provide the core component of management strategies hereafter, is as follows:

> *Chincoteague and Wallops Island National Wildlife Refuges encompass extraordinary and ever-changing lands at the edge of the sea, a place where unique habitats and wildlife flourish. In partnership with others, the refuges are a vital part of a larger system of protected lands and waters on the Delmarva Peninsula critical to migratory birds. People from around the world can visit the refuges to learn, recreate, refresh themselves, be inspired by wildlife and wild lands, and renew their connection with nature.*

We developed the following goals for the CCP in conjunction with feedback and collaboration with local partners, comprising the refuge's CCP/EIS planning team.[2] The goals are descriptive and provide broad statements of desired future conditions that work toward achieving the refuge's purposes and vision. We will use the goals presented below to form management objectives and actions, including forming and evaluating alternatives described in this CCP/EIS. The first four goals incorporate the goals from the draft HMP. Chapter 2 provides objectives for each goal by alternative.

> *Goal 1: Coastal Habitats. Manage quality coastal habitats for biological integrity, diversity, and environmental health of refuge barrier beach and dunes in concert with natural processes as part of the Delmarva Peninsula coastal barrier island system to provide habitat for species of conservation concern.*
>
> *Goal 2: Managed Wetlands (Impoundments). Manage refuge impoundments to support native wildlife and plant communities, including a diversity of waterbirds, aquatic species, and other species of conservation concern.*
>
> *Goal 3: Upland Habitats. Manage upland habitats for biological integrity, diversity, and environmental health of coastal forests and shrublands to sustain native wildlife and plant communities, including species of conservation concern.*[3]
>
> *Goal 4: Southern Barrier Islands Unit (Assawoman, Metompkin, Cedar). Perpetuate the biological integrity, diversity, and long-term viability of natural habitats that support native avian communities and turtles on Assawoman, Metompkin, and Cedar Islands through a partnership approach.*

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[2] The CCP/EIS Planning Team met consistently throughout the planning process for this CCP/EIS. Attendance varied over time but included representatives from: USFWS, NPS Assateague Island National Seashore, town of Chincoteague, Accomack County, Accomack County Board of Supervisors, Accomack-Northampton Planning District Commission, Virginia Marine Resources Commission, Virginia Division of Game and Inland Fisheries, and NASA. The Volpe National Transportation Systems Center served as facilitator.

[3] Focal species are those that received special management considerations due to their status (threatened or endangered), economic importance, declining population status, high degree of public interest, or similar attributes.

Goal 5: Partnerships. Working with partners, protect and restore vigorous, viable populations of migratory and resident wildlife, fish, and native plants and their habitats found on the Delmarva Peninsula and identified in state, national, and international treaties, plans, and initiatives. Take a leadership role in collaborative regional efforts to achieve broader conservation goals and serve as a catalyst for achieving a multi-state, eco-regional partnership. The refuge will continue to work with partners to explore how best to sustain the resiliency of this unique barrier island system, its communities, and its economy, consistent with the refuge's mission and in the face of dynamic coastal processes, climate change, and storm events.

Goal 6: Visitor Services. People of all ages and abilities develop a stewardship ethic while enjoying their refuge experience and increasing their knowledge of the USFWS, Refuge System, and refuge.

Goal 7: Refuge Administration. Maintain and enhance refuge infrastructure and operations responsibly and sustainably for the safety and well-being of the wildlife, cultural resources, public, and employees.

1.14 Issues and Opportunities

As part of the CCP/EIS process, we developed a list of issues and opportunities based on input from public meetings, stakeholder feedback, refuge staff, and planning team meetings. Along with the goals stated above, these issues and opportunities are critical in framing the objectives and strategies for the various alternatives described in chapter 2. While the list of issues and opportunities below is a comprehensive list of those raised during the process to date, it should be recognized that it does not represent every issue which faces the refuge. Furthermore, although all of these issues are recognized here equally, the public commented on beach access, beach parking, and Chincoteague pony management the most during the public review of the alternatives. The issues and opportunities below are not listed in any priority order, but rather are organized by goal area, with those in the first four goal areas again corresponding to and drawing from the draft HMP, and those in the last three goals drawing from various other plans and initiatives. These issues and opportunities are not all relevant to Wallops Island NWR.

1.14.1 Coastal Habitat

Coastal habitats include beach/dune habitat within Chincoteague NWR for nesting, migrating, and wintering shorebirds, as well as turtles and seabeach amaranth. Salt marsh and other habitats within the entire refuge also serve a variety of functions.

Beach/Dune Habitat for Coastal Nesting Birds

Currently, our management goal for the piping plover, as outlined in the Biological Opinion (2008), is a fledge rate goal of 1.2 chicks per pair. The fledge rate needed to keep the population stable is 0.83. The least tern is another high priority BCR 30 species and Tier II species in the Virginia Wildlife Action Plan. American oystercatcher, Wilson's plover, gull-billed tern, and black skimmer are other species of concern with high rankings that nest on refuge beaches that would benefit from management actions for piping plover and least tern.

Beach/Dune Habitat for Migrating and Wintering Shorebirds and Migrating Monarch Butterflies

In 1990, the Virginia and Maryland barrier islands were designated as a Western Hemisphere Shorebird Network Site due to the number of shorebirds using the area during migration, with tens of thousands of shorebirds stopping at Assateague Island between the months of April and September. Since Chincoteague NWR is a high public use refuge, we must continually manage activities with consideration of migrating shorebirds. Shorebirds are susceptible to human disturbances during their breeding season, and management policies that limit this disturbance are of a high priority for the refuge. Assateague Island is a critical stopover point for southbound migrating monarchs that use the refuge's resources to rest, refuel, and roost for the night. Nectar source plants are located in various refuge habitats including Beach Road adjacent to Toms Cove, the Overwash, and tip of the Hook, blooming in succession during the migration period.

Beach/Dune Habitat for Turtles

The loggerhead sea turtle is a Federal and State-listed threatened species with habitat found on the refuge; the northern diamondback terrapin (Virginia Wildlife Action Plan Tier II species) also nests in the sandy beach habitats. There are three main threats to nesting loggerheads on Assateague Island. They are: (1) weather and tides, (2) predation, and (3) human activities. According to refuge files, weather is most likely to cause nest loss or mortality. Currently, no turtle nests have been knowingly lost to predators. Management actions, such as mammalian and avian predator removal and placing protective screening over nests, may have prevented predation.

Federally Endangered Plants and Rare Plant Communities

Seabeach amaranth is native to Atlantic coast barrier island beaches from Massachusetts to South Carolina (USFWS 2008b). Although seabeach amaranth generally grows in sparse to very sparse distribution, the existing population on the refuge is greatly dissipated. Beach stabilization efforts and intensive recreational use, as well as natural species predation, have plagued the species on the refuge. We must evaluate management steps, such as the transplanting and reseeding that was successful in Maryland, in order to implement the most effective recovery method on the refuge. The number of rare species documented in Lucky Boy Fen in Wallops Island NWR is high in proportion to its size. It contains two plant species (brown-fruited rush and few-flowered beakrush) considered "critically imperiled" and four plant species (southern bladderwort, ten-angle pipewort, white beakrush, and white-topped fleabane) considered "imperiled" in the State by the Virginia Department of Conservation and Recreation's Natural Heritage Division. For some of these plant species, Virginia represents the southernmost extent of their range and this is the only habitat that supports these species in the State. Groundwater pollution, encroachment of invasive species and sea level rise are among the greatest threats to Lucky Boy Fen on the refuge.

Salt Marsh Habitats for Nesting, Migrating, and Wintering Birds

Known threats to salt marsh abiding species (like American black duck), besides sea level rise, include the following: (1) grazing by herbivores (i.e. Chincoteague ponies), which alters vegetation structure and species composition resulting in habitat loss for marsh-dependent focal species; (2) direct forage competition, which reduces food resources for wildlife; and (3) mammalian trampling during the nesting season, which can disturb or destroy nests.

1.14.2 Managed Wetlands (Impoundments)

Managed wetlands include impoundments and artificial nesting structures that we maintain on Assateague Island. They provide habitat for migrating, wintering, and breeding wildlife.

Impoundments for Waterfowl, Shorebirds, Waders and Associated Species

Impoundments supply numerous habitat benefits, including wintering/migratory habitat for waterfowl; fresh/brackish vegetation roots and seed as food for wintering waterfowl; food sources for waterbirds of conservation concern such as snowy egret, glossy ibis, Forster's and gull-billed terns; and shorebird migratory stopover habitat for many species of conservation concern including short-billed dowitcher, dunlin, and semipalmated sandpiper. Furthermore, the impoundments concentrate large flocks of birds, providing wildlife viewing, and opportunities for photography, education, and interpretation. In order to provide adequate food, in the form of vegetation (seed or roots) and/or aquatic invertebrates, fresh water, and loafing areas requires the precise management of water levels. All refuge impoundment management strategies depend entirely on precipitation as their sole source of freshwater for the generation of fresh/brackish water plants, and gravity or evaporation for drawdown. Both mechanisms limit management capabilities. Tidal cycles and strong coastal storm events, especially nor'easters and hurricanes, further challenge the attainment of management goals for impoundments. As sea level continues to rise and more frequent overwash events occur, we expect damage to dikes and other impoundment infrastructure. Maintaining water depths at desirable levels may also become more difficult.

1.14.3 Upland Habitats

Upland habitat includes shrub and forested uplands throughout the refuge, with specific conditions for maritime forest on Assateague Island and upland habitat on Wallops Island NWR.

Coastal Shrub Habitat for Breeding and Migrating Landbirds

Bird species that depend on shrubs and other early-successional habitats are declining in the Eastern U.S. due to loss of habitat. Shrubs provide abundance of insect food and berries for birds during the fall migration and/or throughout the winter. The refuge's wax myrtle/bayberry/groundsel shrub community provides migrating birds with an important stopover habitat that supplies the various species with food, water, and protection.

Loblolly Pine Forest for Delmarva Peninsula Fox Squirrel, Brown-headed Nuthatch and Eastern Towhee

Forest habitat on Assateague Island consists largely of monotypic stands of even-aged, mature loblolly pine trees, aged 65 years or older; some are older than 100 years (Merten, pers. comm., 2010). Without management, such as prescribed burning or selective cutting, these mature age classes are vulnerable to catastrophic loss from insect damage or extreme weather/wind events. The southern pine beetle, a native species, is the only major known insect threat to this forest.

Upland Habitats on Wallops Island NWR

Since its establishment in 1971, Wallops Island NWR has been unstaffed with little monitoring and management. We have made some manipulations to the land, with the goal of creating early successional habitat favored by bobwhite and other species that prefer edge and early succession habitats, in the old-field habitat. However, these changes have been poorly documented. Likewise, some mechanical and chemical treatment of invasive plants such as non-native autumn olive,

Phragmites, Nepalese browntop, Japanese siltgrass, Japanese honeysuckle, and several thistles also may have taken place (CNWR 2004).

1.14.4 Southern Barrier Islands Unit (Assawoman, Metompkin, Cedar)

The Southern Barrier Islands Unit consists of Assawoman, Metompkin, and Cedar Islands and share similar mixes of habitats and management conditions.

Beach/Dune Habitat for Breeding Shorebirds and Turtles

The mid-Atlantic barrier islands provide preferred nesting habitat for terns, skimmers, gulls, American oystercatchers, willets, herons, egrets, other waterbirds, shorebirds, and turtles. During the shorebird breeding season, (March 15 to August 31), the southern islands are managed in partnership with the Commonwealth of Virginia and TNC to reduce disturbance, thereby increasing productivity. Despite this and other protective measures, many wildlife species are in decline throughout the flyway, including common terns, least terns, gull-billed terns, black skimmers, American black duck, and several herons. The decline of these species is thought to be linked to severe weather events, sea level rise, competition and displacement from nesting habitat by aggressive avian species, mammalian and avian predators, and unmanaged human disturbance.

Beach/Dune and Tidal Marsh Habitat for Migrating/Wintering Shorebirds/Threatened Plants

The ecological significance of Assawoman, Metompkin, and Cedar Islands is recognized through their inclusion in the WHSRN as a site of international importance, and by their designation as part of a Biosphere Reserve. The refuge does not currently conduct or organize systematic winter/migratory shorebird surveys on the southern islands like those conducted by volunteers on Assateague Island.

Virginia's string of barrier islands, which extend from Assateague Island south to Fisherman Island at the mouth of the Chesapeake Bay, is the largest collection of near pristine barrier islands left in the country (USFWS 1988). Aside from small private in-holdings, all of Virginia's barrier islands are protected by either Federal or State agencies, or TNC. Although preferred habitat for seabeach amaranth is found on refuge barrier islands, it is only currently found on Assateague Island. Potential habitat on Cedar and Metompkin Islands has not been surveyed.

1.14.5 Partnerships

A crucial component of our refuge management strategy is considering both the impacts of refuge actions on the region and our relevant partners, as well as the opportunities for collaboration with partners at the regional level for the purposes of conservation, economic development, and safety.

Regional Conservation

The refuge is located in the southern Delmarva Peninsula, an area of recognized global ecological significance for its remarkable estuarine, coastal, and marine habitats and substantial populations of migratory and breeding shorebirds, colonial waterbirds, landbirds, and raptors. The coastal lagoons and barrier islands represent what is arguably the most significant remaining undeveloped, natural land on the Atlantic coast. In partnership with Federal, State, local, and non-profit organizations, we have long recognized the area's conservation importance, and together we have protected over a quarter of the land on the southern Delmarva Peninsula.

Several real and growing challenges threaten the area's rich and diverse natural heritage and the many benefits humans derive from the region's intact habitats and natural systems. These include

vulnerability of natural systems to global climate change, especially sea level rise, and incompatible land uses and land management activities such as plasticulture, commercial pine plantations, conversion of natural habitats to residential development, shoreline armoring, and increased pumping of groundwater for agricultural irrigation, commercial, and residential uses.

We are currently involved in a number of conservation partnerships including, but not limited to, the Pocomoke River Conservation Partnership and the Southern Tip Ecological Partnership, and are working with a number of conservation entities, such as TNC, the Virginia Eastern Shore Land Trust, the Assateague Coastal Trust, and the Conservation Fund. We are committed to working with partners to address the regional issues identified above through examining opportunities to improve connectivity between protected lands, protecting and restoring the ecological integrity, functionality and value of diverse habitats, buffering harmful effects of coastal flooding and storm surges to local communities and infrastructure, and providing lands for multiple recreational activities to support the tourism economy while also providing ecological, educational, and other benefits.

Although the CCP does not propose additional land protection for Chincoteague NWR, we remain committed to work with communities, other governmental agencies, and non-governmental partners to evaluate predicted land use and climate-related changes on the lower Delmarva Peninsula with the intent of maintaining robust fish and wildlife populations within working landscapes for the economic and other societal benefits they provide.

Economic Development

Access to the refuge is through the town of Chincoteague, the economy of which has become increasingly dependent on the tourism dollars brought into the community by refuge visitors. The Town of Chincoteague's Comprehensive Plan clearly states that proximity to the refuge continues to be its largest economic development opportunity, although the NASA facility and adjacent business activity is also considered important and growing, and finfish and shellfish harvest also contributes to local economic activity.

Based on 2010 data, lodging and food businesses comprise about two-thirds of the tourist-related business in Chincoteague (USFWS 2012a). Tourism not only generates revenue for these sectors, but also generates revenue for the town in the form of food and lodging excise taxes. Spending associated with recreational use of the refuge can generate a substantial amount of economic activity in both local and regional economies. The Accomack County Comprehensive Plan (2008), relying on data from the Accomack County and Northampton County Commissioners of Revenue and the Chincoteague Chamber of Commerce, reports that in 2000 about 83 percent of Accomack County's tourist-related tax revenue was generated by the activities and amenities that the town of Chincoteague and the refuge provide to visitors.

Horseshoe crabs live in and around shallow ocean waters of the refuge. They come onto shore in the springtime at the new and full moon tides to mate and lay eggs. Horseshoe crab eggs serve as a significant source of food for migrating birds. Conservation of migratory birds is the primary purpose of the refuge. During a 2011 coordination meeting with NPS, it came to light that commercial harvest of horseshoe crabs is occurring within Toms Cove on lands administered as part of the refuge and in waters administered as part of Assateague Island National Seashore. USFWS policy and law require that a Special Use Permit (SUP) be issued for any commercial activity that takes place on Refuge System lands and waters. Refuge jurisdiction extends to mean low water (MLW). No SUP has been issued for the commercial harvest of horseshoe crabs; it is,

therefore, an unauthorized activity. In order for any commercial use to be permitted on Refuge System lands or waters, it must be shown to contribute to the purposes of the refuge. We address this commercial use as part of this CCP by finding the commercial harvesting of horseshoe crabs does not contribute to the refuge's migratory bird purpose, does not contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, and is not beneficial to refuge resources; consequently, the use cannot be permitted.

For this CCP/EIS, a regional economic assessment has been completed. This assessment provides a means of estimating how current management and the proposed activities could affect the local economy. This type of analysis provides two critical pieces of information. First, it illustrates a refuge's contribution to the local community. Second, it can help in determining whether local economic effects are, or are not, a real concern in choosing among management alternatives. The public has expressed concern about impacts on visitation levels, with subsequent impacts to the tourism industry and related jobs. Additionally, there are concerns about property values, the capital/infrastructure improvements, maintenance, and operating costs of the different alternatives.

Hazard Mitigation

The town of Chincoteague, adjacent coastal communities, and NASA are concerned about future impacts of sea level rise and storm surge on infrastructure and access. We share this concern and will work in coordination with those entities and others to explore potential impacts and identify protective methods to address hazard mitigation. We will also work with our partners to explore how best to advance the study, information exchange, and project resources for adaptive management practices that sustain the resiliency of this unique barrier island system including, but not limited to, Assateague, Wallops, Assawoman, and Metompkin Islands in the face of dynamic coastal processes and climate change. For this CCP, "resiliency" is defined as in Executive Order 13653, as "*the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.*" This is also consistent with the description used in the Hurricane Sandy Coastal Resiliency Competitive Grant Program, that "*supports projects that reduce communities' vulnerability to the growing risks from coastal storms, sea level rise, flooding, erosion and associated threats through strengthening natural ecosystems that also benefit fish and wildlife.*"

Interagency Federal Facility Management

The refuge is adjacent to several other Federal entities. NASA operates the Goddard Space Flight Center's Wallops Flight Facility, a center for aeronautic research. The Virginia Commercial Space Flight Authority leases space for the Mid-Atlantic Regional Spaceport, which is expected to see an increase in commercial space flight activity. In addition, the United States Navy's Surface Combat Systems Center is co-located with NASA and the National Oceanic and Atmospheric Administration Command and Data Acquisition Station has leased land for its adjacent facility from NASA since 1965 (Town of Chincoteague 2006). NASA has a visitor center that is adjacent to the Wallops Island NWR. NPS and USDA both have a use agreement with USFWS for shared facilities, mainly for storage, on Wallops Island NWR. Finally, as mentioned previously, Assateague Island National Seashore maintains staff and services within Chincoteague NWR.

We have coordinated with these Federal partners on many issues and are interested in identifying potential opportunities for future collaboration on wildlife management, scientific research, public education, and shared facilities.

Local Conservation of Tidal Creeks, Estuaries, Mudflats, and Nearshore Marine Waters

Most species found on the refuge depend on off-refuge habitats to fulfill one or more of their life cycle needs. Pollutants, human disturbance, or other activities off-refuge can influence the success of management activities that the refuge undertakes. For example, off-shore oil drilling and development of wind turbines on- or off-coast are potential activities that could impact migratory birds and bats.

1.14.6 Visitor Services

As mentioned previously, Chincoteague NWR provides a range of recreational opportunities, including the six priority wildlife-dependent activities, while Wallops Island NWR is limited to public access for hunting only. The six priority uses predetermined by the Improvement Act as appropriate are still subject to a positive finding of compatibility with refuge purposes. Other uses must be determined to be both appropriate and compatible. Figure 1-4 identifies the primary public use areas on Assateague Island.

Concerns were expressed by the community that the USFWS would eliminate personal motor vehicle access to the refuge and beach parking. The USFWS has no goal or objective to do so. All public uses are dependent on access to the refuge. Personal motor vehicle access to Assateague Island, including parking at or near the beach, is very important to visitors and local residents. However, the USFWS does have concerns that climate change, with corresponding sea level rise and storms, will have a significant impact on the sustainability of the road and parking areas that serve the recreational beach. The location and maintenance of the beach parking and the role of transit (whether to provide another option for visitors or to supplement available beach parking if reduced) need to be carefully considered and evaluated. Many visitors and residents also enjoy bicycling and walking to and within the refuge. Accessibility for all users, including those with mobility impairment, is also important.

Hunting

Hunting is a priority public use of the Refuge System and remains a popular form of wildlife-dependent recreation on the refuge and a vital part of the cultural, social, and economic fabric of the communities near the refuge. Chincoteague NWR provides big game hunting (sika and white-tailed deer) and migratory game bird hunting. On Wallops Island NWR, we only allow hunting of white-tailed deer.

Fishing

Surf fishing, crabbing, clamming, and oyster harvest are among the most popular wildlife-dependent recreational activities conducted on the refuge. The surf fishing areas south of the current parking lots are accessible via over-sand vehicle (OSV) use, which is administered jointly by NPS and the refuge, and is limited to certain times and areas to provide maximum protection to prime nesting habitat for coastal nesting birds. Fishing is allowed on Assawoman Island but requires a refuge permit to land a boat to fish the area. However, parts of the island may be closed based on nesting behavior.

Figure 1-4. Primary Public Uses of Chincoteague NWR on Assateague Island

Environmental Education and Interpretation

Refuge staff work with local schools, communities, and educational organizations to provide classroom and hands-on programs, both on and off the refuge, for youth. Activities are conducted throughout the region but on the refuge are concentrated on several trails, as well as the Herbert H. Bateman Educational and Administrative Center. NPS offers its own set of programs. The refuge currently provides interpretive opportunities through self-guided interpretation but also through some guided programs.

We are facing a few major challenges, including how to meet the demand for these staff-intensive services, how to expand outreach off of the refuge, and how to provide virtual access to the resources of the refuge through broadband and fiber optic improvements.

Wildlife Observation and Photography

In general, wildlife observation and photography are becoming increasingly popular activities for visitors, and a source of economic growth for many communities where NWRs exist. Chincoteague NWR provides outstanding wildlife viewing opportunities throughout the year along trails, roads, and on the natural beach itself. These sites provide wildlife viewing and opportunities for amateur and professional photographers alike. The public and community desire continued access and additional opportunities for these uses; however, managers must balance opportunities with the need to limit disturbance.

Recreational Beach Use

The beaches of Assateague Island offer a unique experience in the mid-Atlantic area. These beaches exist primarily in an undeveloped setting unlike other beaches (such as Virginia Beach, Virginia, or Ocean City, Maryland) that are heavily developed with motels/hotels, boardwalks, eating establishments, and amusement parks. The natural setting draws many families seeking out a more traditional beach-going experience. Beach activities include sunbathing, swimming, shell collection, and campfires (on NPS lands), among other activities. If one wishes, it is possible to obtain an almost wilderness-like beach experience by hiking to areas where few visitors venture.

At the southern end of Assateague Island within the Chincoteague NWR, the NPS manages an "assigned area" currently consisting of the 1-mile recreational beach and corresponding adjacent 961 parking spaces, provided via a crushed shell surface. The NPS also maintains a visitor contact station, restrooms, and pedestrian trails, as well as seasonal bathhouses, showers, and lifeguard-protected swimming beach. The current recreational beach and facilities on Assateague Island are located in one of the most dynamic areas of the island, which places them under constant threat of damage from flooding and erosion. Over the years, storms and accompanying extreme high tides have repeatedly washed out parts or all of the recreational beach parking lots. NPS has rebuilt and relocated the beach parking lots further to the west as they have been washed out. The 1993 Master Plan addressed these conditions by identifying a long-term strategy to pursue alternative means of transportation such as a shuttle system and off-site parking as necessary to maintain beach use in the future. Section 1.14.7 further addresses climate change impacts to facilities.

In this CCP, we define the "recreational beach" as the zone operated on the refuge by NPS that includes seasonal lifeguards, facilities and infrastructure described above. It is currently 1 mile in length, based on carrying capacity levels evaluated in development with the 1993 Master Plan. While wildlife-dependent recreation may occur on refuge beaches, the recreational beach is

defined here to be separate from other beaches on refuge lands, including Wild Beach (which stretches north 11 miles from the vicinity of D-Dike to the Virginia-Maryland boundary), and the beach at Toms Cove Hook (south of the recreational beach, and extends from the Overwash to Fishing Point).

A brief history of how the jurisdiction associated with the recreational beach at Toms Cove has evolved is included here to provide some clarity into our considerations for current and future planning. In a 1959 agreement, the Bureau of Sport Fisheries and Wildlife (now known as USFWS) assigned to the Chincoteague-Assateague Bridge and Beach Authority (Authority) the south 4 miles of the island for 40 years, renewable for two 15-year periods. The language from Public Law (P.L.) 85-57 states: "*In order to permit the controlled development of a portion of the seashore of the Chincoteague National Wildlife Refuge, Virginia, for recreational purposes, the Secretary of the Interior is authorized to grant to the appropriate agency or agencies of the State of Virginia such easements and rights as may be necessary for the construction and maintenance of a bridge across Assateague Channel and terminating on the Chincoteague National Wildlife Refuge, and also for the construction and maintenance of an access road from the terminus of such bridge to a public beach and recreation area to be developed along the southeastern shore of Assateague Island as designated by the Secretary.*"

In 1966, under P.L. 89-195, the Secretary of the Interior was authorized to acquire all of the right, title, or interest of the Authority. On October 17, 1966, in accordance with the legislation, the NPS acquired all the Authority's interests for some $600,000, the estimated amount of its obligations. By interim agreement dated October 21, 1966, between the Regional Directors of the USFWS and NPS, the NPS assumed the assigned responsibilities of the Authority, pending development and approval of a comprehensive master plan and completion of a subsequent Memorandum of Agreement between the two agencies. P.L. 89-195, Sec. 9(a) states: "*The Secretary of the Interior is authorized and directed to construct and maintain a road from the Chincoteague-Assateague Island Bridge to the area in the wildlife refuge that he deems appropriate for recreation purposes.*" P.L. 89-195 also states: "*Notwithstanding any other provision of this Act, land and waters in the Chincoteague National Wildlife Refuge, which are a part of the seashore, shall be administered for refuge purposes under laws and regulations applicable to national wildlife refuges, including administration for public recreation uses in accordance with provisions of the Act of September 28, 1962 (Public Law 87-714; 76 Stat. 653).*" The Department of the Interior's Regional Solicitor ruled that "When the NPS acquired the interests and rights of the Chincoteague-Assateague Bridge and Beach Authority, the easement merged with the United States' fee simple interest in the property" (Conte memo 2006).

The Refuge System Administration Act was amended by Congress in 1976 (P.L. 94-223) and recognized the authority of the USFWS to control all lands within the boundaries of national wildlife refuges. Thus, USFWS could cooperate with other Federal agencies to carry out the responsibilities on refuges, and the NPS may administer programs for public recreation and use in the Toms Cove Hook area as long as these programs have the approval of the USFWS. Since 1979, the Toms Cove Hook area has been operated by the two agencies under a Memorandum of Understanding (MOU). The original MOU identified the "assigned area" for the first time.

Our cooperative relationship with NPS for management of the recreational beach, defined in a series of MOUs, has evolved over time. The agreements reflect changes in management goals, as well as legislative changes to agency authority and administrative requirements. For example, in 1986 the Atlantic coast population of piping plover was listed as a threatened species, and the 1988

"Environmental Assessment for the Management of Piping Plovers on Toms Cove Hook" established the closure of 2.5 miles of Toms Cove Hook during the piping plover nesting season. Thus, the agreement is necessary for the two agencies to comply with the various public laws.

Public Law 87-714, also known as the Refuge Recreation Act, authorizes the USFWS to administer areas within the Refuge System for public recreation, regardless of whether the recreation is wildlife-dependent. A recreational use that is not wildlife-dependent is an incidental or secondary use. The Refuge Recreation Act permits public recreation within a national wildlife refuge "*only to the extent that is practicable and not inconsistent with other previously authorized Federal operations or with the primary objectives for which each particular area is established.*" This compatibility standard was reinforced by the National Wildlife Administration Act of 1966 and the Refuge System Improvement Act of 1997.

These laws create a situation of competing interests. Language from P.L. 85-57 makes it clear that Congress intended for a recreational beach to be constructed and maintained on the refuge. It is also apparent that Congress believed or anticipated that "traditional" beach recreation (i.e., swimming, sunbathing, volleyball, etc.) could be compatible with refuge purposes, which today would be a difficult, if not impossible, standard to achieve. It may have been possible to meet these dueling mandates in the 1960s, before the ESA was passed, when beach users were fewer in number, and when more wildlife habitat existed in the area than today. It was also a time before the town of Chincoteague's economy became so dependent on tourism from beach goers.

The USFWS Compatibility Policy contains exceptions for when the compatibility standard will not be applied to a refuge use. The policy reads:

"*Exceptions may apply when there are rights or interests imparted by a treaty or other legally binding agreement, where primary jurisdiction of refuge lands falls to an agency other than us, or where legal mandates supersede those requiring compatibility. Where reserved rights or legal mandates provide that we must allow certain activities, we should not prepare a compatibility determination. In the case of reserved rights, the refuge manager should work with the owner of the property interest to develop stipulations in a special use permit or other agreement to alleviate or minimize adverse impacts to the refuge.*"

The policy also states: "*Compatibility provisions of the Refuge Administration Act do not apply to activities authorized, funded, or conducted by another Federal agency that has primary jurisdiction over the area where a refuge or a portion of a refuge has been established, if those activities are conducted in accordance with a memorandum of understanding between the Secretary or the Director and the head of the Federal agency with primary jurisdiction over the area.*"

In order to comply with what we believe was the intent of Congress in passing P.L. 85-57, the USFWS has conveyed primary jurisdiction for beach use and recreation within the "assigned area" to the NPS. We have worked with them to minimize adverse impacts to the refuge, and developed a MOU to document operating procedures and respective responsibilities. Therefore, we will not prepare a CD for those activities administered by the NPS within the "assigned area."

As stated earlier, the location and length of the recreational beach was further established by a public process undertaken as a part of the 1993 Master Plan. That plan determined that based on carrying capacity, a 1-mile beach along the Toms Cove beachfront was the appropriate length and

location for the recreational beach. That evaluation considered factors of safety, beach density sanitation codes, visitor expectations, vicinity of parking, and physical and biological characteristics of the natural resources.

Other Recreational Uses

Other uses on Chincoteague NWR include walking, bicycling, horseback riding, boating, and commercial uses. Non-wildlife dependent recreation beach uses such as swimming, sunbathing, kite flying, campfires, and beachcombing are confined to the 1-mile assigned area of the NPS. All of these uses are limited to specific areas of land and/or times based on wildlife management objectives and might include permits and fees associated with use. There are no campsites on Chincoteague NWR. Visitors are not allowed to feed wildlife and are not allowed to bring alcohol or pets onto the refuge, including in vehicles. Other restricted activities include use of skateboards, roller or in-line skates, and segways, and the collection of plants, animals, or artifacts. However, we allow the collection of 1 gallon per person per day of unoccupied seashells. Motorized vehicles are not allowed on trails and mopeds are not allowed on Wildlife Loop.

1.14.7 Refuge Administration

Refuge administration covers communication, staffing, and management of specific areas, such as wilderness and cultural and historic resources.

Outreach, Communication, and Emergency Communication

USFWS considers communication systems important for stakeholder consultation, public outreach, and emergency management. We have identified, received funding for, and implemented a variety of communication improvements over the past 5 years, including a variable message sign, partnership with the local radio station, reactivation of the 1610 AM radio station, and traffic counters for beach parking. In addition to these improvements focused on traveler information, traffic, and emergency response, we have identified the potential for further improvements, especially in terms of broadband and fiber optic capacity, which will allow for improved use of the refuge Web site and social media to provide environmental education and to better engage the public, in particular those unable to visit or who live far away.

Staffing & Volunteer Program/Friends Group

Chincoteague NWR has staff in the areas of visitor services, law enforcement, biology, administration, fee collection, management, and maintenance. In addition to refuge staff, NPS provides 6 permanent and 15 seasonal employees to provide lifeguard, law enforcement, maintenance, and interpretive services at Toms Cove and the recreational beach. Since its creation in 1971, Wallops Island NWR has been unstaffed, with limited monitoring or management, except in the past by Delmarva Power and now A&N Electric Cooperative, a utility company with a power line right-of-way that removes tall growing trees, primarily the non-native autumn olive, and some brush species.

Staff is supplemented by year-round volunteers, as well as local and national youth and adult groups such as Road Scholar, Youth Conservation Corps (YCC), and the Student Conservation Association (SCA). These individuals and groups provide assistance with wildlife and habitat management programs, wildlife and habitat surveys, invasive species removal, trash pick-up, interpretive education, and other projects. Chincoteague NWR also receives significant support from its non-profit friends group, the Chincoteague Natural History Association (CNHA), which produces and provides interpretive and educational material for refuge visitors and for local

teachers. Additionally, CNHA provides funds for student interns, operates a bus tour, operates two retail stores, provides lighthouse keepers that welcome and guide visitors at the Assateague Lighthouse, and provides a conduit for matching grants for workshops and programs.

Wilderness

In 1974, the USFWS recommended that 1,740 acres on Assateague Island be established as part of the NWPS, as defined by the Wilderness Act of 1964. Of this, 1,300 acres are located in Chincoteague NWR (882 acres in Virginia and 418 acres in Maryland) and 440 acres are within the boundaries of Assateague Island National Seashore in Maryland. A Wilderness Area proposal was submitted to Congress on January 13, 1977, recommending 4,760 acres, mostly located in Maryland, as potential wilderness and to become part of the wilderness when nonconforming uses and structures were eliminated. No action has been taken in regard to this recommendation, and there exists no "congressionally designated wilderness lands" within Chincoteague NWR and Wallops Island NWR (USDOI 1974).

Cultural and Historic Resources

Assateague Island has several cultural and historic resources. Several cemeteries and the ruins of the former Assateague Village from when the island was inhabited remain. The current Assateague Lighthouse was completed in 1867, and the U.S. Coast Guard (the Coast Guard) considered it to be an aid to navigation. In 2004, the Coast Guard transferred ownership of the Assateague Island Lighthouse to the USFWS. The Coast Guard still operates the light, while the USFWS and CNHA share the maintenance of the historic structure. Tours of the lighthouse are provided by CNHA. In August 2008, the lighthouse began a restoration effort, which was completed in 2013.

In addition, following storms, remains of sailing vessels and their cargos are often uncovered and visible on the beach for short periods of time. We manage these resources by balancing preservation and protection with interpretation and public access.

Concerns were expressed by the community that the USFWS would reduce or eliminate the number of Chincoteague ponies grazing on the refuge. The USFWS has no goal or objective that would eliminate ponies from Assateague Island. Many people consider the ponies to be a historic resource, and they are a main source of enjoyment for visitors throughout the year. The Annual Pony Swim and Auction each July attracts an estimated 40,000 visitors and provides funding for the Chincoteague Volunteer Fire Company. The USFWS does have a concern that climate change, with corresponding sea level rise, and pony grazing will significantly impact the salt marsh. In both northern and southern grazing units the salt hay/grasses that come from these marshes are the basic forage upon which the ponies feed both summer and winter and are critical for the life cycle of many native species of animals. Over the life of this CCP, the refuge will work with the Chincoteague Volunteer Fire Company to ensure the health and well-being of Chincoteague ponies and refuge habitats.

Climate Change and Sea Level Rise

The increasing trend in sea level rise currently affecting the Delmarva Peninsula and surrounding areas is primarily driven by water influx from melting polar and glacial ice sheets. The synergistic actions of thermal expansion of the ocean waters (driven by increases in average global temperature), coastal subsidence, and coastal erosion are also greatly influencing the rate and intensity of sea level rise effects upon the refuge.

The rise in relative sea level for the Delmarva Peninsula will have a significant negative impact on the barrier island system where the refuge is located. Such changes from sea level will result in the submergence of the lowest tidal wetlands, erosion of coastal beaches, increased flooding of lowlands, and the alterations in salinity regimes in coastal waters. Low salt marshes could be converted to tidal flats, and existing tidal flats could become permanently inundated shallow water habitats. In places of more pronounced erosion, marshes could change directly to shallow waters. Currently, salt water is penetrating further and further inland, which is changing the local ecology. While this process has occurred in the past, the pace at which these changes are happening has accelerated and their magnitude has increased in recent times.

Climate change may also increase storm frequency and intensity which will further transform shorelines and coastal resources (Intergovernmental Panel on Climate Change (IPCC) 2013). The shoreline of Assateague Island, already impacted by erosion from the current sea level rise rate, is even more vulnerable with projected increases of 2 millimeters (mm) per year (Figure 1-5). If the rate increases by a little as 2mm/year, the island may break up into smaller sections (segmentation). This same rate will likely pose increased risk to back barrier marshes (Figure 1-6). The impacts of a 7mm/year rise would be a concern to coastal communities. (See Appendices E and F for more information about scenario selection). We recognize that various models are being used to predict sea level rise and that no widely acceptable method is currently available for predicting probabilistic projections of sea level rise at actionable (regional and local) scales.

However, by considering consensus projections used by the climate change community at large, provisions for preserving public access and land-use planning in the context of sea level concerns can be considered. These models are based on the best science currently available with the understanding that as new data is generated it will be included in our planning.

With current climate change and sea level rise rates, the continued management of the refuge lands will become increasingly difficult based on the projected 1 meter rise in sea level by 2100 adopted by the Commonwealth of Virginia. Based on this prediction, the refuge has several facilities and resources that may be vulnerable to sea level rise and storm surge, including the recreational beach parking as described in section 1.14.6.

Figure 1-5. Map showing that Assateague Island may already be near its threshold condition and that just a 2mm/year rise in the rate of sea level rise will push it over the threshold which may initiate barrier beach migration and segmentation. (Source: Titus et al. 2009)

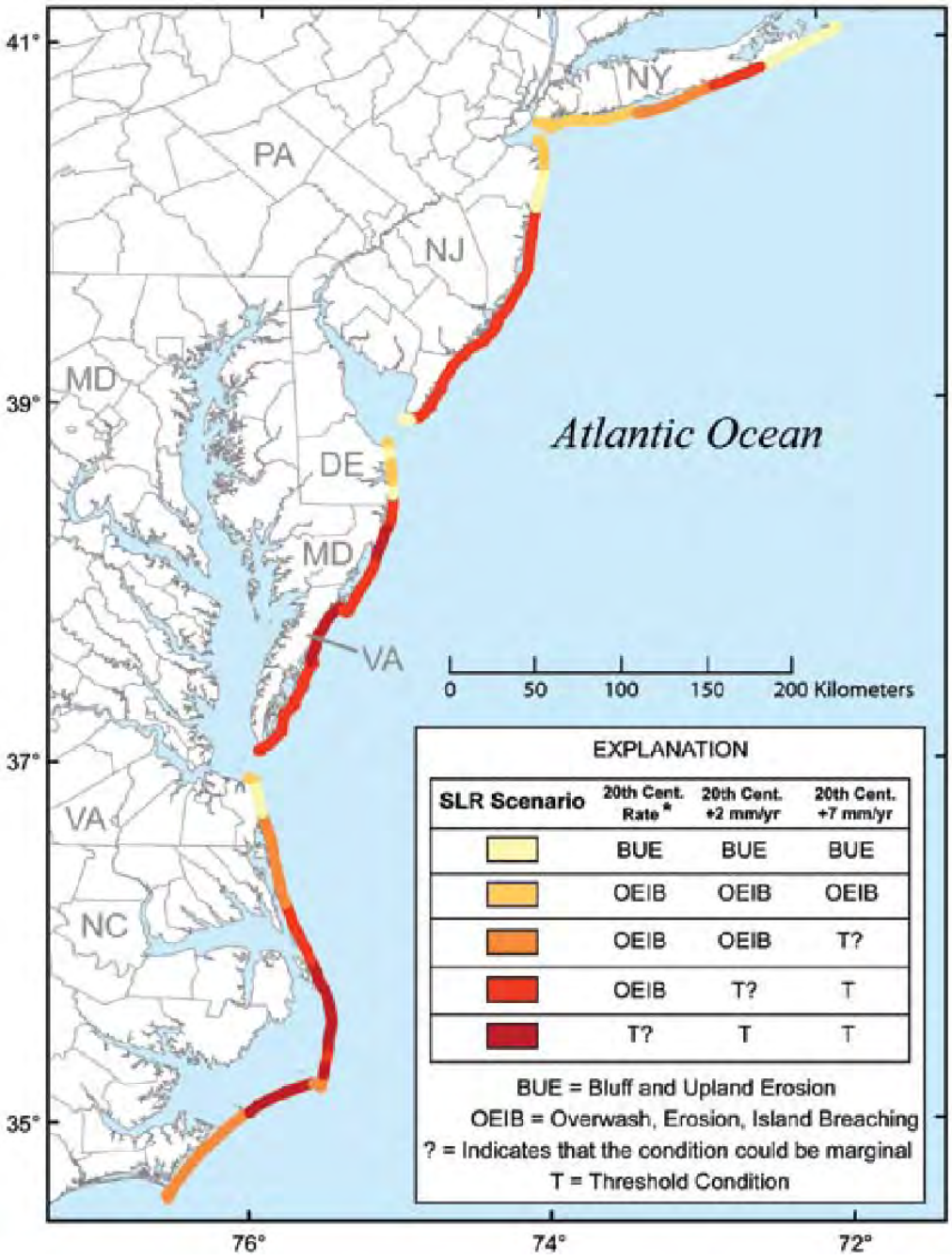
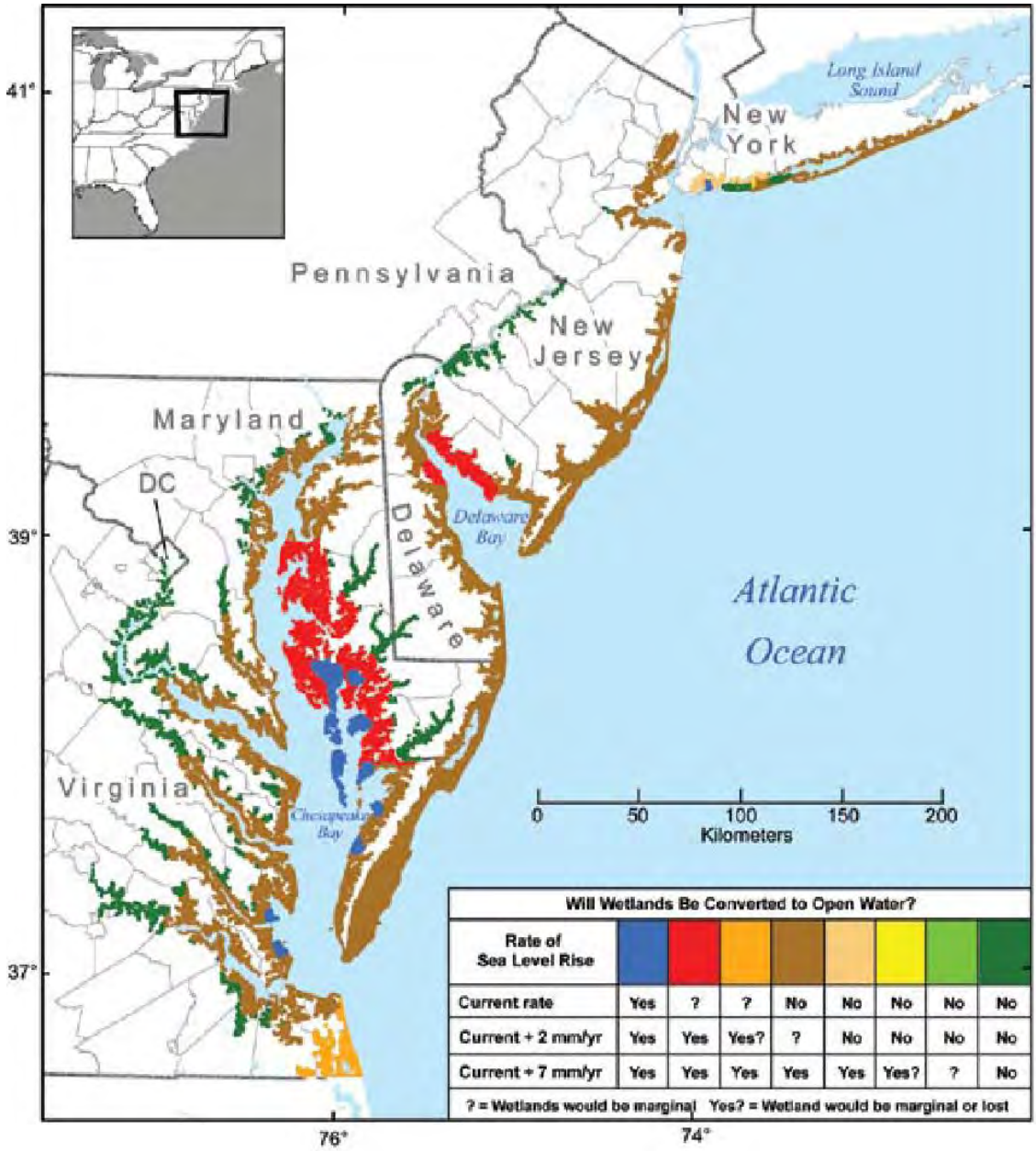


Figure 1-6. Map showing where tidal wetlands may be converted to open water at three rates of sea level rise. A 2mm/year rise in the rate should continue the conversion of low marsh to tidal flat and may even transform these marshes to open water. (Source: Titus et al. 2009)



1.15 Decision to be Made

The USFWS Regional Director will select a preferred alternative based on the USFWS and the Refuge System missions, the purposes for which the refuge was established, other legal mandates, and public and partner responses to this CCP/EIS. The alternative selected could be one of the proposed actions, the no action alternative, or a combination of actions or alternatives presented. The final decision will identify the desired combination of species protection, habitat management, public use and access, and administration for the refuge. A Record of Decision (ROD) will present and explain the decision, and certify that USFWS has met agency compliance requirements and that the CCP, when implemented, would achieve the purposes of the refuge and help fulfill the Refuge System mission. Once the Regional Director has signed the ROD and the CCP is complete, the public will be notified in the *Federal Register*, and implementation would begin.

After its completion, the CCP will be reviewed, evaluated, and subsequently updated approximately every 15 years. However, if and when significant new information becomes available, ecological conditions change, major refuge expansion occurs or the need to do so is identified, the plan can be reviewed sooner. All plan revisions would require NEPA compliance.

Chapter 2

USFWS

Pelican

Alternatives Considered

2.1 Introduction

2.2 Development of Alternatives

2.3 Evaluation of Alternatives

2.4 Alternatives and Components Considered but Eliminated from Detailed Analysis

2.5 Alternatives Carried Forward for Detailed Analysis

Summary of Project Features by Alternative

Chapter 2: Alternatives Considered

2.1 Introduction

In this chapter we present and compare a range of reasonable alternatives for the CCP and its associated EIS, as well as component actions identified by others. We also include information on the process by which we developed and evaluated alternatives, a description of the alternatives or components considered but dropped from further analysis, and the reasons such alternatives or components were dropped. Finally, we describe in detail the alternatives that were retained for detailed analysis in this CCP/EIS, including elements or actions common to all retained alternatives and those that are unique to each retained alternative. At the end of this chapter, we provide a table that enables the reader to compare each retained alternative.

The Council on Environmental Quality (CEQ) regulations that implement NEPA of 1969 (40 CFR Parts 1500-1508) state that the alternatives section is the heart of an EIS. Those regulations and accompanying CEQ guidance, titled *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations* (CEQ 1981) require a Federal decision maker, in this case the USFWS, to:

- Develop and describe a range of alternatives capable of achieving the purpose and need (40 CFR 1505.1), including alternatives not within the jurisdiction of the lead agency (Question 2b of CEQ's Forty Questions) and the No Action Alternative [40 CFR 1502.14(d)]; and

- Rigorously explore and objectively evaluate all reasonable alternatives[1] and provide reasons why we eliminated certain alternatives from detailed study [40 CFR 1502.14 (a)].

2.2 Development of Alternatives

We developed alternatives to achieve the purpose of the CCP and to be reasonable, as required by the NEPA. Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the purposes of the CCP, which are articulated in Section 1.4 of this CCP/EIS and described in subsequent sections of chapter 1. The alternatives were also designed to achieve the vision and goals of refuge, which are articulated in Section 1.13, as required by USFWS planning requirements.

The three alternatives carried forward in this CCP for detailed analysis (Section 2.5) have evolved through the planning process to date, and will likely be revised again after the public comment

1 NEPA requires alternatives to be reasonable and in Question 2a of CEQ's Forty Questions, CEQ defines reasonable as feasible or practical from a technical and economic standpoint and using common sense.

period and before finalization. In summer 2011, after 10 months of initial scoping and public involvement, the USFWS published a newsletter with descriptions of four preliminary draft alternatives. Although there were many common components among them, each of the preliminary draft alternatives had a different focus, which is described below.[2]

- **Preliminary Draft Alternative A** would continue current management strategies, and satisfies the NEPA requirement for a "no action" alternative. Consistent with the 1993 Master Plan, the refuge would allow NPS to maintain parking lots, that currently total 8.5 acres (961 spaces), at the recreational beach. As sea level rise and natural forces reduce the land base capable of supporting current parking, the refuge would pursue alternative parking opportunities and institute a shuttle service to the current recreational beach.
- **Preliminary Draft Alternative B** would mostly continue established habitat and wildlife management strategies, and the refuge would also work with NPS to develop a new recreational beach, beach access, and nearby parking 1.5 miles north of the existing beach. The refuge would allow NPS to maintain 961 parking spaces near the new beach, but would also pursue alternative parking opportunities and institute a shuttle service to supplement the beach parking.
- **Preliminary Draft Alternative C** would allow for natural successional and coastal processes to take place on the refuge with little intervention. Refuge administration of programs would be minimized primarily through reduction of activities, partnerships, and use of volunteer staff. Consistent with the 1993 Master Plan, the refuge would allow NPS to maintain 8.5 acres for parking at the recreational beach, only as long as the land base exists. As sea level rise and natural forces reduce the land base capable of supporting parking, feasible repairs would be made but the number of spaces would be reduced accordingly. While beach users would be able to use all parking available on the refuge, new parking, and a shuttle system would not be pursued by the refuge.[3]
- **Preliminary Draft Alternative D** would direct staffing and funding towards maximizing habitat and wildlife management strategies. Thus, some pubic use activities would be eliminated, such as horseback riding and over-sand vehicle access, and the pony herd would be reduced. The refuge would work with NPS to relocate the recreational beach as in alternative B; however, the capacity of the parking would be less than in alternative B and the refuge would pursue alternative parking opportunities and a shuttle service.

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[2] More detailed descriptions of the preliminary draft alternatives can be found in a newsletter published in August 2011 and found at: http://www.fws.gov/northeast/planning/Chincoteague/PDF/Chincoteague_CCP_Newsletter_August2011_web.pdf.

[3] Preliminary Draft Alternative C was eliminated as a result of this alternatives evaluation process described in this chapter, and Preliminary Draft Alternative D was refined and renamed alternative C. Thus, references to alternative C in this CCP/EIS outside of this section refer to a refined version of the alternative referred to as Preliminary Draft Alternative D in this chapter.

In addition, the newsletter described other components that were raised during the scoping process: elimination of hunting, elimination of the beach parking shuttle from all alternatives, and maintenance of the existing beach and parking through a program of beach nourishment activities and engineering solutions like jetties and groins. These components were considered for inclusion in the draft CCP/EIS, along with the four preliminary draft alternatives, as part of the initial scoping process.

2.3 Evaluation of Alternatives

NEPA requires that alternatives evaluated in an EIS be capable of achieving the purpose and need (40 CFR 1505.1). Table 2-1 provides a summary-level evaluation of how each of the preliminary draft alternatives, and components identified during scoping, contributes to each element of the CCP purpose (as described in detail in chapter 1). Each alternative or component was evaluated as follows: if it would make a positive contribution towards achieving each element of the purpose, would make no contribution (i.e., neutral), or would make a negative contribution (i.e., it would detract from achieving the purpose). The assessment is based on the descriptions of the purposes of this CCP provided in sections 1.5 through 1.9, and the vision and goals described in Section 1.13.

As illustrated in Table 2-1, Preliminary Draft Alternative C, as well as various components (elimination of hunting and the shuttle, and beach nourishment/coastal engineering), would primarily detract from achieving the purpose of the CCP. Section 2.4 discusses in more detail the reasons why one preliminary draft alternative, and different components, were eliminated from further consideration.

Table 2-1. Summary Screening of Preliminary Draft Alternatives - Meeting the Purpose of the CCP

CCP Purpose		CCP/EIS Section	Preliminary Draft Alternatives				Components from Scoping		
			A	B	C*	D*	Eliminate hunting	Beach Nourishment & Coastal Engineering	Elimination of Transit
1	Achieve refuge purposes.	1.4	○	●	○	●	○	○	○
2	Fulfill the Refuge System mission.	1.5	●	●	○	●	○	◐	○
3	Maintain and, where appropriate, restore the ecological integrity of the refuge and Refuge System.	1.6	●	●	◐	●	○	○	N/A
4	Help achieve goals of the National Wilderness Preservation System.	1.7	●	●	●	●	N/A	N/A	N/A
5	Meet other mandates.	1.8	●	●	○	◐	○	○	○
6	Address significant local concerns: climate change and sea level rise; regional conservation; balance between public use and wildlife conservation; public access to the refuge, in particular to the recreational beach; impact to visitor experience; and impact to local economy.**	1.9	○	●	○	○	○	○	○

● = positive contribution toward achieving purpose;
○ = negative contribution (detract from achieving the purpose); and
◐ = no contribution (neutral).

*Preliminary Draft Alternative C was eliminated as a result of the alternatives evaluation process described in this section, and a refined version of Preliminary Draft Alternative D was renamed alternative C. Thus, all other references to alternative C in this CCP/EIS outside of this section refer to a refined version of the alternative originally referred to in this chapter as Preliminary Draft Alternative D.

** Preliminary Draft Alternative D would make a positive contribution to this factor except with regard to the local economy.

As a result of comments received as well as other deliberations among the refuge and the CCP/EIS Planning Team[4], we refined the remaining three preliminary draft alternatives, including but not limited to the following changes:

- We expanded elements common to all to include provision of a recreational beach, access by personal vehicle, and coordination on hazard mitigation, among others;
- We removed a voluntary shuttle from Draft Alternative B; and
- We removed development of a marine sanctuary and restriction of shellfish bed leasing.

These refined alternatives are described in detail in Section 2.5.

2.4 Alternatives and Components Considered but Eliminated from Detailed Analysis

The process of developing alternatives under NEPA and the Improvement Act is designed to allow for consideration of the widest possible range of issues and potential management approaches that achieve the purpose of the CCP. During this process, many different solutions were considered. The following components were considered but not selected for detailed study in this CCP/EIS for the reason(s) described.

2.4.1 Beach Nourishment

Several public comments indicated a desire to maintain the current recreational beach and parking locations through beach nourishment activities and other engineering strategies, such as jetties and groins. As shown in Table 2-1, these components would not contribute to achieving the purpose of the CCP and would in fact, detract from achieving nearly all of the elements of the purpose. It is the position of USFWS that natural shoreline processes (including migration) are beneficial to maintain the biological integrity, diversity, and environmental health of barrier beach islands and salt marsh habitats in the face of rising rates of sea level and climate change. Infrequently, USFWS has utilized site-specific beach nourishment to accomplish other habitat goals, such as at Prime Hook NWR in Delaware to fill breaches as part of a broader marsh restoration project.

A beach nourishment "only" project is unlikely to persist over time. Assateague Island is strongly influenced by a net movement of sand from north to south. As evidenced by the formation of Toms

[4] The CCP/EIS Planning Team met consistently throughout the planning process for this CCP/EIS and included: USFWS, NPS Assateague Island National Seashore, town of Chincoteague, Accomack County, Accomack County Board of Supervisors, Accomack-Northampton Planning District Commission, Virginia Marine Resources Commission, Virginia Division of Game and Inland Fisheries, and NASA. The Volpe National Transportation Systems Center served as facilitator.

Cove Hook over the past 150 years, any sand artificially placed along the ocean beach can be expected to rapidly mobilize and move south away from the placement site. There is also large scale movement of sand on and offshore, reflected by a network of shoals adjacent to the southern end of the island. Because of these processes, beach nourishment would need to be repeated on a regular, recurring basis to be effective in creating a wider and more stable beach, or to prevent the island from breaching during some future storm event.

Beyond the concerns about significantly adverse habitat and aesthetic impacts, it should be noted that beach nourishment is very costly. USACE policy requires that 35 to 50 percent of planning, implementation, and maintenance costs be borne by a state or local government partner (USACE, "Continuing Authorities Program"). The USFWS investigated beach nourishment during the early stages of developing potential alternatives for the CCP, and contacted the USACE to obtain an estimate of the scope and cost of beach nourishment for a project this size. Using research and analysis undertaken for the Wallops Flight Facility (WFF) Shoreline Restoration and Infrastructure Protection Program as a model, the USACE provided an analysis and cost estimate for stabilizing the current recreational beach and parking lots. The resulting analysis estimated that a beach nourishment project of similar scope could require an initial estimated investment of $24 million, with recurring maintenance costs of $8.3 million necessary every 3 to 7 years, for a total cost of nearly $49 million over the 15 year life of the CCP, not including wetland mitigation (USACE 2012; Appendix J). This is more than twice the cost of any of the other alternatives, which range in cost over 15 years from $11.7 to 22.2 million. Adding this component to alternative A or substituting it for the development of a new beach and parking lot proposed in alternative B would result in costs of approximately $54 million dollars, which is 240 percent more than alternative B, the most costly alternative. NEPA requires alternatives to be reasonable from a technical, economic, and common sense perspective[5] and compared to other alternatives evaluated, an alternative that includes the beach nourishment and coastal engineering element is not reasonable from an economic or common sense perspective.

In light of these considerations, the NPS and USFWS do not believe that beach nourishment and engineering strategies would be a responsible and sustainable management tool for use on southern Assateague Island. As described in chapter 1, the purpose and need associated with this CCP requires alternatives to include strategies in accordance with the refuge goals and mission, which would uphold our long-term agreement with the NPS to provide recreational beach access, while also considering its long term sustainability. Because of the predicted short term viability, and environmental factors, in addition to significant estimated cost, the USFWS considers beach

[5] Council on Environmental Quality, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations,* Response to Question 2a, (46 Federal Register 18026, March 23, 1981, as amended).

nourishment to be outside the scope of the CCP, and will not be evaluating nourishment as part of the alternatives under consideration.

2.4.2 Elimination of Hunting

Refuges provide habitat for the conservation and protection of all native species of wildlife. Harvesting surplus animals through hunting is one tool used to manage wildlife populations at a level compatible with the environment, provide wildlife-dependent recreational opportunities, and permit the use of a valuable renewable resource. Closing the refuge to hunting would conflict with the Improvement Act, which lists hunting as an appropriate and priority use of the Refuge System; directs that hunting shall receive priority consideration in refuge planning and management; mandates that hunting opportunities should be facilitated when feasible; and directs USFWS to administer the Refuge System so as to "provide increased opportunities for families to experience compatible wildlife-dependent recreation, particularly opportunities for parents and their children to safely engage in traditional outdoor activities, such as fishing and hunting." Furthermore, "no hunting" would conflict with EO 13443: "Facilitation of Hunting Heritage and Wildlife Conservation." The order directs the DOI and its component agencies, bureaus, and offices, "to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat." For all these reasons, the elimination of hunting would detract from achieving the purpose rather than contribute to meeting the purpose, and is not reasonable from a common sense perspective. Therefore, hunting will not be eliminated.

2.4.3 Preliminary Draft Alternative "C"

Preliminary Draft Alternative "C," as described and illustrated in the August 2011 newsletter, would have utilized a habitat management strategy in which management actions and strategies would allow for natural succession and coastal processes to take place on the refuge with little intervention. Refuge administration of programs would have been minimized primarily through reduction of activities, increases in partnerships, and use of volunteer staff. Specifically, this alternative would only maintain the beach parking, Chincoteague pony units, and Toms Cove Visitor Center as long as the land base allows, would not develop a shuttle service or off-site parking, and would shift towards teacher and partner-led interpretive tours. This alternative does not contribute to achieving the purpose of the CCP; rather, it detracts from achieving the purpose. The public, in addition to key stakeholders, voiced strong opposition to this management alternative. Some comments stated that this alternative was a stop-gap management strategy that would not address longer-term needs, and we agree with this assessment. It was also voiced by the public that this alternative was seen as a solution that assumed limited funding, and therefore could not sustain long-term management. Furthermore, key stakeholders did not support allowing natural forces to reduce the land base for the recreational beach and parking, when there was no plan to replenish the area or to provide alternative off-site parking and access. Ultimately, it was determined that this alternative would not meet the purpose of the CCP and therefore, it was removed from further consideration.

2.4.4 Elimination of Transit

Transit was proposed to provide supplementary beach parking on Chincoteague Island and a shuttle when the parking is at capacity, and would provide access after catastrophic storm events that may temporarily eliminate or restrict beach parking. Some comments received during our planning process requested that transit not be considered in any of the alternatives.

It is the position of USFWS that transit is an important component of responsible management to provide visitors with an alternative option to driving along with bicycling and walking, to address high levels of demand on peak beach visitor use days, and to address impacts on current recreational beach parking resulting from rising rates of sea level and climate change effects. As such, transit is necessary for alternative A, not only to be consistent with the 1993 Master Plan, but also to ensure the same level of access in the future, given the uncertainty in being able to maintain the current level of parking. Transit is also necessary in alternative C due to the reduction in beach parking and the need to provide access during peak visitation. However, as a compromise to address public concerns, and in recognition that relocation of the beach and associated parking will greatly reduce risks to both, a voluntary shuttle was removed from the preferred alternative.

2.5 Alternatives Carried Forward for Detailed Analysis

The alternatives carried forward for detailed analysis are:

- Alternative A – (Current Management)
- Alternative B – (Balanced Approach)
- Alternative C – (Reduced Disturbance)

As an integrated CCP and EIS, details of the alternatives are described in terms of the main components of a CCP, namely measurable objectives and associated strategies to achieve each associated goal. The refuge goals, as listed in chapter 1, are common to all of the alternatives, but objectives and strategies may vary between alternatives. For each alternative, a rationale accompanies each objective to explain its context and why it is considered important. Strategies are also identified for each objective. The strategies are specific actions, tools, techniques, or a combination of these that may be used to achieve the objective. Respective lists of strategies under each objective represent a potential suite of actions to be implemented in step-down plans that will achieve the desired outcomes of the alternative selected.

These alternatives represent different management approaches for managing the refuge over a 15 year time frame. Features common to all three alternatives are summarized below, followed by descriptions, objectives, and strategies for each of the three alternatives. At the end of the chapter, Table 2-2 compares major elements of each alternative. Summary cost information for each alternative is provided in Appendix I.

2.5.1 Existing Management Actions that Continue Under All Alternatives

Although the alternatives differ in many ways, there are similarities among them as well. Throughout this chapter, appropriate references are made to other alternatives when there are similarities, but this section highlights those elements that all alternatives share and captures broader commonalities not captured in the detailed descriptions of each alternative. These are management actions that would not change under any of the alternatives. These commonalities are presented in the order of the CCP goals, not in order of importance.

Resource Protection

The refuge would continue current enforcement of all Federal and State laws applicable to refuge lands to protect all known archaeological and historical sites, including any efforts to increase resource protection through education. Certain mandated responsibilities, such as protection of

Federal trust species and wetlands and prevention and control of invasive species, would be accomplished under all alternatives.

Habitat Management

The refuge would manage the following habitats and management structures the same, regardless of alternative: sea-level fen on Wallops Island NWR, maritime forest on Assateague Island, upland habitats on Wallops Island NWR, and natural coastal processes and habitats on Assawoman, Metompkin, and Cedar islands.

Marine Resource Management

In light of climate change and sea level rise, the refuge would recommend that the Commonwealth of Virginia protect and enhance newly submerged lands for the purpose of preserving wildlife habitat and recreational access. The refuge would encourage and support the Assateague Island National Seashore's Marine Research Reserve in Central Chincoteague Bay should it be proposed in the future.

Threatened and Endangered Species

The refuge would continue to provide protective conservation measures for federally listed species and their habitats on the refuge as indicated in recovery plans and relevant regulations. Although the Delmarva Peninsula fox squirrel has been proposed for delisting from the endangered species list since the draft CCP/EIS was published, it has not been finalized yet.

Exotic, Invasive, and Nuisance Species Management

The refuge would continue to conduct a number of strategies to address invasive species and their impacts. The refuge would continue to scout and remove invasive species such as Phragmites and Asiatic sand sedge by chemical, mechanical, or other means, using all current and future surveys to refine this strategy. The refuge would continue to map and track the changing acreage of invasive species, specifically Phragmites, on at least a bi-annual basis and use the results to prioritize treatments. The refuge would remove Asiatic sand sedge whenever it is found; patches of this highly invasive species are still small enough and occur infrequently to employ a zero tolerance policy. Finally, the refuge would continue to use refuge education programs and outreach efforts to educate visitors, hunters, and other groups about how they can help decrease the spread of invasive plants.

Regional Conservation

As indicated in Goal 5: Partnerships, the refuge would work with partners to conduct research, continue joint management of the southern barrier islands, and explore how best to establish a regional conservation network for the lower Delmarva Peninsula. This area is recognized globally for its remarkable estuarine, coastal, and marine habitats and substantial populations of migratory and breeding shorebirds, colonial waterbirds, landbirds, and raptors. Unfortunately, several real and growing challenges threaten the area's rich and diverse natural heritage and the many benefits humans derive from the region's intact habitats and natural systems. This partnership would seek to expand a resilient, productive, and connected network of protected lands to facilitate adaptation of native species, natural communities, and ecological systems and processes across a full range of representative habitats from tidal salt marshes to upland forests.

Economic Development

The refuge would work with its gateway coastal community, the town of Chincoteague, and regional organizations to support economic development. Continued partnerships with the surrounding community and local businesses, and consideration of economic impacts and opportunities for the town of Chincoteague in future management practices, would be maintained to support and improve the surrounding economy.

Community Resiliency

The refuge would work with the town of Chincoteague to explore potential impacts and identify protective methods to address hazard mitigation, in coordination with others, such as Accomack County, Commonwealth of Virginia, NPS, NASA, FEMA, and USACE. The refuge would also work with partners to explore how best to advance the study, information exchange, and project resources for adaptive management practices that sustain the resiliency of this unique barrier island system including but not limited to Assateague, Wallops, Assawoman, and Metompkin islands in the face of dynamic coastal processes and climate change.

Visitor Survey

The refuge would seek approval from the Office of Management and Budget to develop and conduct a visitor survey every 5 years to assess visitor experience and measure level of satisfaction with visitor service programs.

Parking and Access to the Beach

A 1-mile recreational beach with some level of parking nearby would be maintained on the refuge by NPS as long as funding allows. Personal motor vehicle access to Assateague Island would continue to be permitted. Under all alternatives, the refuge would coordinate with the Town of Chincoteague to allow alternative vehicles, such as golf carts or other small electric vehicles, on town and refuge roads and, thereby, slightly increase parking capacity at the recreational beach parking lots. We do not anticipate a large number of visitors using these vehicles, nor any significant impacts to traffic, safety or air quality. This change would not require additional lanes be built within the refuge.

The refuge considers a well-planned transportation system, in multiple forms (walking, biking, shuttle system, and automobiles) between the town of Chincoteague and Assateague Island essential to meet the expectations of current and future generations of refuge visitors.

Pony Management and Viewing

Chincoteague ponies would continue to inhabit Assateague Island, and management would be specified in the agreement with the Chincoteague Volunteer Fire Company. In light of sea level rise, the refuge would work with the Chincoteague Volunteer Fire Company to manage the ponies, including providing public viewing opportunities.

Access for Space Tourism Viewing

After an unmanned commercial rocket headed for the International Space Station to deliver supplies exploded just after launching on October 28, 2014, the future of access to the recreational beach for launch viewing is yet to be determined. However, the refuge would still like to work with the tourism industry, NASA, and the Virginia Commercial Space Flight Authority and Mid-Atlantic Regional Spaceport to provide safe access for public viewing of rocket launches from the NASA-Wallops Island launch complex. Visitor safety at the current recreational beach site during

launches is of concern to the refuge, as well as NASA. Alternative viewing sites are available that pose less of a risk to viewers than the current recreational beach parking lot. Those alternatives will be assessed as potential launch viewing sites, in coordination with refuge law enforcement and NASA officials.

Bilingual/Multilingual Material

The refuge would include the development of bilingual/multilingual information for regulations and environmental education.

Commercial Uses

In consultation and cooperation with the NPS and the Virginia Marine Resources Commission, the commercial harvest of horseshoe crabs that takes place on refuge lands does not contribute to the refuge's migratory bird purpose, does not contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, and is not beneficial to refuge resources; consequently, the use cannot be permitted.

Facilities and Infrastructure

Universal access, including standards of the Americans with Disabilities Act, would be incorporated into the design of any new or significantly renovated facilities. Safety considerations, such as shelters, would also be included. In addition, impacts on natural resources and visitor satisfaction would be considered in design and construction to minimize any adverse effects.

Climate Change and Sea Level Rise

Each alternative anticipates future conditions as they pertain to climate change and anticipated sea level rise over the next 100 years and proposes a range of adaptation measures. A guiding principle is that sea level rise is a continuous, ongoing process, which along with coastal storms and other natural processes and man-made infrastructure (e.g., jetties and groins), reshapes coastal landscapes. The refuge has several facilities and resources that may be vulnerable to sea level rise and storm surge, including the NPS recreational beach parking area. To minimize facility damage, maintenance costs, and access disruptions in the future, in all alternatives the refuge would consider potential risks and strategies when making decisions about infrastructure that would last beyond the 15-year period covered by the CCP. Also, each alternative would provide for data gathering to measure and monitor the effects of accelerated climate change and sea level rise. Decision-making under this and future step-down planning will be an iterative process incorporating the best climate science and adaptive management strategies available.

The future of sea level change in Virginia is most appropriately forecast by reference to the state of-the-science synthesis and recommendations prepared for the National Climate Assessment (Parris et al. 2012). The consensus of scientists working on this report is that by 2100 global sea level will be between 8 inches and 6.6 feet above the level in 1992. When modified by local and regional factors this information provides the best available basis for planning.

Wilderness

Proposed wilderness areas are managed by the USFWS to maintain their wilderness qualities in the event Congress designates them as wilderness. Hiking, photography, hunting, fishing, and wildlife observation may be among the permitted uses. As part of implementation of *Conserving the Future* and in recognition for the 50th Anniversary of the NWPS in 2014, USFWS recommended the chartering of a Refuge System Wilderness Council to evaluate the 21 proposed

wilderness areas and wilderness study areas and prepare a national strategy to advance priority wilderness proposals to Congress for designation. One of the 21 proposed wilderness areas to be evaluated is located within Chincoteague NWR (proposed in 1974). USFWS will complete a nationwide identification of potential wilderness areas throughout the Refuge System by 2025.

Implementation of the Selected Alternative

This CCP is a 15-year management plan that provides long-term guidance for management decisions on the refuge and set forth goals, objectives, and strategies needed to accomplish refuge purposes. We also identify our best estimate of future needs. This plan details program levels that are sometimes substantially above current budget allocations and, as such, are primarily for USFWS strategic planning and program prioritization purposes. This CCP does not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

When possible, we often identify time frames for implementation of objectives and strategies within the next 15 years. Refuge management would continue as established by the Final EIS for the Chincoteague NWR Master Plan approved in 1992, with a phased implementation of the approved alternative. Once the Regional Director has signed the ROD and the CCP is complete, the public will be notified in the *Federal Register*, and implementation would begin.

2.5.2 Alternative A (Current Management)

Alternative A is the status quo (current management) alternative and satisfies the requirements of NEPA for a no action alternative. This alternative describes the refuge's existing management priorities and activities established by 1992/1993 Master Plan and EIS, and serves as a baseline for comparing alternatives B and C. Figure 2-1 and Figure 2-2 provides an illustration of major spatial elements of the alternative.

Natural Resource Management. Under this alternative, the refuge would continue to protect and maintain all lands it administers, primarily focusing on the needs of threatened and endangered species, with additional emphasis on the needs of migratory birds and resident wildlife. The refuge would continue to preserve approximately 2,650 acres of wetland impoundments based on priority species needs. Natural coastal processes would continue to be the primary force that shapes habitat on the southern barrier islands. There would be no change in the size or location of the 1,300-acre proposed wilderness area within the refuge, and the refuge would continue to protect and enhance its enhanced wilderness character through actions to eliminate incompatible features and activities.

Beach Access and Parking. Consistent with the 1992/1993 Master Plan and EIS, the refuge would continue to allow NPS to maintain 961 automobile parking spaces (8.5 acres) at the recreational beach as long as suitable land base directly behind the recreational beach remains (USFWS 1992a, USFWS 1993a), and as long as funding is available. As sea level rise and natural forces reduce the land base capable of supporting current parking, the refuge would reduce the number of parking spaces accordingly, and would work with the town of Chincoteague and the NPS to identify suitable off-site parking and to implement an alternate means of transportation such as a shuttle system. The refuge would continue the use of Swan Cove Trail for bicycles.

Partnerships. Refuge staff would continue to work with the USDA to reduce the non-migrant Canada goose population. The refuge would continue existing partnerships, including those with the NASA and the U.S. Navy for monitoring and recovery of native species.

Visitor Use and Experience. Existing public uses, including wildlife observation, environmental education, interpretation, walking and bicycling access, fishing, wildlife photography, and hunting of sika, resident white-tailed deer, and off-island migratory birds, would continue with the current facilities, programs, and policies. The OSV closure schedule and vehicle limits would continue as in current management practices. The refuge would continue to manage opportunities for recreational shellfish and crab harvest.

Cultural Resource Management. The refuge would continue its responsibilities for the archaeological, cultural and historical sites on the refuge in compliance with all applicable Federal and State laws. Refuge staff would continue to allow the CNHA and refuge volunteers to conduct tours of the Assateague Lighthouse and would continue restoration of the Lighthouse. The "Chincoteague ponies" have a strong cultural tie to the community, and the refuge would allow grazing of the current pony population, with a maximum herd size of 150 ponies, consistent with the pony management agreement with the Chincoteague Volunteer Fire Company (CVFC).

Figure 2-1. Alternative A – Chincoteague NWR

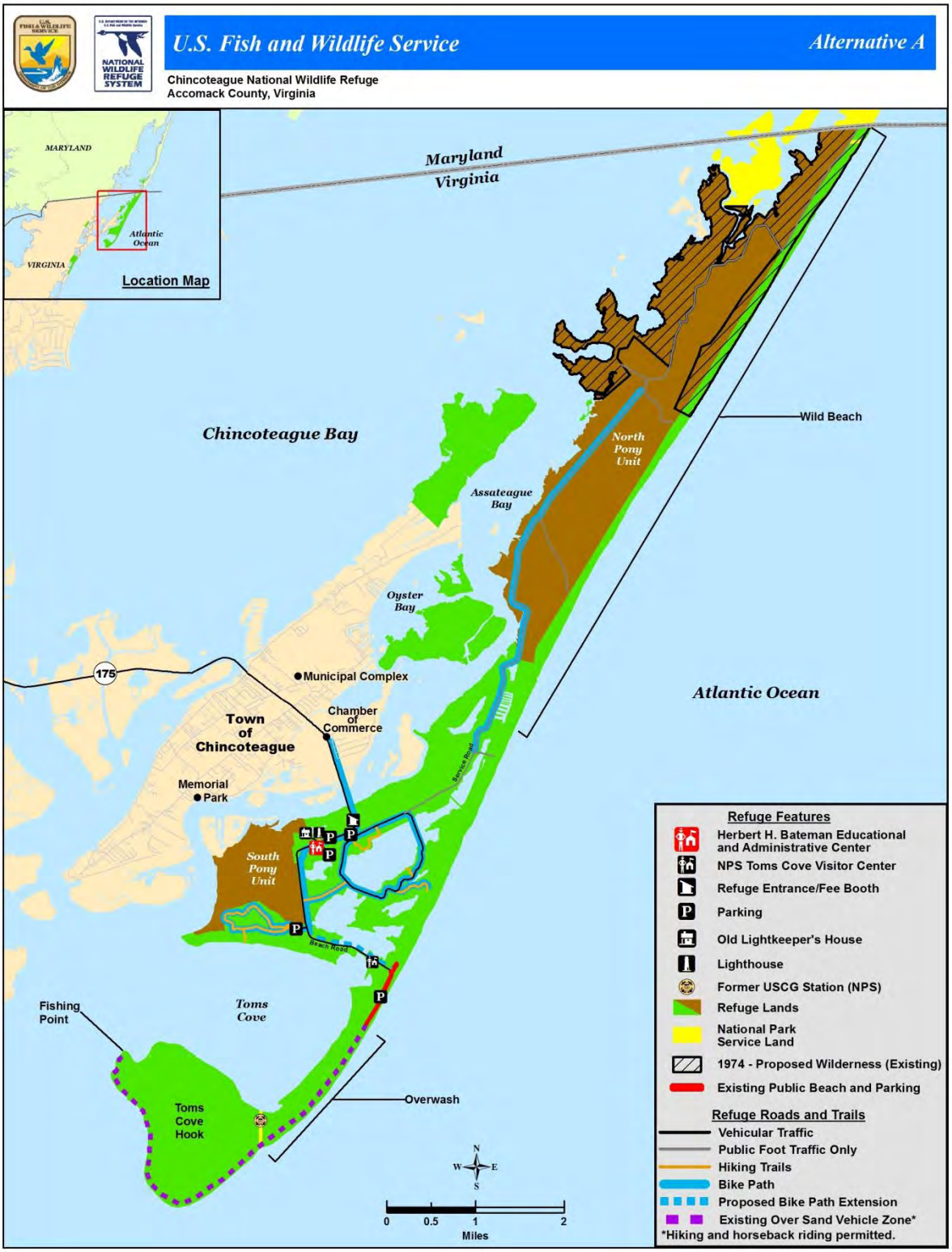
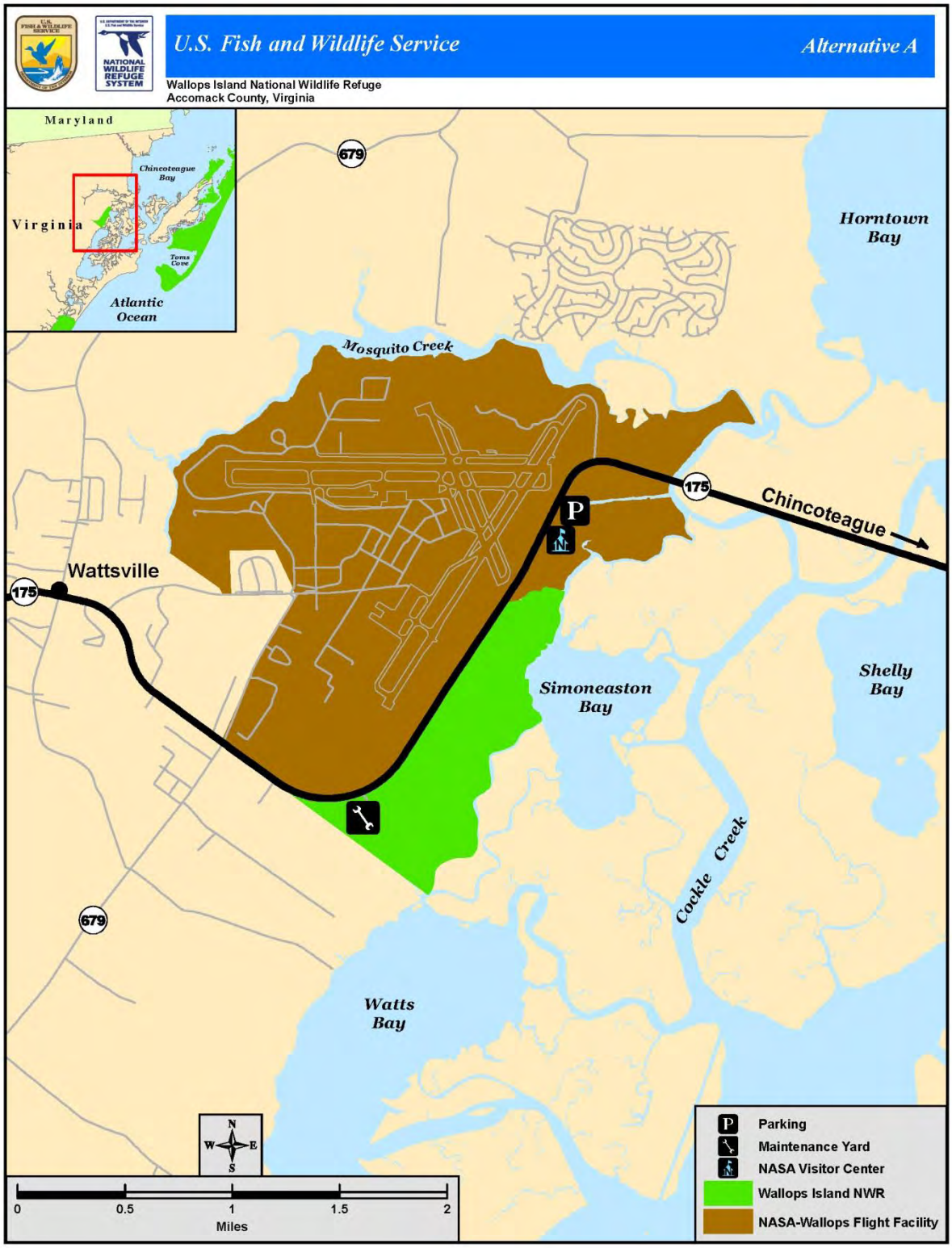


Figure 2-2. Alternative A – Wallops Island NWR



Goal 1: Coastal Habitats

Manage quality coastal habitats for biological integrity, diversity and environmental health of refuge barrier beach and dunes in concert with natural processes as part of the Delmarva Peninsula coastal barrier island system to provide habitat for species of conservation concern.

Objective 1.1 Barrier Beach and Dune Habitat – Coastal Nesting Birds

Manage sandy beach, dune edge, overwash, and intertidal areas on Assateague, Assawoman, Metompkin, and Cedar Islands, and reduce mortality factors, to maintain a refugewide piping plover fledge rate between 1.2 and 1.5 chicks per pair as averaged over a 10-year period. If fledging rate drops below 1.0 chick per pair over a 10-year period, management strategies and prescriptions would be re-evaluated using a formal process and outside expertise.

Rationale:
Management of the Federal and State-listed threatened piping plover is a high priority for the refuge, with management actions to be outlined by the HMP to maintain an acceptable fledge rate. The CCP fledge rate goal of 1.2 to 1.5 chicks per pair is based on Hecht and Melvin's (2009) recent analysis of 1989 to 2006 regionwide productivity data and the Piping Plover Recovery Plan (USFWS 1995). In accordance with research on piping plovers, our current management target allows for population growth necessary to meet current recovery goals. Using 1.0 rather than a previous 0.93 chicks per pair as the trigger to re-evaluate management allows more time to find solutions and implement them. These management actions, though directed specifically at the piping plover, would also benefit other high ranking species such as the least tern, American oystercatcher, black skimmer, Wilson's plover, and gull-billed tern due to their similar habitat needs. Please refer to Piping Plover Recovery goals and objectives at this link: *http://www.fws.gov/northeast/pipingplover/* for more information.

Management Strategies

- Restrict public access to reduce mortality and disturbance on Assateague, Assawoman, Metompkin, and Cedar beach, dune, and overwash areas during the breeding season: March 15 through August 31 or thereafter, until the last chick fledges. (Note: this strategy does not apply to the recreational beach at Toms Cove).
- Continue to implement OSV and pedestrian closures as outlined in the 2008 Biological Opinion (USFWS 2008b; Appendix F): the OSV zone on Toms Cove Hook will be closed from March 15 to August 31 or thereafter, until the last shorebird fledges. The overwash portion of the OSV zone will close 256 feet (200 meters) north of any shorebird brood, and remain closed till the last shorebird fledges. Public use above the high tide zone on Wild Beach will be closed March 15 till August 31 or thereafter, until the last shorebird fledges.
- Erect "Area Closed" signs and symbolic fencing (rope strung between signs) in a buffer zone (minimum 25-foot radius) around nests within Public Beach, and maintain these protective measures until the nest hatches or is determined to be unviable.
- Erect exclosures around individual plover nests where necessary and logistically feasible. (Costs in terms of staff effort outweigh benefits on nesting islands accessible only by boat, where predation levels are low or nil such as on Cedar and Metompkin).
- Remove mammalian nest predators (primarily foxes and raccoons) from nesting habitat and nearby areas and travel corridors prior to and during the breeding season.
- Remove avian predators, such as gulls and corvids, from nesting areas when chicks are present, at other times of the breeding cycle, when needed.

- Conduct an analysis of the refuge's predator control efforts and results to develop recommendations to improve its effectiveness. The analysis would be done in conjunction with other partners' analyses of predator management results on other islands to better understand system-wide responses to reductions in island predator populations.
- Continue interagency agreement between the USFWS and USDA which authorizes USDA to assist the refuge with threatened and endangered species recovery and migratory bird management.
- Continue working with coastal geologists to model the impacts of storm flooding events and other dune breaching scenarios on Assateague Island to evaluate potential effects that erosion of the artificial dunes may have on natural and manmade habitats, refuge infrastructure, and flood control for the town of Chincoteague.
- Allow natural geologic processes to restore overwash to a northern portion of Wild Beach (e.g., the North Wash Flats (NWF) Impoundment) on Assateague Island in order to increase nesting habitat for plover, least terns, sea turtles, and other nesting shorebirds that were lost when the artificial dune system was created. This could also allow natural island movement.
- Continue to work with NPS to replace existing trash bins in parking lots around public beach areas on Assateague Island with a design that excludes bird and mammal predators and scavengers.
- Continue to develop interpretation programs that foster a public appreciation of nesting shorebirds (Shoreline Steward Program) and inspire refuge visitors to reduce their impacts on these species.
- Continue an active role in the Virginia Coastal Avian Partnership (VCAP) to conduct scientific research and education and outreach programs. As an example, the partners developed and distributed an informational brochure targeted for visitors to the barrier islands on how to minimize their disturbance to colonial and other ground-nesting birds.

Biological Monitoring

- Continue to annually monitor reproductive success of piping plover pairs on all islands, which includes determining the number of breeding pairs, nests, and chicks fledged.
- Determine the number of American oystercatcher pairs and fledge rate for all islands. Conduct more intensive monitoring of oystercatchers (e.g. number of nests, hatch success, cause of failure) on one island per year on a rotating basis.
- Annually monitor the number of nesting pairs/nests of least terns, common terns, Forster's terns, and black skimmers on all islands using methods outlined by the Atlantic Coast Least Tern Adult Window Count and Virginia Colonial Waterbird Coastal Plain Survey.
- Annually conduct scouting for invasive plant species on all islands in conjunction with bird monitoring; train interns and bio techs on how to identify invasive plant species of concern. Evaluate the success of refuge treatment programs using periodic aerial Phragmites mapping by the Virginia Department of Conservation and Recreation (DCR).
- Continue to conduct annual predator scent station monitoring in November to determine predator trends and guide predator pre-breeding season control activities.

Objective 1.2 Barrier Beach and Dune Habitat – Migrating and Wintering Shorebirds and Migrating Monarch Butterflies

Manage sandy beach, overwash, and dune grassland habitat along the approximately 17 miles of Assateague Island (Hook, Overwash, Wild Beach) and tidal flats along Toms Cove to benefit red knot, a threatened species, and other migrating/wintering shorebirds.

Rationale:
In 1990, the Virginia and Maryland barrier islands were designated as a Western Hemisphere Shorebird Network Site due to the number of shorebirds using the area during migration, with tens of thousands of shorebirds stopping at Assateague Island between the months of April and September. Protecting and enhancing this habitat would benefit these shorebirds such as red knots, sanderlings, and other migrating/ wintering shorebirds of conservation concern, by regulating and directing public use to less sensitive areas, away from roosting and feeding areas during peak migration.

Shorebirds using the Overwash and Hook are subject to human disturbance during a portion of peak fall migration (September, and sometimes parts of August in the Overwash). Forgues (2010) found that abundance of sanderlings, ruddy turnstones, willets, black-bellied plovers, and whimbrels on Assateague Island during spring and fall migration significantly declined with higher OSV frequency, and concluded that OSVs can interfere with the ability of shorebirds to accumulate fuel stores for migration. OSV use caused shorebirds on Assateague Island to spend less time foraging, and to avoid areas where OSVs were present (Forgues 2010). Five miles of the refuge's 16.8 miles of beach on Assateague Island are open to OSV use during the fall and winter (September 1 to March 14). Morton's (1996) studies of Assateague's wintering shorebirds found that human activity, both pedestrian and vehicular, negatively impacted sanderling use of beach areas, foraging activity, and energetics. Human disturbance caused sanderlings to avoid areas which were otherwise suitable (i.e., had good food resources), flush more, and feed less. This could result in the birds being less fit to make their migration (Morton 1996).

Assateague Island is a critical stopover point for southbound migrating monarchs that use the refuge's resources to rest, refuel, and roost for the night. The migration and wintering biology of the eastern population of the monarch butterfly has been labeled an "endangered biological phenomenon" (Gibbs 2008). The insect makes a journey of up to 2,200 miles, from summer breeding areas in New England and Canada to wintering grounds in Mexico's central mountains, in the State of Michoacán. Nectar source plants are located in various refuge habitats including Beach Road adjacent to Toms Cove, the Overwash, and tip of the Hook, blooming in succession during the migration period. Stands of seaside goldenrod, the most important nectar source on the refuge, can be lost or thinned from natural causes (salt-spray, overwash, storms), or management activities (roadside mowing, parking lot maintenance, facilities maintenance). Recent experiments with seed collection and planting seedlings have been successful in re-establishing/enhancing goldenrod stands.

Management Strategies

- Conduct education and outreach programs to educate visitors, particularly pedestrians on the beach, on how to reduce their disturbance impact on birds. For example, increase understanding of the impacts of people's behavior on wildlife, such as proximity.
- Continue an active role in the VCAP to conduct scientific research and education and outreach programs. As an example, the partners developed and distributed an

informational brochure targeted for visitors to the barrier islands on how to minimize their disturbance to colonial and other ground-nesting birds.

- Continue the partnership with monarch researchers/volunteers whereby refuge volunteers collect seaside goldenrod seeds in November for propagation, and seedlings are planted the following spring or fall.
- As opportunities arise, use volunteers to plant seaside goldenrod seedlings in spring or fall on Toms Cove Hook, small dunes that dot the Overwash area, the north end of Toms Cove (including the causeway west of the NPS Toms Cove Visitor Center), and the backsides of dunes along Wild Beach. Planting should occur on no greater than 5 percent of the Overwash area so as not to conflict with beach nesting birds, which prefer open un-vegetated beaches and shell flats.
- Establish annual temporary fencing (August to October) at dunes adjacent to overwash and public beach locations to aid in monarch nectaring and roosting locations.

Biological Monitoring

- Continue weekly shorebird surveys April through May and July through September, and every-other-week surveys October through March and in June. Since patterns of shorebird use of impoundments are related to the tidal cycle and beachfront is only accessible at low tide, adjust protocol to obtain the most complete count of all surveyed units on Assateague. This can best be accomplished by starting the shorebird survey one hour before low tide on Toms Cove/Hook, then proceeding north on Wild Beach to the beach access road north of Old Fields, and continuing south after surveying Old Fields to complete the remainder of the impoundments. Surveys on the impoundments would thus occur during mid and high tide, when shorebird activity was found to be the highest (Haines 1999).
- Continue re-sight surveys for tagged red knots in fall and spring in conjunction with weekly shorebird surveys and plover/oystercatcher breeding surveys, and using protocols consistent with partners involved with red knot monitoring and research.
- Continue bi-weekly re-sight Chincoteague Bay boat surveys for color-banded American oystercatchers in fall and winter in partnership with Virginia Department of Game and Inland Fisheries (VDGIF) and TNC. Re-evaluate the resources available for this survey, which takes place off-refuge, and the information gained to determine if surveys would continue.
- Encourage partners and volunteers to monitor monarch migration on the refuge through monarchwatch.org or other cooperative efforts outlined in the North American Monarch Conservation Plan.

Objective 1.3 Barrier Beach and Dune Habitat – Turtles

Manage approximately 17 linear miles of sandy beach habitat on Assateague Island for nesting loggerhead sea turtles. Continue *in situ* nest protection such that no more than three nests over any 5 year period, and no more than one in any given year, are lost to human or predator-related causes.

Rationale:
The loggerhead sea turtle is a Federal and State-listed threatened animal with habitat found on the refuge, the management actions of which would benefit other species such as the diamondback terrapin. The three major threats towards these species on the refuge are predation, human

activities, and weather. Currently, no sea turtle nests have known to be lost to predators. Management actions, such as mammalian and avian predator removal directed primarily for piping plover production, and placing protective screening over sea turtle nests, may have prevented predation. Human use of nesting beaches, particularly at night or early morning when females come ashore to nest, can disturb nesting females, prevent egg-laying, and indirectly harm hatchlings. Flashlights, headlights, campfires, or lighting on buildings can cause females to abort nesting attempts and interfere with sea-finding behavior by hatchlings. Beach driving, pedestrian traffic, and beach cleaning poses a risk of injury to nesting females and live stranded turtles and can leave ruts that trap hatchlings attempting to reach the ocean (NOAA and USFWS 1991). Driving directly above incubating egg clutches can cause sand compaction, which may decrease hatching and emergence success and directly kill pre-emergent hatchlings (National Marine Fisheries Service and USFWS 2007). The most recent Biological Opinion (USFWS 2008b; Appendix F) determined that an incidental take of up to three sea turtle nests over a 5year period, and no more than one per year, would not jeopardize the loggerhead sea turtle population. Management activities have kept mortality far below this so far. However, if turtle nesting increases on the refuge, there may be more overlap between human disturbance factors and turtle nesting.

Management Strategies

- Control human disturbance along 17 miles of Assateague Island during the turtle nesting season.
- Continue implementing OSV and pedestrian closures on the Hook, Overwash, and Wild Beach from March 15 through August 31 or thereafter, until the last shorebird fledges, as outlined in the 2008 Biological Opinion (USFWS 2008b; Appendix F).
- Erect "Area Closed" signs and symbolic fencing (rope strung between signs) in a buffer zone (minimum 5-foot radius) around all nests, and maintain these protective measures until the nest hatches or is determined to be unviable.
- Protect sea turtle nests from predators by placing predator screens over all nests and conducting mammalian and avian predator control for piping plovers which would indirectly help sea turtle production.
- Restore dynamic beach and overwash system on Assateague Island by allowing natural geologic processes to restore overwash to a northern portion of Wild Beach in order to increase nesting habitat for sea turtles lost when the artificial dune system was created.

Biological Monitoring

- Conduct sea turtle crawl and nest searches of Assateague beaches at least three times per week June through August, in conjunction with shorebird monitoring activities whenever possible.
- Deploy properly trained staff to determine whether sea turtle crawls resulted in a nest, and monitor all confirmed nests for hatching and emergence as described in the Biological Opinion (USFWS 2008b; Appendix F).

Objective 1.4 Federally Endangered Plants and Rare Plant Communities

Protect the integrity of rare plant communities and maintain or expand 970 acres of sandy beach and washover habitat for the federally endangered seabeach amaranth along refuge shorelines by

allowing natural processes to occur with a goal of increasing the current population of one to five plants, as averages over a 5-year period.

Rationale:
Seabeach amaranth is a Federal endangered plant native to barrier islands beaches and inlets from Massachusetts to South Carolina; the population has been greatly reduced on the refuge due to beach stabilization efforts, increased recreational use, and herbivory. "Soft" stabilization methods such as placement of sand fences and planting vegetation like beachgrass can be detrimental; seabeach amaranth rarely persists where vegetative stabilization efforts have taken place (Weakley et al. 1996). Sika, resident white-tailed deer, cottontail, and Chincoteague ponies are documented herbivores of amaranth found on the refuge.

Seabeach amaranth generally occurs in a sparse to very sparse distribution. A typical density is 62 plants per linear mile of beach (100 plants per linear km) (Weakley et al. 1996). Current density of the one existing population at the north end of Wild Beach is much lower than this - less than 6 plants per mile (10 plants per km). Suitable habitat is defined as overwash flats at accreting spits or ends of barrier islands and the lower foredunes and upper strands of non-eroding beaches. This native plant acts as an important habitat for nesting birds such as plovers, terns, and skimmers.

Lucky Boy Fen is a type of rare habitat that is only found in five different areas of the east coast. A fen is a unique and extremely rare type of freshwater wetland located at the upland edge of a wide, ocean-side tidal marsh. A fen is distinguished from a marsh or a bog by unique hydrological regimes and vegetation that is an unusual combination of northern bog plants and southern tidal freshwater wetlands plants. The number of rare species documented in Lucky Boy Fen is high in proportion to its size. It contains two plant species (brown-fruited rush and few-flowered beakrush) considered "critically imperiled" and four plant species (southern bladderwort, ten-angle pipewort, white beakrush, and white-topped fleabane) considered "imperiled" by the Virginia DCR Natural Heritage Division.

The greatest threat to sea-level fens in general is groundwater pollution. Possible movement of fertilizers and wastes into the groundwater from nearby developments or agricultural fields can lead to increased nutrient levels in the fen. Increased nutrient levels can disrupt soil characteristics and affect the plant species that naturally exist in fen conditions. Nearby developed areas include Highway 175 and the NASA WFF, both within one-half mile of Lucky Boy Fen. Other potential threats to the Lucky Boy Fen include encroachment of invasive species and trampling by grazing animals or visitors (Buffa 2009).

Contained within Assateague Island's 1,600 acres of forested uplands are roughly 400 acres of maritime forest (Berman and Berquist 2007), located primarily in White Hills, Lighthouse, and Woodland Trail areas. This community-type is considered globally rare because of restricted range and narrow habitat requirement (Fleming and Patterson 2010). Only 4,093 acres of maritime forest are found in Virginia, 855 acres of this in Accomack County (Berman and Berquist 2007). More recently, the Virginia DCR developed a list of the Commonwealth's natural communities ranked according to their conservation priority. Maritime Mixed Deciduous Forest is ranked as "critically imperiled", both globally (G1) and in Virginia (S1). Maritime Loblolly Pine Forest and Loblolly/Beach Heather Dune Woodland are ranked "Imperiled" globally (G2) and in Virginia (S2) (Fleming and Patterson 2010). Three hundred acres of loblolly pine/mixed hardwood habitat in the White Hills, Woodland Trail, and Lighthouse compartments are possibly the globally significant Maritime Mixed Deciduous Forest community-type. Other forested uplands

may be part of the Maritime Loblolly Pine Forest or Loblolly/Beach Heather Dune Woodland communities (Buffa 2009). Additional field studies are needed to delineate the boundaries and amount of these important vegetation communities. Silvicultural practices to maintain or enhance the hardwood overstory, sub-canopy, and shrub/herbaceous understory can then be developed to maintain the integrity of maritime forest.

Seabeach Amaranth Management Strategies

- Continue to erect protective cages around amaranth plants each year.

Seabeach Amaranth Biological Monitoring

- Continue the annual August inventory of Assateague Island beaches for amaranth, in cooperation with NPS personnel whenever possible. Conduct inventories on Assawoman Island every 3 to 5 years.

Lucky Boy Fen Management Strategies

- Annually in early November, prior to the deer hunt, check closed area signs around fen and re-post with closed area signs and symbolic fencing (rope strung between posts) if necessary.
- Collaborate with stakeholders and adjacent landowners such as the Virginia Department of Transportation (DOT) and NASA WFF to monitor and preserve the integrity of the Lucky Boy Fen. For example, WFF has an Integrated Contingency Plan which details storm water pollution prevention and spill control measures; contact DOT to see if they have measures to prevent run-off from Highway 175 from degrading the fen.
- Maintain wooded habitat on Wallops Island NWR that serves as a recharge area for Lucky Boy Fen.

Lucky Boy Fen Biological Monitoring

- Monitor for invasive plants during rare plant assessments.

Maritime Forest Management Strategies

- Using the community-type descriptions in Fleming and Patterson (2010) and coastal maritime forest map for Accomack County in Berman and Berquist (2007) as starting points, map the maritime forest on Assateague Island, and other areas on Chincoteague NWR.
- If any portions of the maritime forest type are found to be degraded, develop silvicultural or other forest management practices to restore its integrity.

Objective 1.5 Salt Marsh Habitats for Nesting, Migrating, and Wintering Birds

Manage 3,070 acres of salt marsh in Wildcat Marsh, Morris Island, Assateague Island, and on Wallops Island NWR to include a mix of high and low salt marsh vegetation, pool, mudflat, and panne habitat containing less than 5 percent overall cover of non-native invasive plants, ensuring the quality and natural function of the marsh, as measured by a regionally developed salt marsh integrity index, are sustained and provide habitat for breeding clapper rail, saltmarsh sparrow

and American oystercatcher, as well as, migrating and wintering American black duck and shorebirds.

Rationale:
Sea level rise is a constant threat to the natural salt marsh habitats of the refuge, with marsh submergence having a major negative impact on marsh-nesting species such as clapper rails, black rails, saltmarsh sparrows, seaside sparrows, American oystercatchers, and the American black duck. DGIF notes that other species that may breed in refuge-owned salt marsh habitats can include willets, black ducks, and possibly black-necked stilts. Whimbrel, a species of highest conservation priority in the New England/Mid-Atlantic BCR 30, was selected as a surrogate or representative species by the Mid-Atlantic Landscape Conservation Cooperative to represent the guild of shorebirds that feed in mudflats at low tide and roost in salt marsh vegetation at high tide. Whimbrels only occur in Virginia during spring and fall migration, but like many shorebirds use salt marsh habitats, which include mudflats and salt pannes. The saltmarsh sparrow, a species of highest conservation priority in BCR 30, was selected as a representative species because it is an indicator of healthy salt marsh habitat. Saltmarsh sparrows breed in large patches, greater than or equal to 125 acres (50 hectares) in size, of high marsh dominated by saltmeadow cordgrass; they forage in low marsh dominated by smooth cordgrass and saltgrass (Smith, pers. comm., 2010). Chincoteague NWR is unique in being one of the few places that have good numbers of breeding and wintering saltmarsh sparrows; estimated at 2.47 birds per 2.5 acres (1 hectare) and 2.3 birds per 2.5 acres, respectively (Center for Conservation Biology (CCB) 2010 and Paxton 2007). American oystercatcher was selected as a representative species because it is a Tier II Species of Greatest Conservation Need, indicating it is a species which has a high risk of extinction or extirpation (DGIF 2005). Oystercatchers use a range of salt marsh habitats for their life history needs, nesting on topographical high spots in low salt marsh islands, and during the non-breeding season they gather in communal high-tide roosting flocks on sand or mudflats, oyster shell rakes, and topographic high spots in the marsh (Wilke et al. 2007). The American black duck is a globally vulnerable watch list species, considered one of the highest priority species of concern by the Atlantic Coast and Eastern Habitat joint ventures (Steinkamp 2008); its continental population is half of its historic size (Longcore et al. 2000). Since 2001, the mid-Atlantic region (including New Jersey, Delaware, and Virginia) has accounted for approximately 68 percent of its U.S. wintering population; within the mid-Atlantic region, Virginia comprises about 12 percent of that wintering population (VDGIF 2005).

With the exception of Chincoteague pony grazing on certain areas of Assateague Island, the salt marshes on Chincoteague NWR are relatively unaltered. Grazing effects on wildlife are mixed. Grazing can help attain wildlife objectives. For example, allowing the Chincoteague ponies in the North Wash Flat (NWF) impoundment prior to the breeding season removes vegetation, creating preferred habitat for plovers and other “beach nesting” birds. Pony fecal matter may stimulate the growth of invertebrate food matter for waterfowl. In salt marshes, the impacts of pony grazing on wildlife habitat may outweigh the benefits because: (1) Trampling during the nesting season can disturb or destroy nests; (2) Direct forage competition reduces food resources for wildlife; and (3) Grazing alters vegetation structure and species composition resulting in habitat loss for marsh-dependent representative species. Comparing grazed to ungrazed low salt marsh, study sites on the Maryland side of Assateague Island (Sturm 2008) found that areas grazed by Assateague horses had significantly lower overall plant cover, decreased reproductive success of smooth cordgrass, and resulted in a shift in species composition from smooth cordgrass to saltgrass. Horses alter the species composition of low salt marsh communities by preferentially grazing on smooth cordgrass, thus providing a competitive advantage to other plant species. The latter is

significant for wildlife because saltgrass provides very poor nesting cover and food resources for representative species compared to smooth cordgrass (Sturm 2007 and 2008). Grazing is therefore a concern in salt marshes because it can reduce the abundance and distributions of salt marsh obligate breeding birds such as clapper rail, seaside, and saltmarsh sparrows (NPS 2006). Management strategies would protect the salt marsh to allow for native species to nest and survive on the refuge, helping to meet other species objectives.

Management Strategies

- Work with the Chincoteague Volunteer Fire Company and others with technical expertise in grazing systems. Adjust grazing compartments and/or Chincoteague pony numbers in order to reduce the adverse effect of ponies on the habitat of representative species, and determine if pony grazing can be integrated into impoundment management strategies.

Biological Monitoring

- Use the USFWS Region 5 Salt Marsh Integrity Index for the installation of surface elevation tables in coordination with efforts by NPS in Maryland to assess the rate of sea level rise, assess grazed and ungrazed salt marsh, determine areas of the marsh that are impacted and need to be restored and design a monitoring program to improve salt marsh quality, diversity, and integrity.
- Encourage and work with partners (e.g., NASA, Chincoteague Bay Field Station (CBFS), TNC, NPS, USGS) to conduct studies to better understand saltmarsh health and migration on the refuge, and coastal barrier islands.
- Continue collecting American oystercatcher data on the Chincoteague Bay Boat Route, and coordinate with partner agencies to determine the frequency of future productivity monitoring on this route.
- Encourage partners (e.g., Center for Conservation Biology (CCB) at the College of William and Mary and Virginia Commonwealth University, USGS, VDGIF, and Saltmarsh Habitat and Avian Research Program collaborators) to conduct studies to better understand the distribution and abundance of saltmarsh sparrows on the refuge, and help identify their limiting factors and other threats.

Goal 2: Managed Wetlands (Impoundments)
Manage refuge impoundments to support native wildlife and plant communities, including a diversity of waterbirds, aquatic species, and other species of conservation concern.

Objective 2.1 Impoundments for Waterfowl, Shorebirds, Waders, and associated species
Manage to provide approximately 2,650 acres of wetland habitat with a mosaic of native emergent marsh vegetation (i.e. American three-square, smartweed, Bidens) and mudflat to support migrating and wintering waterfowl and shorebirds, and breeding shorebirds and waterbirds until an impoundment is no longer functioning. Taxa specific objectives may be rotated among impoundments from year to year depending on environmental conditions and impoundment capabilities, and would be directed to provide the following:

(1) Wintering Waterfowl - Manage 55 to 75 percent of the impoundments' surface area each winter (December through mid-March) to provide shallow flooded (less than 12-inch water depth) and seed-producing moist-soil vegetation for wintering waterfowl including black duck, pintail, gadwall, shoveler, teal, and Atlantic population of Canada geese.
(2) Migrating Shorebirds - Manage 35 to 50 percent of the impoundments' surface area each spring (April and May), and 25 to 40 percent each early fall (July through October) to provide a mix of 40 percent mudflat and shallow water (less than 4-inch water depth) with sparse vegetation (less than 15 percent cover) for migrating shorebirds (e.g., short-billed dowitcher, dunlin, semipalmated sandpiper, yellowlegs).
(3) Migrating Waterfowl - Manage 40 to 50 percent of the impoundments' surface area each fall (late October through November) for migrating waterfowl (e.g., black duck, green-winged teal, blue-winged teal) to provide shallow flooded (less than 12-inch water depth) annual vegetation composed primarily of American three-square, grasses of the genus *Echinochloa*, smartweed, Bidens, and other seed producing moist soil vegetation at time of peak migration and by controlling invasives.
(4) Breeding Shorebirds - Manage NWF impoundment (mowing, pumping and pony exclusion fencing) to provide 90 percent dry habitat conditions for breeding piping plover, Wilson's plover and least terns between March 15 and August 31 or thereafter, until all chicks are fledged.
(5) Foraging Waterbirds - Provide concentrated food resources in at least two impoundments during June, July, and August each year for breeding waterbirds such as snowy egrets, glossy ibis, and herons.

Rationale:
All of the refuge impoundments, with one exception, were constructed in the 1950s and 1960s with the primary purpose of providing waterfowl migration and wintering habitat. The impoundments supply numerous habitat benefits, including wintering/migratory habitat for waterfowl; food sources for water birds of conservation concern; and shorebird migratory stopover habitat for many species. The water levels of each impoundment are difficult to manage since they depend entirely on precipitation for their source of freshwater, and continued natural occurrences such as sea level rise and storms introduce more salt water, which diminishes the quality of the habitat. The HMP water control prescriptions will allow the refuge to meet their objectives.

The American black duck is a species that has declined by as much as 60 percent, due in part to the loss of their wintering habitat. Invertebrates comprise the majority of black duck diet, and in Virginia wintering areas, mudflat and salt marsh provide the greatest invertebrate biomass (Eichholz and Yerkes 2009). The refuge impoundments, typical black duck wintering habitat, have

seen less and less of these species due to decreased quality of the habitat, either by an increase in invasive plants, or increase in salinity due to sea level rise. We seek to improve the quality of black duck habitat as part of a regionwide effort to increase this species' population.

Coastal refuges in USFWS Region 5 are currently developing a tool, or model, that can be used to weigh the costs and benefits of maintaining an impoundment, and reach a decision about whether to restore or maintain it. Since this model would be science-based, would have technical expert review, would evaluate refuge impoundment habitat in a regional context, and be consistent with other coastal refuges, refuge staff plan to use the Coastal Impoundment Strategic Decision Making (SDM) model to direct future management for each of the refuge impoundments. Until refined by the outcome of the SDM model, this objective would be met by manipulating impoundment water depths and vegetation Refuge staff would continue to monitor and assess each impoundment using the Coastal Impoundment SDM model to evaluate whether to continue managing it for current capabilities, or to restore it to its natural hydrology.

An Annual Habitat Management Plan (AHMP), detailing management prescriptions to achieve impoundment objectives, would be prepared annually. Impoundments are managed to encourage growth of desirable waterfowl food plants in impoundment bottoms, while balancing the need to maintain a certain amount of woody vegetation along pond edges for black duck thermal cover and songbird habitat. Annual water management plans would prescribe where and how frequently to remove encroaching woody vegetation through mowing, disking, and/or prescribed burning. Vegetation treatments would occur on a rotational basis, with two to four impoundments being manipulated each year. Taxa-specific objectives may be rotated among impoundments from year to year depending on environmental conditions and impoundment capabilities.

Assateague Island is a critical stopover point for southbound migrating monarchs that use the refuge's resources to rest, refuel, and roost for the night. Bidens is a prime peak migration nectar source for monarchs, as well as an excellent seed source for waterfowl. This species grows in the borrow ditches of impoundments, especially those along the Wildlife Loop, and can cover large portions of some impoundments, including Shoveler (B-North Pool), Mallard (C Pool), Pintail (D Pool), and Gadwall (E Pool). Blooming times vary from mid-September to mid-October, depending on rainfall from late summer storms and fall hurricanes; plants often hold buds closed for weeks until there is sufficient rainfall (Gibbs 2008). Bidens is particularly attractive to migrating monarchs because it often covers large areas and provides a quality nectar source.

Periodic mowing and disking seems to enhance the germination and growth of Bidens in refuge impoundments (Savage, pers. comm., 2010). Late summer and early fall are sometimes the only periods that mowing can be accomplished due to breeding birds or wet conditions during other times of the year. Therefore, mowing would be strategically planned so that at least half of the identified nectar sources would be left un-mowed for butterflies.

Management Strategies

- Manage at least 10 impoundments each winter (December through mid-March) for wintering waterfowl. Manage at least 4 impoundments each spring (April and May) and 3 each fall (July through October) for migrating shorebirds. Manage at least 6 impoundments each fall (late October to early November) for migrating waterfowl. Manage at least 2 impoundments during June, July, and August to provide suitable

feeding areas (ponded areas or borrow ditches that concentrate fish) for nesting waterbirds.

- Draw-down NWF impoundment beginning February 15 each year by a combination of pumping and constructing/maintaining shallow ditches. Continue to evaluate the contribution of NWF impoundment to plover reproductive success in the annual shorebird report; if it is determined that these efforts are not contributing to plover recovery or benefitting other species, develop alternate management prescriptions for the NWF impoundment and an alternative plan with USFWS Ecological Services to mitigate for the loss of piping plover habitat due to the current location of the recreational beach.
- On alternate years, enhance piping plover nesting habitat in the NWF impoundment by various methods which may include placing clam shells, constructing low-profile nesting islands, flooding and/or disking/mowing/burning to remove vegetation.
- Prescribe burn, on a rotational basis, 150 to 300 acres in impoundments. This is based on the acres of impoundments covered by burnable vegetation (1500 acres) divided by the fire return interval in this habitat type (T. Craig, USFWS Fire Management, pers. comm., January 27, 2010).
- In cooperation with USDA, continue to reduce, eliminating if possible, populations of non-migrant Canada geese. Control measures would be timed to take place before migrants begin arriving (September). Support the town of Chincoteague's efforts to reduce Canada goose populations, since geese nesting and loafing in town areas move to the refuge.
- Record all management actions implemented in each impoundment in the refuge impoundment database.
- Encourage the growth of Bidens on 40 acres of impoundment bottoms and borrow ditches. Conduct mechanical treatments (disking, mowing) and prescribed burning in impoundments Snow Goose (B-South Pool), Shoveler (B-North Pool), Mallard (C Pool), Pintail (D Pool), and Gadwall (E Pool) on a rotational basis so that at least 50 percent of the Bidens stands are in flower September to October in a minimum of two of these impoundments.
- Avoid mowing or disking any areas with Phragmites because it spreads this invasive.
- Avoid prescribed burning of Bidens stands where natural germination and growth is desirable.
- Adjust the timing of Phragmites aerial spraying so that it is completed prior to September 10th to avoid herbicide contact with butterflies. In addition, avoid overspray and wind-drift onto non-target plants such as, goldenrod, Bidens, and other nectar plants by spraying in calm conditions.
- Delay fall mowing of other monarch nectaring plants on dike tops and slopes until after November 1.
- Collaborate with potential partners doing greenhouse germination experiments of Bidens, and other nectar plants if appropriate, by collecting seeds for propagation.
- Impoundment dikes such as for Mallard (C Dike), Pintail (D Dike), etc.: Mow as needed to prevent woody encroachment. During the growing season mow a 10-foot wide strip on the top of dike, providing un-mowed habitat on slopes and toes of dike for ground nesting birds and monarch nectar plants. Slopes and toes of dike would be mowed early in November to reduce woody encroachment but prevent waterfowl disturbance.

Biological Monitoring

- Continue monitoring for waterfowl, shorebirds, and waders on refuge impoundments and adjacent tidal areas as per the Chincoteague NWR Inventory and Monitoring Plan.
- Continue to collect bi-weekly water level and salinity readings for each impoundment throughout the year. Water gauge readings would be used to adjust impoundments to proper depth for target species use, and to conduct/evaluate water level manipulations as identified in annual work plans.
- Conduct vegetative transects at fixed sampling points in each impoundment in order to monitor the effectiveness of water level management/vegetation management for achieving bird and monarch objectives. Use the results to evaluate vegetation response to management actions, adjust prescriptions in the Annual Water Management Plan.
- Continue to map Phragmites patches in and adjacent to impoundments bi-annually, at a minimum, and annually the year following any major treatment such as aerial spraying or prescribed burning. Use results to prioritize treatment areas.
- Conduct observational walks within the impoundments following mechanical/chemical treatments or water level manipulations to qualitatively assess whether desired results are being achieved. Also scout for invasive species and estimate overall vegetative composition of the impoundments.

Goal 3: Upland Habitats

Manage upland habitats for biological integrity, diversity and environmental health of coastal forests and shrublands to sustain native wildlife and plant communities, including species of conservation concern.

Objective 3.1 Coastal Shrub Habitat for Breeding and Migrating Landbirds

Manage 2,500 acres of coastal shrubland with a continuous band of greater than 500 feet between impoundment and the dunes, comprised of 100 percent native species (wax myrtle, bayberry, and groundsel) with at least 50 percent fruit bearing shrubs averaging about 10 feet in height and containing few or no pine trees, to provide forage and cover for breeding, migrating and wintering landbirds.

Rationale:
Early successional habitats are an important part of the forest landscape for supporting avian communities. Suitable habitat for scrub-shrub bird species has decreased, resulting in significant declines for many species (Greenberg et al. 2011). Shrubs provide abundance of insect food and berries for breeding birds during the fall migration and/or throughout the winter. Migrating birds depend on stopover habitat along migration routes where they can find food, water, and protection to regain energy lost in flight and re-fuel for the next leg of the journey (Duncan et al. 2002). Robert's (2009) 10-year banding study found that the refuge's wax myrtle/bayberry/groundsel shrub community provides important stopover habitat. Dense, tall (10 to 12 feet high) wax myrtle/bayberry habitat between impoundments and the dune line is also preferred nesting habitat for passerines, including several "highest" and "high" priority species of conservation concern in BCR 30, such as prairie warbler, field sparrow, and brown thrasher.

A recent 3-year study at Assateague Island National Seashore in Maryland used a series of exclosure treatments to assess the influence of pony herbivory on Assateague Island's shrub and forest habitats. The results indicate that pony grazing is reducing species diversity in forest

habitats and altering vegetative community composition in both shrub and forest habitats (Sturm 2007). The study found that pony grazing also influences the abundance and average height of several native plant species in these habitats. Grazing by sika and resident white-tailed deer is a potential threat to achieving objectives if numbers are not managed by hunting.

Assateague Island is a critical stopover point for southbound migrating monarchs that use the refuge's resources to rest, refuel, and roost for the night. Monarch roosting site locations vary somewhat from year to year, but they are generally found on the east-facing and/or leeward side of trees and shrub clumps. Roosting habitat is defined as thickets of bayberry, groundsel-tree, black cherry, marsh elder, or red cedar with an eastern exposure of a patch size sufficient to buffer winds adjacent to large open areas such as north side of Toms Cove and western side of impoundments. Monarch seek protection from the wind behind low growing plants, manmade objects such as fences, and even tire tracks in the sand. On very windy days they wait for the wind to dissipate before crossing Chincoteague Inlet. Management activities to return the beach to more natural processes (no longer maintaining the artificial dune around the public beach and removing the split rail fences around the parking areas), removed some monarch wind breaks. Without daytime roosting areas that are protected from the wind on large open areas such as the Hook and Overwash, monarchs may deplete energy reserves to the point they are unable to continue southward migration, or are blown out to sea.

Management Strategies

Manage a 500-foot wide continuous strip of 10- to 12-foot tall myrtle/bayberry shrub, free of trees, parallel to (and behind the) dunes on eastern side of the South Wash Flats impoundment.

- Use a hydroaxe or chainsaw to selectively remove loblolly pine trees greater than or equal to 6.5 feet tall where they are encroaching in otherwise suitable myrtle/bayberry habitat on impoundment edges.
- Carefully manage the encroachment of woody shrubs around the edges of the impoundments around Wildlife Loop to achieve multiple objectives of providing waterbird habitat and wildlife viewing, while maintaining habitat for wintering sparrows. Mow on a rotational basis, leaving at least 50 percent of the brushy vegetation around the perimeter of these impoundments un-mowed in any given winter.
- Wildlife Loop: Mow a strip no wider than 5 feet on either side of the road around the perimeter, with minimal mowing around benches and viewing spots. Primarily for public health and safety reasons, keeping roadside grass low allows pedestrians and bicyclers to step off the road with less concern for ticks and chiggers. Dikes may be mowed between November 1 and April 1 to prevent woody encroachment and maintain wildlife viewing opportunities.
- Pony Fences: Mow only as wide as needed to facilitate inspection and repair of fences and prevent woody plants and vines from strangling the fence. Generally, this would be a swath no more than 6 to 7 feet wide on either side of the fence. In areas where brush or tree limbs need to be trimmed back to a distance greater than 7 feet from the fence to ensure the safety of equipment operators, maintenance and biology staffs would coordinate to flag or otherwise mark the areas prior to mowing. Mowing during the nesting season would be avoided, except where this is not possible (e.g., wet/muddy conditions). Combine with herbicide spraying to increase effectiveness.
- Through hunting, maintain the sika and resident white-tailed deer populations at levels low enough so as not to degrade the shrub vegetation by over-browsing. The present

season: a sika/deer archery season in October, a sika/deer firearms season in early December, and a firearms sika only season in January is currently fulfilling this objective. Depending on the sika/deer population and/or hunter participation, this season may be expanded or contracted in the future.

- Delay mowing, on rotational basis, of monarch nectaring and roosting locations until after November 1 or seed-set (whichever is later) on at least 80 percent of the roost sites and 50 percent of the nectar sources.
- Encourage interested partner(s) to periodically (every 3 to 5 years) reassess important monarch roosting and nectar locations. The dynamic nature of barrier island systems is expected to alter some of the monarch habitat, so monarch habitat protection and management actions would need to be dynamic as well.
- Minimize mowing on Beach Road from Pony Coral to Toms Cove Visitor Center to protect goldenrod and other butterfly nectar plants. Mowing would occur only if needed for safety reasons and only then would grass on the road side of the wooden posts be trimmed so wooden posts are visible to motorists. Care would be taken by maintenance crew so that vegetation behind posts is left uncut for the entire growing season, allowing goldenrod plants to seed and spread. Mowing to control woody vegetation would not take place until after November 1.

Biological Monitoring

- Plot BBS route survey points on the cover map. Use this spatial analysis, together with results from previous strategy, to determine how frequently the refuge's BBS routes should be repeated, and whether additional routes should be added.
- Continue to partner with volunteers and other individuals or organizations as opportunities arise, to increase our understanding of how breeding and migrating landbirds use refuge habitats through banding and other monitoring projects.
- Continue to collaborate with VDGIF and NPS to annually estimate sika and resident white-tailed deer population size and structure on Assateague from deer hunt check station data and other information as appropriate.

Objective 3.2 Loblolly Pine Forest for Delmarva Peninsula fox squirrel, Brown-headed Nuthatch and Eastern Towhee

Manage the biological integrity and diversity of 1,600 acres of mature loblolly pine forest on Assateague Island by diversifying the structure and age class using small openings (2 to 10 acres) that favor hardwood regeneration, to support a minimum population of 200 Delmarva Peninsula fox squirrels as well as, breeding habitat for brown-headed nuthatch and eastern towhee.

Rationale:
Forest habitat on Assateague Island consists largely of monotypic stands of even-aged and mature loblolly pine trees, which are vulnerable to catastrophic loss from insect damage or extreme weather/wind events, without management. The southern pine beetle, a native species, is the only major known insect threat to this forest. Some younger forest stands date back to the southern pine beetle infestations in 1983 and 1994 when blocks of forest were clear-cut in Black Duck Drain (1983) and Woodland Trail/Wildlife Loop/White Hills (1994) to control the outbreak. Many of these younger stands are dense and stunted, with understory habitat conditions unfavorable for focal species. Creating a mosaic of pine and hardwood trees of varying age classes and structural diversity would make the forest more resistant to damaging insect outbreaks, and create habitat

characteristics more favorable to the Delmarva Peninsula fox squirrel, bobwhite, brown-headed nuthatch, and eastern towhee. The southern pine beetle does not attack hardwood trees and younger age-class trees provide a barrier to bark beetle spread (Merten, pers. comm., 2010).

The natural fire frequency for southern pine forests of the mid-Atlantic is estimated at 5 to 15 years (Kulynycz 2004 and Tim Craig, USFWS Fire Management Officer, pers. comm., January 27, 2010). Reintroducing fire into the "pure pine" habitat type described above through prescribed burning could create open understory habitat conditions preferred by Delmarva Peninsula fox squirrel (USFWS 2011), diversify the age-class and structure of the forest, and mimic natural disturbance factors. On the other hand, hardwoods are not resistant to fire, so prescribed burning may be detrimental in increasing the hardwood component. Other silvicultural techniques, such as creating small openings by clear-cutting pine around naturally regenerating hardwood saplings and/or replanting hardwoods in these clearings or natural openings, may better meet the objective (Kellum and Lewis, pers. comm., February 25, 2010).

Management Strategies

- If a southern pine beetle outbreak spreads to cover a single block of 5 contiguous acres in one growing season, assess whether management actions are needed to control the infestation so that it can be contained within a 10-acre or less block (Keller, pers. comm., February 25, 2010). Each situation would need to be evaluated on a case-by-case basis to determine rate of spread and whether natural barriers would contain the outbreak to a size that does not impact Delmarva Peninsula fox squirrels, public safety, or other important resources. If suppression action is determined necessary, the preferred method would be to cut all currently infested pine trees in addition to a green tree buffer of at least the average stand tree height in front of the leading edge or head of the outbreak during the April to October growing season (Merten, pers. comm., 2010). Green and infested trees within the buffer would be felled so they fall in the direction of the infected zone and can be left on the ground. Vacated trees (those with numerous beetle exit holes or with sloughing bark) should be left standing as they provide habitat for the checkered beetle, and other native biological control insects of southern pine beetle (Merten, pers. comm. 2010). Standing dead trees no longer harbor southern pine beetles and provide snag habitat for birds and squirrels. Leaving dead trees also minimizes disturbance to wildlife habitat, and may also promote the growth of hardwood trees in the understory. Hardwoods are not affected by southern pine beetle, but are often damaged by clear-cutting methods to remove infested pine trees.
- Thin overstocked, young, monotypic loblolly pine stands ("pure pine" habitat type) in the Woodland Trail compartment and along Wildlife Loop by mechanical means and/or the use of prescribed fire. Thin to the area's Site Index. Time thinning so that it occurs when cones are green, to avoid spreading mature seeds.
- If supported by the Forest Management Plan and Continuous Forest Inventory (CFI), conduct another prescribed burn in "pure pine" forest habitat. The prescribed burn unit should be planned to avoid the "loblolly pine/mixed hardwood" habitat and maritime forest. The burn would be conducted in late spring/early summer, with the goal of creating a more open understory and increasing structural diversity. If the prescribed burn has the desired effect of creating habitat conditions favored by forest focal species, additional burns could be considered for other areas.
- Through hunting, manage sika and resident white tailed deer, at low enough levels so as not to degrade the shrub vegetation by over-browsing. If population decreases, maintain

practices. Develop a managed threshold to identify desired population size (conduct research to identify vegetation thresholds)

Biological Monitoring

- Continue to regularly scout for natural southern pine beetle outbreaks, focusing the most effort during conditions when the southern pine beetle is most active: spring and fall when daily temperatures are between 60 and 80 degrees Fahrenheit. Scout weekly during these conditions. During periods of successive drought, or other physiological stress, conduct aerial surveys, especially in mid-summer. When southern pine beetle infested tree(s) are discovered, mark individual tree(s) and/or Global Positioning System (GPS) the perimeter of the infestation and monitor for spread of the disease at least monthly. Identify and map natural barriers to the southern pine beetle such as non-pine vegetation, young pine stands, roads, water, etc.
- Continue to perform early detection and rapid response to control invasive, undesirable plants and animal species.
- Refer to previous strategies concerning BBS data analysis and resumption of refuge BBS routes as these would also serve to monitor the response of brown-headed nuthatch and eastern towhee to forest objectives and management actions.
- Conduct woodcock surveys on three of the four refuge routes every 3 to 5 years. Due to the complete lack of detections and marginal habitat, drop the northern Service Road route from the survey. In years that surveys are conducted, conduct a minimum of two surveys: one prior to March 14 and one during the national survey period (April 10 to April 30). Encourage a graduate student or other partner to investigate Assateague Island's importance for migrating and breeding woodcock. Woodcock was considered but eliminated as a focal species because it is thought that Chincoteague NWR does not make a significant contribution to the population; however, this assumption has not been thoroughly investigated.

Delmarva Fox Squirrel Management Strategies

- Protect Delmarva Peninsula fox squirrels from hunting, competition and predation by continuing to prohibit pets on Assateague Island, remove all feral cats, and reduce numbers of red fox. Trap and remove gray squirrels.
- In coordination with USFWS Ecological Services and recommendations from the most recent status review, evaluate the need to maintain Delmarva Peninsula fox squirrel nest boxes (the current number is 127). Decrease or eliminate boxes in favor of natural nesting cavities.
- Conduct Delmarva Peninsula fox squirrel population surveys in loblolly pine forest north of White Hills using Reconyx remote cameras, or other methods.
- Mow a 10- to 12-foot wide swath along each side of Beach Road between Assateague Channel Bridge and the Pony Corral as needed during the growing season to maintain vegetation height at less than or equal to 6 inches, in order to minimize Delmarva Peninsula fox squirrel fatalities due to vehicle strikes.
- Service Road: Mow a strip no wider than 5 feet along the road edge during the growing season to minimize Delmarva Peninsula fox squirrel fatalities due to vehicle strikes and for maintenance of road bed. A wider swath may be mowed between November 1 and April 1 to prevent woody encroachment.

- Do not mow Woodland Trail, except to facilitate public enjoyment of kiosks, benches, and trails.

Delmarva Fox Squirrel Biological Monitoring

- Conduct bi-annual population estimate of Delmarva Peninsula fox squirrel population in White Hills, Lighthouse Ridge, and Woodland Trail areas using mark/re-capture methods.
- Continue to record (including sex and age) all Delmarva Peninsula fox squirrels killed by vehicle strikes and inspect them for Passive Integrated Transponder (PIT) tags to determine whether road-killed Delmarva Peninsula fox squirrels remain below 5 per year.
- (*Although the Delmarva Peninsula fox squirrel has been proposed for delisting from the endangered species list since the draft CCP/EIS was published, it has not been finalized yet.*)

Objective 3.3 Upland Habitats on Wallops Island NWR

On Wallops Island NWR, manage and restore the biological integrity and diversity of 121 acres of mixed hardwood forest and 57 acres of early successional habitat maintained in the power line right-of-way (ROW) and NASA runway approach to benefit migrating and nesting landbirds, bobwhite and woodcock with less than 40 acres infested with invasive plant species.

Rationale:
Since its creation in 1971, Wallops Island NWR has been unstaffed, with little to no monitoring or management, except by A & N Electric Cooperative (ANEC), a utility company with a power line ROW. ANEC removes tall growing trees, primarily the non-native autumn olive, and some brush species. Manipulations, with the goal of creating early successional habitat favored by bobwhite and other species that prefer edge and early succession habitats, have occurred in the old-field habitat, but these have been poorly documented.

Forested habitats have shown the greatest loss of any cover type on the Delmarva Peninsula, and forest cover on the Peninsula is fragmented (Chincoteague NWR 2004). Given that most forests in the area are small private woodlots, maintaining an approximately 175-acre block of mature forest with a significant hardwood component would provide an important habitat type for migrant and resident landbirds.

The spread of invasive plant species is the greatest management concern to upland habitat. Invasive plant mapping conducted in 2004 and 2009 identified autumn olive, Phragmites, Nepalese browntop, Japanese siltgrass, Japanese honeysuckle, and several thistles as non-native species of concern. Approximately 75 acres of autumn olive were mapped in 2009; one-third of the autumn olive mapped was located in monotypic stands along the forest edge, and two-thirds of the acreage consists of autumn olive invading the understory of the pine/hardwood forest. Japanese siltgrass also covers large areas of the forest understory (Buffa 2009). Twenty acres of Phragmites were mapped in wetlands adjacent to the forest.

Management Strategies

- Continue to support and build upon ANEC management of the ROW on Wallops Island NWR which favors maintenance of an early-successional plant community composed primarily of low-growing native shrubs such as dogwoods and warm- season grasses.

ANEC plans to conduct the following actions (Belknap, pers. comm., 2010) to manage their ROW:

- Mechanically (hydro-axe) remove tall-growing trees and shrubs, emphasizing the removal of autumn olive. Most mechanical work was completed in 2008; however, from time to time tall dead, dying, leaning, or brittle trees along the ROW border may need to be removed or topped.
- Selectively remove target growing trees/shrubs (red maple, pine, oak, sweet gum, dense raspberry) and all invasive species with herbicides and backpack sprayers within 3 years, and thereafter, conduct chemical treatments at intervals of 3 years. Manage vegetation selectively for dogwoods, low-growing shrubs like bayberry that don't interfere with ROW maintenance, and grasses.
- Minimize use of heavy equipment in wetlands or other areas where vehicles would tear up the ground or create deep ruts. Use hand tools and backpack sprayers in these areas, or conduct activities in winter when the ground is frozen.
- Time chemical-based vegetation control activities for August or later to avoid impacts to breeding birds.

- Work with ANEC staff to select danger trees that could be topped to create brush piles that would be left in place for wildlife habitat.
- Coordinate with ANEC representative annually (target is March) to review vegetation management plans for the coming year, collect information to prepare Pesticide Use Proposals, and/or conduct a site visit to evaluate vegetation management.
- Through hunting, maintain a sustainable white-tailed deer population that does not degrade the native understory vegetation by over-browsing or pose safety concerns to NASA,WFF, or the Virginia DOT.

Biological Monitoring

- Repeat GPS ground mapping of invasive species' perimeter every 3 years. Scout for invasive species in conjunction with other management or survey activities.
- ANEC would monitor vegetation objectives in the ROW by visual field observations every 1 to 2 years.

Goal 4: Southern Barrier Islands Unit (Assawoman, Metompkin, Cedar)

Perpetuate the biological integrity, diversity, and long term viability of natural habitats that support native avian communities and turtles on Assawoman, Metompkin, and Cedar Islands through a partnership approach.

Objective 4.1 Barrier Beach and Dunes – Breeding Shorebirds and Turtles

Work with partners to prevent disturbance and mortality to nesting representative species (piping plover, least tern, and loggerhead sea turtle) on Assawoman, Metompkin, and Cedar Islands during the breeding season.

Rationale:
Virginia's string of barrier islands, which extend from Assateague Island south to Fisherman Island at the mouth of the Chesapeake Bay, is the largest collection of near pristine barrier islands left in the country (USFWS 1998). Aside from small private in-holdings, all of Virginia's barrier islands are protected by either Federal or State agencies, or TNC. These partners developed a

Conservation Action Plan in 1996 with a goal, "To ensure the long-term viability of the avian communities, species, and habitats in the Virginia barrier islands system through a partnership approach" (TNC 1996). This objective works towards the preservation of these islands in their natural state, allowing coastal processes to continue to shape them.

The mid-Atlantic barrier islands provide preferred nesting habitat for terns, skimmers, gulls, American oystercatchers, willets, herons, egrets, other waterbirds, shorebirds, and turtles. Erwin (1980) found that 81 percent of seabirds, which include terns and skimmers, nest on barrier island beaches, in Virginia. Many of the avian species that nest, migrate, and winter in the Virginia barrier islands system were nearly extirpated at the turn of the 20th century by a combination of hunting and other human activities. Although nearly all of the Virginia barrier islands are in a protected status in one form or another, many wildlife species are still in decline or below objective levels, including common terns, least terns, gull-billed terns, black skimmers, American black duck, piping plover, and several herons. Documented and potential threats include severe weather events, sea level rise, competition and displacement from nesting habitat by aggressive avian species, mammalian and avian predators, and disturbance from recreational use of barrier islands and salt marsh habitats. Public recreational activities are restricted to varying degrees on Assawoman, Metompkin, and Cedar Islands during the shorebird breeding season (March 15 through August 31) (USFWS 2008d), but because the islands are remote and unstaffed, human disturbance has not been measured or monitored.

The intermixed public and private ownership and lack of a complete boundary survey on Cedar Island limits staff's ability to enforce restrictions on this island. Most wildlife-dependent public uses are allowed; however, because it is more remote than either Assawoman or Metompkin Islands and accessible only by boat, it is less visited by the public. The differences in permitted activities, dates of restrictions, and differing policies of the various agencies and organizations that manage the barrier islands also may make it hard for the public to understand and abide by regulations. Working with partners to develop consistent rules and signage, and directing public use to less sensitive areas would help meet this goal.

Where possible, the refuge will take management steps to replant natural vegetation and protect native species, such as conducting a feasibility study to determine if a transplant program to establish seabeach amaranth on southern barrier island(s) sites is desirable, to further enhance the habitat of the barrier islands.

Management Strategies

- Continue to work with VCAP and other partners (TNC, VDCR, VDGIF, etc.) to standardize public use regulations that reduce disturbance to nesting species on all Virginia barrier islands. This would include implementing standard operating procedures and consistent signing; directing recreation to less sensitive areas; and developing outreach materials and educational programs for the public.
- Continue to post the south end of Assawoman Island and the north end of Metompkin Island. Conduct law enforcement patrols during the breeding season, focusing on the period when nests and chicks are present and visitor use is highest: Memorial Day through Labor Day.
- Continue to minimize direct predation of piping plover, least tern, American oystercatcher, and other beach nesting birds through removal of mammalian and avian predators, and erecting nest exclosures. Discourage nesting of gulls by egg-addling, where feasible.

- Protect any sea turtle nests on Assawoman, Metompkin, and Cedar Islands from human disturbance and predators by erecting "closed area" signs, placing predator screens over all nests, and conducting mammalian and avian predator control.
- Maintain a refuge staff presence on Assawoman, Metompkin, and Cedar Islands of at least 3 days per week during the nesting season in order to enforce beach closures and educate the public about the need to minimize wildlife disturbance. At least one day should be on the weekend.
- Continue to work with Virginia DCR to periodically obtain up-to-date aerial mapping of Phragmites on the southern barrier islands.
- Continue early detection and removal of Japanese sedge and beach vitex on all three southern islands.
- Work with partners to obtain improved bathymetry data and vegetation cover mapping of the southern island units and seaside lagoons to better assess and plan for the impacts of sea level rise.

Biological Monitoring

- Continue breeding shorebird and invasive species monitoring on all of the refuge's barrier islands (see Objective 1.1).
- Conduct sea turtle crawl and nest searches of Assawoman and Cedar Island beaches at least 3 times per week June through August, in conjunction with shorebird monitoring activities.
- Train all personnel conducting regular shorebird surveys on the identification of common native and potential non-native plants they may encounter, so that they can perform early detection and removal of invasive plants.

Objective 4.2 Barrier Beach, Dune, and Tidal Marsh – Migrating and Wintering Shorebirds

Manage natural functioning sandy beach and overwash habitat along Assawoman Island, Metompkin Island, and Cedar Island, and the tidal marshes on the backside of the islands to benefit migrating and wintering shorebirds of conservation concern (red knot, sanderling, American oystercatcher, whimbrel).

Rationale:
The ecological significance of Assawoman, Metompkin, and Cedar Islands is recognized through their inclusion in the Western Hemisphere Shorebird Reserve Network; in excess of 100,000 shorebirds migrate along the refuge's barrier islands during their migration season, using the sandy beach, overwash, and tidal marsh areas as habitat for resting and feeding. This objective works to preserve those areas, and allow for migrating shorebirds to continue use of the refuge.

The refuge's southern barrier islands are particularly important as spring stopover sites for migrating red knots between late April to early June, with numbers peaking in late May (Niles et al. 2010). Virginia hosts approximately 30 percent of the hemisphere's red knot rufa subspecies population, and Cedar and Metompkin Islands fall in the upper third of islands in terms of numbers of red knots counted during migration (TNC 1996). The red knot was listed as a Federal threatened species in December 2014.

The refuge does not currently conduct or organize systematic winter/migratory shorebird surveys on the southern islands like those conducted by volunteers on Assateague Island. Aside from the

winter American oystercatcher roost-site surveys conducted over the past several winters by VDGIF and TNC, the level of non-breeding season surveys conducted by partners is unknown. The Wachapreague Christmas Bird Count includes Cedar Island; this 1-day survey in mid-December consists of a volunteer party walking the entire island and counting all birds seen and heard.

Biological Monitoring

- Evaluate existing shorebird and waterfowl data pertaining to islands in the Southern Barrier Islands Unit to identify key habitat use areas on Assawoman, Metompkin, and Cedar Islands for migrating/wintering red knots, American oystercatcher, sanderling, dunlin, whimbrel, American black duck, and other representative species.
- Support research by partners aimed at fostering a better understanding of migrant and winter bird use of Assawoman, Metompkin, and Cedar Islands. An example is the Center for Conservation Biology's study of the red knot use of barrier islands (Smith et al. 2008).
- Annually conduct resight surveys for tagged red knots in fall and spring, as part of cooperative study, using protocols consistent with partners involved with red knot monitoring and research.
- Continue to collaborate with partners on winter resight surveys for color-banded American oystercatchers in fall and winter. Currently, TNC and VDGIF survey roost sites around Metompkin, Assawoman, and Cedar Islands, while the refuge conducts winter roost resight surveys in Chincoteague Bay.

Goal 5: Partnerships

Working with partners, protect and restore vigorous, viable populations of migratory and resident wildlife, fish, and native plants and their habitats found on the Delmarva Peninsula and identified in State, national, and international treaties, plans, and initiatives. Take a leadership role in collaborative regional efforts to achieve broader conservation goals and serve as a catalyst for achieving a multi-state eco-regional partnership. The refuge will continue to work with partners to explore how best to sustain the resiliency of this unique barrier island system, its communities, and its economy, consistent with the refuge's mission and in the face of dynamic coastal processes, climate change, and storm events.

Objective 5.1 Regional Conservation

Enhance partnerships with conservation organizations to support mutual natural resource conservation efforts in the Delmarva Peninsula by establishing the Lower Delmarva Peninsula Conservation Area and developing other regional management strategies with partners.

Rationale:

With the establishment of the Refuge System over a century ago, USFWS created a vision to embrace a scientific, landscape-level approach to conserve, manage, and restore refuge lands and waters, and to facilitate conservation benefits beyond its boundaries. This vision has been revisited recently with the USFWS strategic plan for climate change and the Refuge System's vision document, *Conserving the Future*, which employs a science-based adaptive resource management framework for conserving species on a landscape scale to bring to bear the best available planning, research, monitoring, and management tools to deliver conservation in the right places at the right time to address the challenges posed by climate change and predicted land use changes (USFWS 2010b and USFWS 2011).

The USFWS recognizes the conservation importance of the southern Delmarva Peninsula; over a quarter of the land in the area has been protected by the USFWS and its Federal, State, local, and non-profit partners. New challenges, such as climate change and increasing fragmentation of wildlife habitats, require an adaptive, broad, landscape-level approach to conservation actions. To continue the conservation of the Delmarva area, the refuge currently is involved in a number of conservation partnerships, including but not limited to the Pocomoke River Conservation Partnership and the Southern Tip Ecological Partnership, and is working with a number of conservation entities, such as states of Virginia and Maryland and affected counties, TNC, The Conservation Fund, the Virginia Eastern Shore Land Trust, the Assateague Coastal Trust, and Ducks Unlimited (DU). The refuge also works with Federal partners, including NPS, National Oceanic and Atmospheric Administration (NOAA), NASA, U.S. Navy, and USDA.

Strategies:

- Participate in events with local partners to advocate resource conservation and promote the mission of the Refuge System.

Objective 5.2 Economic Development

Continue partnerships and seek additional collaborative relationships with the gateway community and regional organizations to support economic development by participating in meetings and events and utilize information from a visitor survey to inform refuge management decisions.

Rationale:
Access to the refuge is primarily through the town of Chincoteague, the economy of which has become increasingly dependent on the tourism dollars brought into its community by refuge visitors. Tourism generates revenue for the town and for surrounding counties not only from the purchasing of products from local businesses, but also in the form of food and lodging excise taxes. Tourism also provides jobs and supports property values. Continued partnerships with the surrounding community and local businesses, and consideration of economic impacts and opportunities for the town of Chincoteague in future management practices would be maintained to support and improve the surrounding economy.

Strategies:

- Participate in economic development efforts and meetings of tourism groups (State tourism, Chamber of Commerce, NASA, Mid-Atlantic Regional Spaceport, etc.).
- Collaborate on communication to public about activities/events.
- Increase participation in events with local partners to enhance refuge visibility.
- Continue to work with NPS, the town of Chincoteague, and other partners to provide a high-quality recreational experience.

Objective 5.3 Community Resiliency

Collaborate with Federal, State, and local partners to explore potential impacts and identify protective methods to address hazard mitigation and improve community resiliency, in coordination with others.

Rationale:
The town of Chincoteague, Accomack and Northampton counties, adjacent coastal communities, and NASA are concerned about future impacts of sea level rise and storm surge on infrastructure

and access to the region. The refuge shares this concern and would work in coordination with other state and Federal agencies and other appropriate partners to investigate the vulnerabilities and anticipated impacts of climate change and sea level rise on the Eastern Shore. The refuge would also work with partners to explore how best to advance the study, information exchange, and project resources for adaptive management practices that sustain the resiliency of this unique barrier island system including but not limited to Assateague, Wallops, Assawoman, and Metompkin Islands in the face of dynamic coastal processes and climate change.

Strategies:

- Continue working with coastal geologists to model the impacts of coastal storm events and other dune breaching scenarios on Assateague Island to evaluate potential effects that breaches and modifications to infrastructure may have on natural and manmade habitats, refuge infrastructure, and flood control for the town of Chincoteague.
- Continue our new partnerships to address coastal resiliency on the Eastern Shore of Virginia through Mid-Atlantic Coastal Resiliency Institute (MACRI), which is "*a multi-disciplinary institution dedicated to integrated climate change research with the goal of helping local and regional leaders make coastal communities and habitats more resilient through scaled science and research informing public policy. Its several partners provide specific expertise in environmental monitoring and forecasting, modeling about coastal vulnerability and risk assessment, and moreover access to climate change space-based data.*" The USFWS is committed to exploring the implementation of resiliency strategies informed by the latest science available.

Objective 5.4 Federal Interagency Collaboration and Facility Management

Maintain existing partnerships focused on science research, interpretation, and shared facilities with adjacent Federal entities.

Rationale:
The USFWS recognizes the value of collaborating with other Federal agencies to accommodate their needs, goals, and mandates, when appropriate and when possible within the scope of the refuge purposes and USFWS mission. Currently, NASA and the U.S. Navy own and use land adjacent to the refuge, and NPS has an interagency agreement with the refuge to maintain a specific area and certain activities on Assateague Island. Also, USFWS, NPS, and USDA have a 2007 use agreement for shared facilities, in which the USDA uses area on the refuge to store various types of equipment. The refuge has coordinated with these Federal partners on many issues and is interested in identifying potential opportunities for future collaboration on wildlife management, scientific research, and public education. Furthermore, the refuge recognizes the need to formalize and expand upon arrangements of shared facilities to continue and enhance facility efficiencies in future developments.

Strategies:

- Continue existing partnerships (including monitoring of development impacts and access to Assawoman Island) and assist with trust species management and recovery.
- Continue to monitor and address wildlife/USFWS concerns and opportunities as NASA and the Mid-Atlantic Regional Spaceport explores expansion of its launch facilities and increases activities.
- On an annual basis, execute the objectives and operational activities of the NPS and USFWS MOU and the strategies in the annual work plan developed by staff.

- Continue the use agreements between NPS and USFWS and between USDA and USFWS for maintenance and storage facilities on Wallops Island NWR.

Objective 5.5 Local Conservation of Tidal Creeks, Estuaries, Mudflats, and Nearshore Marine Waters

Over the 15 year lifespan of the CCP, protect the ecological integrity of tidal creeks, estuaries, mudflats and nearshore marine waters through an active role in local, state, and Federal partnerships to ensure the needs of USFWS trust species are addressed in decisions and actions within the focus areas of Chincoteague and Wallops Island NWRs. Increase protection of these habitats by 5 percent through agreements established through these partnerships.

Rationale:
Most species that are found on the refuge depend on off-refuge habitats to fulfill one or more of their life cycle needs. These habitats are highly susceptible to damage through pollution, human disturbance, and off-refuge projects, all which could influence the success of management activities that the refuge undertakes. Protection of these habitats through partnerships and pooling of resources and funding is needed.

Strategies:

- Continue an active role in the VCAP to share monitoring data with adjacent and sister agencies and organizations such as VDGIF, TNC, NASA WFF, and NPS.
- Continue to collect breeding American oystercatcher data on the Chincoteague Bay Boat Route, and coordinate with partner agencies to determine the frequency of future productivity monitoring on this route.
- Through the refuge's monthly Community Leaders Meeting, continue to inform local political leaders, tourism councils, and sister agencies about trust resources that use the refuge and actions they can take to protect and enhance the ecological integrity of Chincoteague Bay and adjacent habitats.
- Conduct outreach or form a collaborative partnership with the aquaculture industry in surrounding refuge waters aimed at eliminating or cleaning up netting that washes up on refuge habitats.
- Work with other members of VCAP to conduct education and outreach programs targeted at eco-tour operators and other boaters on how to minimize their disturbance to nesting birds.
- Participate in watershed, water quality, and other planning meetings hosted by the county, city, and other similar agencies/organizations.

Goal 6: Visitor Services

People of all ages and abilities develop a stewardship ethic while enjoying their refuge experience and increasing their knowledge of the USFWS, Refuge System, and the refuge.

Objective 6.1 Hunting

Maintain current level of opportunities (e.g., number of hunt days) and current level of visitor satisfaction in hunting program that offers high quality hunting opportunities, including migratory bird and big game.

Rationale:
Hunting is one of the priority public uses of the Refuge System and is to be facilitated when compatible. Hunting on the Delmarva Peninsula is a traditional outdoor pastime and remains a popular form of wildlife-dependent recreation on the refuge and a vital part of the cultural, social, and economic fabric of the communities near the refuge. Furthermore, harvesting surplus animals through hunting is one tool used to manage wildlife populations on the refuge at a level compatible with the environment, provide wildlife-dependent recreational opportunities, and permit the use of a valuable renewable resource. Responsible hunting practices can instill a unique understanding and appreciation of wildlife, their behavior, and habitat needs, as well as their role in the surrounding environment.

Strategies:
- Continue current hunting policy on Chincoteague NWR:
    - Big game hunting (white-tailed deer and sika) on Assateague Island with firearms and archery by lottery. (*Note: Although some hunters require OSV to access hunting areas in the Toms Cove Hook area, we address OSV uses primarily in sections where we discuss fishing*).
    - Migratory game bird hunting by water access outside of Assateague Island.
- Continue current hunting policy on Wallops Island NWR:
    - Big game hunting (white-tailed deer).
- Continue to utilize depopulation permits for sika from VDGIF to assess and monitor sika population.
- Continue monitoring techniques in partnership with NPS (e.g., camera detection survey, aerial flight, and remote sensing) to obtain more accurate population counts for sika and resident white-tailed deer.
- Continue to ensure that the white-tailed deer and waterfowl harvest are consistent with State regulations.
- Complete development of opportunity for hunters with disabilities, such as those participating in the Wounded Warriors Project, outside of Woodland Trail area.

Objective 6.2 Fishing and OSV Use

Maintain current level of access to fishing areas (this includes surf fishing, crabbing, oyster harvest, and clamming) and current level of visitor satisfaction in these fishing opportunities for people of all ages and backgrounds, including access by OSV to high-quality surf fishing areas.

Rationale:
Fishing is one of the priority uses of the Refuge System and is to be facilitated when compatible. Surf fishing, crabbing, oyster harvest, and clamming are among the most popular wildlife-dependent recreational activities conducted on the refuge. Surf fishing is allowed anywhere along the Atlantic Ocean outside of the life-guarded area. Those surf fishing areas south of the current parking lots (Overwash and Toms Cove Hook) are accessible via OSV use, which is limited to times of the year to provide maximum protection to prime nesting habitat for coastal nesting birds and sea turtles. Crabbing is allowed in designated areas in Swan Cove Pool (F Pool) and along Beach Road. Clamming and oyster harvest are also allowed as a recreational activity in the bayside areas for Toms Cove, also accessible via the Bi-Valve Trail.

Strategies:
- Maintain existing fishing and crabbing programs and areas.

- Continue to allow surf fishing on Assateague Island without a refuge permit (except to stay after-hours) anywhere along the Atlantic Ocean outside of the life-guarded area, with areas north of the recreational beach accessible by foot only and areas south accessible by foot or OSV, with OSV permit.
- Continue to maintain designated crabbing areas (Toms Cove and Swan Cove Pool (F Pool)) (Areas within Assateague Channel provided by NPS).
- Continue joint programs with NPS on surf fishing demonstrations.
- Continue incorporating crabbing and other fishing activities into youth programs.
- Maintain existing OSV closure schedule, vehicle limits, and permits for fishing access south of recreational beach in coordination with NPS, per the NPS-USFWS MOU.
- Continue yearly OSV permit sales (cost set by NPS). Continue to limit the number of vehicles to 48 at any one time or 18 when the Hook is closed.
- Continue to require OSV operators in designated zone to carry the following equipment:
    - A shovel with a blade at least 6-inch square and at least 18 inches long.
    - A vehicle jack sufficient to lift one wheel clear of the sand.
    - A jack support that is at least 12-inch by 12-inch of non-bending steel, 5/8-inch plywood or 1.5-inch hardwood.
    - A tire gauge with a minimum reading of 15 pounds or less.
    - A tow rope or tow strap, chain or cable with a minimum pulling strength of 6,000 pounds and at least 10 feet long. Minimum diameter is ½-inch for nylon or Dacron ropes; ¾-inch for all other ropes; ¼-inch for carbon steel cable; 5/8-inch for chain links.
- Close Overwash portion of the OSV zone March 15 through August 31 intermittingly based on nesting behavior; close 256 feet (200 meters) north of nesting sites from 2 days prior to any nests hatching to fledging.
- Close Hook portion of the OSV zone from March 15 to August 31 or thereafter, until the last shorebird fledges.

Objective 6.3 Environmental Education and Interpretation

Continue to achieve current level of participation (number of students/programs, number of Web site hits) and current level of visitor satisfaction with environmental education and interpretation opportunities.

Rationale:
Interpretation and environmental education are priority public uses. Interpreting the resources and challenges of the refuge to the general public and incorporating these topics into school curricula is a service welcomed by the general public, communities, and schools. The refuge works with local kindergarten to grade-12 schools, communities, and educational organizations to provide classroom and hands-on programs both on and off the refuge for youth. On the refuge, interpretative hubs are located on several trails, with one trail and pavilion designated for environmental education, as well as the Herbert H. Bateman Educational and Administrative Center, built in 2003. Through the use of interpretation and education, the Refuge System can create a personal, emotional connection with visitors while providing them with a deeper understanding of their ecological place in the natural world, offering a clear understanding of the benefits of the Refuge System, and providing an avenue to promote an ecological conscience in future conservationists.

Strategies:

- Maintain current environmental education opportunities (at least 7,500 education participants annually) as administered by USFWS, including:
    - Serve students by working with NPS, CBFS, Accomack and Northampton County school districts, Girl Scouts, Boy Scouts, and Home School students, among others.
    - Offer teacher workshops and teacher-led learning opportunities when staff guided programs are not available.
    - Offer environmental education programs in the classroom of the Herbert H. Bateman Educational and Administrative Center and in the environmental education pavilion (e.g. Habitat Hunting, Forest Ecology, Nature and ME, Critters and Gadgets).
    - Continue to allow the NPS to offer programs from the Toms Cove Visitor Center (e.g. Aquarium Talk, Beach Walk, Marine Explorers, and Salt Marsh Adventure).
    - Continue to participate in Science on the Shore program in collaboration with NASA, CBFS, TNC, and the Eastern Shore Community College (ESCC) to "provide the Eastern Shore community with an understanding of how local science-based research and preservation techniques are used to solve challenges that impact the nation" (Chincoteague Bay Field Station, formerly Marine Science Consortium).
- Maintain current interpretive opportunities (at least 68,000 interpretation participants annually) primarily through self-guided interpretation:
    - Continue to maintain exhibits and videos at the Herbert H. Bateman Educational and Administrative Center.
    - Continue to offer the Children of the Woods Day Camp (a week long day-camp offered to kids ages 8 to 11 which offers activities such as crabbing, clamming, archery, surf fishing, bicycling, and kayaking), sponsored by the CNHA.
    - Pursue interpretation opportunities on proposed shuttle, through an automated audio recording or staff narration.
    - Continue to maintain the kiosk at the Virginia New Church Welcome Center on Route 13.
    - Continue to partner with the CNHA on tours, lectures, and other programs.
    - Continue to allow the NPS to offer hands-on immersive programs from the Toms Cove Visitor Center (e.g., seining, kayaking).
    - Continue training of volunteers to assist in activities.
    - Continue pursuit of proposal for mobile trailer for outreach/education and acquire by within 3 years.
    - Continue to hold eight major special events (Junior Duck Stamp Contest, International Migratory Bird Day Celebration, National Wildlife Refuge Week, National Public Lands Day, Waterfowl Weekend, Sunrise Pony Walk during Pony Penning, Annual Beach Clean-up, Great Backyard Bird Count).

Objective 6.4 Wildlife Observation and Photography

Maintain current level of visitor satisfaction with opportunities for wildlife observation and photography.

Rationale:
Wildlife observation and photography are two of the six priority public uses of the Refuge System and are to be facilitated when compatible. Both public uses promote visitor understanding of, and

increase visitor appreciation for, the value of and need for fish and wildlife habitat conservation. Refuges facilitate these uses by providing enhanced opportunities to view wildlife in their natural habitat by providing platforms, brochures, interpreters, viewing areas, and tour routes. Developing specific areas for visitors to view wildlife enhances wildlife observation and limits the disturbance to wildlife and habitat.

The refuge provides outstanding wildlife viewing opportunities throughout the year, including migrating birds, sika, and resident white-tailed deer, and others. Birding in particular is a popular wildlife observation activity, with well-used sites at Swan Cove Pool (F Pool), Toms Cove, Woodland Trail, and Snow Goose Pool (B-South Pool) in the Wildlife Loop, all of which provide wildlife viewing and opportunities for amateur and professional photographers. This objective represents the current direction of the wildlife observation and photography program on the refuge and assumes continued funding and staffing for operations and maintenance.

Strategies:

- Maintain current walking, biking, and driving access and allow boating access for wildlife observation and photography:
    - Existing trails;
    - Hand-carried, human-powered, non-motorized boat access;
    - Photography workshops;
    - CNHA Bus Tours.

Objective 6.5 Recreational Beach Use

In cooperation with the NPS, continue to provide a 1-mile recreational beach year-round for enjoyment of an undeveloped, natural setting that is accessible by several means including private vehicles, and parking near the beach, to maintain the current level of visitor use.

Rationale:
The beaches of Assateague Island offer a unique experience in the mid-Atlantic area as they exist primarily in an undeveloped setting, drawing many families seeking out a natural experience. Under a 2012 NPS-USFWS MOU, the NPS currently manages an assigned area consisting of the 1-mile recreational beach and corresponding adjacent 961 parking spaces. The current recreational beach and facilities on Assateague Island are located in one of the most dynamic areas of the island, and over the years, coastal storms and accompanying extreme high tides have repeatedly washed out the recreational beach parking lots. The 1993 Master Plan addressed these conditions by identifying a long-term strategy to pursue alternative means of transportation such as a shuttle system and off-site parking as necessary to maintain beach use in the future. The 1993 Master Plan acknowledged that although the loss of the existing parking will not likely occur for many years, potential parking sites on Chincoteague Island, that are close to the refuge and beneficial from an economic standpoint to the town (in that visitors to the beach would be parking in town), are being lost to other forms of development, and as a result, potential off-site parking locations should be pursued (Master Plan 1992).

Strategies:

- Continue to allow NPS to maintain land for parking, which would preserve the existing capacity of 961 spaces, in the current location at the terminus of Beach Road near Toms Cove, as long as suitable land base directly behind the recreational beach remains. As sea level rise and natural forces reduce the land base capable of supporting the current parking, the number of spaces would be reduced accordingly.

- Continue to coordinate with NPS and the town of Chincoteague to identify a suitable off-site beach parking area for future use once the existing beach parking is reduced or lost due to lack of suitable land base behind the recreational beach.
    - Continue to identify potential Chincoteague Island parking site(s) and pursue funding to acquire land or rights to use. Any decision to pursue purchase of additional property will have a separate public process.
- In being consistent with the 1993 Master Plan, as storms and other natural forces eliminate parking spaces adjacent to the beach, implement an alternate means of transportation such as a shuttle system.
    - The shuttle would have an express route from off-site parking to the recreational beach.
    - Shuttle schedule would be dependent on the number of parking spaces lost, but would initially operate on weekends in May and September and Columbus Day weekend and daily June through August and move to year-round as necessary.
    - Ownership and operation of the shuttle would need to be determined; it may involve USFWS, the town of Chincoteague, or other partner (private or public).
    - Protection from hazardous weather conditions would be provided to shuttle riders in coordination with NPS by providing shelters.
- Continue to confine recreational beach use on Assateague Island to the assigned area identified in the NPS-USFWS MOU.
- Continue to allow only wildlife-oriented recreational activities north of the recreational beach.
- Continue use of Swan Cove Trail for bicycle use and access to the recreational beach.
- Areas important to nesting piping plovers and other shorebirds would continue to be closed to recreational use from March 15 to August 31, or thereafter, until the last shorebird fledges, annually. These closures are subject to extension if the refuge makes the determination that unfledged chicks or other beach nesting birds are still present beyond August 31. Refuge staff would post the nesting areas for protection of nesting birds as well as informing the public of the restricted area.
    - Public use activities would be monitored and if visits increase to a point where disturbance to nesting birds becomes a problem, additional access restrictions would be implemented.

Objective 6.6 Other Recreational Uses

Continue to provide opportunities for public to use the refuge for non-wildlife dependent recreation that is compatible with the refuge purpose and maintain current level of visitor satisfaction.

Rationale:
The refuge does allow uses beyond the six wildlife-dependent public uses but only after determining they are appropriate, compatible with the refuge's purpose, and consistent with public safety. All such uses are required to have a Finding of Appropriateness and a CD, which evaluates an activity's compatibility with refuge purposes and outlines measures to ensure compatibility which must be followed if the use is to be allowed.

Strategies:
- Maintain walking and bicycling on the following trails: Woodland Trail (1.6 miles), Black Duck Trail (1.0 miles), Wildlife Loop Trail (3.2 miles; closed to cars until 3 p.m. each day)

and along Beach Road and connecting to Chincoteague. Continue to restrict bicycling on the Service Road from the Wildlife Loop to the Maryland line.

- Continue to restrict boat access:
    - Allow boats to land on designated areas on Toms Cove Hook from September 1 through March 14 or as otherwise posted.
    - Close refuge impoundments to all boats and flotation devices.
    - Only allow non-motorized, human-powered, hand-carried boats to access water from recreational beach and Toms Cove.
    - No boat ramps or docks available for public use.
- Continue to only allow horseback riding in OSV zone with closures March 15 through August 31 or thereafter, until the last shorebird fledges.
- Maintain current mobility-impaired access: designated mobility-impaired parking spaces, ramp access to boardwalk at NPS Visitor Center, two beach wheelchairs, and one designated accessible hunting zone.
- Continue current commercial use permits and restrictions:
    - Commercial photography allowed by SUP only.
    - Commercial or education films or photography workshops allowed by SUP only.
- Ceremonies/weddings allowed at recreational beach with permit and some restrictions.
- Continue current prohibition policies:
    - No littering;
    - No pets, including in vehicles;
    - No skateboards;
    - No roller or in-line skates;
    - No camping;
    - No alcohol;
    - No collecting plants, animals, or artifacts (exception: 1 gallon per person per day of unoccupied shells);
    - No feeding wildlife;
    - No segways;
    - No use of motorized vehicles on trails; and
    - No mopeds allowed on Wildlife Loop.

Goal 7: Refuge Administration

Maintain and enhance refuge infrastructure and operations responsibly and sustainably for the safety and well-being of the wildlife, cultural resources, public, and employees.

Objective 7.1 Outreach, Communication, and Emergency Communication

Continue to provide information about the refuge to maintain current levels of public awareness of the refuge purpose, programs, and challenges.

Rationale:
Though the fundamental purpose of the refuge is wildlife conservation, it is recognized that keeping the public aware of the refuge and its purpose, programs, and challenges is essential to the overall mission. An informed public can not only take advantage of the recreation afforded by the refuge, but can play a role in influencing and shaping management direction and the challenges which face the refuge. It is no longer acceptable for the refuge to rely solely on posted signs, printed brochures, or interpretive kiosks to orient and educate the public; we must also utilize electronic communications tools (such as Web sites, social media, and mobile applications)

to invite and prepare people to visit refuges, give them up-to-date information on what is happening there, and develop a greater appreciation for natural values.

Strategies:

- Continue to communicate refuge events and information through a variety of media outlets (Junior Duck Stamp Contest, International Migratory Bird Day Celebration, National Wildlife Refuge Week, National Public Lands Day, Waterfowl Weekend, Sunrise Pony Walk during Pony Penning, Annual Beach Clean-up, Great Backyard Bird Count).
- Continue to hold monthly Community Leaders Meetings.
- Continue to host on-site visits of public officials.
- Continue to implement the memorandum of agreement with the town of Chincoteague on emergency management.
- Participate in and support regional and national initiatives (e.g. Connecting People with Nature, America's Great Outdoors).
- Continue Web site updates, seasonal "Eagle Cam" broadcast, and upgrade/changeover of Web site to content management.
- Continue relationship and programs with local radio stations, WCTG 96.5 FM and Delmarva Public Radio's WSDL National Public Radio (NPR) News 90.7.
- Continue to maintain the 1610 AM Radio station (providing information on refuge hours, emergency information, and refuge special events) and continue development of messages in Spanish.
- Continue implementation of fiber optics capacity.
- Continue agreements on radio communications with NASA.
- Continue pursuit of proposal for mobile trailer for outreach/education and acquire within 3 years.
- Continue current outreach activities and implementation of Intelligent Traffic System (Federal Transit Administration implementation grant):
    - Install off-site kiosks for entrance fee pass purchase and information at hotels and public places;
    - Install electronic information signage (variable message sign purchased);
    - Install traffic counters to monitor parking occupancy;
    - Inform the public of peak visitation times and alternative modes by of transportation; and
    - Provide the public with real-time information regarding parking availability, traffic congestion, and expected delays.

Objective 7.2 Staffing and Volunteer Program/Friends Group

Continue to fill any vacancies and otherwise sustain current levels of staffing and volunteer programs to achieve refuge purposes.

Rationale:

In 2007, our Regional Directorate completed a workforce plan to support a new base budget approach. Its goal is a maximum of 75 percent of a refuge station budget to cover salaries and fixed costs, while the remaining 25 percent or more would be operating and maintenance funds. Our strategy is to improve the capability of each refuge manager to do the highest priority work, and not to have most of a refuge budget tied up in inflexible fixed costs. This strategy was successful for a few fiscal years; however, we now anticipate a level or declining budget environment, which will impact flexibility in managing financial resources and may have

implications for the level of permanent staffing. A new round of workforce planning began in 2013 in response to the sequester and anticipated future budget reductions. Our budgets are determined annually by Congress and distributed through our Washington and Regional offices before arriving at field stations.

The Refuge System must continue to be adequately staffed to protect wildlife and habitat, make refuges safe places for staff and visitors, and meet its purposes while continuing opportunities for public use. The current staffing is supplemented by volunteers from the community as well as local and national youth and adult groups, who provide help with invasive plant removal, trash pick-up, interpretive education, and other projects. Chincoteague NWR also receives significant support from its non-profit friends group, the CNHA, which produces and provides interpretive and educational material for refuge visitors and for local teachers, funds student interns, and enables the refuge to receive matching grants for workshops and programs.

Strategies

- Maintain relationship with CNHA Friends group.
- Maintain 23 full-time positions and 10 to 20 part-time, student, or contractor positions in the areas of Visitor Services, Law Enforcement, Biology, administration, fee collection, management, and maintenance (see Appendix K for current staff plan).
- Continue to pursue opportunities for interns with the Student Conservation Association.
- Continue to cooperate with NPS staff, including lifeguard, law enforcement, maintenance, and seasonal interpretive staff, regarding their activities at Toms Cove and the recreational beach.
- Continue work with volunteer groups (e.g., Road Scholars, Master Gardeners, Master Naturalists).

Objective 7.3 Wilderness

Continue to protect and enhance the wilderness character of the proposed wilderness area.

Rationale:
The purpose of designated wilderness under the 1964 Wilderness Act (Public Law 88-577) is to "preserve the wilderness character" and preserve and protect natural conditions. Although there exists no "congressionally designated wilderness lands" within the refuge, there are 1,300 acres of land that have been proposed as wilderness. These areas can also protect watersheds and habitats and provide opportunities for unique scientific research and recreation.

Strategies:

- Continue to protect and enhance the wilderness character of the proposed area through actions to eliminate incompatible features and activities. There would be no change in the size or location of the proposed wilderness.
- Complete wilderness assessment every 5 years to follow monitoring protocol.

Objective 7.4 Cultural and Historic Resources

Continue to maintain and protect all archaeological, cultural and historical sites on the refuge in compliance with all applicable Federal and State laws.

Rationale:
Cultural resources include archaeological resources, historic and architectural properties, and areas or sites of traditional or religious significance to Native Americans. It is the policy of the USFWS to identify, protect, and manage cultural resources located on USFWS lands and affected by USFWS undertakings, in a spirit of stewardship, for future generations. Specifically, USFWS will manage these resources in such a manner that sites, buildings, structures, objects, and values of importance are sufficiently protected for present or future scientific study, public appreciation, and socio-cultural use. Consequently, USFWS will encourage and enhance educational, interpretive, and research opportunities for USFWS managed cultural resources consistent with the overall management objectives of USFWS. The refuge will also protect such resources from illegal take or damage in compliance with all applicable Federal and State laws.

Strategies:
- Continue to maintain cemeteries.
- Continue to allow CNHA and refuge volunteers to give tours of the Assateague Lighthouse.
- Complete restoration of Assateague Lighthouse.
- Working with CNHA, set up endowment account for maintenance funding for Assateague Lighthouse.
- Maintain a Chincoteague pony population consistent with current numbers (125 to 150 ponies), under the pony management agreement in partnership with the Chincoteague Volunteer Fire Company (the current CD allows 150 ponies to graze on 4,000 acres).

Objective 7.5 Climate Change and Sea Level Rise

Incorporate climate change considerations into decisions about facilities and development of new interpretive exhibits and pursue opportunities to contribute to climate change research.

Rationale:
The earth's climate is changing at an accelerating rate that has the potential to cause abrupt changes in ecosystems and increase the risk of species extinction. Climate change transcends USFWS and the Refuge System and poses one of the largest conservation threats of the 21st century. One climate change effect, sea level rise, has specific implications for coastal refuges in terms of habitat, public access, and facility management. The USFWS *Climate Change Strategic Plan* states that it is imperative that the USFWS rise to the challenges at hand, lay the foundation for wise decisions in the future, and begin taking steps right now to begin a continuous and dynamic process of actions that will be crucial to conserving the nation's fish and wildlife resources in the years to come. These steps focus on adaptation, or response to the anticipated impacts; mitigation, or reducing levels of greenhouse gases; and engagement, or soliciting partnerships and raising awareness of the issues. Similarly, *Conserving the Future* recognizes that climate change is a crosscutting theme that interacts with other stressors and requires an assessment of the challenges that climate change poses to refuges as well as of the quantification and reduction of the Refuge System's overall carbon footprint. Refuge operations and facilities generate heat-trapping gases and have other impacts on the environment and wildlife. *Conserving the Future* states that USFWS stewardship of the Refuge System should provide cutting-edge leadership in reducing carbon emissions and implementing sustainable, green business practice, including prioritizing land restoration activities that effectively sequester carbon.

Strategies:

- Incorporate climate change into interpretation:
    - Provide interpretive exhibits on climate change at the global and local levels by replacing the migration exhibit with a climate change/severe weather exhibit.
    - Provide interpretive exhibits to encourage visitors to become citizen scientists and report their observations around the refuge using the National Phenology Network to gather data on climate change effects on the plants and animals they observe on the refuge.
    - Update roadside exhibits with climate-range related content and Quick Response (QR) codes.
    - Add climate change link to refuge Web site.
    - Explore geocaching with climate change theme.
    - Develop questions to be asked as part of an exhibit and incorporated into the broad visitor survey to measure and track visitors' understanding of climate change issues.

2.5.3 Alternative B (Balanced Approach)

Alternative B would continue established habitat and wildlife management strategies but would pursue additional management activities for resources and public use. As introduced in section 1.9.3, a "balanced approach" here still upholds the statutory and policy framework of the Refuge System that states that wildlife and wildlife conservation must come first on refuge lands and waters. Figure 2-3 and Figure 2-4 provides an illustration of major spatial elements of the alternative.

Natural Resource Management. Under this alternative, the refuge would protect and maintain all lands it administers, primarily focusing on the needs of threatened and endangered species, with additional emphasis on the needs of migratory birds and resident wildlife. The refuge would continue to preserve approximately 2,650 acres of wetland impoundments, but make adjustments in accordance with a new impoundment management plan that takes into account various factors, such as the habitat needs of black ducks and monarch butterflies, climate change and natural coastal processes, and relocated beach access and parking. Natural coastal processes would continue to shape habitat on the barrier islands. The refuge would continue to protect and enhance the wilderness character of the 1974 proposed wilderness area, and there would be no change in its size (1,300 acres) or location.

Beach Access and Parking. In recognition of the vulnerability of the current parking, the refuge would develop and implement a site design plan for parking and access to a new beach location, approximately 1.5 miles north of the existing beach. In comments on the draft CCP/EIS regarding beach access and parking from NPS, we concur that "...8.5 acres is not a limit, but a guideline, that can be changed as needed with the actual design of a facility that provides the required 961 spaces and related facilities as part of a well-thought-out plan." Because USFWS is committed to working with NPS and others to future design, refine and analyze beach relocation infrastructure in a separate NEPA document, if the actual footprint becomes larger, then it can more appropriately be considered at that stage. The new recreational beach would offer accessible parking in close proximity to the beach.

The refuge in consultation with NPS would provide management strategies for maintaining the current beach and parking areas in the interim until the newly located recreational beach is ready for visitor use. The refuge would provide a transition plan for moving from the current beach location to the new beach location, including proposed processes (such as construction in phases) and management strategies to ensure access to a recreational beach is always available for visitors.

Visitor Use and Experience. Existing public uses would continue with some exceptions. Hiking would continue to be allowed on the Service Road north of the new recreational beach parking, but private vehicles would be restricted unless authorized under SUP or special day use privileges/openings. A joint NPS and USFWS Visitor Contact Station would be developed near the new recreational beach. OSV and hiking access would continue via Beach Road across Toms Cove south to Fishing Point September 16 through March 14. Access to Toms Cove for environmental education programs would require a permit. Beach Road would continue to be open to vehicles year-round as far as the vicinity of the South Pony Corral, where we would also provide multi-habitat viewshed, access to trails, and viewing of Chincoteague ponies and wildlife, Construction in this area would include a vehicle turn-around area with parking, crabbing dock,

and launch point for non-motorized boats. Assawoman Island would be completely closed to all forms of public use, including fishing, from March 15 through September 15 or thereafter, until the last shorebird fledges. Swan Cove Bicycle Trail would be remain and become part of the new assigned area.

The refuge would maintain and where possible expand current hunting opportunities by including additional species, extending hours, and providing special events and opportunities for youth and women. The refuge would add mourning doves, light geese, and non-migratory Canada goose hunting opportunities to the refuge's migratory bird hunting program. Additionally, the refuge would allow migratory bird hunting on Federal holidays within the Commonwealth of Virginia hunting seasons. The refuge would also add turkeys to the big game hunting program and pursue development of a trapping program for furbearers. The refuge would continue sika hunting and would conduct research to identify a desired population size. The refuge would continue to manage opportunities for recreational shellfish and crab harvest.

OSV use would be permitted for priority public uses, including wildlife observation, fishing and to access hunting zones. We propose to develop a new ½-mile, OSV zone to facilitate the six priority uses (March 15 through September 15) south of new recreational beach, and add this to the new assigned area. We would also continue current management of the Overwash and Hook area for shorebirds until the new recreational beach is established, at which time the March 15 through September 15 closure would go into effect. OSV access from September 16 to March 14 would continue via Beach Road. The refuge would allow recreational horseback riding in the OSV zone from approximately September 16 to March 14. The refuge would allow visitor access by foot to the OSV zone from approximately September 16 to March 14.

Partnerships. The refuge would pursue partnerships to enhance land conservation, environmental education and interpretation on the Delmarva Peninsula.

Cultural Resource Management. With partners, the refuge would restore the light keeper's house and historic landscaping at Assateague Lighthouse and develop new cultural resource and interpretation amenities, including a virtual tour of the lighthouse. The refuge would allow access to the cemetery near Beach Road and develop tours and controlled access opportunities for Assateague Village. The refuge would work with NASA to develop a boardwalk and kiosk from the NASA Visitor Center in or adjacent to Wallops Island NWR.

The "Chincoteague ponies" have a strong cultural tie to the community, and the refuge would implement a Chincoteague pony management plan that meets multiple objectives: visitor viewing, habitat management, and pony health. The refuge would allow grazing of the current pony population, with a maximum pony herd size of 150, per the management agreement with the Chincoteague Volunteer Fire Company.

Figure 2-3. Alternative B – Chincoteague NWR

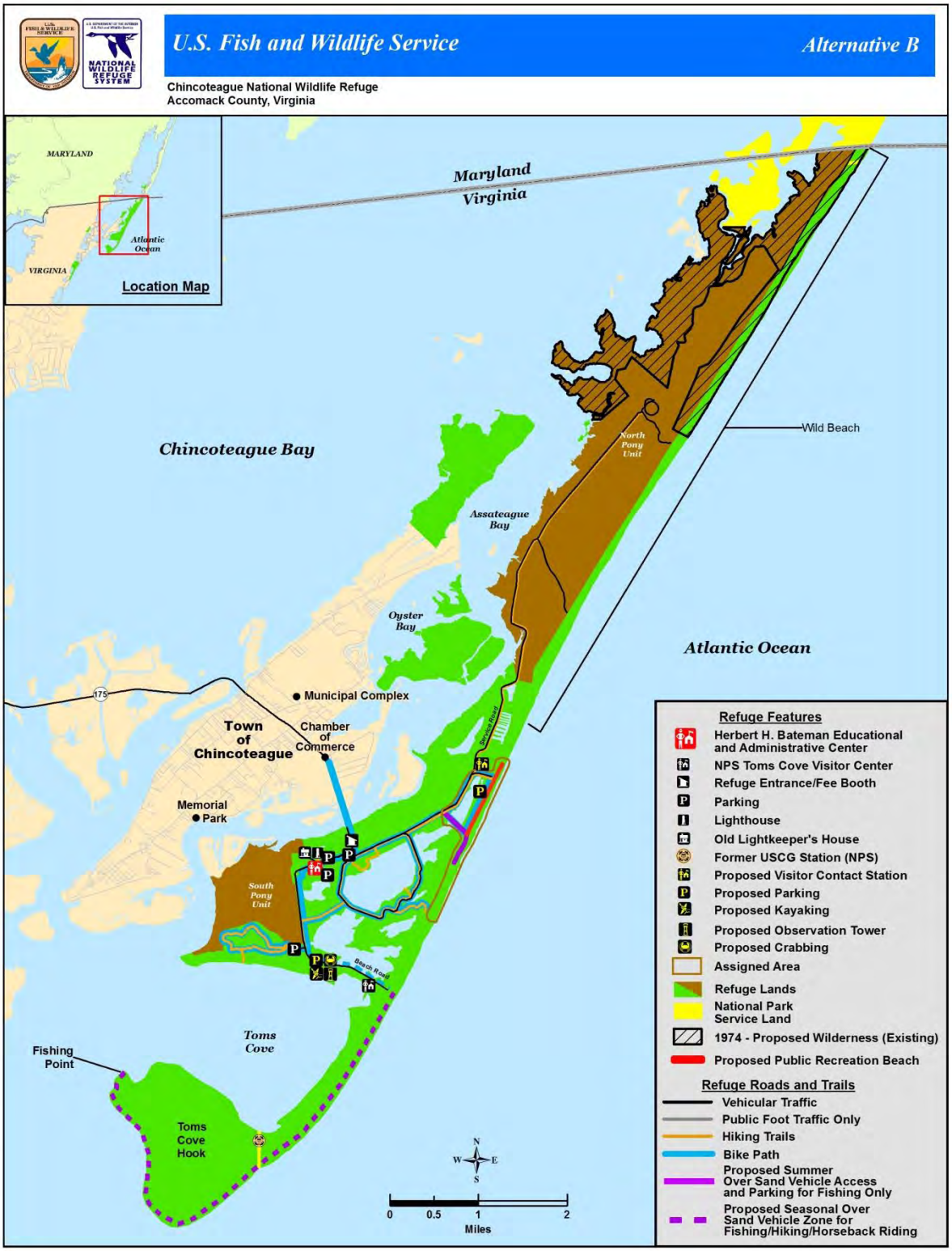
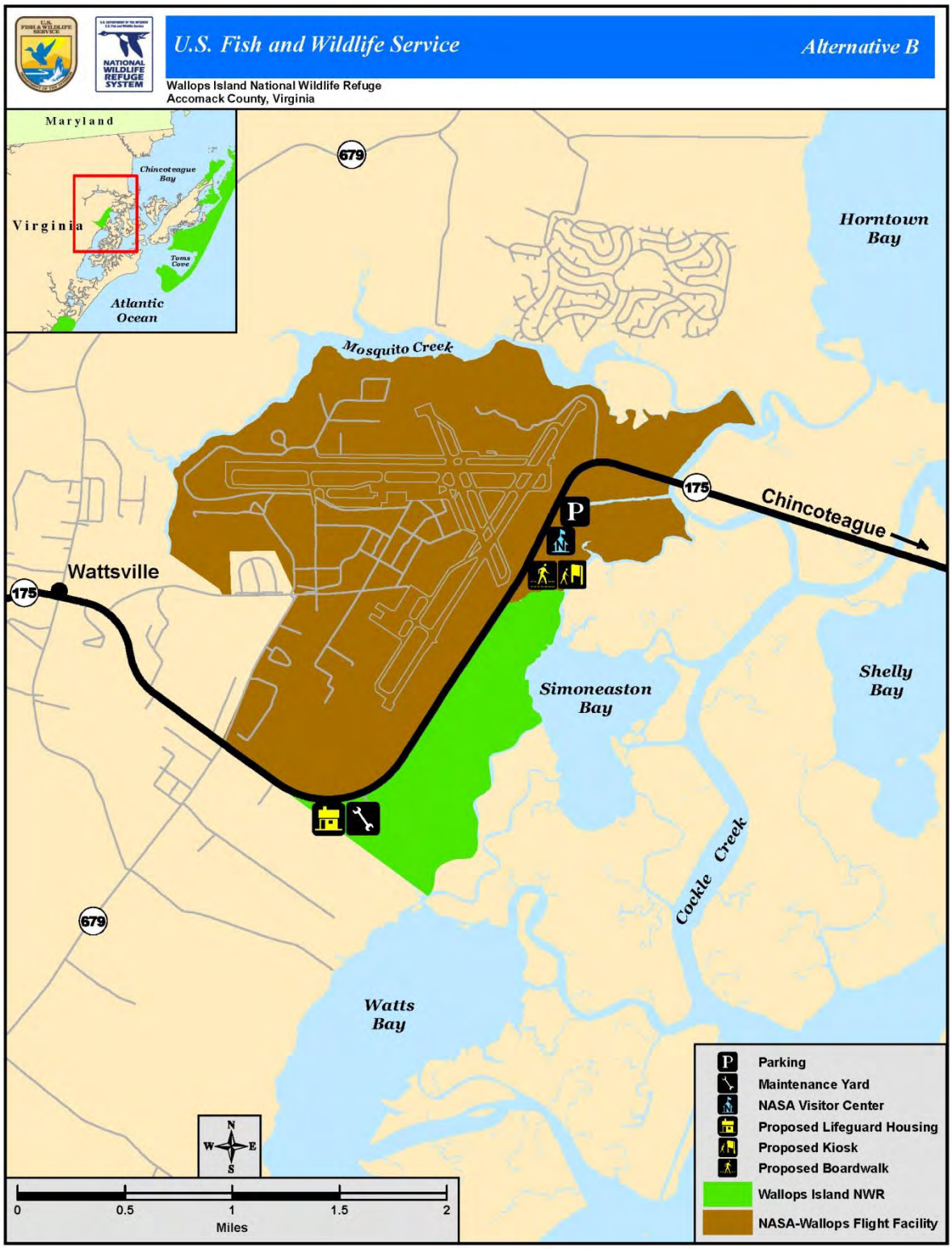


Figure 2-4. Alternative B – Wallops Island NWR



Goal 1: Coastal Habitats

Manage quality coastal habitats for biological integrity, diversity, and environmental health of refuge barrier beach and dunes in concert with natural processes as part of the Delmarva Peninsula coastal barrier island system to provide habitat for species of conservation concern.

Objective 1.1 Barrier Beach and Dune Habitat - Coastal Nesting Birds

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A, plus:

- Allow natural geologic processes to restore overwash to the former recreational beach and parking areas on Assateague Island in order to increase nesting habitat for plover, least terns, sea turtles, and other nesting shorebirds. This would also allow natural island movement, which would buffer the effects of sea level rise and future storms on other wildlife habitats.
- Require all OSV users to be actively engaged in wildlife-dependent priority public uses, such as wildlife observation, photography, surf fishing, or to access hunting zones at Toms Cove Hook during the hunting season, with a valid hunting permit.
- Improve the beach nesting habitat at the former recreational beach parking area (8.5 acres); for example, removal of infrastructure and other man-made structures.

Objective 1.2 Barrier Beach and Dune Habitat - Migrating and Wintering Shorebirds and Migrating Monarch Butterflies

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A, plus:

- Improve the migratory and wintering habitat at the former recreational beach parking area (8.5 acres); for example, removal of infrastructure and other man-made structures.

Objective 1.3 Barrier Beach and Dune Habitat - Turtles

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A, plus:

- Improve beach/dune habitat for turtle nesting areas at the former recreational beach parking area (8.5 acres); for example, removal of infrastructure and other man-made structures.

- Restrict nighttime permitted beach driving in September and October, when the OSV zone is open but the sea turtle nesting season (June through October) is still ongoing. The refuge will continue to monitor the nesting area for artificial light sources caused by nighttime driving, which impairs the natural sea-finding capabilities of nesting female turtles and emerging hatchlings. Future management actions may need to be altered due to a change in current turtle nesting activity. We use the Virginia and Maryland Sea Turtle Conservation Plan to help guide our actions, and will consider daily sea turtle monitoring during the appropriate nesting season on Assateague and Assawoman Islands.
- Limit night use of the beach by official NPS or USFWS vehicles during the plover and sea turtle breeding season to the greatest extent possible.

Objective 1.4 Federally Endangered Plants and Rare Plant Communities

Same as alternative A

Rationale:
Same as alternative A

Seabeach Amaranth Management Strategies:
Same as alternative A, plus:

- Within 3 years of the CCP implementation, evaluate NPS amaranth propagation/transplant methods and success elsewhere (e.g., Assateague Island National Seashore in Maryland), and seek guidance from USFWS Seabeach Amaranth Coordinator to determine whether such methods could be used to establish other populations on refuge lands (particularly southern island units). Seek partners for implementing a transplant program if determined feasible.

Lucky Boy Fen Management Strategies:

- Within 2 years, and/or in conjunction with Virginia DCR's next survey, accurately map the boundaries of the Lucky Boy Fen and a buffer area of sufficient width around the perimeter to protect it from human disturbance and other perturbations.
- Within 5 years, consult the literature and experts in fen management to determine whether the myrtle shrubs and other woody plants in and near the fen pose a threat to the rare plants in this unique habitat type, and determine best management practices to address any problems.

Lucky Boy Fen Biological Monitoring

- Starting in 2014, and at least every 3rd year thereafter, coordinate with Virginia DCR personnel to survey rare plants present during the growing season. Monitoring surveys were previously conducted in 2003 and 1992.
- Within 5 years, initiate simple ground or surface water monitoring at Lucky Boy Fen to determine if pollutants are present, and identify potential limiting factors such as nitrogen or alkalinity. A recommended protocol involves first taking a grab sample to establish a baseline and test for nutrients. Depending on the results, a simple perforated PVC tube ground water monitor or small surface collector (resembles a dustpan) could be installed.
- We will continue to collaborate with Virginia DCR on several projects including management of rare plant communities on the refuge. A re-survey of refuge lands to more accurately document the current location and extent of natural heritage resources will be considered in future step-down planning efforts, such as the HMP.

Objective 1.5 Salt Marsh Habitats for Nesting, Migrating, and Wintering Birds

Same as alternative A

Rationale:
Same as alternative A

Management Strategies:
Same as alternative A, plus:

- In cooperation with USACE and other partners develop strategies that will improve tidal flow to Swan Cove Pool (F Pool). This may be accomplished by engineering new water control structures.
- Use adaptive approach to balance visitor use experience with the need to manage non-migrant Canada goose populations (selecting time and location to avoid negative visitor experience) and work with USDA to reduce non-migrant Canada goose population through addling, firearms, and round-ups.
- Within 5 years, evaluate existing studies conducted by the NPS, refuge, and others on the effects of pony grazing on wildlife and habitat, including the effects of compaction, to identify information gaps.
- Within 5 years, work with partners (Ducks Unlimited, Black Duck Joint Venture, VDGIF) to identify additional habitat restoration projects that can be done to enhance/restore habitat for black ducks.

Biological Monitoring:
Same as alternative A, plus:

- Within 5 years, implement a survey protocol (building on CCB study or the USFWS Region 5 Salt Marsh Integrity Study) to monitor population trends and densities of saltmarsh, Nelson's and seaside sparrows, and clapper rails in high priority salt marshes.

Goal 2: Managed Wetlands (Impoundments)

Manage refuge impoundments to support native wildlife and plant communities, including a diversity of waterbirds, aquatic species, and other species of conservation concern.

Objective 2.1 Impoundments for Waterfowl, Shorebirds, Waders, and associated species

Same as alternative A

Rationale:
Same as alternative A

Management Strategies:
Same as alternative A, plus:

- Within 4 years, complete the habitat analysis of existing impoundments to identify impoundments with the most potential for enhancement to meet black duck feeding, loafing, and thermal requirements; plan and implement habitat restoration/enhancement on one to two impoundments using an Adaptive Management approach.
- Within 4 years, contract a tidal wetland expert or a hydrologist to design several alternative hydrologic models to restore Sow Pond, Ragged Point, or Swan Cove Pool (F Pool) impoundment to salt marsh.

- Within 6 years, develop and implement an adaptive management experiment to flood encroaching myrtle and other encroaching woody vegetation in the impoundments to focus on black duck habitat enhancement and restoration.
- Within 10 years, investigate the feasibility of allowing Lighthouse Meadow impoundment to revert to a tidal salt marsh.
- Due to potential parking lot configuration, Pintail (D Pool) will be removed from impoundment management capabilities.
- Since NWF is no longer needed as a piping plover mitigation area due to the relocation of the recreational beach, pumping operation will no longer be required to create additional piping plover nesting habitat, and artificial shell nesting islands will no longer be maintained.
- Management of NWF will be improved for spring and fall migratory shorebirds and waterfowl.
- In cooperation with USACE and other partners develop strategies that will improve tidal flow to Swan Cove Pool (F Pool). This may be accomplished by engineering new water control structures.
- Improve or replace all water control structures to maximize flow capabilities.
- As opportunities arise, use volunteers to plant seaside goldenrod seedlings in spring or fall on Toms Cove Hook, small dunes that dot the Overwash area, the north end of Toms Cove (including the causeway west of the NPS Toms Cove Visitor Center), and the backsides of dunes along Wild Beach. Goldenrod planting should occur on no greater than 5 percent of the Overwash area so as not to conflict with beach nesting birds, which prefer open un-vegetated beaches and shell flats.
- As opportunities arise, we will incorporate native plants that produce fruits high in antioxidants, such as arrowwood and Virginia creeper, in restoration efforts for the benefit migratory songbirds.
- Within 3 years, fine-tune water level management capability by completing a bathymetric survey of all impoundments so that water depths can be better related to water gauge readings.
- Within 3 years, evaluate whether Chincoteague pony grazing can be used more effectively to meet habitat needs of shorebird and waterfowl species and if so, work with the Chincoteague Volunteer Fire Company to adjust grazing compartments and/or pony numbers in order to accomplish this. We will use this evaluation to determine whether the pony exclosure fencing should be removed.
- Within 3 years, use outcomes from three USFWS efforts (the Integrated Waterbird Project, Region 3/Region 5 Impoundment Study, and the Coastal Impoundment SDM Model) to refine management strategies for impoundments.

Biological Monitoring:

- Within 3 years, analyze 20-year data set of bird use in comparison to water levels and precipitation. Use this data to identify which impoundments have the most potential to manage for different groups of birds.

Goal 3: Upland Habitats

Manage upland habitats for biological integrity, diversity and environmental health of coastal forests and shrublands to sustain native wildlife and plant communities, including species of conservation concern.

Objective 3.1 Coastal Shrub Habitat for Breeding and Migrating Landbirds

Same as alternative A

Rationale:
Scrub shrub habitat provides an abundance of insect food and berries for breeding birds during the fall migration and/or throughout the winter. Migrating birds depend on stopover habitat along migration routes where they can find food, water, and protection to regain energy lost in flight and re-fuel for the next leg of the journey (Duncan et al. 2002). Roberts' (2009) 10-year banding study found that the refuge's wax myrtle/bayberry/groundsel shrub community provides important stopover habitat. Dense, tall (10 to 12 feet high) wax myrtle/bayberry habitat between impoundments and the dune line is also preferred nesting habitat for passerines, including several of highest and high conservation concern BCR 30 species such as prairie warbler, field sparrow, and brown thrasher.

The refuge realizes the benefits of scrub shrub habitat for migrating and neotropical birds, and will therefore allow this habitat to form along the dune system east of the NWF, since mowing these areas would no longer be required to mitigate for the loss of piping plover habitat at the current recreational beach. Within the NWF there is a 704-acre mitigation area that would be allowed to succeed to scrub shrub habitat on approximately 300 acres. This will significantly offset the loss of scrub shrub habitat contained within the 27 acres of habitat lost due to development at the proposed new recreational beach.

Additionally, though the refuge will allow for the natural scrub shrub habitat to grow, we also recognize that natural coastal processes could reshape or change the type of habitat at any point. If overwash or other coastal processes were to occur, the refuge would not mitigate these natural effects. The possible habitat shift, from scrub shrub to coastal, would result in a tradeoff of benefits for species, eliminating migrating bird habitat but providing good nesting habitat for coastal bird species such as the threatened piping plover.

Strategies:
Same as alternative A, plus:

- Manage a minimum 500-foot wide continuous strip of 10- to 12-foot tall myrtle/bayberry shrub, free of trees, parallel to (and behind the) dunes on eastern side of the NWF impoundment.
- Mow a 10- to 12-foot wide swath along each side of the new access road between Assateague Channel Bridge and the newly established parking at Pintail (D Dike) as needed during the growing season to maintain vegetation height at less than or equal to 6 inches, in order to minimize Delmarva Peninsula fox squirrel fatalities due to vehicle strikes.
- Do not mow Woodland Trail, except to facilitate public enjoyment of kiosks, benches, and trails.
- Continue to record (including sex and age) all Delmarva Peninsula fox squirrels killed by vehicle strikes and inspect them for PIT tags to determine whether road-killed Delmarva Peninsula fox squirrels remain below 5 per year.
- Within 5 years, refine first strategy using a combination of ground reconnaissance, aerial photos, and GIS to identify and map additional areas on the eastern side of other impoundments (i.e., behind the dune line), where a 10- to 12-foot tall myrtle/bayberry shrub community would be maintained by various vegetation management techniques.

Biological Monitoring

- Within 5 years, analyze the 10-year data set (1996 to 2006) from the BBS routes conducted in refuge shrub and forest habitats and determine trends of prairie warbler, brown thrasher, northern bobwhite, field sparrow, and other breeding landbirds of Highest, High, or Medium conservation concern on the BCR 30 list, analyzing results in the context of other BBS routes in the Region. Use this analysis to develop additional habitat management actions to benefit these representative species.
- Within 5 years, assess whether elements of the USFWS Region 5 Migrating Landbird Study can be incorporated into refuge monitoring strategies.

Objective 3.2 Loblolly Pine Forest for Delmarva Peninsula fox squirrel, Brown-headed Nuthatch & Eastern Towhee

Same as alternative A

Rationale:
Same as alternative A

Management Strategies:
Same as alternative A, plus:

- Within 5 years, develop silvicultural prescriptions to create small openings (2 to 10 acres) in the forest that would increase the hardwood component.
- Within 5 years, update the vegetation cover map for Assateague Island.
- Within 5 years, develop Forest Management prescriptions for the HMP that integrate the results of the CFI; include silvicultural prescriptions to enhance the hardwood component, enhance habitat for focal species, and incorporate relevant management actions outlined in the 1992 Upland Management Plan.
- Within 7 years, implement a silvicultural prescription on a 100- to 150-acre block of mature forest that creates small openings, totaling no more than 25 acres of the block, and aims to increase the hardwood component and diversify the structure and age-class of loblolly forest.
- Within 3 years, create an updated forest stand/compartment map using CFI Procedures developed by Chesapeake Marshlands NWR Complex, or comparable inventory method that takes into account wildlife variables.

Biological Monitoring:
Same as alternative A, plus:

- Within 5 years, develop a simple monitoring protocol to estimate wild turkey population size and trends. The survey should be designed so volunteers and staff can conduct them easily. Wild turkeys are a popular game species and increasing populations may bring increased interest for opening a hunting season.

Objective 3.3 Upland Habitats on Wallops Island NWR

Same as alternative A

Rationale:
Same as alternative A

Management Strategies:
Same as alternative A, plus:

- Within 5 years, annually remove 5 to 10 acres of dense autumn olive stands by mechanical or chemical means, with the goal of eliminating the 25 acres of autumn olive-dominated stands.
- Within 3 years, develop a plan and funding source to remove autumn olive intermixed in the understory of the 52-acre pine/hardwood forest. "Basal bark treatment" with an oil-based herbicide applied to the bottom foot of individual trees during the winter is one possible technique. Consult with ANEC, Patuxent Research Refuge, TNC, and others experienced in removing this invasive tree to refine methods, schedules, funding sources, etc.
- Within 7 years, conduct a habitat assessment of the 57 acres of former agricultural fields to determine whether a portion of this area should be maintained in an early successional stage to provide bobwhite breeding habitat, in a patch size large enough to attract shrubland breeding birds.

Biological Monitoring:

- Within 5 years, survey suitable habitat for northern bobwhite and American woodcock to determine their breeding and population status on Wallops Island NWR.
- Within 10 years, recruit a graduate student(s), volunteer, or other partner to investigate Wallops Island NWR's importance to migrating and breeding landbirds and make management recommendations.
- Within 3 years, develop a simple monitoring protocol to estimate wild turkey population size and trends. The survey should be designed so volunteers and staff can conduct them easily. Wild turkeys are a popular game species and turkey hunting may be proposed in the future for Wallops Island NWR.

Goal 4: Southern Barrier Islands Unit (Assawoman, Metompkin, Cedar)

Perpetuate the biological integrity, diversity, and long term viability of natural habitats that support native avian communities and turtles on Assawoman, Metompkin and Cedar Islands through a partnership approach.

Objective 4.1 Barrier Beach and Dunes - Breeding Shorebirds and Turtles

Same as alternative A

Rationale:
Same as alternative A

Management Strategies: Same as alternative A, plus:

- Meet with the Virginia Marine Resources Division and DCR staffs to review OSV laws, regulations, and enforcement options for beach driving on Cedar Island.
- Within 3 years of CCP, work with TNC to complete land transfer (fee title or easement) of TNC landholdings on Cedar Island to USFWS so that complete land survey and marking of refuge boundaries can be conducted.

- By 2020, collaborate with other barrier island managers and stakeholders to develop a "Virginia Barrier Island Public Use Management Plan."
- Within 10 years, conduct a feasibility study to see if a population of seabeach amaranth should be established on one or more of the southern island units through a transplant program. According to Weakley et al. (1996), islands longer than 3 miles have the potential for supporting two to three sites, and islands shorter than 3 miles can support one site. Using these guidelines, Assawoman Island appears to have conditions suitable for the establishment of one to two seabeach amaranth sites, and Cedar Island, two to three sites.
- Reduce mortality and disturbance factors on Assawoman Island during the breeding season, by implementing a complete closure, including fishing, from March 15 through September 15 or thereafter, until the last shorebird fledges.

Biological Monitoring

- Within 7 years, conduct systematic search for seabeach amaranth on southern islands in suitable habitat defined as sandy beach zone from 0.7 to 5 feet above the mean high tide in overwash flats, blowouts, lower foredunes, and upper strands of non-eroding beaches. Focus survey on accreting portions of barrier islands that are sparsely vegetated with American sea rocket and seabeach spurge, with which the species always co-occurs (Weakley and Bucher 1992).
- We use the Virginia and Maryland Sea Turtle Conservation Plan to help guide our actions, and will consider daily sea turtle monitoring during the appropriate nesting season on Assateague and Assawoman Islands.

Objective 4.2 Barrier Beach, Dune and Tidal Marsh - Migrating and Wintering Shorebirds

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A

Goal 5: Partnerships

Working with partners, protect and restore vigorous, viable populations of migratory and resident wildlife, fish, and native plants and their habitats found on the Delmarva Peninsula and identified in state, national, and international treaties, plans, and initiatives. Take a leadership role in collaborative regional efforts to achieve broader conservation goals and serve as a catalyst for achieving a multi-state eco-regional partnership. The refuge will continue to work with partners to explore how best to sustain the resiliency of this unique barrier island system, its communities, and its economy, consistent with the refuge's mission and in the face of dynamic coastal processes, climate change, and storm events.

Objective 5.1 Regional Conservation

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A, plus:

- Pursue adoption of a Preliminary Plan Proposal (PPP) or Landscape Conservation Design (LCD) for the Lower Delmarva Peninsula Conservation Area; PPP or LCD allows Washington Office to review any acquisition proposal and provide internal approval by the USFWS Director before proceeding with the Land Protection Plan (LPP).
    - In consultation with local and regional stakeholders, pursue completion of LPP for the Lower Delmarva Peninsula Conservation Area within 3 years.
- Consider land acquisition, easements, and other land conservation strategies with partners and landowners, such as a rolling wetlands easement.
- Engage and work with USDA to conserve family farms, open space, and wildlife habitat in the Lower Delmarva Peninsula.

Objective 5.2 Economic Development

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A, plus:

- Within 5 years, develop a visitor survey to better assess visitation levels and patterns and capture visitor feedback to inform management decisions; the survey will be conducted every 5 years.

Objective 5.3 Community Resilience

Same as alternative A. As stated in alternative A, since release of the draft CCP/EIS we committed to a partnership to address coastal resiliency on the Eastern Shore of Virginia through MACRI, which is "*a multi-disciplinary institution dedicated to integrated climate change research with the goal of helping local and regional leaders make coastal communities and habitats more resilient through scaled science and research informing public policy. Its several partners provide specific expertise in environmental monitoring and forecasting, modeling about coastal vulnerability and risk assessment, and moreover access to climate change space-based data.*" The USFWS is committed to exploring the implementation of resiliency strategies informed by the latest science available.

Rationale:
Same as alternative A

Strategies:
Same as alternative A, plus, within 3 years:

- Identify partners, which may include the town of Chincoteague, Accomack and Northampton counties, Commonwealth of Virginia, NPS, NASA, FEMA, USACE, etc. who may wish to work together to develop plans and strategies toward community resilience in the face of climate change impacts.

- Participate in a study, which would be led by others, to determine potential impacts/vulnerabilities of the coastal communities and identify protective methods for hazard mitigation.
- Work with NASA to conduct workshops and identify strategies on how best to advance the study, information exchange, and project resources for adaptive management practices that sustain the resiliency of this unique barrier island system including but not limited to Assateague, Wallops, Assawoman, and Metompkin Islands in the face of dynamic coastal processes and climate change.

Objective 5.4 Federal Interagency Collaboration and Facility Management

Within 5 years, enhance existing partnerships and develop new relationships focused on science research, interpretation, and shared facilities with adjacent Federal entities.

Rationale:
Same as alternative A

Strategies:
Same as alternative A plus:

- Re-establish an interagency non-exclusive use agreement/MOU with NASA to support wildlife and habitat management for marshlands and uplands not impacted by facilities (3,000 acres).
- Within 3 years, work with NPS to construct additional office space at the existing Herbert H. Bateman Administrative Office Complex.
- Within 4 years, develop boardwalk and kiosk for Wallops Island NWR with access from the NASA Visitor Center.
- Within 3 years, revise the use agreement between NPS and USFWS to include construction of lifeguard housing on Wallops Island NWR. We recognize that the availability of housing for the USFWS and the NPS seasonal workers in the area is an issue. There are no specific plans (blueprints, etc.) developed at this time to share; this strategy would require additional environmental compliance.
- Within 3 years, pursue funding in support of the 2011 non-reimbursable umbrella agreement signed between USFWS, NASA, and the CBFS for establishing a leading research and teaching environment where students and staff address new and evolving challenges such as those posed by climate change and corresponding sea level rise to coastal environments, and work on aerial data gathering platforms supporting the NASA mission theme of conducting earth science measurements, understanding global climate change and conducting coastal research.

Objective 5.5 Local Conservation of Tidal Creeks, Estuaries, Mudflats, and Nearshore Marine Waters

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A, plus:

- Within 5 years of plan implementation, collaborate with the USFWS Maryland Fisheries Office, Virginia Institute of Marine Science, CBFS, and/or other technical experts to develop a fish monitoring program (that includes frequency, location, and protocols) aimed at monitoring refuge fisheries population and water quality implications. Within 5 years, meet with NPS staff monitoring water quality around Assateague Island and Chincoteague Bay to determine how their monitoring results can be used to help meet this objective, and how the refuge can better support NPS water quality monitoring efforts.
- Within 5 years, work with partners to assess and monitor water flow, water quality, and accretion rates within Swan Cove Pool (F Pool).

Goal 6: Visitor Services

People of all ages and abilities develop a stewardship ethic while enjoying their refuge experience and increasing their knowledge of the USFWS, the Refuge System, and refuge.

Objective 6.1 Hunting and Trapping

Within 5 years of CCP approval, increase level of opportunity (e.g., expansion of hunted species) in the hunt program, such as the fall/winter light goose hunt, through expansion of hunted species, trapping, and new hunting programs.

Rationale:
Hunting is one of the priority uses of the Refuge System and is to be facilitated when compatible. Hunting on the Delmarva Peninsula is a traditional outdoor pastime and remains a popular form of wildlife-dependent recreation on the refuge and a vital part of the cultural, social, and economic fabric of the communities near the refuge. Expansion of current hunting practices to incorporate different species, such as fox and raccoon, and trapping opportunities would further reduce the stress of predators for threatened and endangered species. Furthermore, institution of increased hunting opportunities for youth and women would promote traditional wildlife-dependent recreation and provide increased opportunities for learning about wildlife, their habits, life histories and the need to protect their habitats.

Developing and using a visitor survey, whether for hunting or for any public use, is one tool the refuge could utilize to measure visitor satisfaction, experience, and knowledge. Such a survey can be activity-specific, refuge-specific, or completed as part of a larger national effort. Visitor satisfaction surveys are integral to establishing a baseline, and monitoring visitor experiences and responses over time at various levels, well as for assessing meeting of measurable objectives.

Strategies:
Same as alternative A, plus:

- Within 5 years, develop questions on visitor experience of hunting through measuring tools, which could include a refuge-specific visitor survey.
- Within 5 years, develop two partnerships for implementation of hunt programs for non-traditional audiences.
- Within 5 years, maintain, and where possible expand, current hunting opportunities by including additional species, extending hours, and creating events. Any expansions of current hunting programs would require additional environmental analysis and compliance with NEPA beyond that contained in this document. Additional details will be included in the hunt management plan and annual hunt program, but generally these proposed additions would include:
    - Introduce/add non-migratory Canada goose and light goose hunting opportunities in refuge impoundments on Assateague Island.
    - Add mourning doves for migratory bird hunting in areas of the refuge outside of Assateague Island.
    - Add turkey for big game for youth hunting on Assateague Island.
    - Increase outreach to youth, new hunters, and women about hunting opportunities; create an apprentice hunter program.
    - Increase hunter education opportunities (partnership with VDGIF or others).
    - Open refuge for migratory bird hunting on Federal holidays, in accordance with State regulations, in designated areas of the refuge within Wildcat Marsh, Morris Island, Assawoman Island, and Metompkin Island divisions, that occur outside of the current hunting days of Thursday, Friday, and Saturday (Labor Day, Columbus Day, Veteran's Day, Christmas, New Year's, Martin Luther King Jr. Day, President's Day).
    - Reduce/minimize administration of hunt program through streamlining process (kiosks, electronic lottery, etc.).
- Within 10 years, assess opening of fox and raccoon hunting for both Chincoteague and Wallops Island NWRs.
- Within 10 years, assess a trapping program for fur-bearers (including fox, raccoon, opossum, nutria) for Chincoteague and Wallops Island NWRs.

Objective 6.2 Fishing and OSV Use

Within 8 years of CCP approval, achieve a 10 percent increase in visitor satisfaction with fishing (surf fishing, crabbing, oyster harvest, and clamming) through permit improvements, expansion of the OSV zone, and other improvements.

Rationale:
Fishing is one of the priority uses of the Refuge System and is to be facilitated when compatible. Surf fishing, crabbing, oyster harvest, and clamming are among the most popular wildlife-dependent recreational activities conducted on the refuge. The expansion of the OSV zone due to the relocated recreational beach maintains restrictions and closures to protect nesting habitat, while ensuring access for fishing during closure periods on the Hook. Streamlined fishing permit access and enhanced fishing opportunities on the refuge are aimed to increase recreational opportunities and improve visitor experience.

Strategies:
- Reduce mortality and disturbance factors on Assawoman Island during the breeding season, by implementing a complete closure, including fishing, from March 15 through

September 15, or until the last shorebird fledges. Within 5 years, develop questions on visitor experience of fishing for a visitor survey.
- Maintain and assess expansion of current fishing opportunities including shellfishing and crabbing.
- Develop bilingual or multilingual fishing brochure (similar to hunting brochure).
- Collaborate with partners to organize youth fishing event.
- Increase beach access for disabled (beach mats).
- Install self-service electronic kiosk for fishing information, license purchase, and/or registration in the Commonwealth of Virginia's Fisherman Identification Program.
- Streamline fishing permit process for Assawoman and Metompkin Islands:
    - Work with partners (e.g., TNC, Commonwealth of Virginia) to provide QR codes (matrix barcodes readable by smartphones) on signage to link to Web site with permit form specific to each location.
- Within 5 years, work with partners to have consistent messaging across Virginia Eastern Shore islands.
- Improve signing on Woodland Trail for access/info on shellfishing.
- Create fishing access (e.g., crabbing dock) near new Beach Road/South Pony Corral site.
- Increase law enforcement compliance checks on lower Islands and work with state and non-governmental organizations (NGOs) for consistency along islands.
- Make the following changes to OSV use and zone:
    - Develop a designated area for fishing and other priority uses at the southern terminus of the NPS recreational beach then south along the Atlantic Ocean beachfront approximately 0.5 miles. This new OSV zone to facilitate priority uses (March 15 through September 15) south of new recreational beach would be added to the new assigned area.
    - OSV access on Toms Cove Hook from September 16 to March 14 would continue via Beach Road. Continue current management of the Overwash and Hook area for shorebirds until the new recreational beach is established, at which time the March 15 through September 15 closure would go into effect.

Objective 6.3 Environmental Education and Interpretation

Within 5 years, develop three teacher-led curriculum materials online and increase online traffic to the Web site and social media by 25 percent to increase the understanding of the refuge throughout the Delmarva Peninsula and online by utilizing technologies that achieve outreach to a wide, diverse audience.

Rationale:
Environmental education and interpretation are essential parts of the Refuge System that promote knowledge and respect for the refuges purpose and mission. Expanding these opportunities, especially for youth, would make for a more educated visitor and an overall enhanced experience. Finding ways of accomplishing this goal, by reaching out to the community more vigorously, and recognizing the growing online generation and finding ways to communicate more readily, are all appropriate steps for the refuge.

Strategies:
- Within the next 2 years, research technology/social media (e.g., Twitter, Facebook) that can enhance environmental education and interpretation.

- Within 5 years, develop questions on visitor experience of environmental education and interpretation through an appropriate tool, such as a visitor survey.
- Within 5 years, share administration of environmental education and interpretation programs with NPS and the CBFS, including scheduling and reservations, and develop an MOU to define roles and responsibilities.
- Within 10 years, increase current environmental education opportunities to more than 7,500 education participants annually:
    - Add additional programming (e.g., climate change toolkit, pollinator garden).
    - Increase opportunities for citizen science (e.g., e-Bird, Great Backyard Bird Count).
    - Conduct web-based environmental education programs (e.g., distance learning opportunities, especially for schools).
    - Develop web-based/emerging technology lessons for pre/post visit (e.g., incorporation of QR codes on brochures and exhibits).
    - Partner to increase environmental education on the Delmarva Peninsula (e.g., Chincoteague Museum, CBFS, NPS, NASA, Delmarva Discovery Center in Pocomoke, CNHA, Shore People Advancing Readiness for Knowledge (SPARK), and others) through individual outreach efforts.
    - Target local schools/students to conduct offsite visits/outreach in addition to onsite workshops.
    - Develop partnerships (e.g. concessionaire/school district teacher on loan/detailed) to do programs (NPS Teacher-Ranger-Teacher program, grants under Artists in Residence Program).
    - Encourage local schools (K to 12) to utilize refuge as outdoor classroom through marketing and working on outreach to achieve buy-in from administration.
    - Utilize other areas/facilities (e.g., boardwalk, etc.) for educational purposes (contingent upon new facilities with relocated beach, including overlook at new site near Beach Road and South Pony Corral).
    - Increase provision of teacher workshops in coordination with partners.
    - Continue pursuit of proposal for mobile trailer for outreach/education and acquire within 3 years.
- Within 15 years, increase current interpretive opportunities to more than 68,000 interpretation participants annually:
    - Build boardwalk/observation tower in partnership with NASA at or near Wallops Island NWR and provide opportunity for Blue Goose passport signing.
    - Maintain and where possible expand interpretive opportunities by installing new wayside exhibits, offering volunteer-led tours, and develop a portable exhibit.
    - Create a virtual exhibit for Assateague Lighthouse.
    - Restore lightkeeper's house and develop cultural resource/interpretation materials.
    - Develop data for exhibit at NASA visitor center.
    - Develop new Visitor Center exhibits and introductory videos.
    - Replace self service fee station with 24-hour access to kiosk for passes, refuge information, e-Bird/Merlin, etc.
    - Maintain oversight of training or certification of third-party providers; continue training of volunteers to assist in activities.

Objective 6.4 Wildlife Observation and Photography

Within 5 years, increase visitor satisfaction with wildlife observation by 10 percent and provide an opportunity for visitors to share photography reflecting wildlife observation on the refuge online.

Rationale:
Wildlife observation and photography are two of the six priority public uses of the Refuge System and are to be facilitated when compatible. Continued expansion of opportunities for visitors to photograph and observe the wildlife and habitat of the refuge is important to promote visitor understanding of, and increase visitor appreciation for, the value of and need for fish and wildlife habitat conservation. Providing opportunities to view the refuge for those unable to visit is a way for the USFWS to reach more people, particularly children. Change in access or infrastructure should be evaluated for impacts to these two uses and actions should be taken to continue or improve opportunities. New management strategies and enhanced infrastructure as a result of this alternative would provide new photography and observation opportunities.

Strategies:

- Within 5 years, develop questions on visitor experience of wildlife observation and photography for a visitor survey.
- Within 5 years, facilitate real-time, online photography sharing specific to the refuge.
- Within 8 years, at new site near Beach Road and South Pony Corral, build a wildlife viewing tower.
- Within 10 years, maintain and enhance where possible improved walking, driving and kayak access for wildlife observation and photography by exploring options for permanent photo blinds, and extending existing trail system.
    - Work with partners (e.g., North American Nature Photography Association) to determine when and where to install universally accessible photo blinds.
    - Develop new launch point at end of new site near Beach Road and South Pony Corral for small watercraft (non-motorized, hand-carried, manually propelled boats).
    - Work with the land owners of the current Maddox Campground to explore options for kayak/canoe access from site to connect to proposed backcountry canoe/kayak trail.
    - Work with the Commonwealth of Virginia to acknowledge the current dock/platform within Wildcat Marsh.
    - Develop a refuge-run kayak/canoe environmental education program from Wildcat Marsh.

Objective 6.5 Recreational Beach Use

Within 8 years, or sooner if funding is available, complete transition of recreational beach and associated parking from current location to new location and, working with partners including the NPS, the Town of Chincoteague and Accomack County, maintain or exceed current level of visitor satisfaction.

Rationale:
The proposed relocation of the recreational beach and associated parking would be in response to historic and anticipated impairment to the current recreational beach and parking from natural hazards, such as heavy storm damage to parking lots, overwash events, sea level rise, and the natural movement of barrier beach land forms. The relocation is intended to provide a sustainable

situation so that the habitat and recreation portion of the beach can be sustained for as long as possible for both the wildlife of the refuge, and the visitors to the seashore. The relocation is intended to provide a more protected location for the recreational beach and parking, but prior to the relocation, the refuge, NPS, and town of Chincoteague may consider short-term strategies to address access after damage caused by coastal storms at the existing beach. The refuge would develop and implement a site design plan for parking and access to a new beach location, approximately 1.5 miles north of the existing beach. In comments on the draft CCP/EIS regarding beach access and parking from NPS, we concur that "...8.5 acres is not a limit, but a guideline, that can be changed as needed with the actual design of a facility that provides the required 961 spaces and related facilities as part of a well-thought-out plan." Because USFWS is committed to working with NPS and others to future design, refine and analyze beach relocation infrastructure in a separate NEPA document, if the actual footprint becomes larger, then it can more appropriately be considered at that stage. The new recreational beach would offer accessible parking in close proximity to the beach.

The refuge in consultation with NPS would provide management strategies for maintaining the current beach in the interim until the newly located recreational beach is ready for visitor use. The refuge would provide a transition plan for moving from the current beach location to the new beach location, including proposed processes (such as construction in phases) and management strategies to ensure access to a recreational beach is always available for visitors

Strategies:

- Within 2 years, provide management strategies for NPS to maintain the current beach until the newly located recreational beach is ready for visitor use.
- Within 3 years, develop communication plan in conjunction with NPS for timeline for construction and opening of relocated recreational beach, including proposed processes and management strategies for the transition between locations to ensure access to a recreational beach is available for visitors.
- Within 2 years, develop site design plan for parking and access to new beach location.
- Within 5 years, develop questions on visitor experience of recreational beach for a visitor survey.
- Within 8 years, relocate the recreational beach, and the "NPS assigned area" (beach, parking, facilities), to a more stable area(s) that meets visitor service and resource management criteria (as determined through the structured decision-making process) (see Appendix N, and future design and analysis as described above). The Service Road would continue to be open year-round to hikers north to the refuge/National Seashore boundary. Access north of the recreational beach via the Service Road will be available by foot or via the CNHA Wildlife Tour Bus and by other organized groups authorized with a permit or agreement.
- Within 8 years (or with development of relocated beach), revise NPS-USFWS MOU to account for relocated beach/ assigned area.
- In conjunction with building a new parking area for the recreational beach, manage biting insect population at the recreational beach. The refuge is open to using commercially available targeted devices that capture mosquitoes which would improve visitor experiences; however, we will not use Adulticide to address nuisance mosquitoes. The most recent directive from the USFWS;s headquarters regarding mosquito control on lands of the Refuge System is included as an attachment to Appendix C. When a public health authority advises the USFWS of a threat to health and safety of the public from

mosquitoes arising from a refuge, we will work with the public health authority to allow them to reduce the public health risk on the refuge, as long as the activities are in full accordance with our regulations, policies and permitting procedures.

Objective 6.6 Other Recreational Uses

Within 8 years, expand non-wildlife dependent recreation opportunities by adding facilities and improving accessibility, among other strategies, to achieve a 10 percent increase in visitor satisfaction.

Rationale:
The refuge has identified the opportunity for increased non-wildlife dependent recreation that is still appropriate and compatible for the refuge, especially as it supports wildlife-dependent recreation, while also improving visitor experience. In addition, the various actions under this alternative, such as the relocation of the beach, provide opportunities to expand and enhance non-wildlife dependent recreation opportunities with minimal disruption and in some cases, mitigation of impacts by improvements in previous sites of disturbance, such as relocating bicycle trails.

Strategies:

- Within 5 years, develop questions on visitor experience of non-wildlife dependent recreation for a visitor survey.
- Improve bicycle access on the refuge and in the region:
    - Partner with the town of Chincoteague and the Accomack-Northampton Planning District Commission (A-NPDC) as they implement the Town of Chincoteague Bicycle Plan (2008), the Chincoteague Streetscape Enhancement Project (Rizzio & Spivey 2009), and the Eastern Shore of Virginia Bicycle Plan (2004).
    - Increase and formalize bike parking at the relocated public beach with removable bike racks.
    - Maintain Swan Cove Bicycle Trail access, and include terminus at beach into new assigned area.
    - Include bicycle lanes on new access road to relocated public beach.
- Improve non-motorized boat access with the following:
    - Allow non-motorized, hand-carried, manually propelled boats to launch from beach outside of lifeguarded area.
    - Construct a new non-motorized launch site at new site near Beach Road and South Pony Corral.
    - Work with the land owners of the current Maddox Campground to explore options for kayak/canoe access from site to connect to proposed backcountry canoe/kayak trail.
    - Work with the Commonwealth of Virginia and adjacent property owners to acknowledge the current dock/platform within Wildcat Marsh.
    - Develop a refuge-run kayak/canoe environmental education program from Wildcat Marsh following public access improvements along Wildcat Lane to North Main Street.
- Work with NPS to improve accessibility:
    - Increase accessible spaces at beach and improve signage and markings. (To be compliant with the Americans with Disabilities Act (ADA), 2 percent (20) of the approximately 1,000 parking spaces would need to be handicap accessible).
    - Consider wheelchair matting for designated spaces and beach wheelchairs.

  - Add removable wheelchair beach ramps.
  - Add seasonal mobility-impaired parking areas and access ramps (dependent on final configuration of parking).
- Continue enforcement of fees and restrictions on commercial uses and allow increase in uses only if deemed appropriate and compatible.
- Same as alternative A on prohibitions, and promote voluntary antilittering and no smoking campaign on public beach.
- Continuously monitor evolving technologies and modes of recreational transportation to determine if appropriate and compatible.
- Allow use of certain alternative-powered vehicles determined by the refuge manager to be safe, environmentally friendly, appropriate, and compatible, on Wildlife Loop after 3 p.m.

Goal 7: Refuge Administration

Maintain and enhance refuge infrastructure and operations responsibly and sustainably for the safety and well-being of the wildlife, cultural resources, public, and employees.

Objective 7.1 Outreach, Communication, and Emergency Communication

Within 2 years, develop new outreach strategies, including technology-based communication, to communicate refuge purposes and programs and within 5 years, incorporate these strategies into an outreach communication plan and emergency communication infrastructure for the existing and relocated recreational beach.

Rationale:
Continued and improved means of promoting the refuge and communicating any changes occurring on the refuge is necessary to keep the refuge relevant to the public and to maintain transparency and trust. The refuge must find current and relevant ways to communicate with the public beyond traditional media techniques such as newsletters and pamphlets. With social media and web-based technology always advancing, it is important to utilize these opportunities to the benefit of the refuge, and continue to keep the public aware of the refuge and its purpose, programs, and challenges. This communication is especially important when significant changes are being made, such as those changes in infrastructure that this alternative would propose, including the relocated recreational beach.

Strategies:
- Within 2 years, develop new outreach strategies, including technology-based outreach, such as:
  - Improve Web site and identify and pursue social media strategy/new technologies (e.g., Twitter, Facebook) to improve outreach and communication.
  - Consider bilingual/multi-lingual opportunities for materials (e.g., 1610 radio messages in other languages).
  - Develop new fishing brochure and install self-service electronic kiosk for fishing information, license purchase, and/or registration in the Commonwealth of Virginia's Fisherman Identification Program.
- Within 5 years, develop a communication plan and emergency infrastructure for the relocated recreational beach, including:
  - Institute protocols for use of intelligent transportation systems to communicate weather events, status of summer beach parking, and special events (e.g., International Migratory Bird Day).

- Ensure adequate phone access or service at new relocated beach, where new bicycle trail ends at beach, and at new site near Beach Road and South Pony Corral.

Objective 7.2 Staffing and Volunteer Program/Friends Group

Within 5 years, fill vacancies, establish nine additional permanent full-time positions, and increase the number of volunteers by 25 percent.

Rationale:
The Refuge System must continue to be adequately staffed to protect wildlife and habitat, make refuges safe places for staff and visitors, and meet its purposes while continuing opportunities for public use. Wallops Island NWR currently has no designated staff; having designated staff would better enable the refuge to meets its mission and goals. For Chincoteague NWR, in order to implement the changes proposed within alternative B, additional staffing would be necessary in the areas of biology, maintenance, law enforcement, and visitor services.

In 2007, our Regional Directorate completed the "Strategic Workforce Plan for the National Wildlife Refuge System in Region 5" (Phase 2; January 16, 2007) to support a new base budget approach. Its goal is a maximum of 75 percent of a refuge station budget to cover salaries and fixed costs, while the remaining 25 percent or more would be operating and maintenance funds.

Our strategy is to improve the capability of each refuge manager to do the highest priority work, and not to have most of a refuge budget tied up in inflexible fixed costs. This strategy was successful for a few fiscal years; however, we now anticipate a level or declining budget environment, which will affect our flexibility in managing financial resources and may have implications for the level of permanent staffing. A new round of workforce planning began in 2013 in response to the Federal Government's sequestration directive and anticipated future budget reductions.

Within the constraints or opportunities of our budget and in conformance with future workforce plans, we would seek to fill any currently approved but vacant positions, which we believe are necessary to accomplish our highest priority projects.

The current refuge staffing is supplemented by local volunteers as well as local and national youth and adult groups, who provide help with invasive plant species removal, trash pick-up, interpretive education, and other projects. Chincoteague NWR also receives significant support from its non-profit friends group, the CNHA, which facilities and supports the refuge's interpretive and educational programs for refuge visitors and for local teachers, funds student interns, and enables both refuges to receive matching grants for workshops and programs. Although permanent staff is important, making partnerships with volunteer groups, and recruiting new volunteers for the refuge is a high priority. To advance the volunteer and educational programs, a permanent full-time refuge volunteer coordinator position and education program specialist position are necessary.

Strategies:
- Maintain refuge complex budget and fill vacancies to better meet the obligations of wildlife stewardship, habitat management, and public use.
- Strengthen existing volunteer program and recruit new volunteers.
- Expand volunteer program to enhance aspects of all refuge management activities.

- Establish the following permanent full-time positions (see Appendix K for diagram)
    - Wildlife Refuge Specialist for Wallops Island NWR
    - Park Ranger Volunteer Coordinator
    - Education Program Specialist
    - Wildlife Refuge Specialist
    - Forest Technician
    - Wildlife Biologist (additional)
    - Biological Science Technician (additional)
    - Maintenance Worker (additional)
    - Land Management Law Enforcement Officer (additional)
- Increase training opportunities for staff and volunteers to maximize volunteer efforts and self-sufficiency.
- Include residential volunteers, interns, community volunteers, and CNHA in most management efforts.
- Coordinate with NPS to expand and enhance volunteer opportunities.
- Develop relationship with space tourism group (e.g., Star Gazers) to provide programming around launches.

Objective 7.3 Wilderness

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A

Objective 7.4 Cultural and Historic Resources

Within 10 years, establish partnerships to increase protection and visitor experience of archaeological, cultural and historical sites on the refuge in compliance with all applicable Federal and State laws.

Rationale:
Protection of the refuge's cultural and historic resources is a constant struggle in this harsh barrier island environment. Increased protection of these areas through new and enhanced partnerships with the surrounding community would benefit the resources and help preserve them for more visitors to experience. This alternative would also provide high-quality opportunities for Chincoteague pony viewing opportunities.

Strategies:
- Within 5 years, facilitate access to cemetery located near Beach Road
- Within 5 years, develop tours and allow controlled access to Assateague Village for general public (CNHA or volunteer led). We will consider partnering with NPS to provide interpretation for Assateague Village.
- Within 10 years, work with partners to:
    - Restore the historic landscaping around the Assateague Lighthouse.
    - Restore Lightkeeper's house and develop cultural resource/interpretation.
    - Develop a virtual tour and exhibit for lighthouse.

- Within 10 years, take more active role on museum property preservation/restoration and making specimens available to public (stored at Wallops Island NWR, Herbert H. Bateman Educational and Administrative Center, and on loan).
- Within 10 years, assess feasibility of development of a virtual tour of museum property, using a digital photography database.
- Within 8 years, work with the Chincoteague Volunteer Fire Company to implement a Chincoteague pony management plan that designates a new grazing area for a viewable herd for the public along access to the new recreational beach.

Objective 7.5 Climate Change and Sea Level Rise

Same as alternative A

Rationale:
Adaptation to climate change impacts, such as sea level rise, consists of the following options for transportation and other facilities: maintain, manage, and operate; protect and strengthen; relocate and avoid; abandon and disinvest; promote redundancy. While the entire project area and facilities are subjected to impacts of climate change and sea level rise, much of our discussion in this CCP is focused on the beach and related infrastructure as storms and events have historically affected these refuge resources the most. Refuge leadership will utilize the best climate change science and adaptive management strategies available to inform any proposed management actions for coastal environments. The refuge is committed to maintaining access to the recreational beach so we are not considering abandonment. We have historically, in partnership with NPS, been maintaining the recreational beach in place. However, scientific projections indicate that the current segment of land may not be able to continue to sustain the same amount of parking without substantial protection and strengthening actions. As documented previously (USACE 2012), this is not considered an option within the scope of this CCP by either NPS or USFWS. Instead, the refuge is interested in continuing to pursue relocation of facilities to a less vulnerable location. The current recreational beach will be managed by the NPS until the new beach area is designed, approved, and completed; thus, transition from one beach location to the other will not have any loss of access.

Strategies:
Same as alternative A plus:

- Relocate beach parking and related facilities in part in response to climate change considerations and design new facilities to reduce energy use, such as an energy-efficient new visitor facility.
- Within 5 years, develop a process by which climate change is considered in planning and design for any infrastructure changes.
- Within 5 years, will work with others (such as NASA, which is currently exploring solar panels) to determine the feasibility of becoming a pilot site for mitigation research, such as testing the impacts of renewable energy on wildlife. In the event of natural or manmade disasters, we will continue to pursue resources as they become available for restoration and research. Any ensuing projects would likely require NEPA compliance.

2.5.4 Alternative C (Reduced Disturbance)

Alternative C would direct staffing and funding towards maximizing habitat and wildlife management strategies. As a result of prioritizing habitat and wildlife management, public use activities and access would be reduced. Figure 2-5 provides an illustration of major spatial elements of the alternative for Chincoteague NWR; Figure 2-2 provides an illustration for Wallops Island NWR (same as alternative A).

Natural Resource Management. Under this alternative, the refuge would protect and maintain all lands it administers, primarily focusing on the needs of threatened and endangered species, with additional emphasis on the needs of migratory birds and resident wildlife. The refuge would continue to preserve approximately 2,650 acres of wetland impoundments, but make adjustments in accordance with a new impoundment management plan that takes into account various factors including the habitat needs of black ducks and monarch butterflies, climate change and natural coastal processes, and new beach access and parking. The refuge would work with partners to protect comparable freshwater habitat on the Delmarva Peninsula. Natural coastal processes would continue to be the primary force that shapes habitat on the southern barrier islands.

Beach Access and Parking. The refuge would work with NPS to relocate the recreational beach, as indicated in alternative B. The refuge and NPS would allow and maintain 480 automobile parking spaces (approximately 4.25 acres) at the new recreational beach. The new recreational beach would offer accessible parking, pedestrian and bicycle connections, and safe storm shelters for visitors. We would coordinate with NPS and the town of Chincoteague to identify a suitable off-site beach parking area, as close to the beach as possible, and institute a shuttle service from off-site parking to recreational beach for use during specific times of the year when parking capacity is exceeded. The shuttle would have stowing capacity for beach cargo and shelters would be provided for shuttle riders at the beach in case of storms.

The refuge in consultation with NPS would provide management strategies for maintaining the current beach in the interim until the newly located recreational beach is ready for visitor use. The refuge would provide a transition plan for moving from the current beach location to the new beach location, including proposed processes and management strategies to ensure access to a recreational beach is available for visitors.

Visitor Use and Experience. Existing public uses would continue but with several exceptions. All public access on the Service Road north of the new recreational beach parking would be restricted unless authorized under permit, and public access to the beach south of the new recreational beach would be allowed from approximately September 16 to March 14. A joint NPS and USFWS Visitor Contact Station would be developed near the new recreational beach. The Beach Road causeway across Toms Cove would be closed to all public access as soon as the relocated recreational beach was accessible. Assawoman Island would be completely closed to all forms of public use, including fishing, from March 15 through September 15 or thereafter, until the last shorebird fledges.

The refuge would discontinue recreational horseback riding and OSV use. The refuge would prohibit smoking on the recreational beach. These actions are intended to reduce adverse impacts on humans and wildlife.

The refuge would maintain recreational hunting opportunities with a focus on local, regional, and state wildlife priorities like sika, light goose, and non-migrant Canada goose. The refuge would

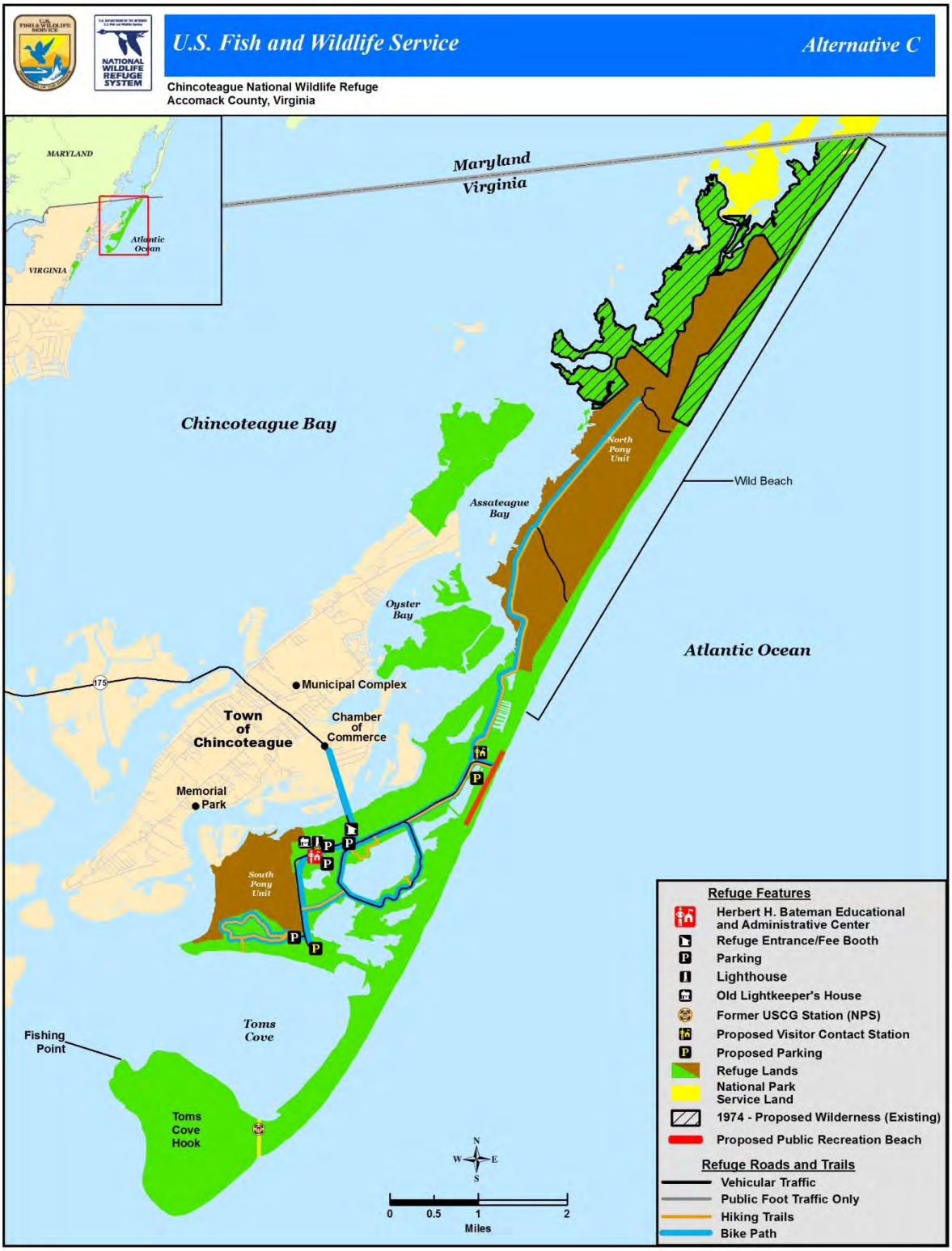
work to phase out the sika population through continued recreational hunt and professional contracts within 5 years. The refuge would expand non-migrant Canada goose and light goose hunting opportunities to other refuge properties where feasible and work to reduce those populations. The refuge would continue to manage opportunities for recreational shellfish and crab harvest.

Partnerships. The refuge would pursue and enhance off-refuge environmental education and interpretation partnerships with an emphasis on wildlife and habitat issues. The refuge would also work with partners to manage exotic, invasive, and nuisance species outside of refuge lands.

Cultural Resource Management. The refuge would complete restoration of Assateague Lighthouse and maintain current access to cultural resources. The refuge would limit the number of Chincoteague ponies allowed to graze on the refuge within 15 years to no more than 125 ponies.

Wilderness. The refuge would continue to protect and enhance the wilderness character of the 1974 proposed area through actions to eliminate incompatible features and activities.

Figure 2-5. Alternative C



Goal 1: Coastal Habitats

Manage quality coastal habitats for biological integrity, diversity, and environmental health of refuge barrier beach and dunes in concert with natural processes as part of the Delmarva Peninsula coastal barrier island system to provide habitat for species of conservation concern.

Objective 1.1 Barrier Beach and Dune Habitat - Coastal Nesting Birds

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B, plus:

- Return footprint of current public beach parking area to wildlife habitat. The parking lot would be relocated to areas less sensitive for wildlife habitat and more stable to the forces of the tides and storms than the existing site, and the size of public beach parking would be reduced.
- Discontinue OSV use and horseback riding.

Objective 1.2 Barrier Beach and Dune Habitat - Migrating and Wintering Shorebirds and Migrating Monarch Butterflies

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A; except discontinue OSV use and horseback riding.

Objective 1.3 Barrier Beach and Dune Habitat - Turtles

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B; except discontinue OSV use and horseback riding.

Objective 1.4 Federally Endangered Plants and Rare Plant Communities

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B

Objective 1.5 Salt Marsh Habitats for Nesting, Migrating, and Wintering Birds

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B except:

- Reduce allowed population of Chincoteague ponies from 150 to 125 and remove ponies from the proposed wilderness area.

Goal 2: Managed Wetlands (Impoundments)

Manage refuge impoundments to support native wildlife and plant communities, including a diversity of waterbirds, aquatic species, and other species of conservation concern.

Objective 2.1 Impoundments for Waterfowl, Shorebirds, Waders, and Associated Species

Same as alternative A

Rationale:
Same as alternative A

Management Strategies/Biological Monitoring:
Same as alternative B

Goal 3: Upland Habitats

Manage upland habitats for biological integrity, diversity, and environmental health of coastal forests and shrublands to sustain native wildlife and plant communities, including species of conservation concern.

Objective 3.1 Coastal Shrub Habitat for Breeding and Migrating Landbirds

Same as alternative A

Rationale:
Same as alternative A

Management Strategies/Biological Monitoring:
Same as alternative B

Objective 3.2 Loblolly Pine Forest for Delmarva Peninsula fox squirrel, Brown-headed Nuthatch, and Eastern Towhee

Same as alternative B

Rationale:
Same as alternative B

Management Strategies/Biological Monitoring:
Same as B, plus:

- Within 5 years, reduce sika population through continued recreational hunt and professional means of elimination.
- Within 15 years, eliminate the sika population, using an aggressive recreational hunt and year-round removal contract for sika, and monitor population and make adjustments to program as necessary to eliminate this exotic species.

Objective 3.3 Upland Habitats on Wallops Island NWR

Same as alternative A

Rationale:
Same as alternative A

Management Strategies/Biological Monitoring:
Same as alternative B

Goal 4: Southern Barrier Islands Unit (Assawoman, Metompkin, Cedar)

Perpetuate the biological integrity, diversity, and long term viability of natural habitats that support native avian communities and turtles on Assawoman, Metompkin and Cedar Islands through a partnership approach.

Objective 4.1 Barrier Beach and Dunes - Breeding Shorebirds and Turtles

Same as alternative A

Rationale:
Same as alternative A

Management Strategies/Biological Monitoring:
Same as alternative B

Objective 4.2 Barrier Beach, Dune, and Tidal Marsh - Migrating and Wintering Shorebirds

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B

Goal 5: Partnerships

Working with partners, protect and restore vigorous, viable populations of migratory and resident wildlife, fish, and native plants and their habitats found on the Delmarva Peninsula and identified in state, national, and international treaties, plans, and initiatives. Take a leadership role in collaborative regional efforts to achieve broader conservation goals and serve as a catalyst for achieving a multi-state eco-regional partnership. The refuge will continue to work with partners to explore how best to sustain the resiliency of this unique barrier island system, its communities,

and its economy, consistent with the refuge's mission and in the face of dynamic coastal processes, climate change, and storm events.

Objective 5.1 Regional Conservation

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B

Objective 5.2 Economic Development

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B

Objective 5.3 Community Resiliency

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative B

Objective 5.4 Federal Interagency Collaboration and Facility Management

Same as alternative B

Rationale:
Same as alternative B

Strategies:
Same as alternative B

Objective 5.5 Local Conservation of Tidal Creeks, Estuaries, Mudflats, and Nearshore Marine Waters

Same as alternative B

Rationale:
Same as alternative B

Strategies:
Same as alternative B

Goal 6: Visitor Services

People of all ages and abilities develop a stewardship ethic while enjoying their refuge experience and increasing their knowledge of the USFWS, Refuge System, and the refuge.

Objective 6.1 Hunting and Trapping

Within 15 years, work to phase out sika and non-migrant Canada goose populations.

Rationale:
Hunting is one of the priority uses of the Refuge System and is to be facilitated when compatible. Hunting can be used as a management tool to harvest surplus wildlife populations and achieve populations levels appropriate for the available habitat and to support other wildlife populations. Current hunting practices could be expanded to incorporate different species, such as fox and raccoon, and trapping opportunities to further reduce the stress of predators for threatened and endangered species. Efforts to reduce sika and non-migrant Canada goose could aid in the refuge's initiative to decrease the non-native, nuisance, or overabundant species that currently impact native species habitat.

Strategies:
Same as alternative A except:

- Expand hunting opportunities for sika, non-migrant Canada goose, and light goose (designated as non-native, nuisance, and/or overabundant species) to reduce populations. Specifically:
    - Within 5 years, reduce sika population through continued recreational hunt and professional means of elimination.
    - Within 15 years, eliminate the sika population, using an aggressive recreational hunt and year-round contract for sika removal, and monitor population and make adjustments to program as necessary to eliminate this exotic species.
- Within 5 years, introduce/add resident Canada goose and light goose hunting opportunities in refuge impoundments on Assateague Island.
- Within 10 years, use all available tools to minimize or eliminate non-migrant Canada goose (e.g. Provide non-migrant Canada goose hunting on all refuge properties).
- Within 10 years, refuge would assess opening of fox and raccoon hunting by assembling a new opportunity package.
- Within 10 years, assess a trapping program for furbearers (including fox, raccoon, opossum, and nutria) for the public.

Objective 6.2 Fishing and OSV Use

Discontinue OSV access in order to further protect refuge habitats, including a 10 percent increase in piping plover fledgling success rate as an annual average over a 5-year period.

Rationale:
Although current OSV management protects nesting habitat, concerns about OSV use still exist for habitat and species management, visitor experience, and administrative resources. Continuous compaction of the coastal zone habitat and deep tire ruts by repeated OSV trips could have adverse effect on unfledged young, invertebrates, and plant species that are part of the refuge ecosystem. Furthermore, visitor experience can be affected by the disruption of the natural landscape by repeated OSV trips.

Strategies:
- Continue fishing access by foot along the Atlantic Ocean except in the lifeguarded beach.
- Do not develop new crabbing docks at new Beach Road/South Pony Corral site.

Objective 6.3 Environmental Education and Interpretation

Same as alternative B

Rationale:
Same as alternative B

Strategies:
Same as alternative B except:
- No Wallops Island NWR boardwalk.
- No public canoe/kayak launch to Toms Cove.
- Develop audio message and/or training for shuttle.

Objective 6.4 Wildlife Observation and Photography

Same as alternative B

Rationale:
Same as alternative B

Strategies:
Same as alternative A except:
- Explore opportunities to restrict public use to specific sites during specific times of year (e.g., restrict access to Beach Road to bicycles and pedestrians before 3 p.m. during certain times of year).
- Restrict access on Service Road north of the recreational beach except under permit.

Objective 6.5 Recreational Beach Use

Within 8 years, complete transition of recreational beach and associated parking from current location to new location and, working with the NPS and town of Chincoteague, maintain current level of visitor satisfaction.

Rationale:
The proposed relocation of the 1-mile recreational beach and associated parking would be in response to historic and anticipated impairment to the current recreational beach and parking from natural hazards, such as heavy storm damage to parking lots, overwash events, sea level rise, and the natural movement of barrier beach land forms. The relocation is intended to provide a sustainable situation so that the habitat and recreation portion of the beach can be sustained for as long as possible for both the wildlife of the refuge, and the visitors of the shoreline. A reduction in parking would preserve more undeveloped, natural habitat and would meet the parking needs for most of the year. Based on hourly manual parking counts for shoulder and off-season weekends (approximately 9 a.m. to 4 p.m. in April 2010, May 2010, and September 2010 through February 2011), the demand for parking did not surpass 480 except for Memorial Day and September weekends. A shuttle system and off-site parking would provide access to visitors at times when 480 spaces are insufficient and provide opportunities for interpretation.

Strategies:
Same as alternative B except:

- Reduce beach parking to 480 spaces (approximately 4.25 acres).
- Coordinate with NPS and the town of Chincoteague to identify a suitable off-site beach parking area, as close to the beach as possible, and institute a shuttle service from off-site parking to recreational beach for use during specific times of the year when parking capacity is exceeded (anticipated to be every weekend in May and September and every day from Memorial Day weekend through Labor Day weekend).
    - The shuttle would operate an express route from identified off-site parking to the recreational beach.
    - For purposes of analysis, route length is assumed to be between 5 to 10 miles and one-way route time 12 to 25 minutes; however, the refuge would work with NPS and the Town to identify a site as close to the beach as possible.
    - The estimated frequency would be 10 minutes, assuming three shuttles each with a capacity of 40 people, as well as accommodation of beach gear and bicycles (actual vehicle type dependent on availability, cost, and other factors, but an open-air tram (power and trailer cars) may be considered). We would work with partners to identify potential mitigation strategies to reduce or avoid shuttles idling.
    - Ownership and operation of the shuttle would need to be determined; it may involve USFWS, the town of Chincoteague, or other partner (private or public).
    - Protection from hazardous weather conditions would be provided to shuttle riders in coordination with NPS by providing shelters

Objective 6.6 Other Recreational Uses

Same as alternative B

Rationale:
Although current management of horseback riding protects nesting habitat, concerns about horseback riding still exist for habitat and species management, visitor experience, and administrative resources, especially when combined with the action to discontinue OSV use. Disturbance of the coastal zone habitat by repeated horse passage could have adverse effects on invertebrates and plant species that are part of the refuge ecosystem.

Strategies:
Same as alternative B except:

- No new off-road bicycle or pedestrian trails.
- No public non-motorized launch site at Beach Road/South Pony Corral site.
- At Beach Road/South Pony Corral site, build a vehicle turn around.
- Continue to allow canoe/kayak access for environmental education and interpretation programs by NPS and the CBFS.
- No horse trailer parking.
- Ensure shuttles are wheelchair accessible and equipped with external bike racks.

Goal 7: Refuge Administration

Maintain and enhance refuge infrastructure and operations responsibly and sustainably for the safety and well-being of the wildlife, cultural resources, public, and employees.

Objective 7.1 Outreach, Communication, and Emergency Communication

Same as alternative B

Rationale:
Same as alternative B

Strategies:
Same as alternative B except:

- Establish outreach activities primarily related to protection of wildlife and habitat.

Objective 7.2 Staffing and Volunteer Program/Friends Group

Within 5 years, fill vacancies, establish eight additional permanent, full-time positions, and otherwise sustain current levels of staffing and volunteer programs to achieve refuge purposes to increase citizen science efforts.

Rationale:
Same as alternative B

Strategies:
Same as alternative B except:

- No Education Program Specialist (see Appendix K).
- Utilize the services of volunteers and Friends group primarily in ways that benefit wildlife and promote a stewardship ethic in visitors.

Objective 7.3 Wilderness

Continue to protect and enhance the wilderness character of the proposed wilderness area.

Rationale:
Congressionally designated wilderness lands are that which are "untrammeled (free from man's control), undeveloped, and natural, offering outstanding opportunities for solitude and primitive recreation" (Wilderness Act of 1964). Actions to reevaluate wilderness potential after a change in public use and restriction of activities within the proposed wilderness area would support the

Wilderness Act and the refuge's purpose and mission. These areas can also protect watersheds and habitats and provide opportunities for unique scientific research and recreation.

Strategies:

- Continue to protect and enhance the wilderness character for the proposed 1,300-acre wilderness area.
- Conduct a new wilderness review and evaluation after beach relocation.
- Restrict Chincoteague pony access to proposed wilderness area.

Objective 7.4 Cultural and Historic Resources

Same as alternative A

Rationale:
Same as alternative A

Strategies:
Same as alternative A, except:

- Where possible, increase law enforcement patrols on all known sites to inspect for disturbances and illegal digging and or looting.
- Do not invest resources in seeking shipwreck or any new historic structures.
- Limit the number of Chincoteague ponies allowed to graze on the refuge within 15 years to no more than 125 ponies.
- Maintain viewable herd along access to recreational beach and explore options to increase Chincoteague pony viewing opportunities with new relocated beach.

Objective 7.5 Climate Change and Sea Level Rise

Same as alternative A

Rationale:
Same as alternative B

Strategies:
Same as alternative B plus:

- Consider alternative fuel options for shuttle.

Table 2-2: Summary of Project Features by Alternative

Issue	Alternative A	Alternative B	Alternative C
Recreational Beach	• Continue to allow NPS to manage a 1-mile recreational beach. • Continue to allow NPS to maintain 8.5 acres of land (and preserve the capacity of 961 spaces) for parking at the existing recreational beach as long as suitable land base directly behind the recreational beach remains. • Continue to coordinate with NPS and the town of Chincoteague to identify a suitable off-site beach parking area for future use once existing beach parking is lost due to lack of suitable land base behind the recreational beach. • In being consistent with the 1993 Master Plan, as storms and other natural forces eliminate parking spaces adjacent to the beach, implement an alternate means of transportation such as a shuttle system. • Allow hiking/intertidal zone access north of recreational beach.	• Continue to allow NPS to manage a 1-mile recreational beach. • Relocate recreational beach and parking approximately 1.5 miles north of current area. • Allow hiking/intertidal zone access north of recreational beach. • Allow pedestrian access south of recreational beach outside of breeding season, between approximately September 16 and March 14.	Same as alternative B, except: • Reduce beach parking to 480 spaces (approximately 4.25 acres) • Coordinate with NPS and the town of Chincoteague to identify a suitable off-site beach parking area, as close to the beach as possible, and institute a shuttle service from off-site parking to recreational beach for use during specific times of the year when parking capacity exceeded (anticipated to be every weekend in May and September and every day from Memorial Day weekend through Labor Day weekend).
Service Road	• Maintain current access of the Service Road.	• Close Service Road to private motor vehicles north of relocated parking except by special use permit or special day use privileges/openings. Hiking allowed.	• Close Service Road to all public access north of relocated parking except by special use permit or special day use privileges/openings.

Issue	Alternative A	Alternative B	Alternative C
Beach Road causeway	• Continue current policy to allow access to the recreational beach, Toms Cove, and Toms Cove Hook via Beach Road. • Continue to allow canoe/kayak access for environmental education and interpretation programs by NPS and the CBFS.	• OSV and hiking access would continue via Beach Road across Toms Cove south to Fishing Point September 16 through March 14. Access for environmental education programs would require a permit. Beach Road would continue to be open to vehicles year-round as far east as the vicinity of the South Pony Corral. • At new site near Beach Road and South Pony Corral, build a vehicle turn-around, crabbing dock, wildlife viewing tower, and new launching area for small non-motorized vessels. • Continue to allow canoe/kayak access for environmental education and interpretation programs by NPS and the CBFS.	• Close Beach Road causeway to all public access. • At Beach Road/South Pony Corral site, build a vehicle turn-around. • Continue to allow canoe/kayak access for environmental education and interpretation programs by NPS and the CBFS.

Issue	Alternative A	Alternative B	Alternative C
Fishing and OSV Use	• Maintain current access and closures.	• Improve signage, promotion, and coordination of the permit process for fishing throughout the refuge. • Create fishing access (e.g., crabbing dock) at new Beach Road/South Pony Corral site. • Close Assawoman Island to fishing during breeding season from March 15 until September 15 or thereafter until the last shorebird fledges. • Develop designated area for fishing and other priority uses at southern terminus of the NPS recreational beach then south along the Atlantic Ocean beachfront approximately .5 mile. This new OSV zone to facilitate priority uses (March 15 through September 15) south of new recreational beach would be added to the new assigned area. • OSV access on Toms Cove Hook from September 16 to March 14 would continue via Beach Road. Continue current management of the Overwash and Hook area for shorebirds until the new recreational beach is established, at which time the March 15 through September 15 closure would go into effect.	• Discontinue OSV use.
Horseback riding	• Maintain current access.	• Allow horseback riding within OSV zone. • Develop horse-trailer parking area.	• Discontinue horseback riding.

Issue	Alternative A	Alternative B	Alternative C
Hunting and Trapping	• Maintain current hunting policy of big game and migratory bird on Chincoteague NWR. • Maintain current hunting policy of big game on Wallops Island NWR.	Same as alternative A plus: • Introduce non-migratory Canada goose and light goose hunting within Assateague Island impoundments. • Add mourning dove hunting in areas outside of Assateague Island. • Add turkey to big game for youth hunting. • Open refuge for migratory bird hunting on Federal holidays in designated areas of the refuge within Wildcat Marsh, Morris Island, Assawoman Island and Metompkin Island divisions, that occur outside of the current hunting days of Thursday, Friday, and Saturday. • Pursue opening for fox and raccoon hunting on Assateague Island. • Pursue opportunity for fur-bearer trapping on Assateague Island.	Same as alternative A except: Work to eliminate sika and reduce non-migratory Canada goose populations. Same as alternative A plus: • Introduce non-migratory Canada goose and light goose hunting within Assateague Island impoundments. • Pursue opening for fox and raccoon hunting on Assateague Island. • Pursue opportunity for fur-bearer trapping on Assateague Island.
Pony Management	• Continue to allow current population of up to 150.	• Implement revised Chincoteague pony management plan. • Continue to allow for current pony population of up to 150.	• Within 15 years, phase in requirement for Chincoteague pony population to consist of no more than 125.
Cultural and Historic Resources	• Complete restoration of Assateague Lighthouse.	Same as alternative A plus: • Restore Lightkeeper's house, and historic landscaping and facilitate limited public access to cemetery and Assateague Village.	Same as alternative A
Wilderness	• Continue to protect the wilderness character of the 1974 proposed wilderness area.	Same as alternative A	• Same as alternative A plus remove Chincoteague ponies from proposed wilderness area and conduct wilderness review after relocation of recreational beach.

Chapter 3

USFWS

Beach Vegetation

Affected Environment

3.1 Introduction
3.2 Physical Environment
3.3 Vegetation
3.4 Wildlife
3.5 Socioeconomic Setting
3.6 Land Use Setting and Transportation
3.7 Visitor Services
3.8 Cultural Resources
3.9 Refuge Administration

Chapter 3: Affected Environment

3.1 Introduction

This chapter describes the physical, biological, and socioeconomic environment of the refuge. The physical environment section includes the refuge's geographic setting, its hydrogeomorphic features, soil information, and air and water quality. Biological resources are covered in sections on vegetation and wildlife that discuss how those resources have been influenced by human activity and management. For the refuge's current sociological environment, we explain refuge socioeconomics, land use and transportation, and visitor services. Finally, at the end of the chapter we explain the cultural and historic resources on the refuge, as well as important aspects of refuge administration. The information in this chapter acts as a reference for chapter 4, which documents the Environmental Consequences of each alternative on these resources.

3.2 Physical Environment

3.2.1 Geology

Geology

Regionally, the Delmarva Peninsula lies in the Atlantic Coastal Plain physiographic province, a seaward sloping province bounded on the west by a fall line and the Chesapeake Bay, and on the east by the Atlantic Ocean. The peninsula extends about 200 miles in a north-south direction and includes the State of Delaware and the eastern shores of Maryland and Virginia. The surficial sediments of Assateague Island are discontinuous Holocene Series deposits (tidal marsh and barrier sands). The subsurface sediments of the Delmarva Peninsula form a wedge of unconsolidated sands, silts, and clays that is over 7,000 feet thick and ranges in age from Cretaceous to Tertiary. The subsurface sediments rest on a seaward sloping basement of Paleozoic crystalline rocks. The basement is folded and faulted into a series of northwest-southeast trending ridges and depressions.

The Delmarva Peninsula was formed about 14,000 to 18,000 years ago during the last glacial retreat, when rising sea levels filled the large valley of the lower Susquehanna River, which became the Chesapeake Bay, thus isolating the area from the mainland. Consequently, the Delmarva Peninsula coastline with its barrier islands has changed dramatically since the retreat of the last glacial ice sheets and the melting of the polar ice caps. Sea level has risen more than 300 feet and the shoreline has shifted approximately 50 miles to the west. In general, the continued sea level rise will result in the submerging of the continental shelf and shifting barrier islands landward and upward.

However, the processes of barrier island and marsh-lagoonal system formation, and the migration of barrier islands along the eastern side of the Delmarva Peninsula (formed over several thousand years by broad sea level fluctuations) are not completely understood. One hypothesis is that as the sea level rose along the coastline, beaches retreated. Ridges of beach dunes originally formed by wind-blown sands were breached by storm waves from the rising water. The lowlands between the ridges and the coast were flooded and the ridges became barrier islands.

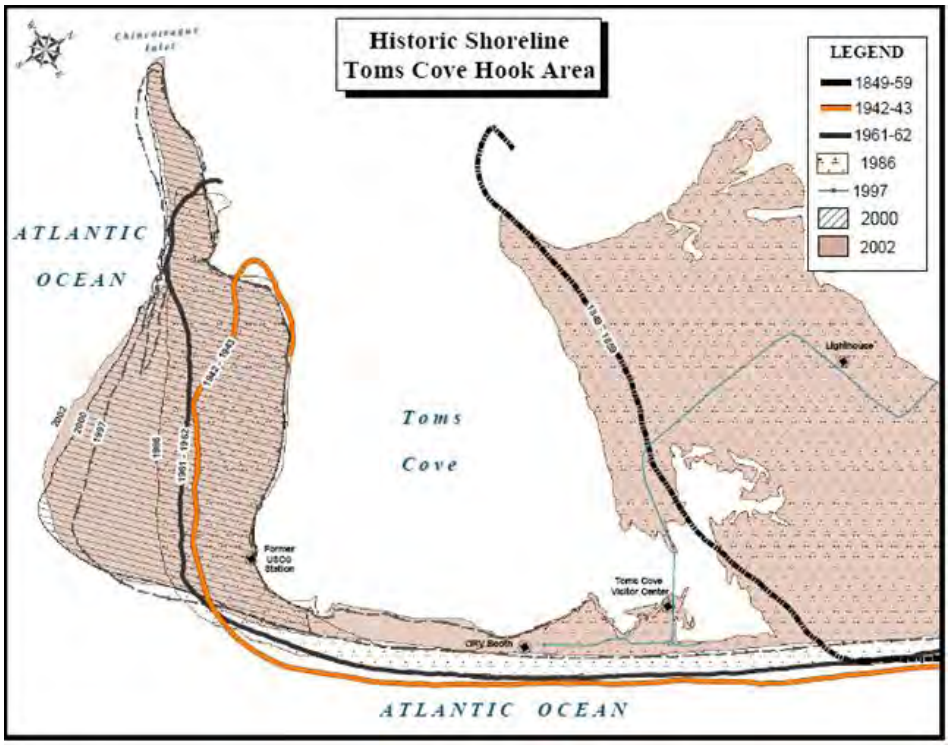
Assateague Island is a sand barrier resting on soft lagoonal mud that contains oyster, clam, and snail shells. The lagoonal mud overlies organic coastal salt marsh mud, and peat, which, in turn, overlies organic debris-rich sandy mud (USACE 1994). The sand and mud surface of Assateague

Island is underlain by 4,500 to 7,500 feet of discontinuous layers of sand, gravel, and clay that have accumulated during 135 million years of continental erosion and coastal action. Cretaceous Cenozoic and Mesozoic sands, silts, and clays account for more than half of the thickness of subsurface sediments (USDA 1994).

Today, Assateague Island (the longest barrier island on the Delmarva coast) is more than 37 miles long, but it is changing daily. Sea level rise, ocean currents, hurricanes and storms, and the very nature of barrier islands have created inlets and divided the island several times over the past few centuries. Geological research suggests that the southern portion of Assateague Island has developed as a series of recurved spits deposited by currents that erode the sands from northern beaches. Historical maps of the island indicate Toms Cove Hook is a sand spit that accreted since the 1850s (Figure 3-1).

Assawoman Island is approximately 2.5 miles long and, in recent years, joined to Wallops Island when Assawoman Inlet closed. Metompkin Island is 6.6 miles long and is also cut by an inlet. Cedar Island is 6.5 miles in length. Since Cedar Island does not have a large offshore sand supply similar to the other islands, it is moving westward at a greater rate than the other islands in the refuge (USFWS 1993a).

Figure 3-1. Changing Shoreline of Southern Assateague Island (USFWS 2004c)



Topography

Topographically, the Delmarva Peninsula region is nearly flat, indicating the past influence of the ocean and the more recent leveling effects of winds. The topography of Assateague Island, like other mid-Atlantic barrier islands, rises from the sea to merge into flat and gently rolling sand dunes. These dunes may exhibit a transition from beachgrass to myrtle brush to loblolly pine on higher ground, or fall gently into low-lying potholes and salt meadows in the interior of the island.

Island elevations range from sea level to approximately 14 meters mean sea level (MSL) (about 46 feet) with the bay side of the island mostly timbered with pines and bordered by salt marsh and salt meadows.

Accretion and Erosion—Wind and Wave Effects on Barrier Islands

Due to the natural phenomenon of barrier island systems, Assateague Island is changing. The Maryland Geological Survey estimates that the eastern shore of Assateague Island is eroding at a rate of about 1.5 feet each year. Barrier islands are coastal features composed of sand and other loose sediments transported by waves, currents, storm surges, and winds. They are formed by sediments eroded from glacial deposits, or from ocean bottom sediments and/or coastal plain materials. For every 1-foot rise in sea level, it has been estimated that coastal barrier islands move 100 to 1,000 feet inland. When more sand is deposited than removed, the beach is said to be accreting. When long shore transport results in a net loss of sand, it is eroding. Erosion and accretion rates differ from island to island, as a result of differing sand supplies, prevailing winds, and wave energies; this, coupled with sea level rise, leads to an ever-changing landscape throughout the Virginia Barrier Islands (USFWS 1988).

The near shore zone is an area of wave turbulence and littoral drift where constant ocean currents and wave action create sand bars and shallow troughs that are exposed at low tide. Long shore currents move from north to south, transporting sands to Toms Cove Hook, where they accrete on bars and flats. Accreting spits, like Toms Cove Hook, are often sites for beach ridge development. Long shore currents and waves build new platforms of sand (i.e., beach), and organic debris accumulates on the beach crests. As sands continue to build, plants grow from buried drift lines, accumulating more sand in curved ridges corresponding to the original drift line position. Continued shoreline accretion builds more curvilinear ridges. The resulting spit displays a system of ridges with upland vegetation; between them, low interdunal areas support wetland species.

The beach is the transition area between marine and upland environments. By definition, barrier islands protect other features, such as lagoons and salt marshes, from direct ocean wave attack. Assateague Island protects Chincoteague Bay from the forces of the open sea, providing quiet waters where sands and silts settle out and accumulate. Inlet currents and wave action along the shore push these sediments into calmer areas where they eventually build up into the intertidal zone as sand and mudflats. The intertidal foreshore is flooded and exposed by daily tides; the backshore, separated from the foreshore by a berm, or terrace, is subject to storm waves. Broken rhizomes and beach plant seeds, along with other organic debris, accumulate in drift lines along the backshore. Windblown sands are caught in this debris and build up around sprouting plants. Capable of surviving sand burial, beach grasses grow with the accumulating sand, providing a relatively stable substrate and facilitating dune development. Erosion by storm action or other interference often precludes this process.

3.2.2 Soils

Soils directly influence habitat by shaping the kind and amount of vegetation and the amount of water available. In this way, they indirectly influence the kind of wildlife that can live in an area. Soils are organized into a taxonomic classification system by the USDA, Natural Resources Conservation Service, in which each soil is categorized by order, suborder, great group, subgroup, family, and soil series. Nationwide, there are 12 soil orders. Entisols are the dominant soil order on the refuge. Entisols are soils defined by the absence or near absence of horizons (layers) that clearly reflect soil-forming processes. The soils of the refuge consist of sand, silty loams, and shell

fragments, with sands found primarily on upland areas and silty loams found on tidal marshes and other wetlands. The soils of the refuge are a mixture of several Entisol soil series, all of which have a thermic soil temperature regime and mixed mineralogy as shown in Table 3-1, Figure 3-2, Figure 3-3, Figure 3-4, and Figure 3-5. Chincoteague NWR Soil Cover Map – Cedar Island (USFWS refuge staff). Chincoteague silt loam (0 to 1 percent slope), Assateague fine sand (2 to 35 percent slope), Camocca fine sand (0 to 2 percent slope), Fisherman fine sand (0 to 6 percent slope), Beach sand (1 to 5 percent slope), and other Entisol soils that occur within Udorthents and Udipsamments great group soils (see below) are the dominant soils found on the refuge. All of these soils are mixed and intermingled in many locations on the islands. Other associated soil complexes recognized by the soil scientists include Fisherman-Camocca (0 to 6 percent slope) and Fisherman-Assateague (0 to 35 percent slope) (USFWS 1992a).

Details for the dominant soil series are:

- Soils of the Chincoteague silt loam series are nonacid Typic Sulfaquents (great group) that are very deep and very poorly drained. They are formed in loamy sediments and are found throughout the refuge impoundments and in salt marshes primarily between the barrier islands and the seaside mainland as well as some barrier tidal flats. Soil permeability is moderately slow and they are very poorly drained with slow runoff, and saturated with salt water. These soils provide habitat for wetland wildlife and spawning grounds for shellfish and fin-fish species. Common plant life consists of cordgrasses, glasswort, and saltgrass. Cultivated crops, nursery stock, pasture grasses and legumes, and loblolly pines are all unsuitable on this soil because of flooding by salt water, wetness, excess salt, and ponding. Construction is similarly unsuitable with additional limitations of low strength and potential groundwater pollution.

- Soils of the Assateague fine sand series are primarily quartz (and other heavy minerals) within Typic Udipsammments (great group). They are very deep and excessively drained with very rapid permeability and are formed in sandy sediments. Assateague soils are found on undulating to steep sand dunes associated with beaches and salt marshes throughout Assateague Island. Assateague fine sand areas are rarely flooded. These soils provide habitat for wildlife and recreation. Common plant life consists of wax myrtle, bayberry, loblolly pine, and beach grasses. Potential for loblolly pine productivity on this soil is moderately high, although some areas support only salt-tolerant shrubs because of salt spray. Seedling survival is limited by moisture stress (very low water storage capacity). Cultivated crops, pasture grasses, and legumes are all unsuited to this soil. Flooding by salt water, low availability of fresh water, and erosion by water (slight) and wind (severe) are limitations.

- Soils of the Camocca fine sand series are Typic Psammaquents (great group) with a mixed mineralogy. Camocca soils are very deep, poorly drained and rapidly permeable. They are formed in sandy sediments and are found in shallow depressions (concave surface) between coastal dunes and on nearly level flats between dunes and marshes. Salt water flooding is common and the soil is periodically inundated by storm tides. The soil provides habitat for wildlife and a foundation for recreation. Common plant life consists of waxmyrtle, cordgrass, and greenbrier shrub community. Some areas support sparse stands of native pines and hardwoods where salt water flooding is less frequent.

- Soils of the Fisherman fine sand series are Aquic Udipsamments with a mixed mineralogy. Fisherman soils are very deep, moderately well drained, have very rapid permeability, and are formed in sandy sediments. They are found on nearly level and gently sloping areas and in depressions of undulating areas (back dunes) associated with dunes and salt marshes on Assateague and Chincoteague Islands. Depth to the water table is usually only 18 to 36 inches. The soil provides habitat for wildlife and a foundation for recreation. The natural plants are commonly cordgrasses, saltgrasses, and wax myrtle.

- Beach soils are found along a thin strip on the seaward side of the island. These are regularly flooded and generally characterized by poor drainage and are subject to wave, wind, and tidal action. This nearly level to moderately sloping soil unit consists of sandy sediments deposited by wave action. It is used primarily for recreation and for wildlife habitat. Most other uses are limited by flooding with salt water, severe erosion, and accretion of sediments.

Other sulfaquent soils are found in association with tidal marshes located behind the beaches on all three southern islands (Cedar, Metompkin and Assawoman). They have high sulfur content, drain poorly, and subject to tidal flooding, excessive settlement, and salinity (USFWS 1988).

Table 3-1: Soil Map Legend

Soil Abbreviation	Soil Taxonomic Name
As	Askecksy loamy sand
AtD	Assateague fine sand, 2 to 35 percent slopes, rarely flooded
Be	Beaches
BeB	Beaches, 1 to 5 percent slopes
BoA	Bojac fine sandy loam, 0 to 2 percent slopes
BX	Boxiron and Broadkill Soils
CaA	Camocca fine sand, 0 to 2 percent slopes, frequently flooded
ChA	Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded
FhB	Fisherman fine sand, 0 to 6 percent slopes, occasionally flooded
FmD	Fisherman-Assateague complex, 0 to 35 percent slopes, rarely flooded
FrB	Fisherman-Camocca complex, 0 to 6 percent slopes, frequently flooded
MaA	Magotha fine sandy loam, 0 to 2 percent slopes, frequently flooded
MoB	Molena loamy sand, 0 to 6 percent slopes
MoD	Molena loamy sand, 6 to 35 percent slopes
MuA	Munden sandy loam, 0 to 2 percent slopes
PoA	Polawana mucky sandy loam, 0 to 2 percent slopes, frequently flooded
Pu	Purnell Peat
TP	Transquaking and Mispillion Soils
UnK	Unknown
UpD	Udorthent and Udipsamment soils, 0 to 30 percent slopes
W	Water

Figure 3-2. Chincoteague NWR Soil Cover Map – Northern Assateague Island (USFWS refuge staff)

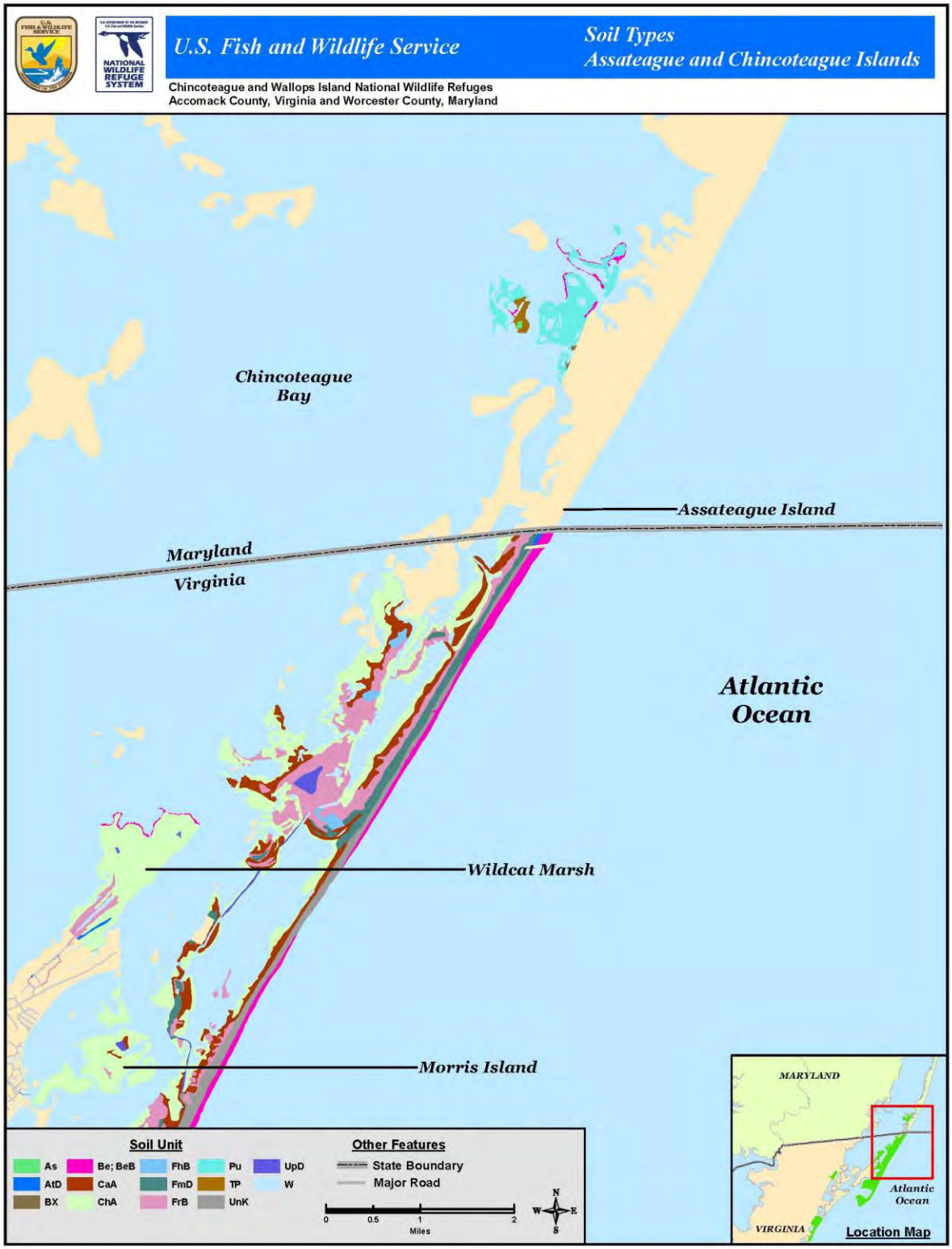


Figure 3-3. Chincoteague NWR Soil Cover Map – Southern Assateague Island (USFWS refuge staff)

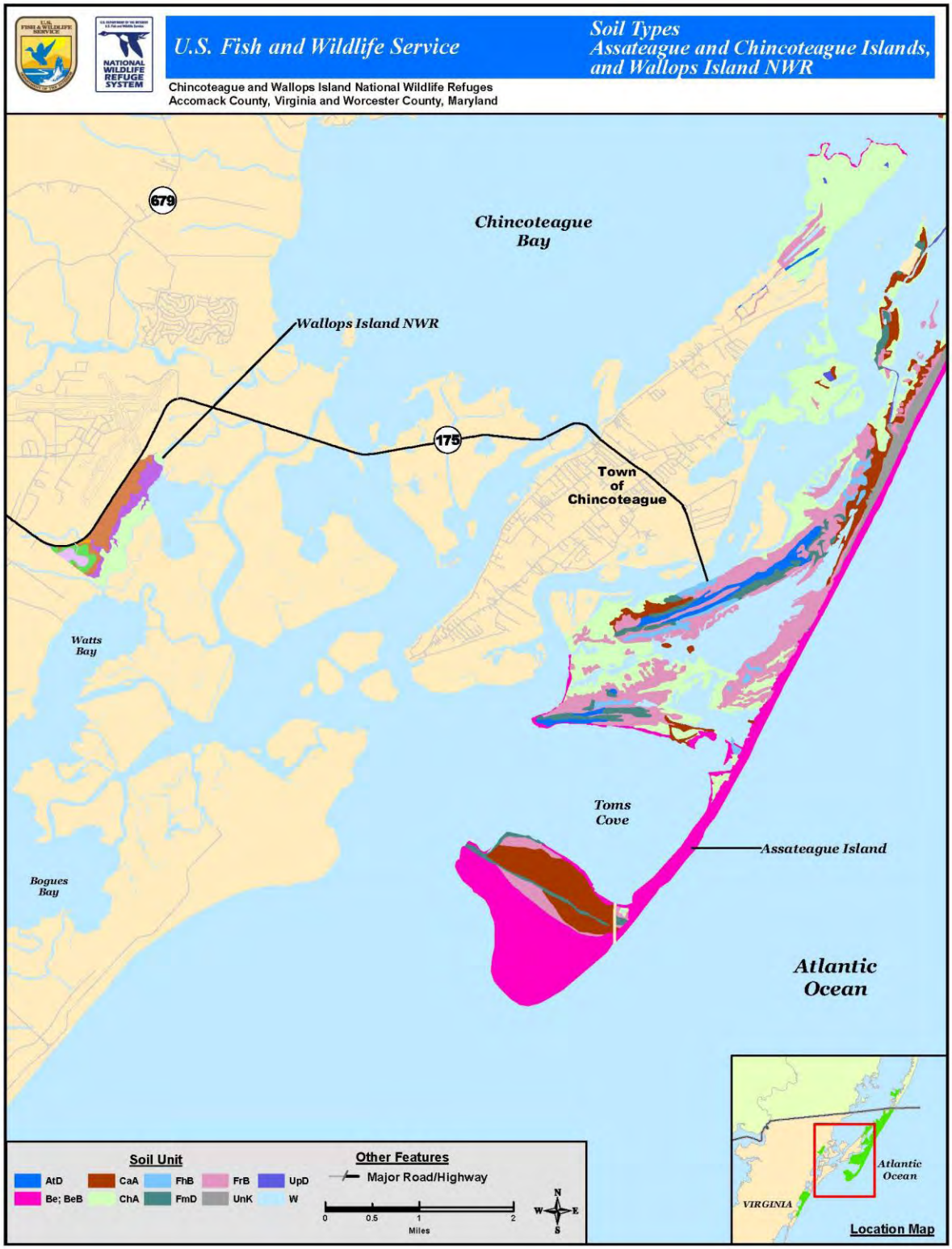


Figure 3-4. Chincoteague NWR Soil Cover Map – Assawoman and Metompkin Island Islands (USFWS refuge staff)

Figure 3-5. Chincoteague NWR Soil Cover Map – Cedar Island (USFWS refuge staff)

3.2.3 Air Quality

Air quality in the area of the refuge is influenced both by local sources of pollutants, such as ammonia from agricultural operations, and by industrial and automobile emissions occurring hundreds of miles away.

Since 2000, a National Atmospheric Deposition Program monitoring station (NADP-MD18) that is located on Assateague Island, adjacent to Assateague State Park in Worchester County, Maryland, has been monitoring atmospheric (wet) deposition of nitrogen, a major source of the nutrient load affecting the coastal bays adjacent to Assateague Island. The NADP station collects rainwater samples weekly and measures them for nitrogen compounds. Atmospheric deposition makes up more than 30 percent of the overall nitrogen load to the bays. Other air pollutants such as mercury seem to be less problematic as recurring surveys of aquatic sediments have failed to detect heavy metals at levels of concern. Recent ozone monitoring data from 2004 to present indicate that the area does experience periodic high levels during the summer months, but that local meteorological conditions serve to moderate the potential threat (National Parks Conservation Association 2007).

The Clean Air Act (CAA) of 1970 (as amended in 1990 and 1997) requires the U.S. Environmental Protection Agency (EPA) to implement air quality standards to protect the nation's health and welfare. National Ambient Air Quality Standards (NAAQS) were set for six pollutants commonly found throughout the United States: lead, ozone, nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter less than 1.0 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$).

Regionally, the states of Virginia, Maryland, and Delaware all maintain and operate air quality programs that satisfy the CAA monitoring requirements to assess compliance with the NAAQS. The Office of Air Quality Monitoring in Virginia's Department of Environmental Quality measures ambient air quality at approximately 45 locations throughout the Commonwealth (Virginia Department of Environmental Quality 2007). Maryland's Air Quality Monitoring Program in the Air and Radiation Management Administration, Department of the Environment, conducts ambient air monitoring at 26 sites (Maryland Department of the Environment 2006). The Air Quality Management Section of Delaware's Division of Air and Waste Management, Department of Natural Resources and Environmental Control, maintains an ambient air monitoring network consisting of 11 sites (Delaware Department of Natural Resources 2006 and 2008). Although these monitoring sites are located throughout the region, most of the sites are concentrated in the urban/industrial areas, which have the highest population and largest number of pollutant sources. Areas that meet the NAAQS are designated “attainment areas,” while areas not meeting the standards are termed “non-attainment” areas.

On a regional basis (including the refuge), NAAQS for ambient concentrations of lead, carbon monoxide, nitrogen dioxide, and sulfur dioxide are in attainment; and long-term trends indicate that concentrations of the criteria pollutants have either been level or declining.

EPA's Air Quality Index (AQI) is a summary index for reporting daily air quality. It tells how clean or polluted the air is, and what associated health effects might be of concern. The AQI focuses on health effects that humans may have experienced within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the CAA: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. Because all areas of the United States are currently attaining the

NAAQS for lead, the AQI does not specifically address lead. For each of these pollutants, EPA has established national air quality standards to protect public health. The higher the AQI value is, the greater the level of air pollution, and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value over 300 represents hazardous air quality. An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level EPA has set to protect public health. AQI values below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy at first for certain sensitive groups of people, then for everyone as AQI values get higher (EPA 2011).

More than 80 air quality monitoring sites are located within 100 miles of the refuge. However, the two closest sites, and thereby those two sites assumed to be most representative of the air quality of Assateague Island, are located in Sussex County on the Delaware Eastern Shore, about 70 air miles north of the refuges. They are Lewes (site # 10-005-1003), a coastal site, and Seaford (site #10-005-1002), a suburban site. Calculated AQI values, based on data collected in 2006 and 2007 at these two sites, showed that the air quality in Sussex County (representative of the air quality on the refuge) had good air quality 67 to 70 percent of the time; moderate air quality 26 to 27 percent of the time, and unhealthy/sensitive air quality 4 to 6 percent of the time. The single pollutant responsible for the highest index value is referred to as the "Main Pollutant." The Main Pollutant was ozone (74 to 75 percent of the time) and particulate matter less than 2.5 microns (25 to 26 percent of the time). High AQI values due to ozone and small particulate matter are often associated with bright summer days and periods of hot, stagnant, summertime air, favoring the formation of ozone and condensation nuclei (EPA 2009).

3.2.4 Hydrology and Water Quality

Hydrology

No natural freshwater streams or lakes exist on the refuge. Rainfall and tidal overwash are the only sources of surface water on Assateague Island. Overwash is the process that causes the transportation and deposition of water and sediment over the beach crest. The man-made moist-soil units (impoundments) are slightly brackish to highly saline because of tidal overwash, salt spray, and the accumulation of salt residue as water evaporates. These same environmental factors also render the shallow groundwater beneath the islands brackish. Evaporation and transpiration account for major surface water depletion during the summer months. The drinking water supply for Chincoteague Island and the refuge comes via pipeline from three deep wells and a shallow well field near the NASA base on the mainland. On Cedar Island, there are approximately a dozen wells, and none currently exist on either Metompkin or Assawoman Islands (USFWS 1988). Large bodies of water bordering the island are the Atlantic Ocean (to the east) and Chincoteague Bay and Assateague Channel (to the west) (USFWS 2007b).

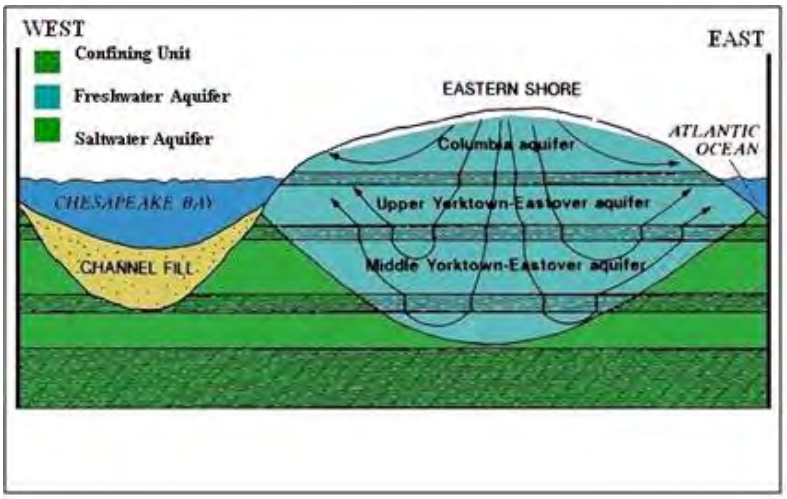
Assateague Island protects Chincoteague Bay from the strong wave activity of the open ocean, which allows for the accumulation of sands and silts that can eventually build up into mud flats. Algal mats, salt marsh cord grass, and mollusk colonies help stabilize the flats. This low salt marsh zone is flooded by tides twice daily. Tides and tidal currents in the inshore waters of Chincoteague Bay are controlled by the inlets at either end of Assateague Island. Ocean City inlet to the north and Chincoteague inlet to the south have mean tidal ranges of 3.4 to 3.8 feet, but near the midpoint between the two inlets in Chincoteague Bay, the tidal range is only about 0.4 feet. Through the

tides, approximately 7 percent of the water in the bays is renewed each day (USACE 1994, USFWS 1992a).

Groundwater

On the Eastern Shore, there are four major aquifers that make up the near surface system (see Figure 3-6). The system is comprised of the near-surface, unconfined Columbia (or Quaternary) aquifer (commonly referred to as the water table aquifer) and a series of deeper, confined aquifers and intervening semi-confining units. The Columbia aquifer is composed of sediments that are primarily sands with inter-fingering clay and silt beds. It ranges from near surface to a depth of about 100 feet, resulting in more susceptibility to surface sources of contamination. Consequently, the Columbia aquifer is not used as a major source of drinking water. The three deeper, confined aquifers deposited during the Miocene era (with depths up to 800 feet) consist of coarse shelly sands and are found in three layers separated by clay confining units. They are known as the Upper Yorktown-Eastover (or Pocomoke) aquifer; the Middle Yorktown-Eastover aquifer, and the Lower Yorktown-Eastover aquifer. The clay confining units help to protect the Yorktown-Eastover aquifer from surface water contamination, and generally the deeper aquifers have better water quality. The clay confining units separating the aquifers are somewhat porous and allow some groundwater exchange between the two deeper Yorktown-Eastover aquifers. Recharge of the aquifers comes from surface water—rain, snow, and leakage from ponds. The total available ground water supply is limited to the amount of fresh water recharging the aquifers from precipitation directly falling on the land surface. The salt water that completely surrounds Assateague Island (Atlantic Ocean and Chincoteague Bay) causes the groundwater to become brackish at relatively shallow depths (Horsley Witten Hegemann, Inc. 1992).

Figure 3-6. Schematic of Ground Water Aquifers—East-West Cross Section of the Eastern Shore of Virginia (Horsley Witten Hegemann, Inc. 1992)



Surface Water

Because there are no perennial freshwater streams on Assateague Island, surface water systems are vitally important for fish and other wildlife on the island and are managed accordingly. Many of the freshwater ponds are surface expressions of shallow groundwater, often ephemeral,

forming during the wet winter months and drying during the summer. Surface waters consist of bays, lagoons, and ponds. The numerous bays and inlets formed by the barrier island serve as a mixing zone for sea water that flows from the east and for the less saline waters from mainland creeks and streams. Due to the lack of a significant freshwater inflow, these back bays are not considered to be estuaries in the classical sense. Nonetheless, they are extremely important as finfish and shellfish areas, providing important nursery habitat for a rich variety of fish (USFWS 1988).

Freshwater wetlands on Chincoteague NWR occur at natural low points in the dunes or flats, or, impounded areas. On Toms Cove Hook, low areas between the beach ridges and dunes collect rainwater and support wetland vegetation. A few other small natural freshwater marshes occur behind the dunes of the northern beach. The refuge's impoundments are located between mean high and spring high tide and abut upland areas as well as fresh or brackish marshes not affected by tides (USFWS 1992a).

Thirteen impoundments covering over 2,650 acres were constructed on Chincoteague NWR to provide submergent and emergent wetland vegetation as forage for waterfowl and habitat for a variety of waterbirds (see Figure 3-7). Management of these impoundments is directed at providing fall and winter habitat for waterfowl and spring/fall stopover habitat for migrating shorebirds. A system of dikes confines these wetlands. Most dikes are also maintained as roads for public and/or staff access. Beach Road from the bend beyond the refuge headquarters to the rotary at the beach is a dike separating Black Duck Pool (A Pool) from the Black Duck Marsh and Swan Cove Pool (F Pool) from Little Toms Cove. Approximately half of the Wildlife Loop is a dike surrounding Snow Goose (B-South Pool), separating it from Black Duck Pool (A Pool), Swan Cove Pool (F Pool), and Shoveler Pool (B-North Pool). The dike between Black Duck and Swan Cove Pool (A and F Pools) is a bike trail. The Swan Cove bike trail, with access to the recreational beach, is built on a dike separating Swan Cove Pool (F Pool) from natural wetlands to the east.

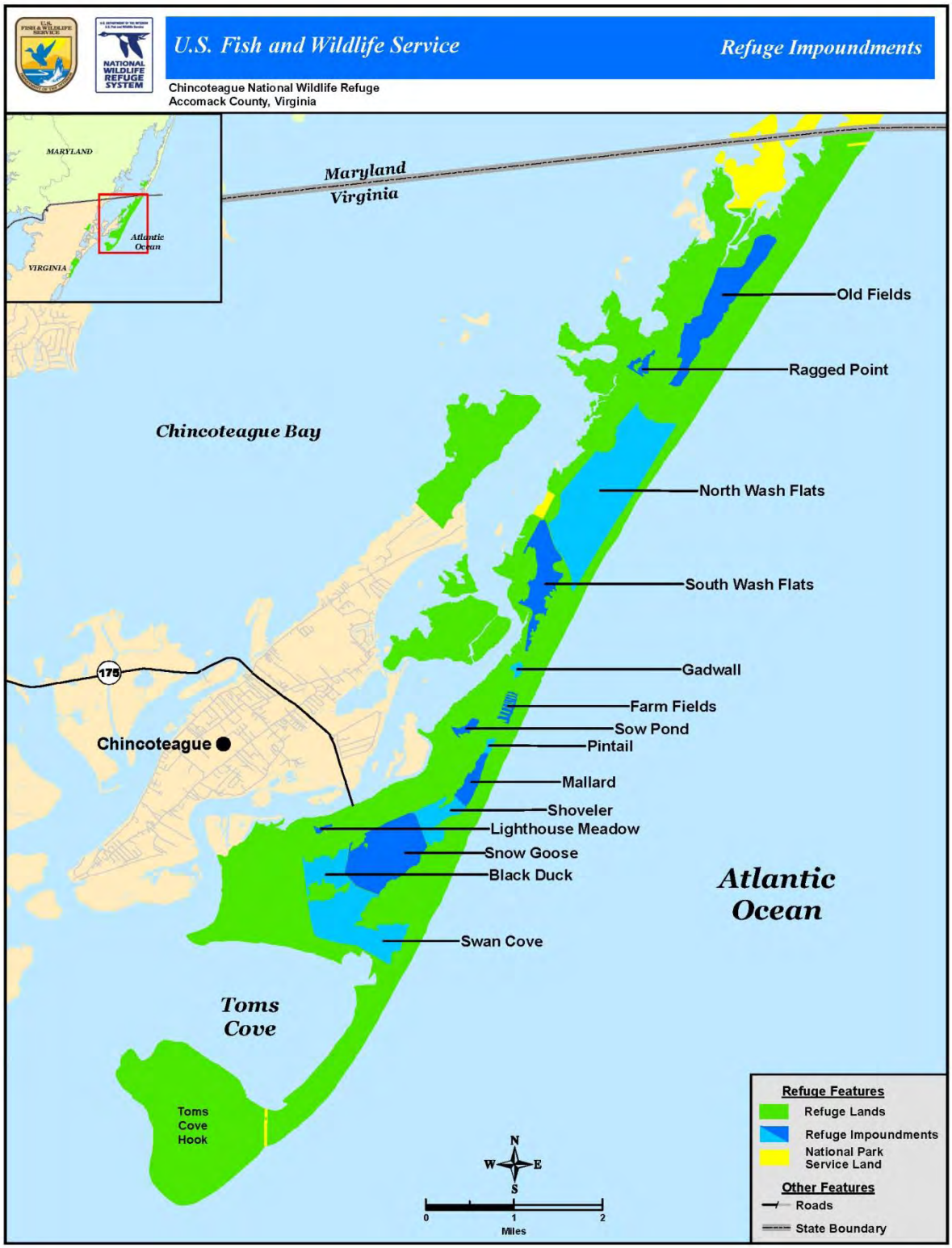
Most dikes have adjacent borrow ditches along their pool side. These ditches serve to:

- provide wading bird resting and feeding habitat;
- provide wading bird and waterfowl brood rearing habitat, an especially important function when drought or impoundment drawdown removes open water from other pool areas;
- facilitate drainage as flow channels to water control structures; and
- restrict visitors to use of dikes only, minimizing intrusion into protected wetland habitats.

Water control structures are used to manipulate impoundment water levels according to which species of plant or animal is being managed. These structures release water either into adjacent pools or through bayside channels into the tidal marshes. Impoundment water level control enables production of good quality wildlife food and assures a variety of wetland habitats for diverse species of wildlife.

In general, impoundments are located above high tide level so estuarine water cannot enter them; however, tidal influx can occur through the Virginia Creek water control structure (WCS) into Old Fields Impoundment. During severe weather and extreme high tides, overwash reaches impoundments from the sea and bay side; Black Duck (A) Pool, Snow Goose (B-South) Pool, Shoveler (B-North) Pool, Mallard (C) Pool, Pintail (D) Pool, Swan Cove (F) Pool, Wash Flats, and Old Fields impoundments are most susceptible. Other than these cases, impoundment water supply comes from direct precipitation. Impoundments receive very little surface run-off because surrounding soils are highly permeable (USFWS 1992a).

Figure 3-7. Refuge Impoundments – Chincoteague NWR (USFWS refuge staff)



Water Quality Concerns

Dissolved ammonia and nitrates are the dominant nutrients in ground water in the area. Submarine discharges from the shallow groundwater aquifer into the estuarine system have been found to carry nutrient and contaminant loads. Chincoteague Bay (and Sinepuxent Bay) suffers from an influx of excess nutrients, primarily nitrogen and phosphorus. As much as one-half of the excess nutrients are believed to come from agricultural sources such as chemical fertilizers and manure generated by intensive chicken production facilities on the mainland. Atmospheric nitrogen, primarily from coal-fired power plants and motor vehicles, is also a significant source (approximately 30 percent) of nutrient deposition into Chincoteague Bay surface waters. These nutrients promote the growth of algae blooms that deplete dissolved oxygen levels in the water when the algae die and decompose, resulting in fish die-offs. Since 1972, the Maryland DNR has documented a decrease in the abundance of forage species such as bay anchovy, menhaden, spot, and Atlantic silverside in Assateague Island's bayside waters. Small forage fish are most susceptible to fish kills when summer algal blooms create anaerobic conditions in shallow bays and canals. Brown tide, a harmful alga that can kill sedentary species such as shellfish, has been documented every year since 1999 in Assateague's bayside waters. Sea grasses have been increasingly stressed by deteriorating water quality and the associated proliferation of algae, which reduce light availability. Bays such as Chincoteague are particularly prone to algal blooms because their waters are exchanged with open ocean waters relatively slowly. At Chincoteague, flushing may take as long as 63 days (National Parks Conservation Association 2007 and Dillow 2002).

Floodplains

The majority of the Chincoteague NWR landmass falls within the 1-percent flood zone, commonly called the 100-year flood line. The only portions of the island not in the 100 year flood zone are the White Hills, located north of the Wildlife Loop. These hills, with the highest elevation of the refuge, are located within the 0.2 percent or 500-year flood zone (FEMA 2009). The average base flood elevation for the flood zones on the island are approximately 8 to 9 feet, meaning that this elevation, relative to the mean sea level, has a one percent chance or greater of flooding in a given year as determined by FEMA.

3.2.5 Climate Change and Sea Level Rise

Current Climate and Overwash Conditions

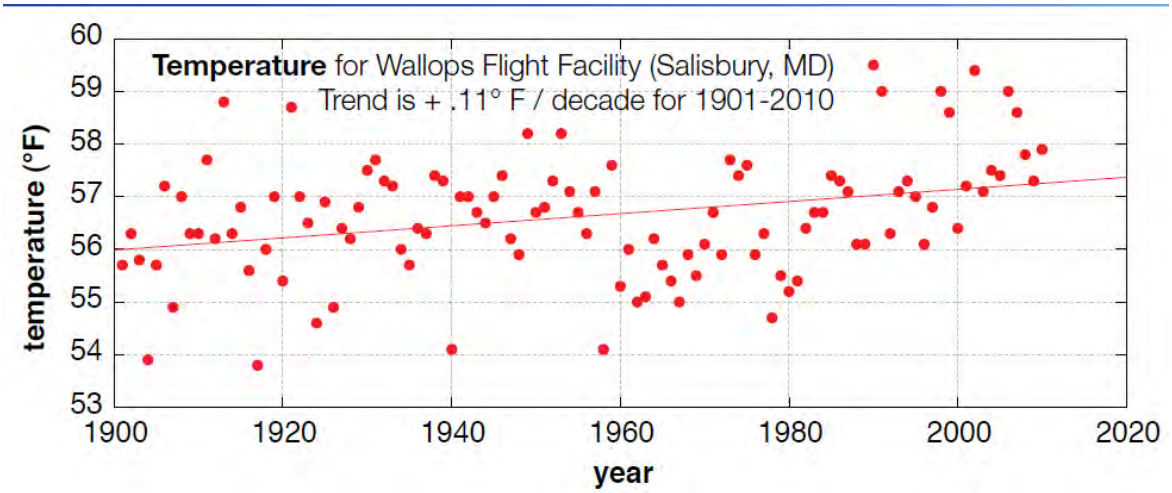
The climate of the refuge is generally temperate and humid. Seasonal temperature ranges are influenced by the moderating effects of the Delmarva Peninsula's proximity to Chesapeake Bay and the Atlantic Ocean. The area lies in the zone of prevailing westerlies, where most weather systems track west to east. The low relief and Atlantic exposure of the refuge make it extremely vulnerable to storms.

The climatic conditions of the refuge are moderated by the Atlantic Ocean. Summer days are typically hot and humid, with prevailing winds from the northeast and southeast. Occasional thunderstorms hit with little notice, presenting danger of lightning strikes and exposure to beach goers and other visitors. Although autumn days are typically cool and clear, the season also marks the onset of nor'easters. These low pressure systems move up the coast, generating storms caused by counterclockwise cycling of moist air. Nor'easters are characterized by heavy rain, strong northeast winds, high tides, and rough seas. Conditions may last for 2 to 5 days. Winter temperatures tend to be mild, though nor'easters are usually more intense, and carry the greatest

potential for overwash of the primary dunes along the ocean side of Assateague Island (USFWS 1992a).

Figure 3-8 and Table 3-2 present historic temperature and precipitation data for Assateague Island. The lowest mean monthly temperature is about 36°Fahrenheit , in January; and, the highest monthly mean temperature is about 76°F, in August. Rainfall is rather uniformly distributed throughout the year averaging about 3.5 inches a month and totaling about 43 inches a year. Annual precipitation totals have ranged from between 30 to 60 inches. Snowfall is light, with February historically having accumulations of about 2 inches. Total annual snowfall is only about 5 inches (Southeast Regional Climate Center 2007 and USFWS 2007d).

Figure 3-8. Daily Average Temperature for Assateague Island National Seashore area, and Predicated Future Climate Change (NASA 2012)



	2020's	2050's	2080's
Average Annual Precipitation	0 to +10%	0 to +10%	0 to +15%
Sea Level (inches)	+2 to +5	+7 to +11	+12 to +21
Sea Level–Rapid Ice Melt Scenario (inches)	+5 to +9	+19 to +28	+42 to +56
Average Annual Temperature (F°)	+1.5° to +2.5°	+2.5° to +4.5°	+3.5° to +6.5°

Table 3-2. Temperature and Precipitation Data Assateague Island Area (December 1, 1955 to April 29, 2012) (Southeast Regional Climate Center 2012. http://www.sercc.com/)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (F)	46.7	49.1	56.8	66.8	75.1	82.8	86.7	85.3	79.7	69.7	60.4	50.7	67.5
Average Minimum Temperature (F)	29.5	30.8	37.4	45.9	55.0	64.0	68.8	67.4	61.3	50.4	41.8	33.3	48.8
Average Total Precipitation (in.)	3.48	3.22	4.16	3.12	3.38	3.82	4.61	4.17	3.60	3.66	2.99	3.62	43.82
Average Total SnowFall (in.)	3.9	2.7	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	9.4

The tropical storm and hurricane season runs from June through November. Summer season hurricanes, occurring June through August, originate over the Atlantic in the vicinity of the Bahamas, Leeward, or Windward Islands. Storm centers usually remain offshore, bringing heavy rains, high winds, high tides, and rough seas. Hurricanes and storms occurring later in the season, September through late October, tend to originate in the Caribbean. Though hurricane storms lose much of their force as they travel across the southeastern states, they still carry a potential for devastating effects when they reach the Delmarva Peninsula.

Past documentation and observations show that normal daily tide cycles and coastal storm processes actively change the configuration of the coastline. Normal low-energy processes move small volumes of sand and are both erosional and depositional in nature. High-energy coastal storm processes involve large volumes of sediment movement (Kraft and John 1976).

One of these high-energy storms, nor'easter Ida, struck Chincoteague NWR and Assateague Island National Seashore in November 2009. This storm damaged public beach parking lots, which were washed away or buried under 3 feet of sand; brought about a tidal overwash of part of Assateague Island such that Toms Cove Hook was not accessible during high tide; and resulted in the flooding of Swan Cove Pool (F Pool), which put significant hydraulic pressure on Beach Road and undermined the road's structural stability. This storm also closed the refuge and seashore for several days and limited access for some time thereafter (Volpe National Transportation Systems Center 2009). Though storms of this magnitude have historically been sporadic, the refuge has been experiencing more frequent nor'easter activity with multiple big coastal storms making landfall during a single season, creating more rapid landscape and coastal changes. Table 3-3, below, is taken from the Chincoteague NWR: Recreational Beach Structural Decision Making Study (2011) and lists all the notable storm events since the 1800s. There have been a number of significant storms recorded over the last 200 years, some which have caused great damage to the refuge, such as the March 1962 nor'easter that destroyed most of Assateague Island's natural

foredune, and the storm in January 1992, which destroyed much of the dune line on the lower portion of the island and greatly reduced the primary dune line to the north.

More recently, in October 2012, the refuge was significantly impacted by damaging winds and water as a result of Hurricane Sandy. Trees knocked down by strong winds fell across many refuge roads and trails. One remote restroom was destroyed, some shingles were lost, and the bunkhouse roof was damaged, but other refuge buildings were spared major damage. Earthen dikes surrounding refuge impoundments suffered some erosion but there were no major breaches in these dikes. There was one ocean breach, just north of parking lot 1. All beach parking lots were washed over by the storm surge, which compromised the clay base and shell surface. The asphalt surface and shoulders of Beach Road were significantly damaged.

Table 3-3. Notable Chincoteague NWR Storm Events Since the 1800s

1800s	1900 – 1999 (100 years)	2000 – 2012 (13 years)
1878 - September Gale	1933 – August Hurricane	2000 – December Snowstorm
1888 - Great Blizzard	1936 – September Hurricane	2003 – North American Blizzard
	1962 – Ash Wednesday Storm	2005 – North American Blizzard
	1976 – NE U.S. Blizzard	2006 – Late November Nor'easter
	1984 – November Nor'easter	2007 – April Nor'easter
	1991 – 'Perfect Storm'	2009 – November Nor'easter (Nor'Ida)
	1993 – 'Storm of the Century'	2009 – December Nor'easter
	1994 – Christmas Nor'easter	2010 – March Winter Storm
	1996 – North American Blizzard	2010 – November Nor'easter
	1997 – April Fools' Day Blizzard	2010 – December Blizzard
		2011 – January Blizzard
		2011 – Hurricane Irene
		2011 – October Nor'easter
		2012 – Hurricane Sandy

Coastal storms with sustained winds can lead to prolonged flooding of refuge impoundments and roads and increase the erosion of refuge dunes. The surge of storm water landward results in heavy saltwater intrusion of freshwater wetlands and adjacent upland habitats. Long-term geologic changes from these coastal storms include beach erosion, dune erosion, and possible inlet formation from stronger flood and ebb tide surges (USFWS 2011b).

Wind and saltwater intrusion, nearshore channeling, and sedimentation also cause landscape changes. The advent of overwash along barrier coastlines is determined by the height and wave parameters. In general on the east coast, overwash threshold conditions have been steadily increasing since the 1990s. The refuge has been experiencing more frequent nor'easter activity with multiple big coastal storms making landfall during a single season, creating more rapid landscape and coastal changes. For example, the coastal storms of December 10 to 14, 1991, and January 4, 1992, had associated storm surges of up to 8.5 feet above mean high water. After these two storms, overwash and breaching of dunes occurred at scattered locations along the Delmarva Peninsula. This increased occurrence and severity of shoreline regression and overwash are continuously transforming the profile of Assateague Island, as shown in Figure 3-9.

Figure 3-9. Changes in shoreline of Assateague Island, 2006 through 2013, with consistent marking of the same features over time (Photo credit: Patrick J. Hendrickson 2013)

Global Climate Change and Warming

According to NOAA and NASA data, the Earth's average surface temperature has increased by about 1.2 to 1.4°F since 1900 (IPCC 2007). In January of 2008, NOAA reported that seven of the 8 warmest years on record have occurred since 2001, part of a rise in temperatures of more than 1°F since 1900. In 2008, NOAA reported that for the preceding three decades, the rate of warming in global temperatures was approximately three times greater than the century scale trend. Per the latest IPCC report (2012), the earth's surface has been successively warmer than any preceding decade since 1950 (analysis included 1983 to 2012). If greenhouse gases, primarily carbon dioxide, methane, and nitrous oxide, continue to increase, climate models predict that the average temperature at the Earth's surface could increase from 3.2°F to 7.2°F above 1990 levels by the end of this century (IPCC 2007).

The effect of climate change and global warming are anticipated to result in changes in weather/rainfall patterns (fewer but more intense storms), decreases in snow and ice cover, rising sea levels, and stressed ecosystems. For the mid-Atlantic region, this can mean extreme precipitation events, greater likelihood of warmer/dryer summers, and wetter/reduced winter cold. During the past 100 years, the average temperature in the mid-Atlantic region has risen by nearly 1°F, and precipitation has increased by up to 10 percent. Compared with today's temperatures, climate models project that the region's climate may become approximately 2°F warmer by 2030, with an additional 3°F to 8°F average temperature increase by the end of the 21st century. These all would lead to alterations of ecosystems, habitats, and species distributions due to the changes in weather patterns (EPA, NPS, and USFWS 2009).

Global warming, resulting in both melting of glaciers and ice sheets and ocean water thermal expansion, will cause sea levels to rise. Worldwide measurements of sea level show a rise of about 0.17 meters (0.56 feet) during the 20th century (NASA, August 12, 2009). New satellite measurements reveal that the Greenland and West Antarctic ice sheets are shedding about 125 billion tons of ice per year (Solomon 2007). Considering that land less than 10 meters above sea level contains 2 percent of the world's land surface, but 10 percent of its population, major impacts in the United States will be felt by large numbers of people living on the low lying coastlands. We commissioned a study using the sea level rise model simulation SLAMM to predict refuge impacts

from future sea level rise, based on an estimate of a one meter rise in sea level along the Virginia coast line by the year by 2100. This assumption is consistent with Virginia's Climate Change Action Plan (Governor's Commission on Climate Change 2008). Rising sea levels will result in tidal marsh submergence and habitat migration as salt marshes transgress landward and replace tidal freshwater wetlands and brackish marsh, in addition to increased beach and shoreline erosion due to wave activity. The SLAMM analysis further projects that climate change could cause a variety of coastal habitat changes, including increased loss of barrier islands and wetlands; increased risk of shoreline flooding due to sea level rise, storm surge, and extreme overwash events; and alterations of ecosystems and habitats due to changes in weather patterns.

The IPCC estimates that 20 to 30 percent of plant and animal species will be at risk of extinction if temperatures climb more than 1.5° to 2.5°C (Solomon 2007). Warmer air or water temperatures can also impact animal species. For example, evidence suggests that the gender of sea turtles is determined by the surrounding temperature at critical stages in development, with warmer temperatures producing more females. Warmer temperatures could thus create reproductive problems for an already declining species (Mrosovsky and Provancha 1992). A recent study of the effects of climate change on eastern U.S. bird species concluded that as many as 78 bird species could decrease by at least 25 percent, while as many as 33 species could increase in abundance by at least 25 percent (Matthews et al. 2004).

Potential Effects and Shoreline Vulnerability due to Climate Change and Sea Level Rise

Department of the Interior (DOI) Secretarial Order 3226 (2001) states there is a consensus in the international community that global climate change is occurring, and that it should be addressed in Federal governmental decision-making. This Order requires Departmental planning and decision-making to take climate change impacts into account. Additionally, it calls for the incorporation of climate change considerations into long-term planning documents, such as a CCP. It is difficult to predict the specific effects climate change and potential sea level rise will have on the refuge in the future, but past and current events have been documented and analyzed to allow for more informed management. As a barrier island with an elevation of no more than 46 feet (14 meters) at its highest points, Assateague Island will be greatly affected by the predicted changes in sea level associated with global climate change. Furthermore, the refuge is located in a "hotspot" of accelerated sea level rise. For this "hotspot," which spans 1,000 kilometers along the highly populated North American Atlantic coast north of Cape Hatteras, scientists estimate that sea level rise increased at a much higher rate than the global average between 1950 to 1979 and 1980 to 2009 (Sallenger 2012). DOI Secretarial Order 3289 (2009) reiterates this mandate and states that "Management decisions made in response to climate change impacts must be informed by science and require that scientists work in tandem with those managers who are confronting climate change impacts and evaluating options to respond to such impacts."

Meteorological and climatological events, such as hurricanes and sea level rise, pose challenges for refuge management, and continuously morph the landscape of the refuge. To highlight the change in shoreline, Figure 3-10 shows the historic shoreline change of southern Assateague Island. This figure represents how significantly a barrier island can change in a mere 150 years, and specifically shows the variability in the refuge's shoreline due to increased storm activity, continued shoreline erosion, and sedimentary transportation events such as overwash.

Figure 3-10. Shoreline Change for Toms Cove, Assateague Island, from 1850 to 2005 (Assateague Island National Seashore/NPS staff)

Further climate change related stressors will likely enhance impacts on shoreline morphology even more in years to come. Using past climate and weather data, we commissioned a study to project the effects of sea level rise on the barrier islands extending from Ocean City Inlet, Maryland to Fisherman Island, Virginia in the Delmarva Peninsula with a main focus on Chincoteague NWR, incorporating the SLAMM model (Nieves 2009). The study itself used three different model scenarios for sea level rise: the IPCC prediction of 0.7 m by 2100, and a 1 m, and 1.5 m global sea level rise by 2100. Simulations were executed in 25 year increments from the date of available existing conditions (1988 to 2003) until 2100. The study found that the most significant changes would occur on the eastern shore beaches and marshes. A significant conversion of salt marsh to open estuarine water is anticipated for Assateague Island and other barrier islands within the refuge by 2075 or 2100 in the 1.0 and 1.5 meter rise scenarios, respectively. Ocean beach habitat would decline by 80 percent by the year 2100 in the 1.0 meter sea level rise scenario, while estuarine beaches, on the other hand, are projected to gain habitat. Table 3-4 shows the total habitat change percentages for the refuge assuming the 1.0 m sea level rise by 2100 scenario, which the refuge currently uses for management purposes.

Table 3-4. One meter sea level rise scenario by 2100 (Nieves 2009)

	Area of habitat change					Percentage of habitat change				
	Initial Condition	2025	2050	2075	2100	Initial Condition	2025	2050	2075	2100
Dev. Dry Land	3021	3021	3021	3018	3003	0.5%	0%	0%	0%	1%
Undev. Dry Land	164043	153740	148629	142518	133655	28.6%	-6%	-9%	-13%	19%
Swamp	56721	65889	67200	67609	64828	9.9%	16%	18%	19%	14%
Inland Fresh Marsh	8120	8484	8541	8564	8527	1.4%	4%	5%	5%	5%
Tidal Fresh Marsh	635	583	567	521	452	0.1%	-8%	-11%	-18%	-29%
Trans. Salt Marsh	3016	3102	3966	4953	9205	0.5%	3%	32%	64%	205%
Saltmarsh	30374	29728	28798	22076	13055	5.3%	-2%	-5%	-27%	-57%
Estuarine Beach	1304	1275	1721	2405	3940	0.2%	-2%	32%	84%	202%
Tidal Flat	41220	39610	32746	34430	31477	7.2%	-4%	-21%	-16%	-24%
Ocean Beach	1618	1558	1443	1025	329	0.3%	-4%	-11%	-37%	-80%
Rocky Intertidal	1	1	1	0	0	0.0%	-7%	-44%	-78%	-95%
Inland Open Water	1395	1372	1349	1304	1231	0.2%	-2%	-3%	-7%	-12%
Riverine Tidal	489	284	222	75	53	0.1%	-42%	-55%	-85%	-89%
Estuarine Open Water	124230	127702	144259	163248	185390	21.6%	3%	16%	31%	49%
Open Ocean	109667	110426	111124	112206	113765	19.1%	1%	1%	2%	4%
Brackish Marsh	19164	18761	14020	6403	3362	3.3%	-2%	-27%	-67%	-82%
Inland Shore	33	30	30	30	29	0.0%	-10%	-10%	-10%	-10%
Tidal Swamp	9108	8593	6524	3774	1860	1.6%	-6%	-28%	-59%	-80%
Grand Total	574159	574159	574159	574159	574159	100.0%	(-) pct. habitat loss			

As can be derived from the data, most of the habitat diversity on the refuge will be lost or reduced due to shifts in habitat types. The rise in sea level will cause the shoreline and the near shore habitats to recede back and diminish, decreasing near shore habitats such as the ocean beaches and tidal flats. This increased sea level will quickly envelop the coastline, turning most of the current coastal habitats into transitional zones, where the inland fresh water meets with the rising salt water. As can be seen in the table, by 2100 most of the habitat will be open water, estuarine beach, or transitional salt marsh. Most of the smaller diverse habitats will be lost, and these main broader habitats will envelop most of the refuge.

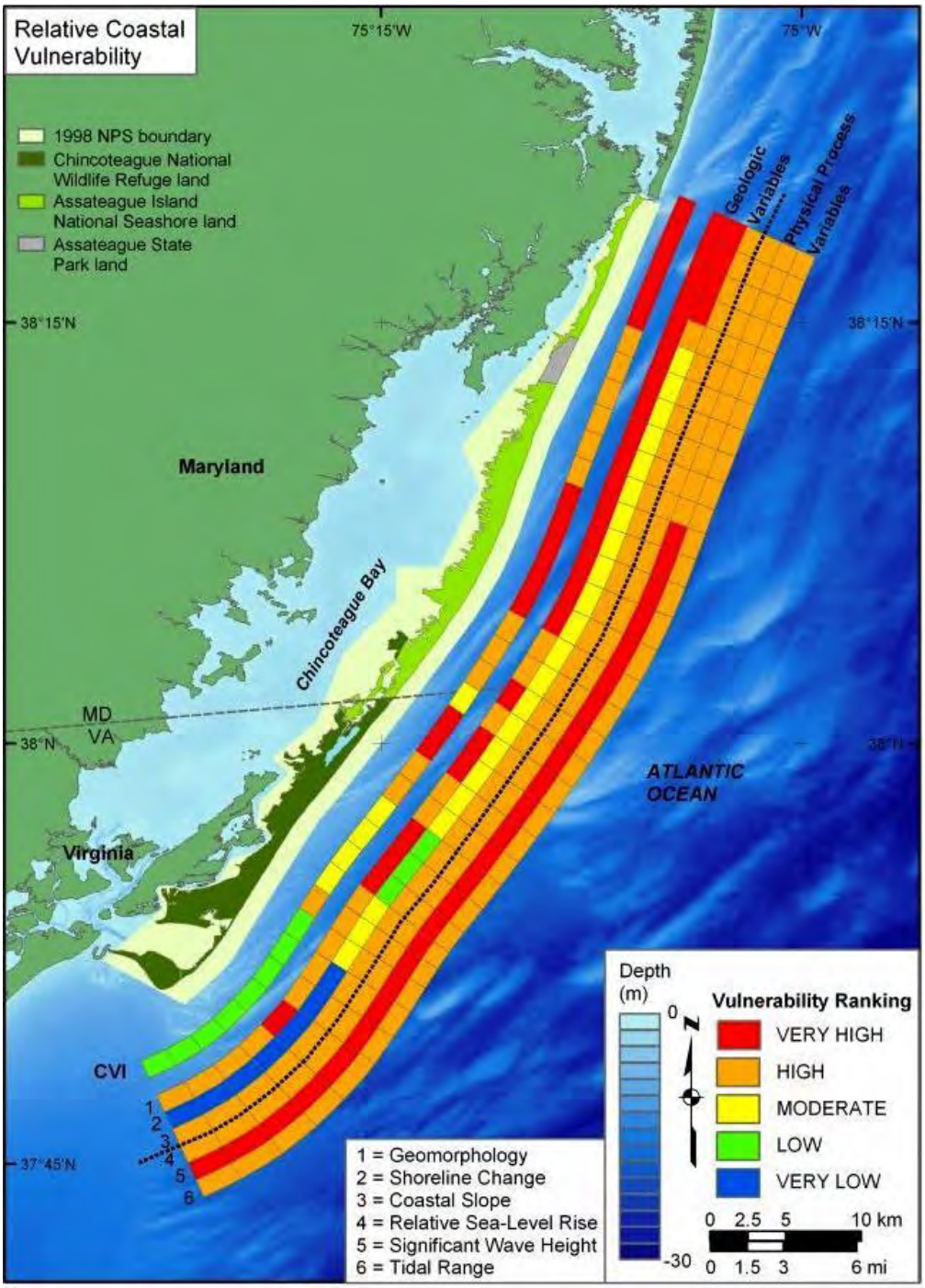
These changes in shoreline and refuge habitat have already been observed in the refuge. Severe overwash events, as documented in the Chincoteague NWR: Recreational Beach Structured Decision Making (SDM) Process Study (2011), have already begun to deposit more sand on the shores of the refuge, and move the shoreline westward. The first photo (Figure 3-11) from 1991 shows the parking area and visitor center that was located behind the artificial dunes. The second photo (2003) shows the deposition of sand after a storm that is building the island to the west.

Figure 3-11. Chincoteague NWR parking area (1991) and Overwash Event (2003) (USFWS 2011b)

Furthermore, a 2004 study by the USGS assessed the coastal vulnerability of Assateague Island to sea level rise based on six variables (geomorphology, shoreline erosion/accretion rate, coastal slope, relative sea level rise rate, mean wave height, and mean tide range). It reports that over 60 percent of the 37 miles of shoreline of Assateague Island are classified as being very highly vulnerable or highly vulnerable to future sea level rise and future storm washover events, as was outlined in the SDM study. The areas within Assateague Island that are the most vulnerable to sea level rise are those with the highest occurrence of overwash and the highest rates of shoreline change. These areas are found predominantly on the north end of the island. Details are given in Figure 3-12. (Pendleton 2004).

Low-lying islands will always face impacts from global climate change, particularly rising sea level and coastal storms. Such occurrences have already been experienced; however, these events may become more frequent and severe within the 15-year time period covered by this CCP, based on recent projections by the IPCC (Solomon 2007). Saline intrusion into the subsurface freshwater lens from sea level rise and saltwater inundation of surface freshwaters from storm surges can alter coastal ecosystems and freshwater marshes resulting in more salt-tolerant aquatic plant communities.

Figure 3-12. Coastal Vulnerability Rankings for Assateague Island (Pendleton 2004)



3.3 Vegetation

From sandy beaches along the island's seaward side to salt marshes on the western bay side, Assateague Island hosts a wide variety of habitats and vegetative communities. A diverse array of environmental conditions—elevation, the availability of water, ranging from fresh to salt, distance from the impacts of the ocean, the movement of sand, storm-driven winds and seas—all work to shape these habitats and vegetative communities, providing unique environs within which a plethora of different species live.

Chincoteague NWR is a dynamic area with constant fluctuations in its shoreline boundaries and habitat acreage. Current vegetation cover is strongly associated with a certain habitat, and is so described in this section. There are five major habitat types found on the refuge (which include three smaller divisions: Assawoman Island, Metompkin Island, and Cedar Island). They are: Beach-Dune habitat (approximately 1,800 acres); Shrub-Early Successional habitat (approximately 2,900 acres); Forested Uplands habitat (approximately 1,800 acres); Impoundments and Freshwater Wetlands habitat (approximately 2,000 acres); and over 5,800 acres of salt marshes.

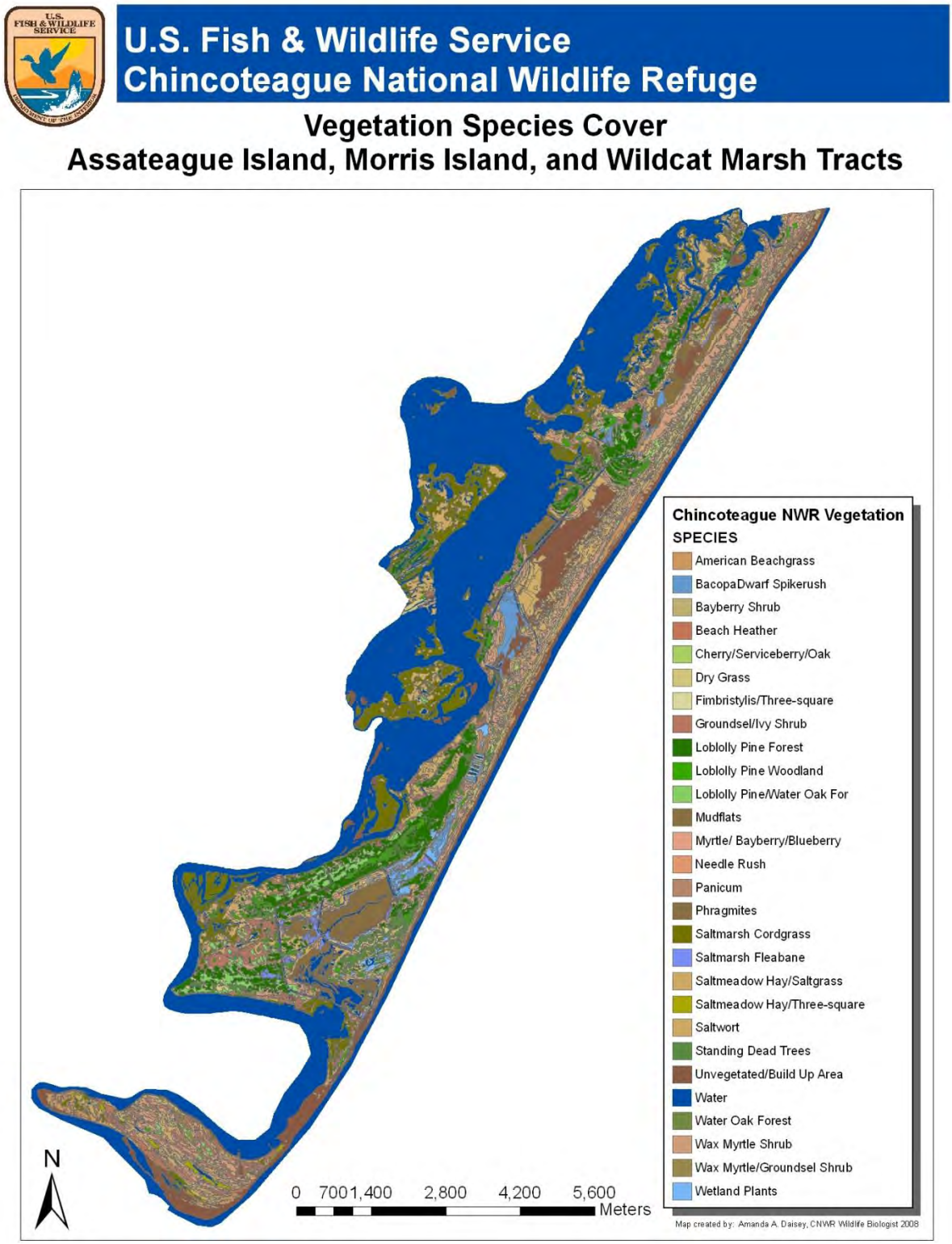
This section describes habitat types and vegetation for the refuge. Habitat type descriptions are separated into the Assateague Island Unit (Figure 3-13), the Southern Barrier Islands Unit of Chincoteague NWR, and Wallops Island NWR. Latin names for vegetation can be found in Appendix L.

3.3.1 Assateague Island Unit

The most dominant vegetation on Assateague Island is the loblolly pine and loblolly pine/hardwoods maritime forest, encompassing much of the upland habitat, with salt marsh grasses encompassing much of the lowland habitats. Associated upland plant species include southern red oak, sweetgum, and sassafras. Understory associates include wild grape, Japanese honeysuckle, greenbriar, and American holly. The predominant vegetation in the open areas includes a variety of grasses, wax myrtle, and groundsel tree. Common fresh marsh vegetation consists of dwarf spike rush, smartweed, fleabane, swamp rose mallow, American three-square, umbrella-grass, saltgrass, beggartick, catttail, and eastern baccharis. Salt marsh vegetation consists mainly of salt marsh cord grass and salt meadow hay.

Seabeach amaranth was federally listed as threatened in 1993 by the USFWS. Seabeach amaranth is an annual plant species that occurs on the upper beach and sparsely vegetated overwash fans and inter-dune areas. This species appears to require extensive areas of barrier island beaches and inlets functioning in a relatively natural and dynamic manner. In the absence of overwash and storms, other plants less tolerant of disturbance colonize the sparsely vegetated areas and ultimately outcompete amaranth. Threats include beach stabilization efforts (particularly the use of beach armoring, such as sea walls and riprap), intensive recreational use, and herbivory (grass eating) by white-tailed deer, sika, and Chincoteague ponies.

Figure 3-13. Chincoteage NWR Vegetation Map (Source USFWS Refuge Staff)



Seabeach amaranth was first documented on the refuge in 1966 by Dr. Elizabeth Higgins as a graduate student, and the species was also present in 1967 and 1972. It was not recorded on the refuge between 1972 and 2001, nor were any surveys documented. In 2001, nine plants were found just south of the Maryland/Virginia border, a year after the NPS began a program to restore the species in Maryland. Since 2001, refuge staff has conducted surveys for seabeach amaranth on the beaches of Assateague Island each August, often in conjunction with NPS personnel. The number of plants identified varies but a peak of 69 plants was documented in 2005.

In addition to seabeach amaranth, Assateague Island supports several other rare plants, in particular: seabeach knotweed, sea purslane, seabeach orach, and seabeach sandwort, which all occupy beach habitats similar to amaranth.

Fragile communities of submerged aquatic vegetation along Assateague's bay side are an important component of the estuarine ecosystem. Beds of sea grasses such as eelgrass and less abundant widgeon grass provide shelter for mollusks such as the Atlantic bay scallop, critical nursery habitat for fish and crustaceans, and foraging grounds for waterfowl, river otters, and other animals. Sea grasses are extremely sensitive to water quality. Excess suspended sediments and algal blooms caused by nutrient enrichment can kill sea grass by blocking sunlight. Boats can also destroy sea grasses in shallow waters when they become grounded or when propellers churn through and tear up the grasses. Boating restrictions help protect against this damage. A southern corridor provides access to the north side of Toms Cove for personal watercraft from nearby Chincoteague Island. Another corridor provides access to the north end of the island close to Ocean City where boat traffic has traditionally been heaviest. All other personal watercraft use within Assateague Island National Seashore is prohibited.

Beach – Dune

This habitat type covers approximately 970 acres, or 10 percent, of the Assateague Island Unit. Its width varies along its 27 kilometers (km) (17 mile) interface with the ocean. Considered pioneer species, beach plants are exposed and adapted to constantly shifting sands, limited fresh water, temperature and wind extremes, and frequent salt water spray and overwash. The entire community can be covered by tidal surges. The beach extends from the intertidal zone into the dunes along the entire east and south sides of Assateague Island. Smaller areas are along Toms Cove and Assateague Point and Channel. The most common beach species are American sea rocket and sea lavender.

The dune habitat serves as a line of defense against storm surges, protecting other habitats from alteration due to salt water intrusion. A gradual transition to the dune grass community occurs beyond the high tide line. Dune grass establishes readily on the stabilized dunes as well as in natural areas. Characteristic species are American beach grass, sea oats, saltmeadow cordgrass, seaside goldenrod, dune sandbur, rough buttonweed, carpetweed, and seabeach evening primrose. Seabeach amaranth occurs in very low numbers.

Shrub-Early Successional

Between the dunes and the upland forest community lies a lower, flat expanse (swales) with a successional shrub community that covers about 2,872 acres (roughly 25 to 30 percent) of the Assateague Island Unit. Deciduous trees, shrubs, and vines are the predominant plant forms. This shrub community is important for migrating and nesting songbirds, as well as to migrating monarch butterflies. The shrub habitat adjacent to the freshwater impoundments and the

transition zone between the forest and salt and fresh water marshes provide important foraging for a variety of neotropical migrant birds. The shrub community composition varies with groundwater supply, elevation, proximity to salt spray, and frequency of tidal inundation. In general, the shrub community vegetation zone extends north and south on barrier flats and backdunes, gradually merging on the east with dunegrasses and on the west with forests or marshes. The majority of shrub habitat is scattered throughout the refuge with most adjacent to the forests, saltmarshes, and impoundments. In the sheltered zone beyond the dunes where fresh water is more plentiful, vegetative cover can reach 80 percent and is predominantly characterized by less salt-tolerant shrubs and thickets. Here, taller plants undergo a natural pruning process, as salt-laden winds blowing over the dunes stunt their growth.

Common species in these areas include wax myrtle and northern bayberry, which provide food and cover for songbirds, small rodents, and rabbits. Other common shrub species include black cherry, serviceberry, blackberry, poison ivy, and greenbrier. Evergreens are less frequent, but include red cedar and American holly. False heather or beach-heath along with jointweed and broom-sedge can be the dominant species in localized areas within the shrub community. These species form large mound-shaped colonies on low interior dunes that are generally very dry and free of salt spray. This plant community is an important dune stabilizer, capturing windblown sands. Most of the shrub species occur to a lesser degree in the forest community.

Forested Uplands

Where Assateague Island is wide enough to allow sufficient protection from the ocean's salt spray and overwash, trees are able to establish a foothold. The forest stands occur on large stable dunes (such as White Hills), generally west of shrub areas and impoundments, indicative of parts of the island that have been stable for several decades. Approximately 1,600 acres (17 percent) of the Assateague Island Unit are classified as upland forest and are comprised almost entirely of loblolly pine, a hardy salt-tolerant and fire-resistant tree. Loblolly pine requires full sunlight to establish new stands, and can produce cone crops in as little as 10 years, although seed production is greater in older trees. Thinning of stands has been shown to increase production of cones and seeds by dominant and co-dominant trees. These forests are important to the survival of the endangered Delmarva fox squirrel and other forest dwelling wildlife, particularly the white-tailed deer, turkey, eastern hognose snake, and many species of woodland migratory birds.

Mixed stands of loblolly pine and hardwood usually contain southern red oak, white oak, and water oak as the most abundant hardwoods. The mixed hardwood forest provides premium Delmarva Peninsula fox squirrel and woodcock habitat. The hardwood stands have developed only in areas where topography and distance from salt water provide maximum protection from aerosol salt spray. Other mixed hardwood species may include red maple, sweet gum, sassafras, black gum, black cherry, American holly, and wax myrtle. Forested wetlands occur on the west side of Snow Goose (B-South) Pool, in the vicinity of the Woodland Trail, and in lowlands near the White Hills. Dominant vegetative species in these areas include red maple, black willow, wax myrtle, and marsh elder.

Forested understory vegetation is usually composed of dogwood, high-bush blueberry, blackberry, greenbrier, poison ivy, common chokecherry, and fox grape. Many of the rarest plants on Assateague Island are found in the forests, including Indian pipe, crested yellow orchid, spotted wintergreen, and partridgeberry.

Approximately 400 acres of the forested uplands on Assateague Island in Virginia were mapped as maritime upland forest community as defined by the Virginia DCR and 50 CFR 84.11 (Berman and Berquist 2007). According to Virginia DCR, maritime upland forests are considered globally rare because of restricted ranges, narrow habitat requirements, and threats from coastal development. Maritime upland forests contain species-poor evergreen and mixed coastal forests, often pine-dominated with an understory of deciduous trees; they grow in well to rapidly drained nutrient poor sandy soils (Berman and Berquist 2007). They occur on old coastal dunes that have been stable long enough to sustain forests, have well-drained sandy soils, and a water table close to the surface (50 CFR 84.11).

Wetlands

The 13 impoundments (roughly 22 to 28 percent of the Assateague Island Unit) are managed to provide submergent and emergent wetland vegetation and mudflats as foraging areas and cover for waterfowl, shorebirds, and other waterbirds. Approximately 2,650 acres of this "habitat type" is contained within the dikes. The discrepancy between this and the 2,012 acreage figure obtained from the cover map is due to shrub encroachment on the edges, which was mapped as shrub/early successional. Since many impoundments tend to be brackish due to storm overwash and salty soils, they are inhabited by plants with some salt tolerance. Characteristic plants include dwarf spike rush, salt marsh fleabane, Bacopa, sago pondweed, American three-square, saltgrass, Bidens, smartweed, umbrella-grass, and salt meadow grass. Non-native Phragmites grows in many of the impoundments and other wetland areas. This invasive plant has been the target of mechanical and chemical control efforts.

Wax myrtle and loblolly pine encroach into some of the impoundments where these woody species are not regularly controlled. Currently, Sow Pond, Ragged Point, Pintail Pool (D Pool), South Wash Flats, and NWF have expanding areas of woody vegetation that will require management to maintain open shallow water habitat favored by shorebirds and some waterfowl. On the other hand, flooded myrtle habitat is used by wintering black ducks, and landbirds use shrub habitat on impoundment edges for breeding, winter, and migration habitat.

Forested wetlands occur on the west side of Snow Goose (B-South) Pool, in the vicinity of the Woodland Trail, and in lowlands near the White Hills. Dominant species include red maple, black willow, wax myrtle, ferns, and blueberries.

A more open transitional freshwater marsh that borders uplands and salt marshes on the bayside of Assateague Island includes groundsel tree, cattails, wax myrtle, swamp rose, and marsh elder. Approximately 108 acres of wetlands also occur on Toms Cove Hook on the flats and in low areas between the beach ridges and dunes that pond collect rainwater. A few other small natural freshwater marshes occur behind the dunes of the northern beach.

Salt Marsh

Approximately 2,875 acres of salt marshes are located along the western boundaries of the Assateague Island Unit. Tidal flooding influences the distribution of salt marsh plants. Salt marsh cordgrass is the dominant species in the low marsh, the zone between mean high tide and mean low tide. Salt meadow cordgrass (also called salt meadow hay), saltgrass, and saltwort grow in the less frequently flooded high marsh. Northern sea lavender and marsh elder occur at upper levels, along the marsh/upland edge.

3.3.2 Southern Island Units

Salt marsh habitat covers approximately 95 percent (406 acres) of the Morris Island Unit and approximately 87 percent (485 acres) of the Wildcat Marsh Unit. Salt marsh cord grass, salt meadow cordgrass, and saltwort are the major vegetation species. Upland vegetation on Morris Island is limited to a few scattered sites (21 acres) of loblolly pine, wax myrtle, black cherry, and sassafras. Approximately 13 percent (73 acres) of the southern part of Wildcat Marsh is an upland forest consisting of loblolly pine, oak, and typical understory associates. Wax myrtle is scattered throughout the area.

Assawoman and Metompkin islands are barrier islands with habitat types consisting of beach, dunes, and extensive salt marshes to the west of the islands. The predominant species in the marsh include salt marsh cordgrass and salt meadow hay. On Metompkin, the marsh extends to the mainland, although it is intersected by numerous creeks and channels. The remainder of the island is predominantly sparse grasslands with little woody growth. Assawoman Island also contains extensive salt marshes, particularly in the northern half of the island. A cobble-laden washover area, located at the northern tip and formed by the sealing of Assawoman Inlet, provides good habitat for nesting birds. Pockets of woody shrubs occur in depressions between the beach front and the westward marshes. Plants found here include wax myrtle, bayberry and groundsel bush.

Cedar Island is dominated by beach and dune habitats on the ocean side and a brackish marsh dominated by salt meadow cordgrass on the bay side. A small thicket dominated by eastern red cedar and poison ivy occurs on the north end of the island. It is adjacent to the beach and is eroding rapidly. The north end also supports most of the island's other plant diversity. Dead shrubs and some low-growing vegetation are present in overwash areas. Other habitat types found on Cedar Island include a salt flat to the south and mudflats that are exposed at low tide.

3.3.3 Wallops Island NWR

Wallops Island NWR is composed of 195 acres of salt marsh, 121 acres of forest, and 57 acres of old-field/early successional forests. Loblolly pine is the dominant species in the forest habitat and secondary components include: tulip poplar, red maple, southern red oak, wild cherry, dogwood, sassafras, and sweet gum. Understory includes: American holly, spicebush, Devil's walkingstick, and greenbrier. Transition zones between the marsh and woodland are dominated by groundsel tree and wax myrtle. The salt marsh is dominated by cordgrasses.

A Simoneaston Bay sea-level fen, named the Lucky Boy Fen, is found on Wallops Island NWR. Sea level fens are nutrient-poor, maritime seepage wetlands, confined to a few sites within the mid-Atlantic region that have an unusual combination of environmental conditions (DCR 2001). The sea level fen is a globally significant (ranked as "G1" or critically imperiled) community type (Fleming and Patterson 2010); only four occur in Virginia, all of them in Accomack County (DCR 2001). Lucky Boy Fen is located just above highest tide levels, at the base of a slope where abundant groundwater discharges. It is less than ½-half acre in size, but supports six rare plant species.

3.4 Wildlife

Despite the often harsh conditions that occur in a coastal environment, a wide variety of wildlife species thrive on the refuge. Each of the islands' different habitats supports a multitude of birds, mammals, reptiles, amphibians, and invertebrates. In addition, the coastal waters that surround

the refuge teem with life. The sheltered, nutrient-rich waters of the estuary formed by the islands provide breeding and spawning habitat for many aquatic species, and important feeding areas for birds. Wildlife species in the refuge are described below. Latin names for wildlife can be found in Appendix L.

3.4.1 Federal and State Threatened and Endangered Species

Although the refuge habitat is used by several protected species, the only resident Federal endangered species is the Delmarva Peninsula fox squirrel. Other known Federal endangered or threatened species that can be found on the refuge but that are not resident include the piping plover, roseate tern, and the leatherback and loggerhead sea turtles. After release of the draft CCP/EIS, the red knot, went from the candidate list proposed to be listed as threatened, to threatened under the ESA. The red knot uses Chincoteague NWR beaches during spring and fall migration.

Wilson's plover is on Virginia's State endangered bird list. State-threatened birds that are present or breed on the refuge include the gulled tern, upland sandpiper, and the peregrine falcon. In 2012, the Board of the VDGIF decided to remove the bald eagle from the Virginia State list of threatened and endangered species effective January 1, 2013.

Several Federal listed threatened and/or endangered species are found in the study area, although not all of them are resident to the refuge. A full list of threatened and endangered flora and fauna that are found in the vicinity of the refuge is provided in Appendix L. The species that are most pertinent to the refuge are described in detail below.

Delmarva Peninsula fox squirrel

The Delmarva Peninsula fox squirrel is both a Federal- and State-listed endangered species inhabiting the Chincoteague NWR's loblolly pine forests. Although the Delmarva Peninsula fox squirrel has been proposed for delisting from the endangered species list since the draft CCP/EIS was published, it has not been finalized yet. Fox squirrels can be commonly seen in the headquarters area and around the Woodland Trail. Their coloring is similar to the gray squirrel, but the fox squirrel is larger with a bushier tail and is more terrestrial than the gray squirrel.

The Delmarva Peninsula fox squirrel's original range stretched from central New Jersey south through eastern Pennsylvania and down the length of the Delmarva Peninsula. As woodland has been cleared for farming and altered by forestry, available fox squirrel habitat has dwindled, and the known population has been reduced to several sites in Maryland, Delaware, and Chincoteague NWR in Virginia. The refuge population was translocated here in the early l970s. Over the past few years their numbers on the refuge have stabilized.

On Chincoteague NWR, Delmarva Peninsula fox squirrels live in forest stands predominated by mature loblolly pines. In other parts of its range, the fox squirrel is usually found in mixed stands of mature hardwoods where a variety of mast-producing trees ensure a reliable food source. With its terrestrial habits, the fox squirrel is adapted to a park-like, open understory and is rarely found in dense underbrush, although production in areas with a developed understory has been observed on Chincoteague NWR. Because they spend so much time on the ground, road accidents are a mortality factor of the Delmarva Peninsula fox squirrel. Major natural predators are red fox, raccoon, and great horned owl.

Refuge forest management and predator control objectives are designed to provide optimum fox squirrel habitat. Specific practices include:

- Maintain open understory in specified areas;
- Provide nesting boxes to supplement natural tree cavities;
- Reduce competition from gray squirrels;
- Protect from hunting and natural predation;
- Supply reliable food source through management of vegetation.

Marine Mammals

Federal endangered marine mammals with ranges that encompass the waters of Assateague Island include: five species of baleen whales (humpback, gin, sei, blue, and northern right); one toothed whale (sperm); and, one sirenian (West Indian manatee). Anecdotal observations suggest that these species visit the Island's waters; however, most do so only as occasional transients or seasonal migrants. The species most at risk is the northern right whale, with a North Atlantic population of approximately 200. A number of right whales winter along the Assateague Island coastline and can occasionally be seen from the beach.

Sea Turtles

Five species of Federal-listed sea turtles use Assateague Island's ocean and bay waters. The leatherback sea turtle, Kemp's Ridley sea turtle, and the hawkbill sea turtle are Federal endangered species. The loggerhead sea turtle and green sea turtle are Federal-threatened. In Virginia, the state status is the same as the Federal status for these species.

Piping Plover

The piping plover, a Federal- and State-threatened species since January 1986, nests on sandy or cobble beaches and overwash areas. The eastern coast of Virginia is a significant area for nesting piping plovers, supporting approximately 20 percent of the breeding population on the U.S. Atlantic Coast. Chincoteague NWR is one of the most important plover nesting areas of any of the Virginia barrier islands and supports one of the largest concentrations of piping plovers along the Atlantic coast. In order to protect this species, the Chincoteague NWR closes certain critical nesting areas to public entry.

In Virginia, piping plovers begin displaying territorial behavior and their elaborate courtship rituals in mid-March. This is followed by egg-laying in mid-April. Each pair forms a shallow depression in the sand to serve as a nest in which usually four eggs are laid. The eggs hatch in about 25 days, and the downy young are soon able to follow their parents in foraging for marine worms, crustaceans, and insects, which they pluck from sand and mudflats in the intertidal zone. Both eggs and young are so well-camouflaged that they are apt to go undetected. When predators and other intruders come close, the young squat motionless on the sand while the parents attempt to attract the attention of the intruders to themselves, often by feigning a broken wing. Surviving young fly within about 30 days of hatching. Storm tides, predators, or human activity often disrupt nesting before the eggs hatch. When this happens, fledglings from late nesting efforts may not fly until mid-August. Plovers commonly gather in groups on undisturbed beaches prior to their southward migration. Feeding occurs along the intertidal zone and on sand flats and mudflats. The plover's diet consists mainly of worms, crustaceans, mollusks, and other invertebrates.

Beaches on Assateague (including the Hook, Overwash, and Wild Beach), Assawoman, Metompkin, and Cedar islands are managed and intensively monitored for nesting shorebirds

including the American oystercatcher, terns, and piping plover. The NWF impoundment is also intensely managed for piping plover nesting habitat as mitigation for the loss of habitat at the recreational beach. The number of piping plover nesting pairs on Chincoteague NWR has increased from 50 pairs in 1987 to 100 or more pairs in recent years (2005 to 2010). The number of piping plover chicks fledged increased steadily between 1987 (when monitoring began) and 2004 (with a peak of 224 fledged chicks), declined from 2005 to 2008, and increased slightly (132 chicks fledged) in 2009 and 2010. Weather events and predation affect fledgling success. Productivity has reached or exceeded the Recovery Plan goal of 1.5 chicks/pair in 5 of the last 10 years (USFWS 1995). Prior to 2007, Assateague Island consistently had the highest number of nesting plover pairs, but in recent years (2007 to 2009), Cedar and Assawoman islands have had more breeding pairs and higher fledgling success. Increased flooding events due to high tides on the Hook and Overwash during the breeding season, and erosion of Wild Beach are factors.

The following factors have contributed to the decline of the piping plover along the Atlantic Coast and depress plover production at Chincoteague NWR:

- Human disturbance can curtail breeding success. Pedestrians and off-road vehicles may cause plover parents to desert the nest, exposing eggs or chicks to the summer sun and predators, not to mention the possibility of the vehicles crushing the well-camouflaged nests or young. Interruption of feeding may stress juvenile birds during critical periods in their development.
- Predation from ghost crabs and foxes is a significant factor in survival. Six total nests on Assateague Island were disturbed by predators in 2011 (Refuge biology data), resulting in significant loss of eggs. However, in 2011, the most significant loss of eggs (a total of 42) was due to weather and tide, with the nests being over washed during full or new moon tide cycles (USFWS 2011a)).

Monitoring and management efforts for the 2011 nesting season (USFWS 2011a) included:

- Pre-season surveys were conducted opportunistically beginning in March; staff surveyed all shorebird breeding areas for plover and other nesting shorebird species arrival, establishment of territories, courtship display, and preliminary nest scrapes. Initial surveys allowed observers to estimate the number of potential nesting plover and shorebird pairs for the season. More intense monitoring began in mid-April when territorial pairs were firmly documented.
- Using binoculars and spotting scopes, staff observed individual nesting shorebirds or pairs from a vehicle or dune. As mating pairs were identified, staff walked through nesting areas at a slow pace looking for scrapes and bird tracks. Once the nest was located, the observer placed a paint stick 10 meters (m) from the nest and recorded the location. Paint sticks allowed observers to identify and observe a nest from a distance without disturbing the incubating adults. Weather conditions, time, and potential stress on the birds was considered while nest searching. Nests were located from late April through early July 2011.
- Brood monitoring (determining the location and number of chicks in each brood) was attempted 7 days a week on Assateague and Assawoman Islands and 4 days on Cedar Island. Metompkin Island was monitored weekly by Chincoteague NWR staff. NASA staff attempted brood monitoring on Wallops Island three mornings a week. Brood monitoring was accomplished by observations of chicks from a vehicle using spotting scopes or by foot. Metompkin and Cedar islands are not accessible by vehicle. Staff traveled to and from the

islands by boat. Shorebird surveys, nest searches, and brood monitoring were conducted by foot. To reduce brood disturbance, chick observations lasted only long enough to count the chick numbers. Brood monitoring was not conducted in extreme weather conditions such as mid-day heat, rain, or high wind.

- Staff used invasive plant management, crushed shells, pony grazing, ditching, and water pumps as tools to improve shorebird nesting habitat on Chincoteague NWR. A portable diesel water pump was used to reduce the level of water held on the NWF shorebird breeding area into the South Wash Flats impoundment during breeding season. This season, maintenance staff placed crushed shells on the flats as a continuation of the nesting island creation on the area. Due to dry weather conditions and previous management, the maintenance staff operated the pump in February for 16 hours, a considerable lower amount compared to last year (335 hours).
- As part of the invasive plant management to improve shorebird nesting habitat, USFWS along with cooperating agencies sprayed patches of Phragmites along the Virginia barrier island system, in September 2009 and 2010. Due to the success of this effort, no treatment occurred in 2011.
- Predator management activities began on Assateague Island from February through June and on Assawoman Island from January to May confined to areas known to be piping plover habitat. Chincoteague NWR possesses a VDGIF Scientific Collections permit to conduct mammalian predator management on refuge lands targeting red fox, raccoon, mink, and opossum.
- Predator exclosures were also used on the refuge to help protect nesting birds and eggs. Exclosures used on the Hook, Overwash, Public Beach, and Wild Beach formed a 3.7 m diameter around nests. Six 1.5 m pieces of 12.7 mm diameter rebar were evenly spaced around the perimeter and driven into the ground to secure the welded wire in place.

Loggerhead sea turtle

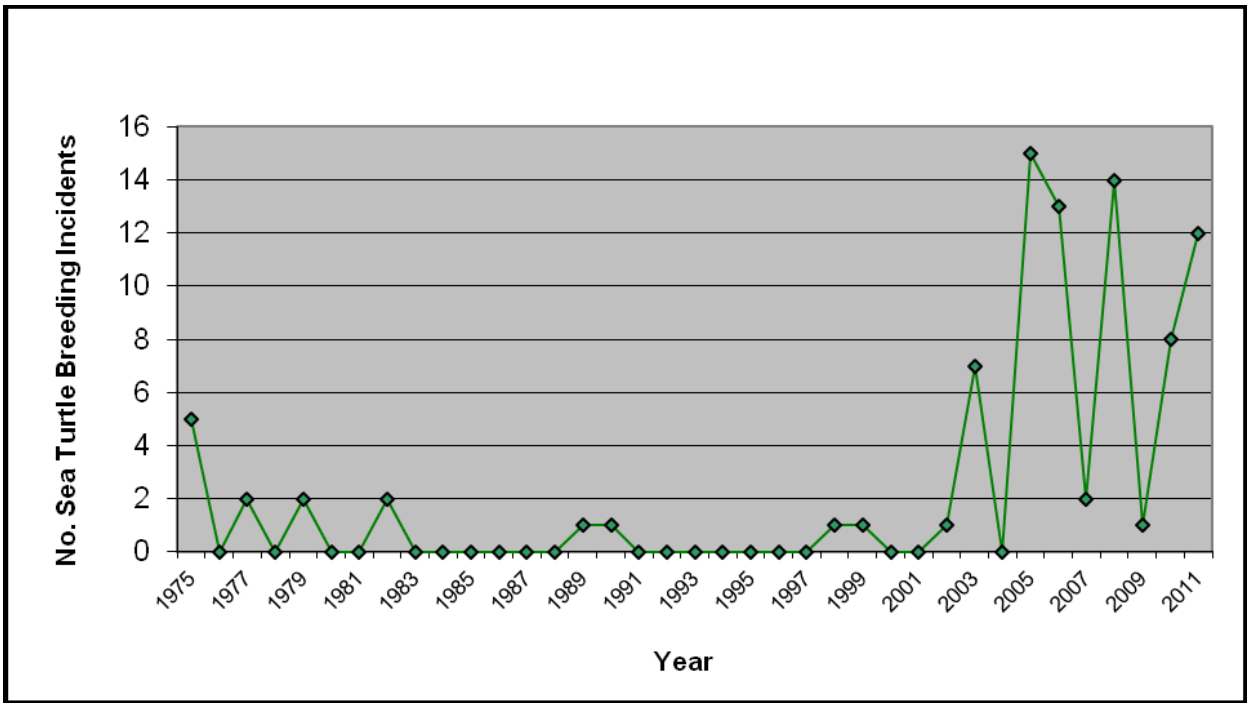
The Federal- and State-threatened loggerhead sea turtle nests on Assateague Island, which is the northern extent of its breeding range. Crawl and nesting activity occurs June through August, but activity tends to occur every other year according to refuge data. Because incubation takes longer (90 or more days) at this latitude, the hatch window is August through October. Nesting activity on Assateague Island and Wallops Island has risen noticeably in recent years, perhaps the result of a loggerhead translocation project. From 1969 to 1979, sea turtle eggs from nests laid on Cape Island of Cape Romain NWR, South Carolina were translocated to Chincoteague NWR. During this time, and the two decades following (1970 to 1999), staff recorded 16 crawls on Assateague Island and Wallops Island; 10 resulted in nests and 6 were false crawls, meaning no nest was made. Loggerhead nesting activity from 2000 to 2010 had a total of 62 crawls; 22 resulted in nests and 40 were false crawls. Loggerhead sea turtles take 30 years to reach maturity, so females that were part of the transplant project may now be returning to their hatch and release sites.

Chincoteague NWR staff monitors for and manages sea turtle crawls and nests on the Virginia portion of Assateague Island and assists when needed on NASA's Wallops Island and the Maryland portion of Assateague Island, in accordance with the Chincoteague NWR Intra-Service Section 7 and Biological Opinion (USFWS 2008b). Chincoteague NWR maintained records of all crawl, nesting, and hatching activity (Figure 3-14).

During the 2011 nesting season, 12 loggerhead sea turtle crawls were identified on Assateague Island's Maryland and Virginia sides combined; 2 crawls with no confirmed nesting in Maryland and 10 crawls with 5 confirmed nests on Chincoteague NWR in Virginia. All nests received

predator screening and barriers to deter walking and driving near or on the nests (USFWS 2008b). Ropes and poles were placed around Wild Beach 01 and Wild Beach 02 nests as they were in areas not already closed to public access. During routine monitoring, Chincoteague NWR biological staff identified and took precautions for potential nest disturbances. Only one of Chincoteague NWR's 5 nests exhibited signs of hatching. Wild Beach 01 began a trickle style hatch on August 8, 13 days into its hatch window. Twenty-three hatchlings were confirmed to have emerged from the nest, but a success rate is indeterminable due to impacts from Hurricane Irene. The Overwash reopened to public access on August 12, prior to which, symbolic ropes and poles were erected around the Overwash 01 nest. Over Sand Vehicles users were instructed to drive west of the nest. Similar precautions were taken for Hook 02 nest following the opening of the Hook to OSVs on September 1.

Figure 3-14. Sea Turtle Breeding Activity (Crawls and Nests), Assateague Island and NASA Wallops Island, 1974 to 2011 (Source USFWS 2011a)



*2010 – Includes one Assateague Island National Seashore nest.

3.4.2 Birds

The refuge is renowned for its abundant, diverse bird life. Situated on the Atlantic migratory flyway, the refuge provides crucial migratory stopover habitat for many species of shorebirds and waterfowl in the spring and fall. Shorebirds by the tens of thousands use Assateague Island's ocean beaches, impoundments, and other intertidal habitats to forage and rest. Shrub habitats behind the dunes provide important resting and feeding habitat for southbound neotropical migratory songbirds including warblers, flycatchers, and thrushes. Assateague Island also offers important winter habitat for numerous waterfowl and breeding habitat during spring and summer for colonial waterbirds and ground-nesting shorebirds such as the threatened piping plover. More than 320 species are known to use the refuge regularly for nesting and brood rearing, feeding, resting and staging during migration, or wintering. Most conspicuous to visitors are the

waterfowl, shorebirds, wading birds, and raptors. A full listing of bird species frequenting the refuge is given in Appendix L.

Waterfowl

Because the refuge lies strategically within the Atlantic flyway, dozens of waterfowl species stop to feed and rest on the refuge during the spring and fall migration seasons. The maximum number of waterfowl using refuge impoundments usually occurs in November, but occasionally peak numbers occur in December due to drought or other factors. The refuge supports wintering greater snow geese, Canada geese, American black ducks, mallards, green-winged teal, northern pintail, northern shoveler, gadwall, American widgeon, bufflehead, red-breasted merganser, ruddy duck, tundra swan, and others. Assateague Channel and Toms Cove provide critical winter feeding habitat for Atlantic brant, which also use refuge impoundments for fresh water and resting.

Recorded numbers of waterfowl on the refuge can be seen in Table 3-5, but no negative or positive trend in overall waterfowl numbers is apparent in the past two decades.

Table 3-5 Chincoteague NWR Waterfowl Maximum Population Estimates from 1989 to 2009

Year (Winter of)	November	December	Month Peak Occurred
1989/90	8,710	4,739	Nov
1990/91	8,917	14,879	Dec
1991/92	13,414	17,452	Dec
1992/93	18,282	19,680	Dec
1993/94	22,824	14,504	Nov
1994/95	33,025	23,549	Nov
1995/96	28,973	35,437	Dec
1996/97	51,790	24,432	Nov
1997/98	40,559	51,349	Dec
1998/99	11,494	19,438	Dec
1999/2000	25,711	22,465	Nov
2000/01	16,345	11,766	Nov
2001/02	8,062	8,274	Dec
2002/03	49,818	16,937	Nov
2003/04	44,395	10,932	Nov
2004/05	Unavailable	23,077	Dec
2005/06	47,776	27,711	Nov
2006/07	23,444	32,734	Dec
2007/08	3,616	3,904	Dec
2008/09	56,326	36,222	Nov
20-yr Average	25,674	20,974	

Impoundments are managed for waterfowl to provide invertebrate and plant food sources, loafing cover, and winter thermo-regulatory cover. Vegetation is kept at an early successional stage by a combination of mowing, disking, prescribed fire, and chemical treatments (for invasive plants such as Phragmites). Water levels are manipulated in spring to provide moist soil conditions conducive

to production of preferred waterfowl food plants. Dewatering of impoundments occurs mid-March through mid-June depending on the desired plant response and rainfall. Earlier draw-downs favor sedges, smartweeds, and bulrushes, while later drawdowns favor grasses. Late summer re-flooding provides desirable feeding sites for early fall migrants, particularly shorebirds. However, this is only possible with adequate rainfall. Fall re-flooding produces feeding conditions conducive to later migrants and to wintering waterfowl. Maintaining certain impoundments with high water levels year round, and flooding very large impoundments during the fall migration, creates roosting and loafing sites. Thermo-regulatory areas for waterfowl are maintained by allowing woody plants to remain within certain impoundments, or by raising the water level to flood wooded areas.

Black duck management is a high priority throughout this species' range because of declining populations and hybridization with mallards. Wintering habitat quality on the refuge is enhanced by controlling Phragmites and wax myrtle in favor of vegetation with higher waterfowl food value, such as three square, spikerush, and red root flat-sedge. Refuge black duck populations peak during fall migration when 1,100 to 1,400 are typically counted during November impoundment surveys. Black ducks in winter use tidal salt marsh and impoundments to a lesser extent.

Snow goose populations have recovered significantly since the 1930s and 1940s, when they were considered an imperiled species. The refuge's current mid-winter snow goose population averages around 6,000 to 12,000 geese but can range as high as 50,000 for a few weeks. These birds rest in the protected refuge impoundments, and regularly feed in adjacent salt marshes and in agricultural fields on the mainland. Occasionally geese feeding activity is concentrated in particular salt marsh locations, undesirably uprooting salt marsh cordgrass and creating muddy devegetated "eat-out" areas.

Chincoteague is not considered a significant waterfowl production refuge, and production data is not collected. However, during the 1980s, duck and goose production was emphasized on this refuge and many others throughout the Refuge System due to extended prairie drought and declining duck numbers. Intensive management activities to enhance waterfowl nesting no longer occur. Usually, a few broods of gadwall, mallards, black ducks, and wood ducks are present each year. Resident geese and non-native mute swans are selectively removed from Chincoteague NWR because they damage habitat on which migrant and wintering species depend.

Wading Marsh and Waterbirds

A variety of wading birds inhabit the tidal creeks and moist soil management units of the refuge to include the glossy ibis, great egrets, snowy egrets, green herons, little blue herons, tri-colored herons, black-crowned night herons, and cattle egrets, as well as several rail species. Being fairly large, beautiful, and plentiful along refuge trails, these birds offer visitors with excellent viewing and photography moments, particularly during the spring and summer when species of egret, heron, and ibis frequent the impoundment borrow ditches, eating small finfish and eels. Colonial nesting birds such as heron, egret, and ibis commonly nest on salt marsh islands in Chincoteague Bay. Other rookeries are located in the outer marsh fringe between Chincoteague Island and the mainland. Grebes and loons winter at the refuge, resting and feeding on adjacent waters. The eastern brown pelican (whose populations have recovered from population declines due to the use of the pesticide dichlorodiphenyltrichloroethane (DDT) and are now no longer endangered) frequent the refuge's intertidal zones, the ocean, and Assateague Channel. Pelicans nest in coastal areas south of the refuge; however, over the past few years they have nested progressively northward.

Shorebirds, Gulls, and Terns

Chincoteague NWR is one of the country's top five shorebird migration staging areas east of the Rocky Mountains (USFWS 1993a). It is designated a site of international importance by the WHSRN. Peak shorebird numbers during spring migration occur in May. The fall migration usually peaks in August and spans the period of July to October.

Spring migration begins with the arrival of piping plovers in March, but there are few other signs of migration before mid-April. During early spring migration, defined as the period of April 7 to May 6, 1,000 to 4,000 shorebirds may be present on Assateague Island habitats. The great majority are dunlins (50 percent) and sanderlings (22 percent), but short-billed dowitchers, black-bellied plovers, willets, and whimbrel are also present (Wilds 2007 and Refuge unpubl. data). During late spring migration, defined as the period of May 7 to June 6, between 6,000 and 26,000 (typically 12,000 to 13,000) birds are present on Assateague Island. The majority (46 percent) are semipalmated sandpipers, but good numbers of dowitchers, sanderlings, least sandpipers, dunlin, and ruddy turnstones are also present (Wilds 2007 and Refuge unpublished data).

Fall migration begins around July 1 with the arrival of short-billed dowitchers. Soon thereafter greater and lesser yellowlegs and least and semipalmated sandpipers arrive, the latter species making up the vast majority (around 40 percent) of shorebird numbers present July through September (Wilds 2007). Virtually all migrants present in July are adults. Hatching year migrants are not common until the last third of August, and by the last third of September, juveniles usually comprise the only shorebirds around, except for adults of shorebird species that overwinter.

Red knot, newly listed as threatened under the ESA, uses Chincoteague NWR beaches during spring and fall migration, with peak spring numbers occurring in the last half of May and peak fall numbers occurring in August (Smith et al. 2008a), as confirmed by refuge data. Since the 1980s, the population of red knots has declined 68 to 80 percent; the severe decrease in a major food item during migration—horseshoe crab eggs in Delaware Bay—is a suspected cause (Cohen et al. 2009). A significant proportion (25 to 30 percent) of the population of red knots (estimate 10,000 to 13,000) use Virginia's barrier islands during spring migration (Cohen et al. 2009). These recent findings that Virginia barrier islands support migratory red knot population add importance to Chincoteague NWR's role in red knot conservation.

Shorebirds were historically reported to occur in "huge numbers," but hunting for sport and food during the late 1800s and early 1900s resulted in decreases in populations of many species of shorebirds. Although hunting has been illegal for all but two species of shorebirds since 1916, many populations of shorebirds are still declining today. Many of the negative shorebird population trends suggest habitat degradation (50 percent of U.S. wetlands have been lost or degraded), depletion of critical food supplies (over-harvest of Delaware horseshoe crabs may be the most recent example), or other factors at work" (Harrington 1999). The United States Shorebird Conservation Plan identifies a number of shorebird characteristics that pose "conservation challenges" including: (1) long distance migration; (2) low productivity and resulting slow population recovery; (3) concentration of populations and increased vulnerability to environmental occurrences; (4) dispersed and ephemeral habitat; (5) loss of habitat; (6) population changes, and (7) the need to conserve across international borders (Brown et al 2001).

Avian migration is largely governed by endogenous rhythms, but annual variations in schedules may occur due to sex and age composition of flocks (Holmgren et al. 1993, Nebel et al. 2000), and weather, tides, and prey availability at stopover sites (Akesson and Hedenstrom 2000, Alerstam

2003). Virginia stopover site has been of historic importance in supporting red knots during spring migration and is not simply an ephemerally used satellite site to Delaware Bay (Cohen et al. 2009). The diet of red knots in Virginia includes coquina clams (Donax variabilis) and blue mussels (Mytilus edulis; Truitt et al. 2001), as was also the case historically (MacKay 1893), and lacks the horseshoe crab (Limulus polyphemus) eggs that are a staple in the Delaware Bay. Furthermore, unlike Delaware Bay, the Virginia habitat consists of high–wave-energy ocean shoreline, similar to much of the rest of the historic stopover range (Cohen et al. 2009). As many as 10,000 knots also stage on the outer barrier islands along the Virginia coast (Watts and Truitt 2000). Red knots tagged in Argentina, Brazil, and Chile stopped in Virginia in 2007 (Smith et al. 2008) as well as in Delaware and New Jersey, providing evidence that both stopover sites hosted birds from the southern wintering sites (Cohen et al. 2009).

Stopover duration for knots in Virginia from 2006 to 2010 was shorter, on average, than for Delaware Bay. The duration in Virginia was 7 to 8 days through May 25, and increased to 9 to 12 days from May 26 to June 6. Red knots exhibited two peaks in the duration of stopover. The first occurred during the first through third week of May, and the second occurred from the last week in May to the first week in June. The pattern of stopover duration in Virginia may be driven by abundance of benthic prey. In 2007, prey peaked at the end of May through early June (Cohen et al. 2009). Arrival to Virginia appears to be constant throughout stopover, while changes in fidelity rates (0.76 to 0.84) mirror peaks in total stopover duration (Duerr et al. 2011). Analysis of mark-resight data on an annual basis (Cohen et al. 2009) provided evidence that red knots from Virginia move between Virginia and one or more other spring locations. Movement from Virginia to an unobserved location (60 percent) was greater than fidelity to Virginia (40 percent). However, this movement was not permanent, as many (48 percent) returned in subsequent years (Duerr et al. 2011).

Virginia supports the second largest number of red knots in the Eastern U.S. during their final stopover during the northward migration in spring (Duerr et al. 2011). Although numbers of animals that use an area is not an indication of habitat quality (Van Horne 1983), survival of those animals is a valid indicator of quality. The Virginia annual survival (0.87) is higher than the estimates for knots from Tierra del Fuego and Delaware Bay prior to (0.84) and after (0.54) a population decline in 2000 (Baker et al. 2004, Duerr et al. 2011).

The barrier islands along the Delmarva Peninsula in Virginia provide high quality habitat for migrating red knots. This area contributes to high survival, and supports tens of thousands of birds. Early preservation of the barrier islands and lagoon systems in Virginia contribute to the long-term survival of the rufa subspecies, potentially helping to avert steep short-term declines that were predicted (Baker et al. 2004) for Delaware Bay. Knots using Virginia and Delaware Bay constitute a single population that includes red knots from throughout their winter range (Duerr et al. 2011).

Migrant shorebirds use Assateague Island beaches, tidal flats, and impoundments. Shoveler Pool (B-North Pool), Snow Goose Pool (B-South Pool), Swan Cove Pool (F Pool), Black Duck Pool (A Pool), Old Fields, South Wash Flats, and NWF are the most important for shorebirds (Wilds 2007), as confirmed by refuge data. Pintail and Gadwall (D and E Pools), Sow Pond, and Ragged Point typically have little or no shorebird use. The Hook is the most important beach area on Assateague Island for migrant and nesting shorebirds (Refuge unpublished data).

Refuge staff have cooperated with the VDGIF and TNC to monitor American oystercatcher population size and breeding success since 2001. In 2008, the refuge supported 25 percent (100) of the total number (395) of nesting pairs on Virginia's barrier islands. This amounts to 14 percent of the State's total number of breeding pairs (731). Cedar Island has the most breeding pairs on the refuge, followed by Assawoman and Assateague Islands. Metompkin Island had the largest population (95 breeding pairs) of oystercatchers on any of Virginia's barrier islands, however only 14 pairs nested on the refuge portion. Refuge staff also conduct boat-based breeding and fall/winter roost surveys of oystercatchers in Chincoteague Bay, when staffing allows.

The refuge also provides excellent nesting habitat for colonial and other beach nesting birds. Colonial species include common terns, least terns, gull-billed terns, and black skimmers. Wilson's and piping plovers nest on beach ridges and overwash areas (Assateague Island is the northern limit of Wilson's plover breeding range). Intertidal sand and mud flats on the cove side of Toms Cove Hook contain horseshoe crab eggs and other high quality food during the entire shorebird season. Willets and oystercatchers nest on the cove side beach and around the natural freshwater marsh in the Hook interior. Oystercatchers also nest in the dunes and recently-vegetated areas near Fishing Point.

Herring, ring-billed, and laughing gulls are the three gull species commonly seen during summer months. Great black-backed gulls have recently expanded their range southward, and can be found on the refuge yearlong. Gulls nest along the causeway connecting Chincoteague Island to the mainland. They feed and rest along refuge beaches and in impoundments.

In regards to numbers of shorebirds using an area during the southward migration, Chincoteague NWR ranks fourth among 454 sites east of the Rockies where a census was taken in the U.S., and is important for many species on an international scale. The refuge ranked second in diversity of shorebird species from among all 450 sites in the International Shorebird Survey network (Schulte and Chan 1985, Manomet 2008), and the barrier islands of Virginia and Maryland were dedicated as part of the International Shorebird Reserve.

Raptors

Many raptors are known to be present on or adjacent to the refuge, with the American kestrel, osprey, black vulture, red-tailed hawk, bald eagle, and great horned owl among the most common species.

Bald eagles were de-listed from the Federal ESA in 2007 and de-listed from the Virginia list as of January 1, 2013. The three known bald eagle nests on Chincoteague NWR are checked for activity in March and May each year by VDGIF; they are currently located in a loblolly pine tree at Black Duck Pool (A Pool), Great Neck (directly west of Old Fields), and Wallops Island.

Assateague Island is a major resting and feeding area for peregrine falcons during fall migration. They hunt shorebirds and other prey and use the beach as a resting area. In 1980, a peregrine hacking tower was erected on the NWF. Hacking is a falconry technique in which chicks are placed in artificial nests and fed until they are ready to fly. Eight falcon chicks were hacked from the tower in 1980 and 1981. The first successful nesting of peregrine falcons in Virginia after the DDT era occurred on the NWF tower in 1982, and pairs nesting on this tower produced a total of 54 fledglings between 1982 and 2003. Between 2004 and 2008, pairs occupied the tower, but nesting was assumed to be unsuccessful based on behavior and aerial surveys. In 2008, the tower was climbed for the first time in several years, and evidence of mammalian predation (probably

raccoon) on the eggs was found, and the predator guards were in disrepair. The tower was removed prior to the 2009 breeding season because of conflicts with piping plover management objectives on the NWF and a Statewide decision to not repair or maintain existing peregrine towers located in important shorebird areas within the seaside lagoon system. The peregrine hacking tower on Metompkin Island was removed in 2010 for this reason (Watts et al. 2008).

Ospreys fish in refuge marshes and Swan Cove Pool (F Pool), northern harriers hunt in marshes and impoundments, and red-tailed hawks nest in forests. Three species of owls are year-round residents. Eastern screech owls nest in Delmarva Peninsula fox squirrel and wood duck nest boxes, as well as in natural cavities. Barn owls often nest in hunting blinds on adjacent marshes. Great horned owls prey on rabbits, Delmarva Peninsula fox squirrels, and shorebirds. Southbound migrating hawks stop to rest and feed on the refuge during fall migration as they fly over the Delmarva Peninsula. Large numbers of hawks stop to rest and feed during their fall migration, including kestrels, merlins, sharp-shinned hawks, and Cooper's hawks. Turkey vultures are occasionally seen roosting in trees or flying over the refuge in search of carrion. The known raptor migration through the area occurs in September and October.

Landbirds

From 1999 to 2009, refuge volunteer Dr. Richard (Dick) Roberts monitored landbird habitat use through mist netting and banding. During these 10 years, Dr. Roberts sampled 14 different areas on Chincoteague NWR, comprising shrub/early successional, forested uplands, and shrub/pine edge habitats. Some areas have been sampled for 5 consecutive years or more, others for 3 years or fewer (Roberts 2009). Nets were operated year-round, weather permitting. Overall goals of this monitoring were to:

- Collect baseline data on species using refuge habitats as a basis for management decisions;
- Identify habitats being used by species of special concern;
- Document/confirm nesting and migrating species;
- Document the occurrence of rare or unusual species; and
- Conduct environmental education.

In shrub habitat dominated by wax myrtle/bayberry vegetation adjacent to the South Wash Flats impoundment, 72 species were captured during the 5-year sample period. Evidence of breeding of common yellowthroats, gray catbirds, and prairie warblers was found. The latter is a highest priority BCC for BCR 30, and gray catbird is a medium priority BCR 30 species (USFWS 2008c). Yellow-rumped (myrtle) warblers depend upon this habitat extensively during migration and winter. BCR Highest or High Priority Species that have been banded in this habitat during breeding or migration include (in order of relative abundance): field sparrow, prairie warbler, brown thrasher, eastern towhee, great crested flycatcher, Baltimore oriole, eastern kingbird, worm-eating warbler, and northern flicker. Medium priority BCR 30 species captured in this habitat in order of relative abundance are gray catbird, Canada warbler, and blackburnian warbler.

Dr. Roberts considers shrub habitats behind beach dunes, such as that typified by his study site adjacent to Toms Cove Visitor Center, essential stopover habitat for southbound fall migrants. This habitat is particularly important to juvenile birds (and hence recruitment into the population), since 85 to 90 percent of birds migrating southbound through the mid-Atlantic coast are hatch-year birds (2009). This vegetation on the lee side of the dunes appears to provide

important refuge to birds inexperienced in navigation that may otherwise be blown out to sea without somewhere to shelter and re-fuel (Roberts 2009). BCR Highest or High Priority Species that have been captured in migration during 5 years of mist-netting in this site include (in order of relative abundance): field sparrow, black-and-white warbler, eastern towhee, eastern kingbird, prairie warbler, Louisiana waterthrush, Baltimore oriole. Gray catbird, a medium priority BCR 30 species, was captured in this study site, but at relatively low numbers compared to other sites.

Mist-netting/banding sites in forest habitat have been operated for 1 to 3-year periods in approximately six locations along the Woodland Trail and Wildlife Loop to measure response to habitat modifications such as pine bark beetle outbreaks and prescribed burns. The following BCR Highest or High Priority Species have been among the 75 species captured in this habitat in order of relative abundance: brown thrasher, field sparrow, northern flicker, eastern towhee, black-and-white warbler, Baltimore oriole, great-crested flycatcher, prairie warbler, eastern kingbird, and worm-eating warbler. Medium priority BCR 30 species captured in this habitat in order of relative abundance are gray catbird, brown-headed nuthatch, and red-headed woodpecker.

The longest consecutive mist netting/banding site operated by Dr. Roberts (2001 to 2009) is adjacent to the Woodland Trail parking lot. It is located on the edge between forested uplands and salt marsh habitat and contains more understory shrubs (myrtle, bayberry, greenbrier, and other berry-producing shrubs) than typical mature loblolly pine forest on Assateague Island. Bird species diversity was high: 87 species captured in a 9-year period. Gray catbird, a medium priority BCR 30 species, has the highest number of captures here compared to any other site. The following BCR Highest or High Priority Species have been captured at this site (in order of relative abundance): black and white warbler, eastern towhee, Baltimore oriole, prairie warbler, eastern kingbird, northern flicker, field sparrow, and worm-eating warbler (Roberts 2009).

The mist-netting study has provided valuable data, particularly for skulking species, non-singing migrants, and wintering birds. However, canopy birds and larger species such as crows and bobwhite are under-represented. A BBS conducted for 10 years between 1996 and 2006, provides additional data on the refuge's landbird population. Two BBS routes of 30 points each, spaced 0.5 miles apart, in myrtle shrub and loblolly pine forest (total = 60 points) were run during the second week of June using slightly modified BBS protocols (Chincoteague NWR 1996).

Appendix L lists the 20 most abundant birds (in order of relative abundance) observed in each of the two habitats (myrtle shrub and loblolly pine forest) during the 10-year BBS period. Ten BCR 30 Priority Species breed on the refuge: gray catbird, northern bobwhite, and brown thrasher—found in both habitats; field sparrow, eastern kingbird, and prairie warbler—found in myrtle shrub; and eastern towhee, great-crested flycatcher, northern flicker, and brown-headed nuthatch—found in loblolly pine forest.

Appendix L also compares the BBS results with Dr. Robert's 20 most abundant mist-net captures (1999 to 2007). Only 9 species were on the top 20 in both the BBS and the mist net study: gray catbird, common yellowthroat, song sparrow, house wren, northern cardinal, common grackle, Carolina wren, field sparrow, and yellow-breasted chat. Birds that appear on Dr. Robert's "Top 20" and not on the BBS are generally wintering or migrant birds. For example, the most numerous wintering and migrant bird on the refuge—yellow-rumped warbler—was not encountered at all on the BBS. Birds that appear on the BBS "Top 20" and not on Dr. Robert's

study are canopy birds such as eastern wood peewee, brown-headed nuthatch, and great-crested flycatcher, or species too large to be captured in passerine mist nets such as crows and bobwhite.

Upland Game Birds

Based on the 10-year BBS noted above, northern bobwhite quail are widespread with a stable to increasing population trend on the refuge. They were detected on 29 of 30 possible points in myrtle shrub vegetation over the 10-year period, and on average detected on 40 percent of the points each year. Quail were detected on all 30 points in loblolly pine vegetation at one time or another during the 10-year survey and on average detected on 36 percent of the points each year. According to refuge data records, the number of quail counted in both the myrtle shrub and loblolly forest BBS routes has increased between 1996 and 2006 (unpubl. data, Refuge files).

Four American woodcock singing-ground survey routes (totaling 40 survey points) encompass all suitable woodcock habitat on the refuge accessible by road. Routes have been run intermittently in 8 of the past 20 years, beginning in 1990. A maximum of 15 woodcock were detected during the 2000 survey, and the most recent survey in 2009 counted 5 woodcock. Birds have been counted on each route with the exception of the North Service Road. Beach Road/Woodland Trail has had the highest number of detections and been the most consistent in having woodcock over the years. The Swan Cove Trail/Wildlife Loop did not have any woodcock during the first 10 years of the survey but has had more woodcock than any other route during the most recent decade. It was the only area with woodcock in 2009. No long-term trend can be determined from the data except that higher numbers of woodcock were counted during the first half of March, irrespective of the year. Counts after March 21 generally detect fewer birds, perhaps indicating that Chincoteague NWR is more important to migrating or wintering woodcock than breeding birds. Wallops Island NWR appears to have suitable habitat but lacks survey data.

The first turkeys on Assateague Island were sighted in March 2005 by an employed law enforcement officer. Coincidentally, the NPS staff reported turkeys on the north end of Assateague Island around the same time. Turkeys are regularly encountered on the bi-weekly waterfowl survey. The population size of turkeys is unknown, but a flock no greater than 20 birds (adults and juveniles) was observed in December 2009 (Buffa 2009). Turkeys are thought to be at least stable and probably increasing, according to refuge data. Turkeys are also frequently sighted on Wallops Island NWR.

3.4.3 Fish and Other Aquatic Species

A full list of fish species collected on the refuge during the refuge's Fish Survey is listed in Appendix L.

Finfish

The refuge and surrounding area has a diverse assemblage of fish species that inhabit the impoundments and is somewhat tolerant of fluctuating water salinity. During droughts and periods of water level drawdown, fish are confined to borrow ditches, where they are an easy food source for wading birds, skimmers, terns, and osprey. Species include the sheepshead minnow, rainwater killifish, striped killifish, mummichog, banded killifish, tidewater silverside, threespine and fourspine stickle-back, white and yellowperch, and American eel.

Myriads of fish spawn and feed in the nutrient rich, protected waters on Assateague Island's bay side. Marine finfish of primary recreational or commercial importance in the refuge vicinity

include the black drum, red drum or channel bass, bluefish, winter and summer flounder, menhaden, spot, Atlantic croaker, weakfish, mullet, and spotted sea trout. Other common species are puffer, rockfish, spotfin killifish, king fish, and sand tiger shark.

Since 1972, the Maryland DNR Critical Area Commission for the Chesapeake and Atlantic Coastal Bays has documented a decrease in the abundance of forage species such as bay anchovy, menhaden, spot, and Atlantic silverside in Assateague Island's bayside waters. Small forage fish are most susceptible to fish kills when summer algal blooms create anaerobic conditions in shallow bays and canals. Other finfish populations in Chincoteague and Sinepuxent Bays appear relatively stable. Summer flounder, however, are still recovering from a 1989 population crash. Declining populations of forage fish commonly eaten by the flounder may be slowing recovery rates. Disease also presents a threat of unknown magnitude as different species of fish in the bays periodically show symptoms such as lesions. Scientists are currently attempting to better understand these afflictions and how they may be related to observed changes in water quality.

Other Marine Resources

Historically, the mollusks and crustaceans of Assateague's bayside waters were an important food source for American Indians and a commercial resource for local communities dating back to the earliest settlers. Oysters were abundant in Assateague Island's bays until the mid-1930s, when construction of the Ocean City inlet and jetty system dramatically altered the salinity regime and the abundance of native predators. Coupled with chronic overharvesting and the introduction of two aggressive single-celled oyster parasites during the 1950s (multinucleated sphere X (MSX) and dermo), the oyster population plummeted and is now in danger of disappearing altogether. Presently, Virginia oysters are grown commercially on leased beds below the low tide mark in Toms Cove and along Assateague Channel. A few "wild oysters" may be found along the low marsh edge and the banks of Toms Cove (as well as some ribbed mussels that cling to banks of low tidal marsh creeks.)

The mollusk community was further disrupted during the mid-20th century by the virtual disappearance of eelgrass resulting from a viral disease that affected sea grasses worldwide. Atlantic bay scallops, once regionally abundant, were nearly extirpated by the outbreak. With the resurgence of eelgrass during the 1980s and 1990s, scallops have begun to repopulate the bays, though numbers remain very low. Quahogs, or hard shell clams, which live in bayside sand and mudflats, showed greater resistance to the forces driving population decline in other mollusk species and remain an important component of the estuarine ecosystem. Introduction of the hydraulic clam dredge during the 1960s increased harvest efficiencies and fueled the development of commercial clam industries in Maryland and Virginia. Unfortunately, hydraulic clam dredging damages sea grass beds and other bottom habitats, reducing habitat value and altering community structure.

Blue crabs are also abundant in cove and bay waters adjacent to the refuge. Crabs can also be found in Swan Cove Pool (F Pool) on the refuge, where crabbing is a popular activity of summer visitors. Blue crabs are food for wading birds, otters, and raccoon; and harvest of hard- and soft-shelled blue crabs is important both recreationally and commercially, which takes place in the National Seashore waterway. After declines in the 1950s and increases through the 1970s and 1980s, crab populations currently seem stable

Ghost crabs are small omnivores that burrow in the less-traveled sections of the refuge beach, eating detritus and dead organisms that wash up in tidal drift. They also prey on eggs and young chicks of beach nesting birds. Their predators include raccoon, fox, gulls, and various shorebirds.

The horseshoe crab is an endemic species found on the east coast of the U.S., with the center of abundance between New Jersey and Virginia. This species spawns in the spring during new and full moon periods starting the end of April and lasting into June. This period of time coincides with the spring migration of shorebirds. Migration is an extremely energetic undertaking for these birds and their success or failure is dependent upon finding sufficient energy (food) to complete migration and then to breed. Studies have shown that horseshoe crab eggs that wash up on beaches after a spawning cycle are known to supply some or the entire energy requirement to complete migration. The Chincoteague NWR location along the Atlantic flyway makes it a vital resting and feeding spot for a large number of migrating shorebirds.

American horseshoe crab is one of four extant species of horseshoe crabs; it is the only North American representative (Shuster 1982). Horseshoe crabs are slow to reach sexual maturity (USFWS 2006; Shuster 1982). Although female horseshoe crabs lay thousands of eggs each spawning attempt, it is unknown how many of these eggs result in mature, reproducing crabs.

3.4.4 Mammals

The refuge supports relatively few native, terrestrial mammalian species. Among the more common terrestrial species are white-tailed deer and cottontail rabbit. Less common mammals include muskrat, river otter, opossum, gray squirrel, and three species of bat. Mammal diversity ranges from a variety of rodents and shrews to large marine mammals—the latter including the bottlenose dolphin and several species of whale that feed in the island's offshore waters.

Assateague Island and Chincoteague NWR are perhaps more noted for their exotic mammals (sika and Chincoteague ponies—see below) than for their native mammals. The endangered Delmarva Peninsula fox squirrel was introduced to Chincoteague NWR as part of a regional recovery effort (see “Federal Endangered Species” section above). Red fox, which is not native to barrier islands, impacts piping plovers and other ground-nesting birds on Assateague and Assawoman Islands. Red fox and raccoon are selectively controlled through a trapping program to minimize their predation on nesting piping plovers, American oystercatchers, terns, and skimmers (USDA 2005).

Deer

White-tailed deer are the largest native land mammals on the refuge. They are abundant in wooded areas and upland meadows, but they are also attracted to sites where dead trees have been cleared and tender regenerating forest vegetation is plentiful. They are managed through a regulated hunt program on Assateague Island, Wildcat Marsh, and Wallops Island NWR to maintain populations at levels that are commensurate with refuge habitat objectives, and to provide recreational hunting opportunities (USFWS 2007d and 2007e). The refuge partners with NPS on monitoring population size. Some white-tailed deer also use Cedar and Assawoman islands, as evidenced by tracks and scat.

Sika

Sika, a species native to east Asia and Japan, were released on the northern end of Assateague (MD) in the 1920s when the island was privately owned (Flyger 1960). They increased in number

and expanded their range to occupy the entire island, and sika were well established on the Virginia end of the island when Chincoteague NWR was established in 1943. By 1963, refuge records estimated the sika population at 1,300 and reported that a browse line was becoming evident on refuge vegetation, indicating an over-population. Public hunting, started in 1964, has continued to the present in order to reduce the abundance of an exotic animal, preventing habitat degradation, and providing a public recreational opportunity. The refuge also uses depopulation permits from the VDGIF to control the population.

The population of sika on the Chincoteague NWR portion of Assateague Island was estimated at 1,000 animals in the mid-1990s using a model combined with spotlight surveys (Bicksler et al. 1995). The minimum population estimate for sika in the fall of 2007 and 2008 was 600 animals based on Chincoteague NWR harvest data and the Downing population reconstruction model (Davis et al. 2007). Each year harvest data and staff observations of habitat conditions are evaluated to determine season lengths, hunt areas, and bag limits needed to control the herd and keep deer and elk from causing resource damage. The refuge also partners with NPS on monitoring population size.

Chincoteague Ponies

The origin of the ponies is unknown, although there are several theories. One popular legend is that a Spanish galleon carrying a cargo of ponies sank off Assateague in the 1700s, and some of the ponies were able to swim to shore. Another theory is that the "Chincoteague Ponies" are descendants of colonial horses brought to Assateague Island in the l7th century by Eastern Shore planters when crop damage caused by free roaming animals led colonial legislatures to enact laws requiring fencing and taxes on livestock. The modern-day descendants of those domestic horses are wild and have adapted to their environment. The year 1925 marked the first year that Chincoteague Volunteer Fire Company members, later dubbed "saltwater cowboys," herded the ponies to the Assateague Channel and swam them to nearby Chincoteague Island for auction. This event is now known as the annual pony swim and auction. The land used for the ponies' herding became part of the Chincoteague NWR with its creation in 1943, so the USFWS issued the Fire Company a SUP to allow no more than 150 head of horses to graze in designated areas of the refuge, a permit that is still in effect today.

The ponies' status as managed grazing livestock, and their strong cultural tie to the community, is often at odds with their adverse effects on the island's habitats such as salt marshes and forests. Consequently, managing their populations is needed to maintain a balance with the island's ecosystem and remain compatible with refuge purposes. A fence along the Virginia/Maryland State line (the northern refuge boundary) separates the island's ponies into two herds. There are approximately 130 adult ponies on the southern Virginia end of the island. The Virginia herd is managed by the Chincoteague Volunteer Fire Company and is grazed in two designated compartments on the refuge, known as the North and South Pony Units.

Marine Mammals

Marine mammals are often sighted in waters around the refuge, and occasionally wash onto shore. With the exception of several common dolphins and seals, most marine mammals occur as occasional transients or seasonal migrants. Documented marine mammals in the ocean and bayside waters surrounding Assateague Island include six species of baleen whales, of which five are endangered; 16 species of toothed whales (including dolphins), one of which is endangered; and the West Indian manatee, which is also endangered. Other recorded species include: harbor

seals; Risso's dolphins, long-finned pilot whales, humpback whales, fin-backed whales, sperm whales, pygmy sperm whales, spotted and Atlantic bottle-nosed porpoises, and common dolphins. Most at risk is the northern right whale, with a North Atlantic population of perhaps only 200 individuals.

3.4.5 Reptiles and Amphibians

Reptile and amphibian diversity on the refuge is relatively limited owing to the island's isolation and harsh environmental conditions. (A full list of reptiles and amphibians occurring on Chincoteague NWR is included in Appendix L). Several species of reptiles possess morphological adaptations necessary to survive the varying and sometimes harsh conditions of barrier island life. Many reptiles, for instance, have tough skins that exclude salt and retain moisture. Still others exhibit behavioral adaptations that limit their exposure to severe temperature or salinity. Due to their highly permeable skins, most amphibians cannot tolerate the infusion of salt that occurs when submersed in seawater. Another major limiting factor is the relative scarcity of fresh water habitats available on the island. Assateague Island's amphibian species require fresh water to reproduce, but vary in the amount of moisture they require for day-to-day survival. Fowler's toads can actually tolerate low levels of salinity and are able to absorb moisture from their environment directly through their skin. This decreased dependence on fresh water explains their larger range and ability to survive in most of island's habitats.

Documented reptile and amphibian species on Assateague Island include 11 turtles, 7 frogs and toads, 7 nonvenomous snakes, and 1 lizard; of which approximately 20 of these reptile and amphibian species are assumed to be present on the Chincoteague NWR. Reptiles most likely to be observed on the refuge are: eastern box turtle, Northern diamond back terrapin, eastern mud turtle, eastern hognose snake, black rat snake, and northern water snake. Chincoteague's commonly observed amphibians include Fowler's toad, southern leopard frog, bull frog, and green tree frog.

Reptiles

Eastern box turtles, painted turtles, and mud turtles are seen occasionally in the fresh water impoundments, as are snapping turtles, which can grow quite large and prey on fish, frogs, and young waterfowl. Northern diamondback terrapin inhabit the salt marsh and more brackish impoundments. One freshwater species, the spotted turtle, is known to live only in a small group of ponds located in the oldest part of the island.

The northern diamondback terrapin dwells in refuge salt marshes. Female terrapins lay eggs on beach habitats (i.e., berms, dunes, and washover sand flats) of Assateague, Assawoman, Cedar, and Metompkin Islands from early June through early August (Feinberg and Burke 2003). A 3-year study (2006 to 2008) of terrapins nesting on south Cedar Island found that egg-laying peaks in June and tapers off in late July; predation followed by wash-out are the leading causes of mortality (Boettcher, unpubl. data). Predators (ghost crabs and red fox) destroyed 94 percent of nests in 2006 and only 38 percent in 2007, following the implementation of a predator control program (Boettcher, unpubl. data). Raccoons were not present on Cedar Island during this study, but are considered major predators where they occur on barrier islands (Feinburg and Burke 2003). Therefore, predator control programs to protect beach nesting birds also benefit terrapins.

No venomous snakes are known to inhabit Assateague Island. The most commonly seen snakes are the eastern hognose snakes, which prefer sandy woods, fields, and dune areas; and black rat

snakes, which grow to 5 feet long, are excellent climbers, and live in high tree cavities. The less common northern water snake is also an excellent tree climber and is seen in the impoundments.

Northern fence lizards are very rare on the island and have not been observed in recent years.

As mentioned in Section 3.4.1, four species of Federal listed sea turtles use Assateague Island's ocean and bay waters, and presumably the coastal waters of the refuge: leatherback sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, and green sea turtle.

Amphibians

Of the six frog and toad species, four were commonly encountered by Toadvine (2000) and during aural call count surveys conducted by refuge staff in 2003, 2004, and 2005: Fowler's toad, southern leopard frog, green tree frog, and bullfrog. The New Jersey chorus frog (last observed in 1970s at one location near the lighthouse), and green frog (not reported since Conant 1990) may no longer be present on the island. Green frogs occupy permanent bodies of freshwater, and several periods of drought in the 1990s may have eliminated habitat on Assateague Island (Toadvine 2000). Re-colonization is still a possibility (Mitchell et al. 1993 and Conant et al. 1990).

The red-back salamander may be becoming more common on the refuge. Few individuals were found by Toadvine (2000) and Mitchell et al. (1993). A quick survey using the White Hills Delmarva Peninsula fox squirrel trap line as a sampling transect line in December 2008 found these salamanders to be common under mixed hardwood/loblolly pines with adequate leaf litter, and absent under pure loblolly pine stands with relatively dry sandy substrate and no litter.

3.4.6 Invertebrates

Invertebrates are the most diverse and abundant animals in natural ecosystems, but their importance in sustaining those systems is not commonly understood or appreciated. Chincoteague NWR is home to several types of invertebrates, as well as used as a resting area for other migrating species. Invertebrate conservation and management depends on sound knowledge of the distribution, biology, and food web dynamics of individual species and ecosystem interrelations which all have far-reaching implications for migratory bird management. Both terrestrial and aquatic invertebrate communities are very important components within the Chincoteague NWR ecosystem and more than outweigh all the taxa combined in species richness, abundance, and biomass. Invertebrates serve vital functions as pollinators and detritivores (facilitating decomposition of matter and returning nutrients to the soil), and are critical food resources for birds, insectivorous mammals, fish, reptiles, and amphibians. They play predominant roles in all ecosystem processes and are necessary links in all food webs in refuge biological communities. Invertebrates represent critical elements of biological integrity, diversity, and environmental health, and are essential to the maintenance of ecosystem services. Few formal surveys on invertebrates have been conducted on the refuge, but casual observations show a rich diversity of terrestrial insects such as spiders, beetles, ants, dragonflies, butterflies, moths, flies, wasps, and bees, and certainly a healthy population of ticks, chiggers, and mosquitoes. Although not prudent to highlight all invertebrate types individually, there are some that require specific discussion due to their importance to the refuge and visitor experiences.

Bees are among the most common flower visitors of the refuge, acting as important pollinators through their nectar feeding. According to a 2006 bee collection survey, Chincoteague NWR is

home to at least 41 species of bees. The majority of the species were recorded in areas of deep sandy soil, and wherever flowers could be found (USGS 2006).

The northeastern beach tiger beetle, a State and federally threatened species, inhabits beaches on the Chesapeake Bay and parts of the Atlantic coast, and is one of four subspecies of the eastern beach tiger beetle. Broad sandy beaches provide the best habitat for these beetles. Adults live in the zone between the high-tide line and the dunes; larvae inhabit burrows in the upper intertidal zone. These beetles have learned to adapt to this active habitat that is constantly disturbed by erosion and weather, and their presence is an indicator of a healthy beach. Adult beetles roam and fly over the sand foraging for other insects and small crustaceans, and also scavenge dead fish and crabs. Surveys for northeastern beach tiger beetle have been conducted on the refuge, but none have been found.

Eastern beach tiger beetles (with the exception of the northeastern subspecies) are greatest on the refuge during the months of June through August, which is their breeding season and during which the females lay eggs in shallow burrows on the beach. As a species, the eastern beach tiger beetle is rated by Nature Serve as common and globally secure, but the northeastern subspecies is ranked imperiled both globally and at the State level. The USFWS has developed a conservation and recovery plan for sites inhabited by the beetle. Key components of that plan include monitoring populations, protecting beach habitat from foot and vehicular traffic, and educating landowners and the public about the endangered beetle (VNHP 2008).

Assateague Island is a critical stopover area for fall-migrating monarch butterflies migrating south from Canada and New England to Mexico, with sometimes as many as 100,000 monarchs counted migrating over the beach dunes. Refuge habitats provide an abundance of nectar sources such as seaside goldenrod, climbing hempweed, Biden, groundsel-tree, and horsemint, which fuel the monarch's journey to wintering sites in Mexico. Important night-roosting sites are located in thickets of bayberry, wax myrtle, groundsel-tree, loblolly pine, and eastern red-cedar in the vicinity of Toms Cove and along the Service Road. The largest night roost recorded at Chincoteague NWR has over 30,000 monarchs clustering in the branches of a wild cherry tree (Gibbs 2008).

Peak migration usually occurs during the last week of September and the first week in October, with a second wave occurring during mid-October in some years. In most years, there are three peaks or "waves" of monarchs. Monarchs at Chincoteague NWR typically stay a maximum of 5 days, nectaring on the flowers to build up enough fat to sustain them on the rest of their journey to Mexico. The waves most often occur after the passing of a cold front, and large waves also occur after hurricanes (Gibbs 2008).

Several insect pests are common on the refuge, most notably the mosquito and the southern pine beetle. Although no formal surveys for mosquitos have been done on a refuge specific level, their existence has been noted and is incorporated within the refuge management practices for mitigating in areas of high public visitation when needed.

The southern pine beetle is a native species that has likely been present on the Delmarva Peninsula since the last ice age. Adult beetles are 0.08 to 0.16 inches (2 to 4 mm) in length with short legs and cylindrical bodies and are brown to black in color. The southern pine beetle is one of the most destructive insect enemies in the southern United States, Mexico, and Central America for pine trees. Adult beetles locate a host tree during their breeding cycle and bore into it. The

beetles then release pheromones used to attract a mate; as the species breed and more beetles bore into the tree, eggs are deposited and egg galleries form inside the tree, which then hatch into young beetles. When they have developed into adult beetles, they leave the host tree in search of other trees to colonize and infect, repeating the cycle in a different tree. This continued boring and feeding on the tree by adults and broods will ultimately kill a tree, and the area of destruction can quickly increase if the population is not controlled. Certain management methods, such as "fell in" method of management in which the infested trees are cut down and pushed to the center of the infested area, or burning certain areas, are practiced on the refuge to help control the beetle population.

3.4.7 Invasive/Exotic Species of Concern

Harsh environmental conditions such as exposure to saltwater spray and periodic storm overwash help prevent the introduction and spread of invasive/exotic plant species. By far the invasive plant causing the most resource impacts on Assateague Island is the common reed, Phragmites. It accounts for the majority of the acreage estimated to be affected by invasive plants, and occurs on all of the barrier islands on Chincoteague NWR as well as Wallops Island NWR. Phragmites outcompetes native wetland vegetation and provides little or no food or shelter for most wildlife. Phragmites can also eliminate small intertidal channels and obliterate pool habitat that offers natural refuge and feeding grounds for wildlife. The USFWS has been cooperating with other state and private landowners on the Delmarva Peninsula's eastern shore to eradicate Phragmites using herbicide and other control techniques. Other invasive species on Chincoteague NWR include Asiatic sand sedge, climbing fern, Japanese stilt-grass, Japanese wisteria, and Japanese Honeysuckle.

Autumn olive, a non-native tree, was widely planted for wildlife habitat "improvement" in the 1960s and 1970s. It was planted along the edges of Wallops Island NWR as one of the refuge's early management actions, but has spread to additional areas and is now considered an invasive exotic.

An invasive marine species potentially threatening the refuge's aquatic habitat is dead man's fingers, a macro algae or seaweed that arrived in New York in 1957 and has been making its way south along the coast. In parts of the northeast, dead man's fingers has outcompeted native algae species and overrun shellfish beds by monopolizing limited space on suitable substrate in intertidal areas.

Non-native faunal species in refuge estuaries and intertidal zones may prove to be a formidable threat. Several invasive species have recently established themselves in portions of the bays, particularly along shorelines armored with rock such as bridge abutments and jetties. Three species of crabs—green crabs, Asian shore crabs, and possibly Chinese mitten crabs—may threaten native species and ecosystem health. Asian shore crabs were transported to the Atlantic via ship ballast water in the 1950s, while green crabs were probably introduced as bait for tautog, a fish popular with anglers.

Other non-native species of concern include nutria, a large South American aquatic rodent capable of devastating tidal marshes and other wetland habitats. Fortunately, the spread of nutria up the Atlantic seaboard has not yet reached Assateague Island, although occasional sightings have been made on the adjacent mainland. Although native to North America, nonmigratory Canada geese present a continuing challenge as regional populations are rapidly expanding and causing a variety of conflicts with both humans and native wildlife.

3.5 Socioeconomic Setting

This section provides a summary of information from the baseline report, *Chincoteague National Wildlife Refuge Economic Analysis in support of Comprehensive Conservation Plan* (USFWS 2012e), a full version of which is in Appendix M, as well as an analysis of environmental justice characteristics.

3.5.1 Socio-Demographic Characteristics

According to the U.S. Census Bureau, the population of Chincoteague grew 21 percent (from 3,572 to 4,317 individuals) between 1990 and 2000, but declined 32 percent (to 2,941 residents) between 2000 and 2010 (U.S. Census Bureau 2010). In comparison, Accomack County's population declined by 13.4 percent over the same time period, while the total population for the Commonwealth of Virginia increased by 13 percent, an amount greater than U.S. population growth. Table 3-6 shows the comparison between these geographical entities.

Table 3-6 Change in Population, 2010 and 2000

Year	Chincoteague Town	Accomack County	Virginia	U.S.
2010	2,941	33,164	8,001,024	308,745,538
2000	4,317	38,305	7,078,515	281,421,906
Percent (%) Change	-31.9%	-13.4%	13.0%	9.7%

U.S. Census Bureau, 2010 and 2000 Demographic Profile Data, DP-1. Accessed at www.factfinder2.census.gov on March 20, 2012

Chincoteague has nearly three times the number of housing units as total households, reflecting the town's linkages to the tourism-based industry. The Census reports that nearly 60 percent of all vacant housing units were built for seasonal, recreational, or occasional use, compared to a state average of 2.4 percent.

Demographically, the town of Chincoteague is older and less racially and ethnically diverse than the surrounding county, State, and nation. Chincoteague has 1,417 households. Over 40 percent of these households are made of up individuals 65 years and older, reflecting Chincoteague's popularity as a retirement destination, and over 95 percent of residents are white. Both of these figures are higher than county, State, and national characteristics. Chincoteague's average household size of 2.06 is slightly smaller than that of the county, State, or nation. Over 83 percent of Chincoteague residents have a high school degree or higher, which is close to the national average of 85 percent. Compared to the county, Chincoteague has a higher percentage of residents with a bachelor's, graduate, or professional degree (13.7 percent vs. 10.3 percent). Only 16.6 percent of Chincoteague residents have not achieved a high school diploma, which is less than the county but more than the state (13.9 percent) and national (14.9 percent) averages.

The average earnings for people 25 years and over is less in Chincoteague than in other areas. Specifically, the average earnings for a town resident is $23,000 compared to $27,406 for a county resident, $39,409 for a State resident, and $34,665 for an average national resident. However, these estimates are heavily influenced by the lower earnings power of town residents with only a high school diploma or less. Town residents with a bachelor's degree or higher earn more on average than a resident of the county or nation (but not the State). Regardless of educational attainment, however, a higher percentage of Chincoteague residents experience poverty

compared to State or national residents. Table 3-7 presents an overview of poverty status and earnings.

Table 3-7. Poverty Status and Earnings

Category	Chincoteague, Virginia	Accomack County, Virginia	Virginia	United States
	Total Estimate	Total Estimate	Total Estimate	Total Estimate
Poverty Rate For The Population 25 Years And Over For Whom Poverty Status Is Determined By Educational Attainment Level				
Less than high school graduate	30.7%	28.0%	21.3%	24.7%
High school graduate (includes equivalency)	22.8%	13.2%	9.6%	12.0%
Some college or associate's degree	9.4%	12.2%	6.2%	8.4%
Bachelor's degree or higher	5.4%	3.6%	2.5%	3.8%
Median Earnings In The Past 12 Months (In 2010 Inflation-Adjusted Dollars)				
Population 25 years and over with earnings	23,000	27,406	39,409	34,665
Less than high school graduate	12,852	16,634	21,001	19,492
High school graduate (includes equivalency)	15,729	25,979	29,064	27,281
Some college or associate's degree	28,495	27,535	36,137	33,593
Bachelor's degree	52,417	40,809	53,522	48,485
Graduate or professional degree	66,563	50,898	75,613	63,612
Source: U.S. Census, American Community Survey 5 year estimates, 2006 to 2010.				

3.5.2 Economic Characteristics of Chincoteague and Accomack County

The town of Chincoteague has several sources of economic activity, including tourism (both refuge-related and other outdoor-based recreation opportunities), commercial fishing and seafood manufacturing, and impacts from the nearby NASA Wallops Island Flight Facility. This section will summarize some general economic characteristics for Chincoteague and discuss tourist-related characteristics of the economy, the commercial and seafood manufacturing sectors and the impacts of the NASA Wallops Island Flight Facility.

Employment

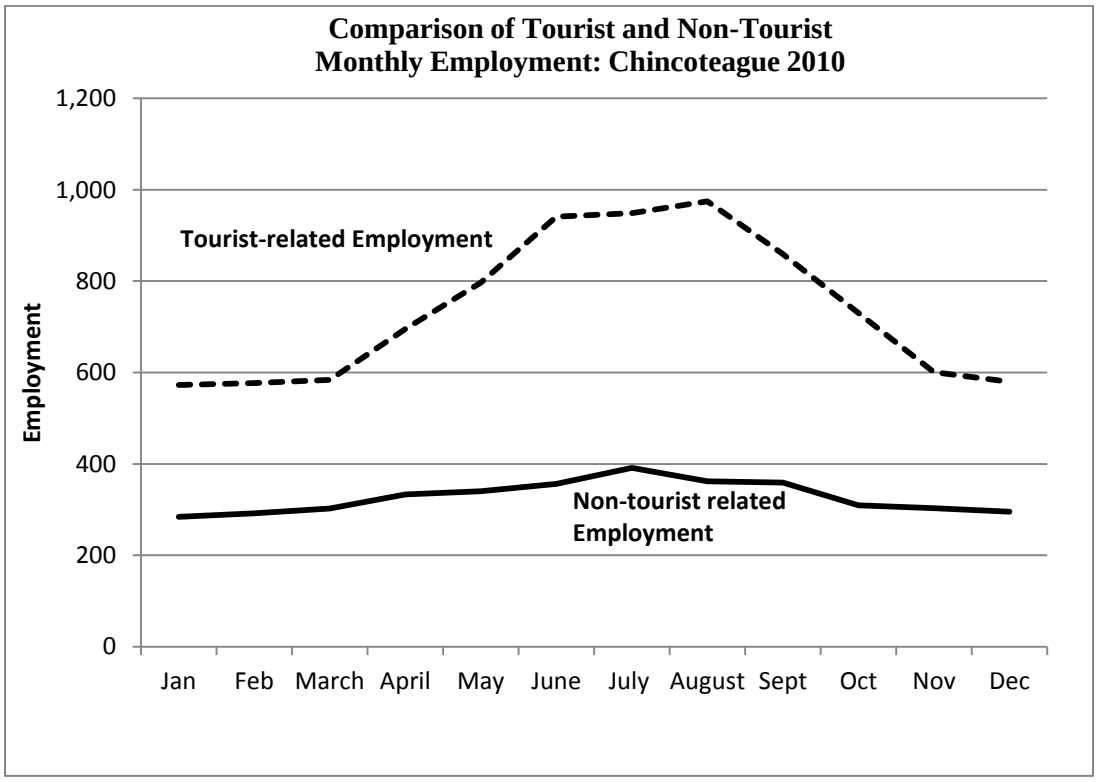
The Census estimates that during the year 2010, there were a total of 1,363 people employed in the town of Chincoteague. Roughly two-thirds were employed year-round while a third was seasonally employed. The three largest employment sectors, accommodation and food services, retail trade, and health care and social assistance, accounted for almost 75 percent of total wage and salary employment. The accommodation and food services sector accounted for 47 businesses, the retail trade sector accounted for 31, the construction sector for 15, and the real estate, rental

and leasing sector for 11. These four sectors accounted for 70 percent of all businesses which hired workers in 2010.

Chincoteague also has a substantial number of self-employed, as evidenced by the number of business licenses issued in 2011 compared with the number of businesses which employed at least one person during the year. In 2011, Chincoteague issued 1,269 business licenses, of which 149 employed at least one person, 700+ were for tourist rental homes, and approximately 416 were for other types of self-employment aside from tourist rental homes.

Chincoteague relies to a significant degree on tourism for town income. Tourism is not constant throughout the year, the summer months have the highest concentration of visitors and the winter months, the lowest. Consequently, much of the employment in Chincoteague follows a similar pattern. Total employment is lowest in January and highest in July, ranging from 857 to 1,340. Tourist-related employment ranges from 573 in January to 975 in August, representing an increase of 70 percent. In contrast, non-tourist related employment ranges from 284 in January to 391 in July, an increase of 38 percent. Figure 3-15 shows a monthly graph of tourist and non-tourist employment in 2010.

Figure 3-15. Comparison of Tourist and Non-Tourist Monthly Employment. Source: Virginia Employment Commission 2011



Real Estate

In terms of the real estate, rental and leasing sector, in the year 2010 there were a total of 2,775 combined rooms, spaces, and sites provided by 707 establishments. Ninety percent of these establishments were vacation rental homes. There were also 21 hotels/motels offering 849 rooms,

6 bed and breakfasts offering 33 rooms, and 6 cottages offering 80 rooms. Four campsites offered 1,143 spaces. The rental of these places to tourists not only generates revenue for the owners but also generates revenue for the town in the form of food and lodging excise taxes.

Tax Revenues

The Town of Chincoteague levies taxes on many of the tourist-related business to help pay for the provision of many public goods. In particular, taxes are levied on real estate, business licenses, occupancy, and meals.

Real estate is assessed by the Accomack County Assessor. Real estate within the town of Chincoteague is taxed by both the Town and Accomack County, with each having different rates. Real estate taxes for the Town are billed in early November of each year and are due on or before December 5 of the same year. The current Town real estate tax rate is $0.06 per $100 of assessed value.[1]

Personal property taxes are assessed by the Accomack County Commissioner of Revenue on such items as automobiles, motorcycles, travel trailers, boats, and mobile homes. Personal property is also taxed by the Town and Accomack County with different rates. Personal property bills are mailed the same time as real estate and have the same due date. The current Town personal property tax rate is $0.85 per $100 of assessed value. However, mobile homes are billed at the real estate rate.

The Town of Chincoteague levies an annual business license tax on all persons conducting business within the town. The tax is due on April 30 of each year. For most business categories, the current rate for this tax is $0.13 per $100 of gross receipts of the previous year, with a minimum tax of $50 and a maximum tax of $500 per year.

Transient occupancy tax is charged by providers of lodging for less than 30 days. The current town transient occupancy tax rate is 3 percent. Meals tax is charged on all prepared meals including beverages within the town. The current meals tax rate is 5 percent. Over the 10-year period from 2000 to 2010, hotels and motels accounted for 60.5 percent of the average annual gross receipts from the transient occupancy lodging tax, tourist homes 31.3 percent, campgrounds 4.7 percent, and bed and breakfasts 3.5 percent. Annual receipts averaged $17.6 million over the 10-year period. Chincoteague also contributed roughly 55 percent of Accomack County's lodging tax receipts between 2005 and 2010.

Both food and lodging excise tax receipts increased from 2004 to 2010. Food tax receipts for the town have increased 12.5 percent, while lodging tax receipts increased 84 percent, leading to an overall 43.1 percent in revenue increase from excise taxes.

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[1] The Town offers tax relief on real estate for certain elderly or handicapped individuals. The relief may be 50 percent or 100 percent. There are eligibility criteria, such as: income and amount of real estate owned. The contact is the Accomack County Commissioner of Revenue. The Commissioner of Revenue will notify the Town of those eligible for this relief.

Non-Tourism Sectors

In addition to tourist revenue, Chincoteague also harvests finfish and shellfish from the waters surrounding the refuge and benefits from its adjacency to NASA and associated facilities.

In 2010, the value of the harvest was over $3.3 million, more than half of which came from private shellfish farms that began forming recently. Blue crab and quahog represent the most valuable harvest. Data from the Virginia Marine Resources Commission show that the annual total amount of the finfish harvest is declining over the years, while the amount of the shellfish harvest has been increasing. In 1993, Accomack County waters produced nearly 400,000 pounds of finfish and 400,000 pounds of shellfish. By 2010, shellfish harvests increased to nearly 1.8 million pounds, while finfish harvests declined to less than 100,000 pounds.

The NASA Wallops Flight Facility and Mid-Atlantic Regional Spaceport also provide economic activity for the town and county. It has been estimated that of the $188.3 million it brings to the region from its operations and the spending of the employees and tourists it attracts, $77.8 million ends up in Accomack County while $110.5 million go to the Lower Eastern Shore. The facility and spaceport are also responsible for 2,347 jobs, of which 1,206 are in Accomack County.

3.5.3 Refuge Recreation Visits and Economics

The refuge attracts visitors to the region for a number of reasons. Visitors come for the beach, the wildlife and Chincoteague ponies, surf fishing, off-road vehicle use, and waterfowl and big game hunting. In 2010, the refuge had almost 1.4 million visits, with over half of those visits occurring in the peak summer months.[2] The beach parking lot closed five times that year due to over capacity.

Visitors stimulate the economy through direct payments for food, lodging, transportation, equipment, and supplies. In turn, local merchants use a portion of the money spent to buy other local goods, resulting in a multiplier effect. While refuge specific expenditures are not available, estimates can be derived from averages taken from the 2007 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. The percentages of expenditures estimated are then apportioned among Accomack County, Worcester County, and outside the area. The expenditure percentages are assumed to be 45 percent for Accomack County, 45 percent for Worcester County, and 10 percent for outside the area, based on a study of expenditures resulting from the WFF.

Total visitor recreation expenditures and associated economic output for Accomack and Worcester Counties in 2010 are summarized in Table 3-8. Based on the percentages noted above and the assumption, supported by the Springsted report, *Review of Revenues Received by the Accomack County from the Town* (2010), that Chincoteague brings in 85 percent of tourism revenue for Accomack County, total refuge-related expenditures by visitors was $42.4 million, supporting roughly 593 jobs in the lodging, food (including groceries), and retail sectors.

In addition to the revenue coming from visitors, the refuge itself spends $3.4 million in operations and maintenance each year, three-quarters of which goes to employees who live in the area,

[2] A "visitor" is one person visiting the refuge for all or part of one day.

supporting roughly 44 jobs.[3] In addition, refuge revenue sharing agreements resulted in $99,300 to Accomack County, $2,900 to Chincoteague, and $587 to Worcester County, Maryland in fiscal year 2008.

Table 3-8. 2010 Visitor Recreation Expenditures and Associated Economic Output for Accomack and Worcester Counties (in millions)

Economic Category	Residents	Non-Residents	Total
Retail Expenditures	$2.9	$110.9	$113.8
Economic Output	$3.8	$146.5	$150.3
Job Income	$1.2	$47.4	$48.6
Tax Revenue	$0.6	$10.0	$10.6
Total	$8.50	$314.80	$323.30
Jobs	45	1,749	1,794
Source: Estimates compiled by the Division of Economics, USFWS.			

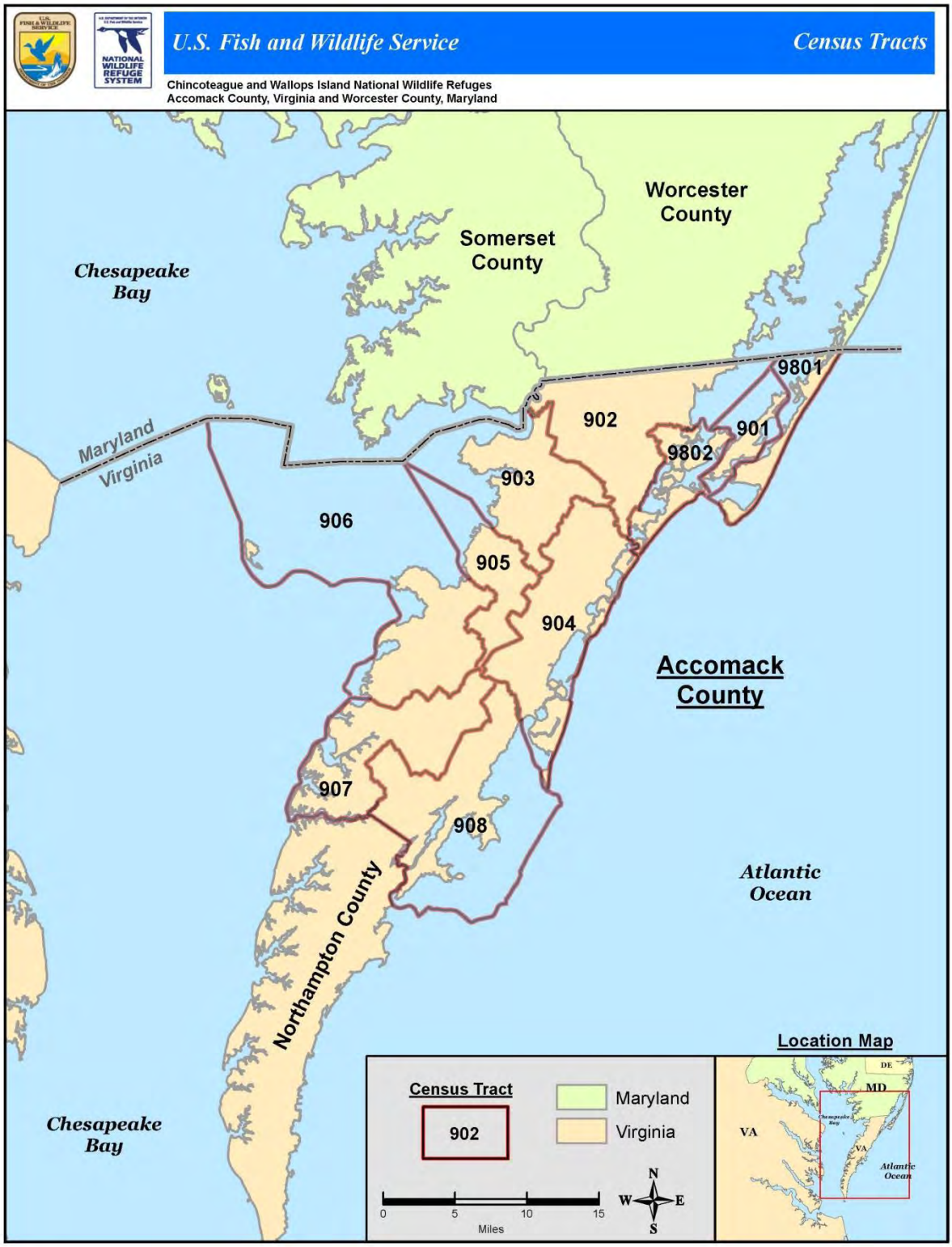
3.5.4 Environmental Justice

Executive Order 12898, General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (1994), requires all Federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. As defined by the EPA on their Web site, environmental justice is the "fair treatment and meaningful involvement of all people, regardless of race, color, national origin or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and Tribal programs and policies.

This section identifies the location of environmental justice populations in the study area, including minorities and those with incomes at or below the federal poverty level. For the purposes of this assessment, the study area is defined as Accomack County, consistent with the definition used in the socioeconomic analysis. The presence of environmental justice populations in the study area is determined based on U.S. Census tract information. Figure 3-16 shows the U.S. Census tracts located in Accomack County.

[3] The jobs number includes both refuge jobs and jobs supported by its spending.

Figure 3-16. Map of Census Tracts for Accomack County



One difficulty in identifying the location of these populations within the study area is the highly seasonal nature of Chincoteague's population, which fluctuates based on peak season tourist activities and services during the summer months. The U.S. Census Bureau recording date of April 1 is not during the peak season for the town, leading to a petition by the Town and County for an adjustment to the Census population count. Specific details about the town economics and employment are provided in Section 3.5.2.

Minority Population

As shown in Table 3-9, the town of Chincoteague (Census Tract 901) contains a much smaller proportion of minorities (5 percent) than the surrounding county (35 percent) or the Commonwealth of Virginia (33 percent). Four of the eight census tracts in Accomack County have a higher proportion of minority population than the county as a whole, as shown in Table 3-9.

Low-Income Populations

Two Federal agencies, the Economic Development Administration (EDA) and the Housing and Urban Development Administration (HUD), have developed thresholds to identify concentrations of low-income populations that are commonly used in environmental justice analysis. EDA defines its eligibility for assistance as 80 percent of national per-capita income. HUD defines poverty level for a family of four at 60 percent of the median national household income. Neither total population for Accomack County nor for the town of Chincoteague is below either threshold. However, half (four) of individual census tracts within Accomack Country fall below the EDA threshold, as shown in Table 3-9 (see Figure 3-16 for the tracts located in Accomack County).

Table 3-9. Low-Income Thresholds and Minority Population by Census Tract (see Figure 3-16 for location of census tracts) NOTE: Underlined figures signal that a census tract has a lower income level than the national poverty level or is above the percent minority of Accomack County.

Area	Per Capita Income	Median Household Income	Minority Population
United States	$27,334	$51,914	28%
80%/60% of National	$21,867	$31,148	N/A
Virginia	$32,145	$61,406	33%
Accomack County	$22,766	$41,372	35%
Tract 901 (Chincoteague)	$29,752	$33,109	5%
Tract 902	$23,343	$43,212	35%
Tract 903	$17,595	$35,368	26%
Tract 904	$17,542	$40,412	50%
Tract 905	$20,496	$41,042	38%
Tract 906	$31,658	$50,278	21%
Tract 907	$22,548	$43,629	39%

Tract 908	$20,033	$35,329	47%

3.6 Land Use Setting and Transportation

The refuge has a history of prior land use, as well as several adjacent land uses. Access to the refuge relies primarily on the personal motor vehicle, but there are a range of adjacent transportation systems, some of which connect to the refuge.

3.6.1 Land Use

This section describes use of land adjacent to the refuge, which includes other federally owned lands, the town of Chincoteague, and Accomack County.

Other Federal Lands

Adjacent Federal lands consist of the NPS Assateague Island National Seashore and the NASA Goddard Space Flight Center's WFF, which has U.S. Navy and Commonwealth of Virginia tenants. The Flight Facility is a center for aeronautic research, and it has a visitor center that is adjacent to the Wallops Island NWR. It has launched approximately 16,000 rockets and expects an increase in commercial launch activity in the near future (Orbital 2008). The Virginia Commercial Space Flight Authority leases space for the Mid-Atlantic Regional Spaceport, which offers launch facilities for government, commercial, and academic/scientific uses and is expected to see an increase in commercial space flight activity (Orbital 2008). In addition, the U.S. Navy's Surface Combat Systems Center is co-located with NASA and the NOAA Command and Data Acquisition Station has leased land for its adjacent facility from NASA since 1965 (Town of Chincoteague 2010a).

Chincoteague Island

Figure 3-17 shows land use as of 2005 within the town of Chincoteague as presented in the *Comprehensive Plan* (2010). The two primary commercial areas are located on South Main Street, in the historic downtown area, and along Maddox Boulevard. The remaining land uses are predominantly residential or vacant, with businesses, tourist facilities, and public facilities scattered throughout the Town. Public facilities include schools, the Chincoteague Center, public service and safety facilities, and municipal offices.

According to the *Comprehensive Plan* (2010), Chincoteague's growth is constrained by land, capacity of the drinking water system, and the lack of a centralized sewage treatment system. Although there is vacant land, only a limited amount is available or feasible for commercial or residential development. For drinking water, Chincoteague is entirely dependent upon 5 miles of pipeline that carry water from underground wells on the mainland to the island; withdrawal of water from these wells is regulated by the Virginia Department of Health. There is currently no central sewage collection and treatment system serving the Island. Instead, wastewater is primarily disposed of by discharge directly into seepage pits, cesspools, or by the use of holding tanks or septic tanks and drain fields. Some residents have recently installed "package" sewage treatment systems.

Accomack County

The Accomack County Comprehensive Plan (2008) includes a thorough description of existing land use. The county's landscape consists mostly of farms, forests, and marshlands, interspersed with towns, villages and hamlets. The distribution of these land uses are shown in the County's zoning

map (see Figure 3-18). The plan reports that 1996 satellite land use imagery shows that less than 2 percent of the county is developed, 35 percent is crop and field, 39 percent is wooded, and 24 percent wetlands. The plan also notes the extensive conservation ownership within the county,

Figure 3-17. Town of Chincoteague: Existing Land Use (2005) (Town of Chincoteague 2010a)

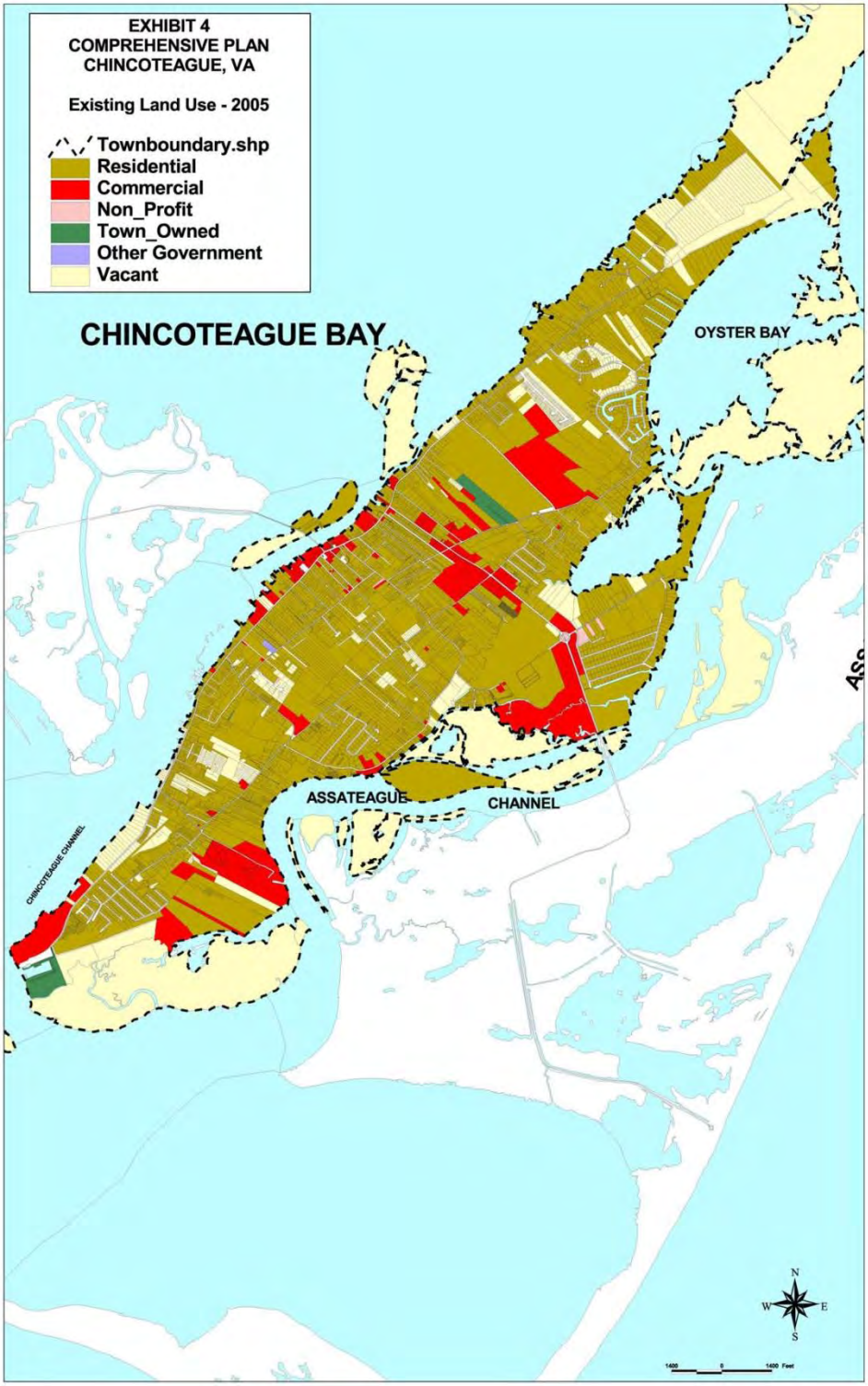
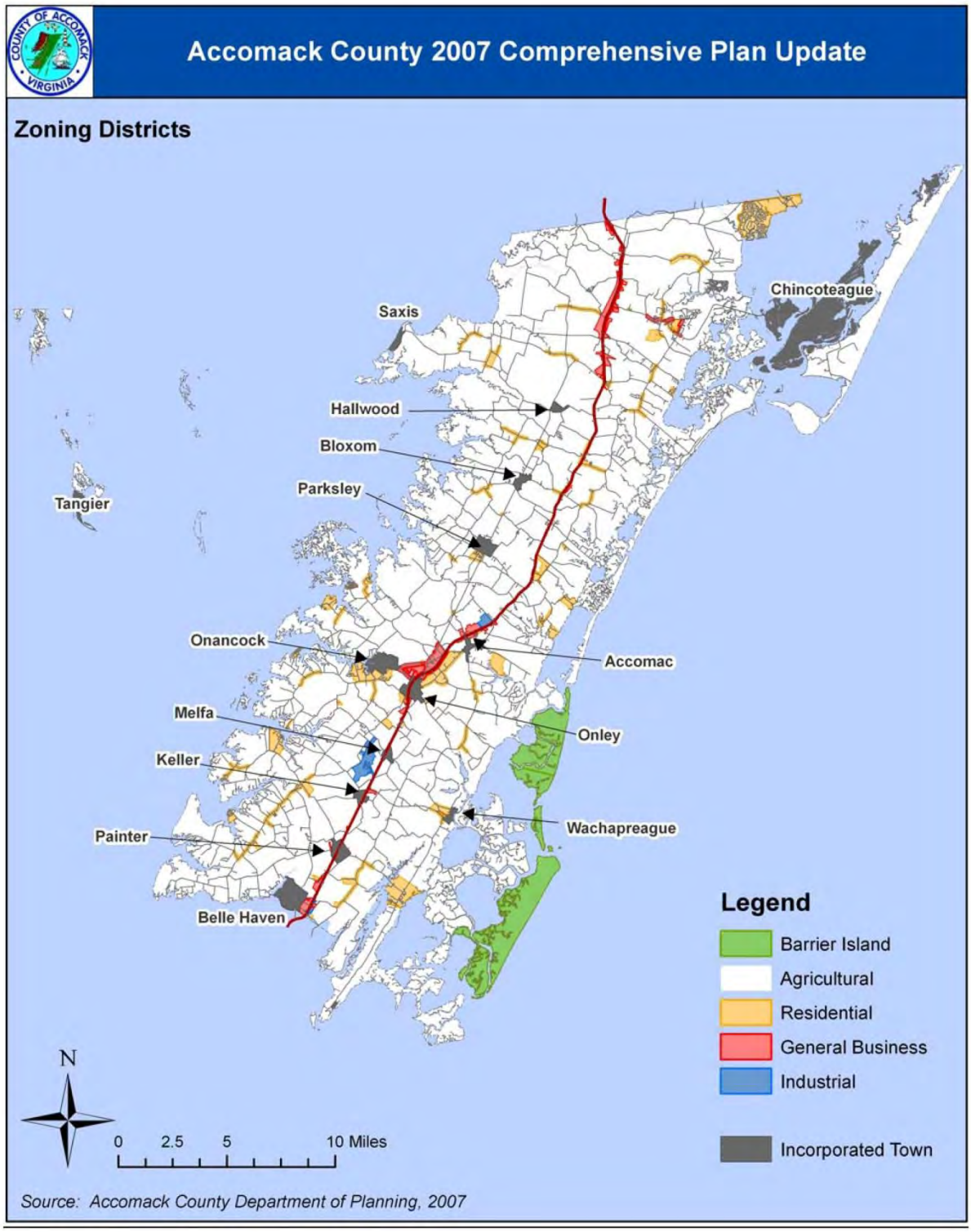


Figure 3-18. Accomack County Zoning Districts (Refuge Lands Excluded) (Accomack County 2008)



including lands owned and managed by the by the NPS, USFWS, VDGIF, the VDCR, TNC, and The Chesapeake Bay Foundation (see Figure 3 19).

Special Designations

In addition to NWR status, the lands within individual refuges may be recognized by additional designations, either legislatively or administratively. Special designation may also occur through the actions of other agencies or organizations. The influence that special designations may have on the management of refuge lands and waters may vary considerably.

Authority for designation of some special management area types (e.g., Research Natural Areas) on refuges lies solely with the USFWS. Wilderness Areas, on the other hand, must be legislatively designated by the U.S. Congress. For most special management area types, responsibility is held by or shared with others.

Refuges may also be included within much larger special management areas designated by other agencies or organizations, such as Western Hemisphere Shorebird Reserves, National Marine Sanctuaries, Estuarine Sanctuaries and Biosphere Reserves. Such designation may result in changes in management strategies, pursuant to this additional designation.

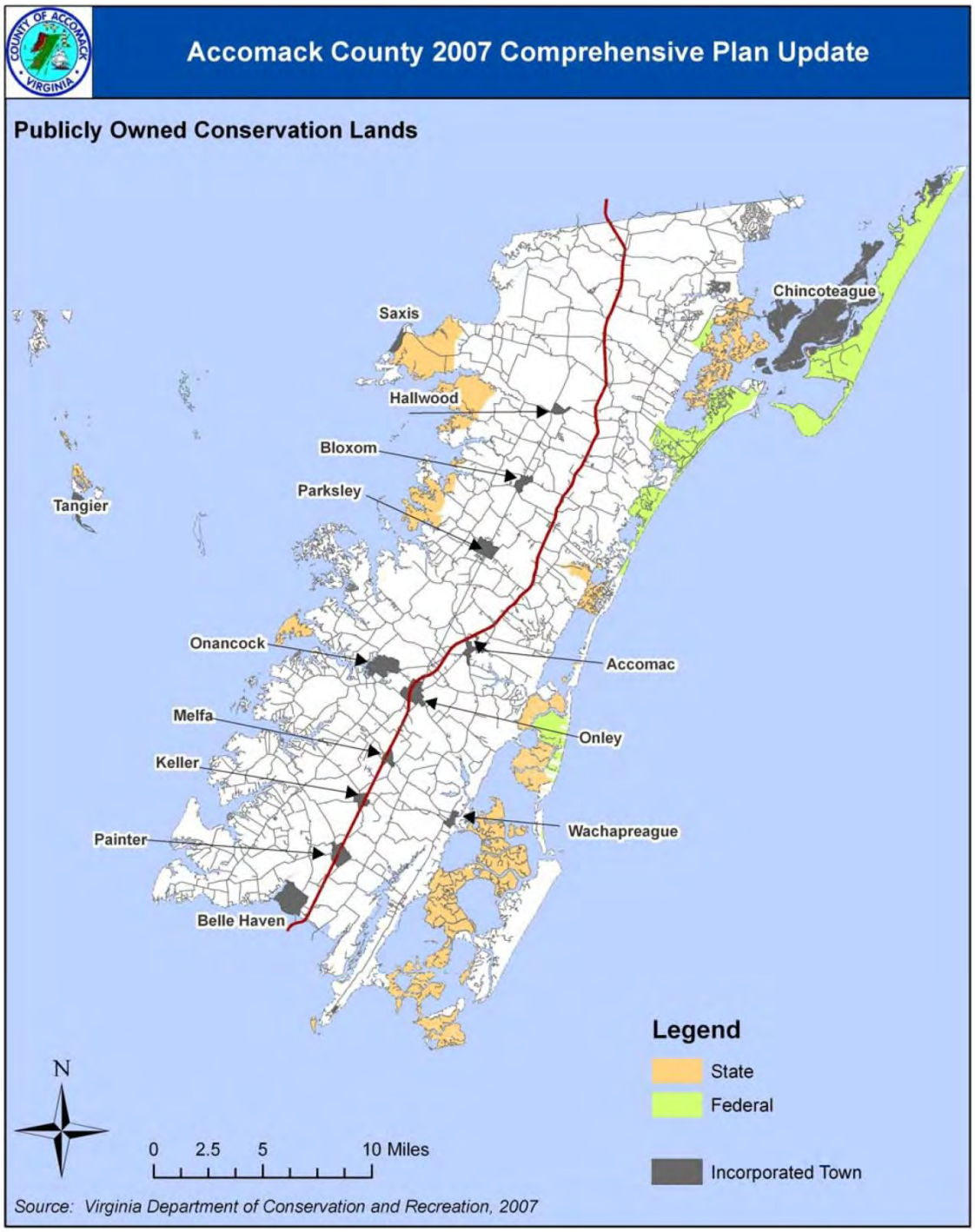
The following specially designated areas exist within the refuge:

Research Natural Areas

Chincoteague NWR contains approximately 150 acres of loblolly pine-shortleaf pine designated as a research natural area. We administratively designate research natural areas on refuges; currently there are 210 such areas on refuges totaling almost 2 million acres. Research natural areas are part of a national network of reserved areas under various ownerships and are intended to represent the full array of North American ecosystems with their biological communities, habitats, natural phenomena, and geological and hydrological formations. In research natural areas, as in designated wilderness, natural processes are allowed to predominate without human intervention. Under certain circumstances, deliberate manipulation may be used to maintain the unique features for which the research natural area was established.

Activities such as hiking, bird watching, hunting, fishing, wildlife observation, and photography are permissible, but not mandated, in research natural areas. Research natural areas may be closed to all public use if such use is determined to be incompatible with primary refuge purposes.

Figure 3-19. Accomack County Conservation Areas (Accomack County 2008)



Western Hemisphere Shorebird Reserves

The Maryland/Virginia Barrier Islands International Reserve, extending along the Atlantic coast of Maryland and Virginia, includes the Chincoteague NWR, Eastern Shore of Virginia NWR, and the Assateague National Seashore. These Barrier Islands are extremely important to migratory shorebirds during both spring and fall migrations. Results obtained from the International Shorebird Surveys (Schulte and Chan 1985 with recent 2008 update) show that of all 600 sites surveyed to the east of the Rocky Mountains, Chincoteague NWR ranks second in species diversity during both spring and fall migrations, and is among the top 10 for sites with greatest maximum counts. Further investigation may likely reveal that the Barrier Islands host numbers of shorebirds well exceeding 500,000 annually. Additional information regarding the Maryland/Virginia Barrier Islands International Reserve can be found at *http://www.whsrn.org/index.html*.

Assateague Island National Seashore

Assateague Island National Seashore was authorized by Congress in PL 89-195, on September 21, 1965, for the purpose of protecting Assateague Island and ". . . for public outdoor recreation and enjoyment . . ." The National Seashore includes approximately 48,000 acres of land, marsh wetlands and water, featuring the 37 miles of Assateague Island's beautiful sandy coastline. Chincoteague NWR (approximately 14,000 acres) and Assateague State Park (approximately 800 acres) are located within the boundaries of the National Seashore. The Seashore exists to preserve the unique mid-Atlantic coastal resources and natural ecosystem conditions and processes upon which they depend while providing high quality resource-compatible recreational opportunities.

Globally Important Bird Area (IBA) – Audubon

The Virginia Barrier Island Lagoon System, which extends from the Maryland-Virginia border south along the eastern coast of the lower Delmarva Peninsula, meets the criteria for, and has been designated as, an IBA by the Audubon Society. The area provides breeding habitat for 100 percent of Virginia's piping plover population, as well as a majority percentage of many other bird populations, and also provides wintering and migration locations for species at risk, such as the red knot.

Coastal Bays Program – National Estuary Program

Established in 1987 under the Clean Water Act, the National Estuary Program was developed to protect economically and environmentally sensitive estuaries across the United States by engaging all user groups. As part of the National Estuary Program, the Coastal Bays Program is a partnership among the towns of Ocean City and Berlin, NPS, Worcester County, EPA, and the Maryland DNR, Agriculture, Environment, and Planning, to manage and protects the land and waters of Assawoman, Isle of Wight, Sinepuxent, Newport, and Chincoteague bays.

UNESCO and DOI

The coastal barrier island/lagoon system of Chincoteague NWR has also been designated a World Biosphere Reserve by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in recognition of its great ecological value. Moreover, the DOI designated the area a National Natural Landmark in recognition of its outstanding natural values.

Wilderness Areas

Chincoteague and Wallops Island NWRs have been reviewed for their suitability in meeting the criteria for Wilderness Areas, as defined by the Wilderness Act of 1964. In 1974, the USFWS recommended that 1,740 acres on Assateague Island be established as part of the NWPS. Of this,

1,300 are located in Chincoteague NWR (882 acres in Virginia and 418 acres in Maryland) and 440 acres are within the boundaries of Assateague Island National Seashore in Maryland. In addition, 4,760 acres, mostly located in Maryland, were recommended as potential wilderness, to become part of the wilderness when nonconforming uses and structures were eliminated (USDOI 1974). However, at the present time, no action has been taken in regard to this recommendation and there exist no "congressionally designated wilderness lands" within the refuge.

Atlantic Coastal Bays Critical Area

The Chesapeake Bay Critical Area Protection Act was enacted in 1984 by the Maryland General Assembly to help reverse the deterioration of the Chesapeake Bay's (and later the Atlantic Coastal Bay's) environments. The Law and Criteria were designed to foster more sensitive land use and development activity along the shoreline of the Chesapeake Bay, Atlantic Coastal Bays, their tributaries, and tidal wetlands and to ensure the implementation of appropriate long-term conservation measures to protect important habitats. The Atlantic Coastal Bays, including Assawoman Bay, Isle of Wight Bay, and the St. Martin River, Sinepuxent Bay, Newport Bay, and Chincoteague Bay (totaling approximately 30,000 acres), were added to the Critical Area Program in 2002. The three goals of the Critical Area Program are: the protection of water quality; the conservation of fish, wildlife, and plant habitat; and, the accommodation of future growth and development without adverse environmental impacts. The law requires the establishment and maintenance of a minimum 100-foot naturally vegetated buffer adjacent to all tidal waters, tidal wetlands, and tributary streams.

3.6.2 Transportation and Access

Automobile Traffic and Circulation

Private automobile travel is the primary mode of transportation to the refuge from the mainland (see Figure 3-20). U.S. Route 13 is the principal north-south corridor linking the Eastern Shore of Virginia (Accomack and Northampton Counties) with the mainland of Virginia to the south and the State of Maryland to the northeast. On the Eastern Shore, U.S. Route 13 is a four-lane arterial with a variable-width median separating northbound and southbound traffic throughout most of the corridor.

U.S. Route 13 provides a direct connection to Route 175, the only access road to Chincoteague Island and the Virginia section of Assateague Island. Route 175 runs east across the Delmarva Peninsula from Route 13 to the town of Chincoteague, crossing over the Wire Narrows and Black Narrows Salt Marshes. From Route 13, Route 175 is a two-lane road with no shoulders until its intersection with Route 679, where the road broadens to include paved shoulders until it reaches the shore. The John Whealton Memorial Causeway ("Route 175 Causeway"), built in 1922, is a 2.5-mile stretch of two-lane road with no shoulders and a limited number of pull-off zones. The Causeway connects to Chincoteague Island via the Chincoteague Channel Route 175 Bridge, which leads to Maddox Boulevard. There is one parking area off of the Causeway, at Queen Sound Landing, for fishing and boat launching.

The road network in the town of Chincoteague consists of two-lane commercial and residential streets with varying levels of traffic and service. Circulation on local roadways features local and non-local traffic accessing residential, commercial, and recreational destinations.

Once on the refuge, visitors can access the various refuge sites, including the recreational beach, via the two-lane Beach Road. Refuge roads and parking are discussed further in Section 3.9.

Figure 3-20. Transportation Access to the Refuge

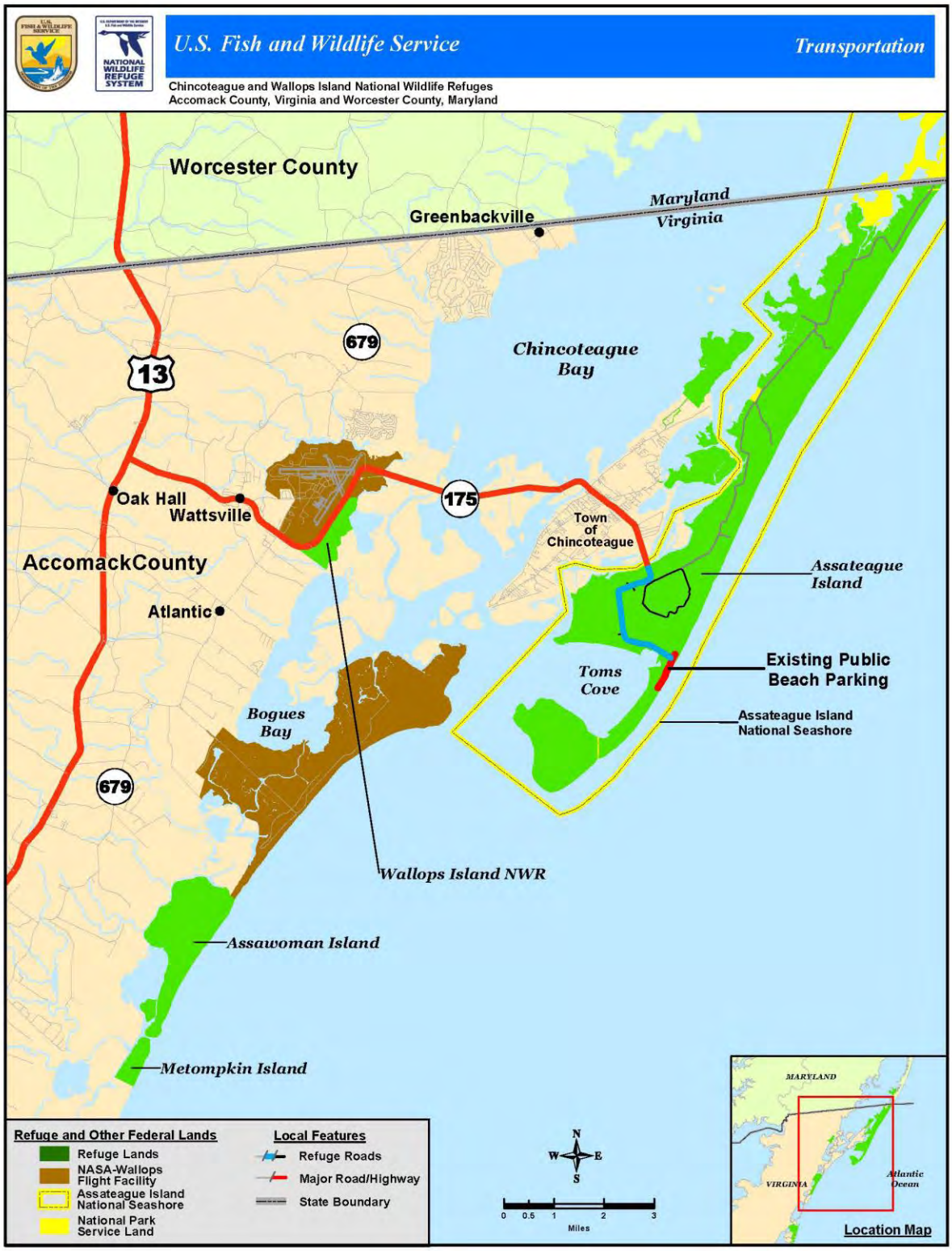
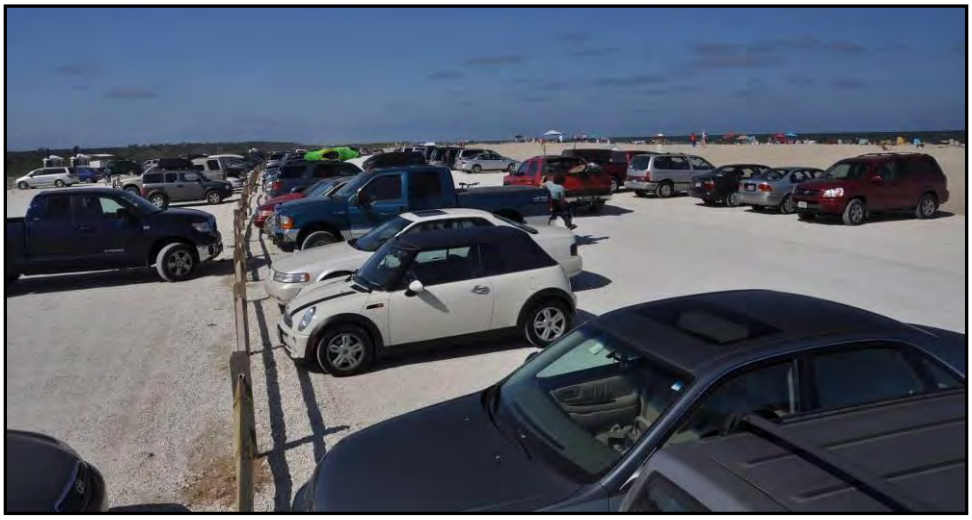


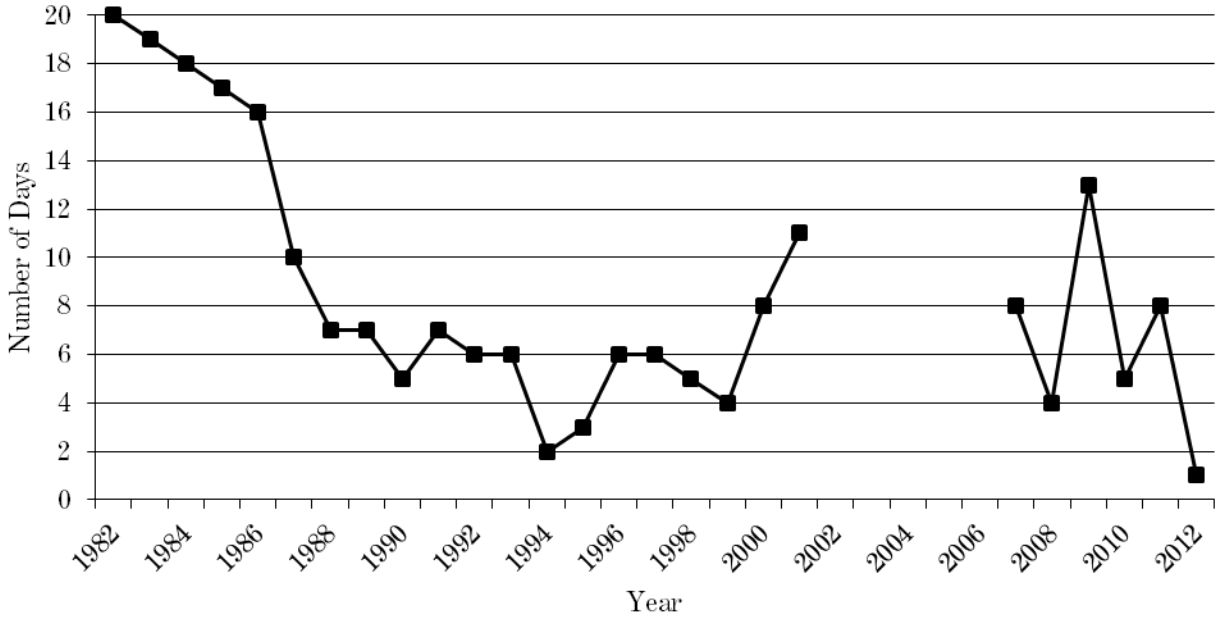
Figure 3-21. Chincoteague NWR Beach Parking Lot (Volpe Center July 2009)



The recreational beach parking consists of four unpaved parking areas at the terminus of Beach Road at the recreational beach (see Figure 3 21). The Chincoteague NWR Master Plan (1993a) references 961 existing spaces on the beach, but the spaces are not marked so the actual maximum capacity is reported as higher by refuge staff, dependent on people's parking and the size of vehicles. Parking capacity at the beach lots is sufficient for most days of the year but occasionally the lots reach capacity resulting in temporary closures. In addition, storm events can temporarily close the lots due to overwash and subsequent restoration efforts. From 1982 to 2001, the refuge and Seashore kept records of the frequency and dates for when the beach parking lots reached capacity; the refuge began recording frequency again in 2007 (see Figure 3-22). A review of data from 2000 and 2001 indicates that closures last from 30 minutes to 4 hours and were always initiated between 11:00 a.m. and 2:00 p.m. There are no similar records for a more recent year, but refuge staff anecdotally reported that there are typically 4 to 6 closures a year, also occurring between the peak hours noted above, and lasting approximately 30 minutes to 2 hours. These closures are highly weather-dependent but usually occur on the 4th of July if it is a 3-day weekend, and on the first two Saturdays and Sundays in August. The capacity closure data do not include closures due to damage to the parking from storm events.

In terms of parking occupancy for non-summer months, the refuge conducted hourly manual parking counts (approximately 9 a.m. through 4 p.m.) for the weekends of April and May 2010 and September 2010 through February 2011. The data indicates that total parked vehicles did not surpass 200 between November and April, and did not surpass 480 from October through May except for Memorial Day weekend.

Figure 3-22. Chincoteague NWR Entrance Closures Due to Full Beach Parking Lots (Seashore and refuge staff)



Intelligent Transportation and Traveler Information Systems

The refuge has been expanding its intelligent transportation and traveler information systems on the refuge using funding from a grant from the Paul S. Sarbanes Transit in Parks and technical assistance from Eastern Federal Lands, a division of the Federal Highway Administration's (FHWA) Office of Federal Lands Highway. The refuge purchased a solar-powered, portable variable message sign (VMS) in October 2009 to inform visitors of refuge and beach conditions, in particular during storm events and parking lot closures. In 2012, the refuge successfully re-activated an AM radio station, installed a traffic counter for the beach parking area, and explored options to sell passes and provide information via off-site kiosks. At the regional level, although VDOT manages a traffic and traveler information website to provide road condition information, it does not yet cover the Eastern Shore.

Public Transportation

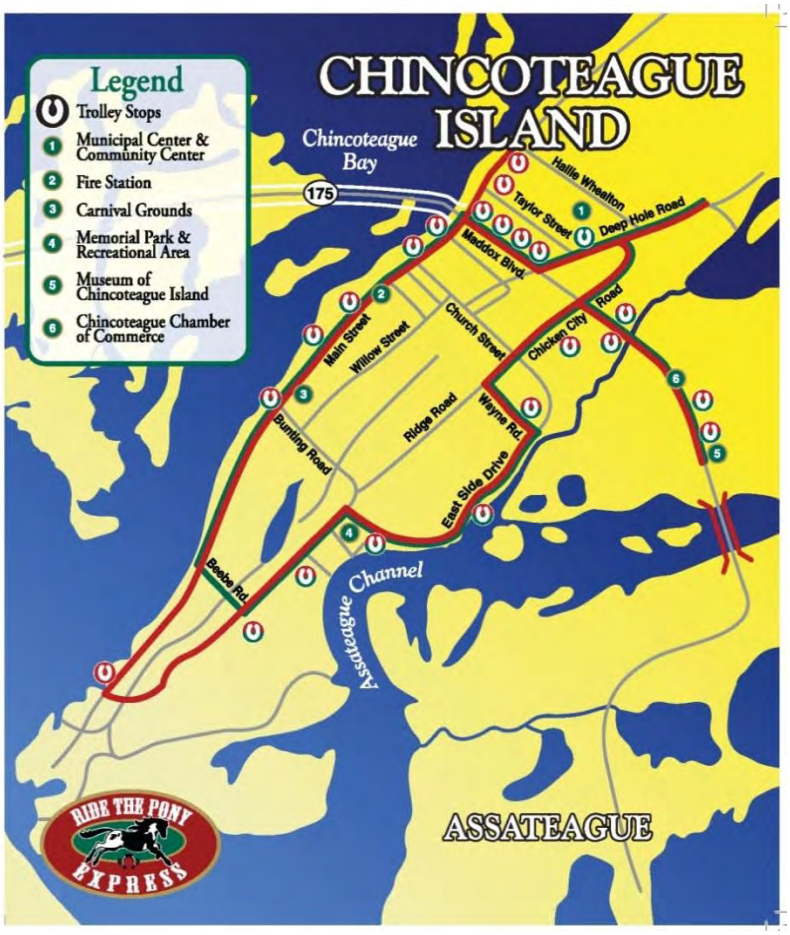
There are two public transportation systems that serve the town of Chincoteague. The town has a public transit system, the Pony Express, which is owned and operated by the Town of Chincoteague and that is also used for a historic tour of the town. Accomack and Northampton counties also have a public transit system, Shore Transit and Rideshare (STAR) Transit, which currently provides limited service to the town of Chincoteague. The refuge's friends group, the CNHA, provides an interpretive tour and has partnered in the past with the refuge to offer transportation to the beach when the parking lots were temporarily destroyed by Hurricane Irene. The town of Chincoteague and CNHA also provide special event public transportation during the Annual Pony Penning in July. The town of Chincoteague is not served by intercity bus transportation.

Pony Express

The Pony Express was initiated in 2004. It is a seasonal trolley that serves primary community and tourist sites throughout the Town but does not currently serve the refuge. The service has two routes (see Figure 3-23) and only operates in the evening from approximately 5 p.m. to 10:30 p.m. every day from the first weekend in June through the end of August. Extended service is provided after 10:30 p.m. on specific dates in May, July, and October and daytime service is provided the week of the Pony Swim and Auction (see below). The service also operates on the weekends in May, September, and October. Frequency varies by route and stop but is either every 30 or 60 minutes. The Town owns three trolleys. Fares are $0.25 per ride.

The Pony Express trolleys are also used by the History Tour Volunteers for an historical tour of the Town that is offered on Tuesday and Thursday afternoons from mid-June through Labor Day. Adult fares are $3 and reduced fares ($2) are available for riders aged 2 to 12. Children under 2 years of age ride free.

Figure 3-23. Pony Express Routes



STAR Transit

STAR Transit began in 1996 and currently runs four fixed-route bus services on weekdays, one of which served the town of Chincoteague from 1996 to 2010, and a demand-response service. STAR Transit offers a deviated route service (1.5 miles) on all its routes for those with an approved ADA

application and its buses are all equipped with external bicycle racks. For 2012, STAR Transit received Federal Transit Administration (FTA) Section 5317 (New Freedom) funds to begin deviated fixed-route service on weekdays to Chincoteague to provide service for the elderly, disabled, and unemployed community from Chincoteague to Route 13, where it will connect to one of STAR Transit's existing fixed route services (KFH Group 2011).

CNHA Services

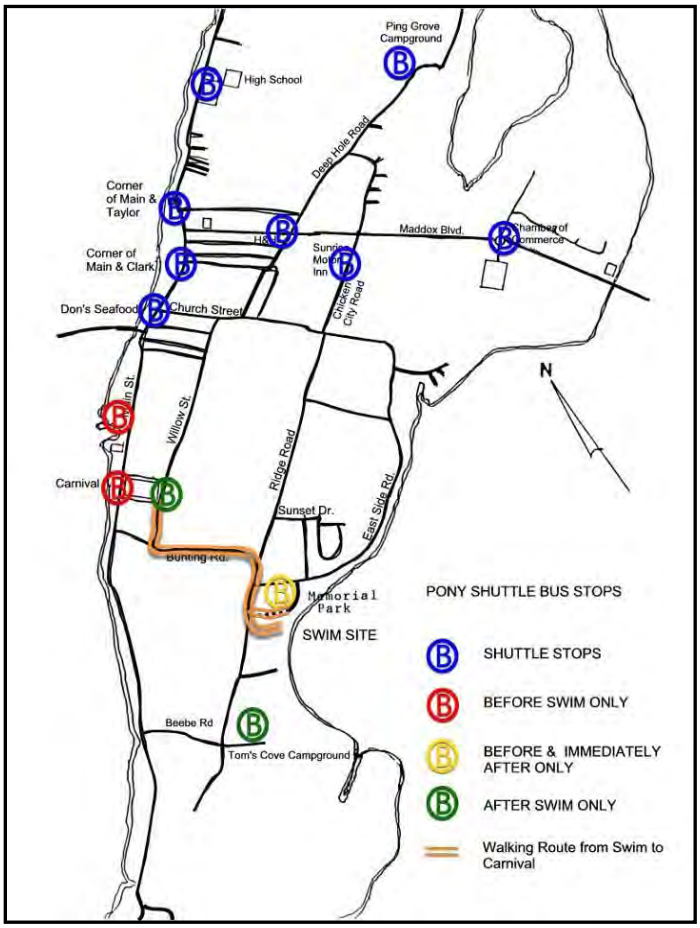
The CNHA provides a seasonal, interpretive bus tour service within the Chincoteague NWR under a cooperative agreement. The service began in 2004 to provide opportunities for the public to develop an understanding and appreciation for wildlife. As a nonprofit enterprise, CNHA uses proceeds collected from the tour to support its interpretation services. The tour operates from April through November and takes visitors to a part of the island that is not publically accessible by vehicles, including one of the best locations to see the Chincoteague ponies. The tour departs from the Visitor Center parking lot and travels to the end of the Service Road and back, a distance of approximately 15 miles round trip. The tour lasts 1.5 hours and is accompanied by an interpreter/guide who provides information about wildlife and ecology. The cost in 2012 is $12 for adults, $8 for CNHA members (except July and August), and $6 for children ages 2 to 12. The CNHA operates a used, 32-seat bus equipped with air conditioning and a wheelchair lift. CNHA contracts with a small company, Eastern Shore Action, to provide drivers.

In 2011, after Hurricane Irene damaged the parking lots and recreational beach (see section 3.9.1), the public beach was temporarily moved to an alternate site outfitted with lifeguard stands and portable toilets. This location was about 1.5 miles away from the closest refuge parking lots. CNHA partnered with the refuge to provide temporary bus transportation every 30 minutes from 10 a.m. to 5 p.m. from the parking for the Herbert H. Bateman Educational and Administrative Center and Wildlife Loop to Swan Cove Trail, from where visitors could walk one-half mile to the beach (USFWS "CNHA Offers Shuttle Service," 2011)). The fare per person was $1. The service ran for 5 days and served 3,286 beach visitors, according to refuge staff.

Pony Swim and Auction Special Event Transportation

During the Annual Pony Swim and Auction each July, several special event transportation services are offered. During the round-up of the northern pony herd, CNHA provides bus services from the Herbert H. Bateman Educational and Administrative Center to the beach on the morning of the Beach Walk, when the ponies from the northern herd are brought to the southern pony corral in preparation for the swim. On the day of the Pony Swim, the Town offers a free shuttle service from Chincoteague High School, which is used for parking, to Memorial Park, near the site of the Pony Swim, where the ponies come ashore from Assateague Island, and then back to the High School or site of the Carnival (see Figure 3-24). The shuttle consists of Accomack County school buses and a rented handicapped-accessible vehicle (note that the Pony Express trolleys maintain their scheduled service). Buses begin operation at 5 a.m. from the High School and operate until approximately 2 p.m., one hour after the ponies reach the Carnival. Volunteer guides are present on each bus.

Figure 3-24. Pony Swim Shuttle Route



Non-motorized Transportation

The refuge has several facilities and opportunities for walking, bicycling, and non-motorized boating. This section focuses on bicycling for transportation; other activities will be covered under section 3.8 Visitor Services and 3.9 Refuge Administration.

Cycling in the town of Chincoteague and within the refuge is a popular recreational activity as well as a mode of transportation for visitors and residents. The bicycle connection between the refuge and the Town is very important because many bicyclists travel from the Town, where they are staying or where they rent bicycles, into the refuge. Rental options within the Town include a variety of two-wheel bicycles (e.g., recumbent, tandem, side-by-side tandem) as well as four-wheel bicycle surreys. Many bicyclists also drive into the refuge with their bicycles to park at the Wildlife Loop or one of the other parking areas to bike recreationally. Limited data exists on the number of cyclists and bicycle trips to and within the refuge, but annual estimates range from 65,000 (Chincoteague Recreation and Community Enhancement Committee, May 19, 2009) to 75,000 (FHWA 2008) bicycle trips between the Town and refuge, with up to 300,000 bicycle trips within the refuge.

Within the refuge, bicycle use enables visitors to observe wildlife. Construction of bicycle trails began in the 1970s and 1980s and currently consists of several trails throughout the refuge (see

Figure 1-4 in chapter 1). An alternating paved and gravel bicycle trail runs from Chincoteague across the bridges between Assateague and Chincoteague (see Figure 3-25) to the Woodland Trail parking lot. It begins at the bridge between Chincoteague and Assateague islands as a paved trail that runs to the Wildlife Loop parking area and shortly beyond, where it then joins the road as a gravel path. The Wildlife Loop itself offers a 3-mile paved loop for exclusive use by bicyclists, runners, and walkers each day before 3 p.m., after which vehicular traffic is permitted. From the Wildlife Loop, bicyclists can access Beach Road via the paved Black Duck Trail or access the beach via the paved Swan Cove Trail. The Swan Cove Trail formerly ran south along the beach to the lifeguarded beach but the refuge stopped maintaining it after it was repeatedly washed away by wave and sand action. In response to the lost connection to the lifeguarded beach, the refuge provided bicycle parking and an emergency cellular phone booth where the Swan Cove Trail met the beach. However, such services were badly damaged by the 2009 nor'easter and have not been replaced. The current plan for the future is to develop a bicycle trail along Beach Road to replace the Swan Cove Trail connection.

Figure 3-25. Bicycle Trail over the Bridge (Volpe Center July 2009)

In 2008, the refuge received a implementation project grant for $600,000 from the FTA's Paul S. Sarbanes Transit in Parks Program to extend the existing pedestrian/bicycle path a quarter-mile (0.25) from the Assateague Channel Bridge to the Maddox Boulevard traffic circle (see Figure 3-26). After design and environmental compliance work, in 2012 a bicycle lane was added along Maddox Boulevard from the traffic circle to the end of private development, and an elevated boardwalk trail was constructed along the remaining road section before the bridge.

Figure 3-26. Section of Maddox Boulevard Bicycle/Pedestrian Trail Extension Before/After Trail Installation (USFWS refuge staff 2008 and Volpe Center March 2012)

Alternative Vehicles

There are a number of rental options for small motorized vehicles for visitors and some electric vehicle use, primarily modified golf carts, by residents. Visitors to Chincoteague have the opportunity to rent several small motorized vehicles including: mopeds, scooters, and the Scoot Coupe, a three-wheeled, two-passenger scooter. The Scoot Coupe meets all Federal safety standards for motorcycles and are "street legal" in all 50 states. Depending on the model, the Scoot Coup is classified as either a moped/scooter or motorcycle and operates at a top speed of 30 or 55 miles per hour (MPH), respectively.

3.7 Visitor Services

Chincoteague NWR provides a range of recreational opportunities, including the six wildlife-dependent activities as well as beach recreation and other uses, while Wallops Island NWR is limited to public access for hunting only. For all activities and facilities, the refuge maintains some mobility-impaired access, such as paved trails, designated mobility-impaired parking spaces, ramp access to boardwalk at the NPS Visitor Center, two beach wheelchairs, and one designated accessible hunting zone. The USFWS and NPS visitor centers are also accessible.

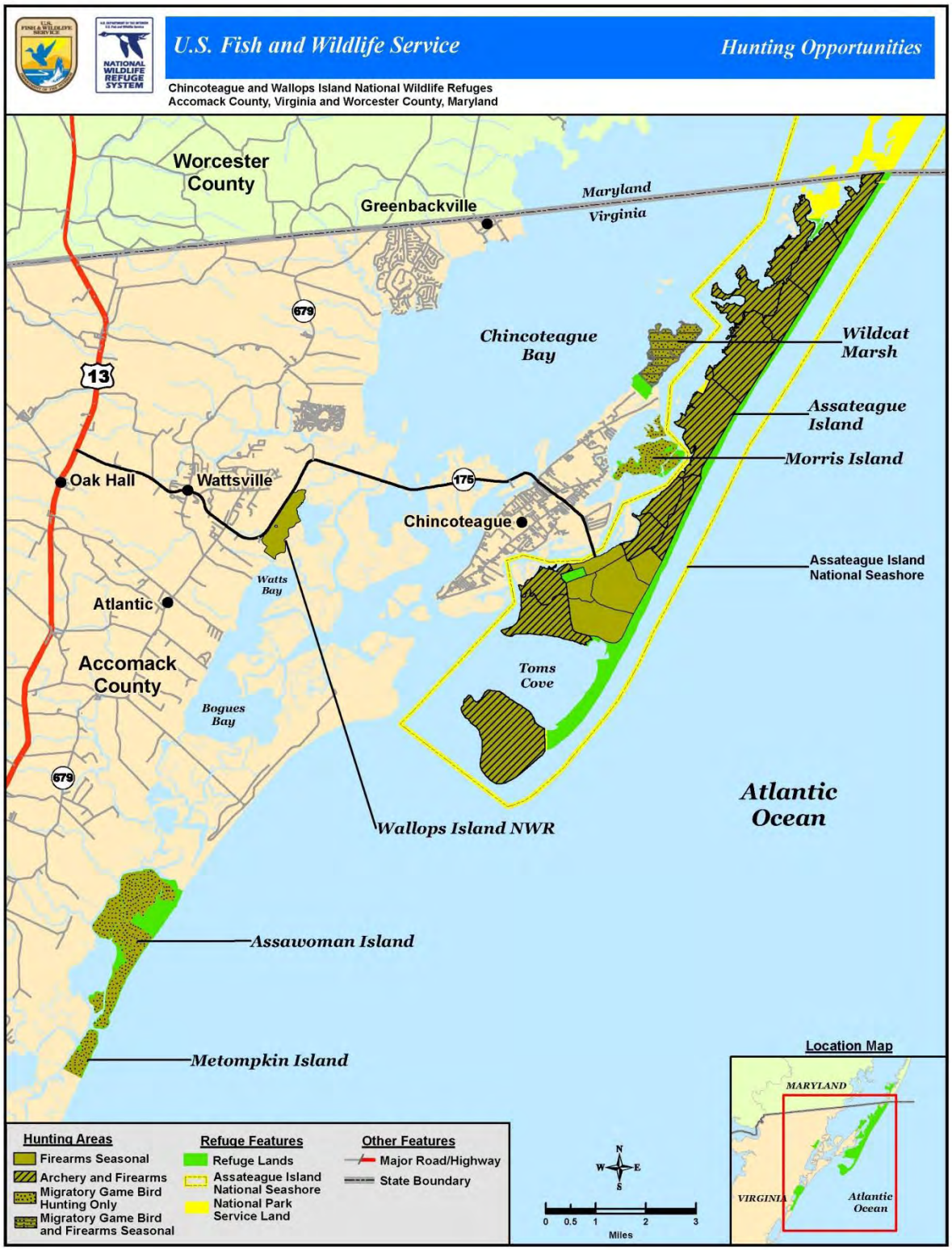
3.7.1 Hunting

Big game hunting and migratory game bird hunting opportunities are provided in designated areas throughout the refuge. Figure 3-27 provides an overview of where each opportunity is allowed. Brochures with specific regulations and maps are available on the refuge Web site: *http://www.fws.gov/northeast/chinco/hunting.html*. All hunting is conducted within the regulatory framework established annually by the Commonwealth of Virginia.

Big Game Hunting

The current big game hunting program for Chincoteague NWR consists of sika (Oriental Elk) and white-tailed deer with archery or firearms. The opportunity for big game hunting is controlled through a lottery process. Once selected by the lottery system, firearm hunters must attend a firearms orientation session prior to hunting on the refuge. The refuge is divided into 11 primary hunting zones, with a few of those zones that are located closer to developed portions of the refuge subdivided for smaller force firearms for safety considerations to the public. A user fee helps defray the annual administrative costs of the program. In 2011, big game hunting saw 1,230 visits.

Figure 3-27. Hunting Opportunities



Each year the deer herds are evaluated, after which species hunted, season lengths, and bag limits are determined for the Annual Hunt Program. Approximately 150 to 200 sika are taken each year, from an estimated populated of 600 to 800.

Wallops Island NWR only allows hunting of white-tailed deer, per the same conditions as described above, including the lottery. Each fall, 25 hunters participate in the big game hunt, either with firearms or archery. A user fee helps defray the annual administrative costs of the program. In 2011, 60 visits were recorded for hunting. All big game lottery applications, which have a $5 application fee, and permits for hunting ($20) are administered online.

Migratory Game Bird Hunting

Hunters must obtain a Migratory Game Bird Hunting permit in order to hunt on the refuge. Hunters must also possess valid hunting license, stamp(s), and/or permits as required by the Commonwealth of Virginia and Federal statutes/regulations. Migratory game bird hunting occurs in the fall on Thursdays, Fridays, and Saturdays and is only provided via water access for four hunt units, Wildcat Marsh, Morris Island, Assawoman, and Metompkin. Hunters may harvest ducks, geese, swans, coots, and rails. In 2011, only 99 visits occurred on the refuge for migratory bird hunting, possibly because the hunt areas are only accessible by boat.

Other Programs

The refuge is currently working with the Wounded Warriors Project, a non-profit dedicated to fostering successful, well-adjusted wounded service members through programs for the mind and body, to develop an opportunity for hunters with disabilities.

3.7.2 Fishing

Surf fishing, crabbing, and clamming are among the most popular wildlife-dependent recreational activities conducted on the refuge. For all activities, Virginia Marine Resources Commission regulations must be observed, including licenses and catch and size limits. Anglers age 16 and older must possess a valid Virginia Saltwater Fishing or Potomac River Fisheries Sport Fishing license. Anglers who are exempt from licensing and holders of out of state reciprocal licenses must register with the Virginia Fisherman Identification Program (FIP). Visitors may fish after refuge operating hours ("overnight") by procuring an overnight fishing permit from NPS. The refuge does not host any fishing tournaments.

Assateague Island

Crabbing and Clamming

Crabbing and clamming on Chincoteague NWR are allowed as recreational activities in accordance with Virginia Marine Resources Commission regulations.[4] Crabbing is allowed in designated areas in Swan Cove Pool (F Pool) and along Beach Road. Clamming is also allowed in the bayside areas for Toms Cove, also accessible via the Bi-Valve Trail. The refuge incorporates crabbing and fishing into its various youth and visitor programs.

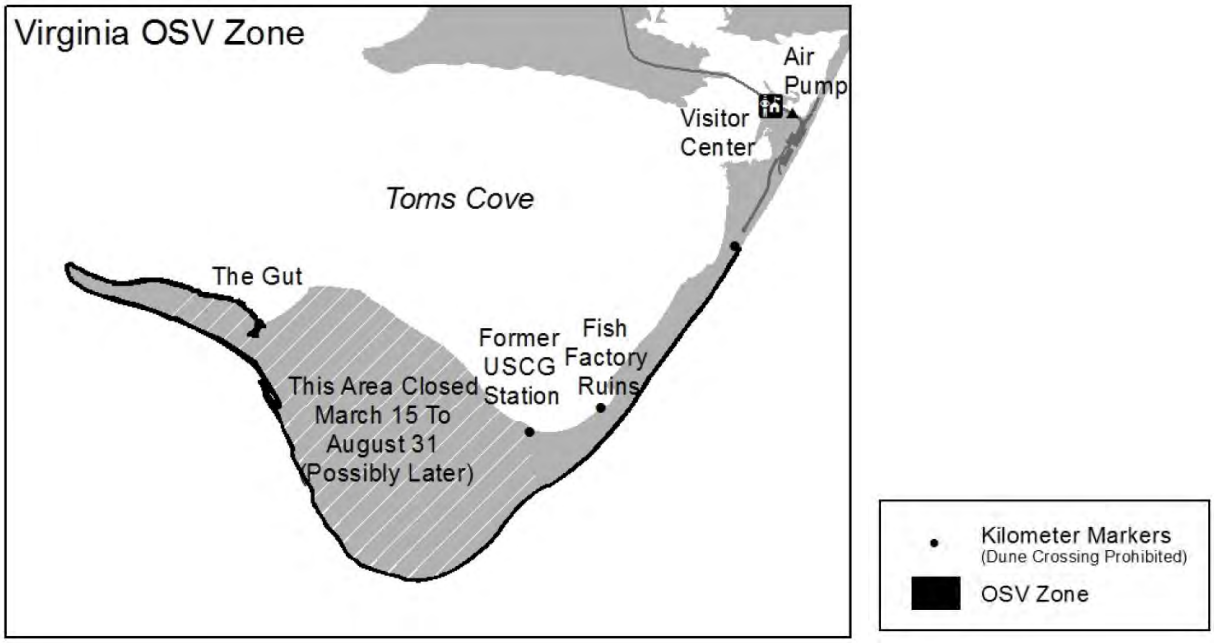
[4] http://www.mrc.virginia.gov/regulations/recfish&crabrules.shtm

Surf Fishing

Some of the fish common to the waters around the refuge are bluefish, striped bass, summer flounder, Atlantic croaker, spot, and red drum. Clearnose skate, bullfish, and southern stingrays may be caught, as well as smooth or spiny dogfish sharks. Surf fishing is allowed anywhere along the Atlantic Ocean on Assateague Island outside of the life-guarded areas and areas closed for coastal nesting birds. NPS and USFWS provide joint programs that include surf fishing demonstrations.

The surf fishing areas south of the current parking lots (overwash and Toms Cove Hook) are also accessible via OSV use, which is administered by NPS and the refuge. Such access is limited to certain times and areas to provide maximum protection to prime nesting habitat for coastal nesting birds. OSV use is limited to the OSV zone, located between the recreational beach and the end of Toms Cove Hook (see Figure 3-28). The Hook portion of the zone is closed to OSV use from March 15 through August 31 or until the last shorebird fledges; the Overwash portion is closed intermittingly during the same period based on nesting behavior. Access can be further restricted based on wildlife management practices. OSV use requires a permit and specific equipment, both of which are set by NPS, and is restricted to 48 vehicles at any one time when the entire zone is open and to 18 vehicles when the Hook portion is closed. More information on OSV use regulations can be found at the NPS webpage: http://www.nps.gov/asis/planyourvisit/osv.htm.

Figure 3-28: Virginia OSV Zone (Source: NPS)



Southern Barrier Islands

Fishing is allowed on Assawoman Island but requires a refuge permit to land a boat to fish the area. However, parts of the island may be closed based on nesting behavior.

3.7.3 Environmental Education and Interpretation

The refuge works with local kindergarten through grade-12 schools, communities, and educational organizations to provide classroom and hands-on programs both on and off the refuge for youth.

Partner agencies include the NPS, local school districts, Eastern Shore Environmental Education Council (sponsored by the Eastern Shore Soil and Water Council), SPARK, CBFS, formerly the Marine Science Consortium (MSC), and CNHA. Activities are conducted throughout the region but on the refuge are concentrated on several trails as well as the Herbert H. Bateman Educational and Administrative Center, a green facility that opened in 2003, offering 5,000 square feet for interpretive natural history exhibits, educational programming, a 125 seat auditorium, and a classroom/wet lab.

The refuge currently provides environmental education opportunities for approximately 7,500 participants annually, primarily through classroom and onsite programs with students as well as programs in collaboration with other groups. The refuge serves students by working with NPS, CBFS, Accomack and Northampton County school districts, Girl Scouts, Boy Scouts, and Home School students, among others. Student programs occur in the classroom of the Herbert H. Bateman Educational and Administrative Center and in the environmental education pavilion (e.g. Habitat Hunting, Forest Ecology, Nature and ME, Critters and Gadgets). The refuge also offers teacher workshops and Teacher Guided Learning Opportunities when staff guided programs are not available. NPS offers several programs from Toms Cove Visitor Center (e.g. Aquarium Talk, Beach Walk, Marine Explorers, and Salt Marsh Adventure). The refuge is also participating in collaboration with NASA, CBFS, TNC, and the Eastern Shore Community College called "Science on the Shore" to "provide the Eastern Shore community with an understanding of how local science-based research and preservation techniques are used to solve challenges that impact the nation."

The refuge currently provides interpretive opportunities to approximately 68,000 participants annually, primarily through self-guided interpretation but also through some guided programs. Refuge staff give presentations at the Herbert H. Bateman Educational and Administrative Center and also lead popular bird walks, crabbing and surf fishing demonstrations, marsh walks, and photography hikes, and assist with NPS beach campfires. Interpretative hubs are located on several trails, with one trail and pavilion designated for environmental education. The refuge maintains exhibits and videos at the Herbert H. Bateman Educational and Administrative Center. The refuge also maintains an outdoor information kiosk at the Virginia New Church Welcome Center on Route 13. The refuge offers multiple week-long day camps, the Children in the Woods Day Camp, for children ages 8 to 11 with activities such as crabbing, clamming, archery, surf fishing, bicycling, and kayaking. The Camp is sponsored by CNHA. NPS also offers interpretive exhibits at the visitor center and activities, such as kayaking programs from Toms Cove. Finally, the refuge holds eight major special events: Great Backyard Bird Count (February), Junior Duck Stamp Contest (April), International Migratory Bird Day Celebration (May), Sunrise Pony Walk during Pony Penning (July), Annual Beach Clean-up (September), National Public Lands Day (September), National Wildlife Refuge Week (October), and Waterfowl Weekend (November).

3.7.4 Wildlife Observation and Photography

Chincoteague NWR provides outstanding wildlife viewing opportunities throughout the year, including migrating birds, resident sika and white-tailed deer, Chincoteague ponies, and others. Birding in particular is a popular wildlife observation activity, with popular sites at Swan Cove Pool (F pool), Toms Cove, Woodland Trail, and Snow Goose Pool (B-South Pool) in the Wildlife Loop. The Wildlife Loop, Marsh Trail, and Woodland Trail, as well as water access, various pull-offs along Beach Road, and the natural beach itself, provide wildlife viewing and opportunities for

amateur and professional photographers. In partnership with the CNHA, the refuge hosts lectures on wildlife and conservation topics throughout the year.

3.7.5 Recreational Beach Use

The beaches of Assateague Island offer a unique experience in the mid-Atlantic area as they exist primarily in an undeveloped setting unlike other nearby beaches, such as Virginia Beach, Virginia or Ocean City, Maryland that are heavily developed. This natural setting draws many families seeking activities such as sunbathing, swimming, shell collection, and campfires.

At the southern end of Assateague Island within the Chincoteague NWR, the NPS manages an "assigned area" that currently includes the 1-mile recreational beach and corresponding adjacent 961 parking spaces, provided via a crushed shell surface. The NPS maintains a visitor contact station, restrooms, and pedestrian trails, as well as seasonal bathhouses, showers, and lifeguard-protected swimming beach. Beyond this recreational area, only wildlife-oriented recreational activities are allowed.

After the establishment of the refuge in 1943, the only public recreation that occurred on Chincoteague before the bridge was constructed in 1962 was beach use, primarily surf fishing. Visitors would drive down the beach from the Maryland end of Assateague Island. On June 17, 1957, Congress passed Public Law 85-57, Chincoteague National Wildlife Refuge, Virginia - Bridge and Road. This law authorized the Secretary of the Interior to permit the construction of a bridge and road across Chincoteague NWR. The objective of this law was "to permit the controlled development of a portion of the seashore of the Chincoteague National Wildlife Refuge, Virginia for recreational purposes, ..." This law also authorized the Secretary to enter into agreements for the construction, maintenance, and operation "of a public beach, concession, parking areas, and other related public conveniences..."

On April 1, 1959, the Bureau of Sport Fisheries and Wildlife (precursor to USFWS) entered into an agreement with the Chincoteague-Assateague Bridge and Beach Authority whereby a public access easement to the Atlantic Ocean beach was established (Mackintosh 1982). The deed of easement provided for the construction of a bridge and access road to the Toms Cove Hook and assigned to the Authority the south 4 miles of the island for 40 years, renewable for two 15-year periods. These rights were subject to "such terms and conditions as the Secretary of the Interior deems appropriate for the adequate protection of the wildlife refuge." The 1959 public access easement has not been in effect since 1966, when it was acquired by the Federal government as directed by the Assateague Island National Seashore enabling legislation (Public Law 89-195), which states: "Notwithstanding any other provision of this Act [16 USCS §§ 459f et seq.], land and waters in the Chincoteague National Wildlife Refuge, which are a part of the seashore, shall be administered for refuge purposes under laws and regulations applicable to national wildlife refuges, including administration for public recreation uses in accordance with the provisions of the Act of September 28, 1962 (Public Law 87-714; 76 Stat. 653) [16 USCS §§ 460k et seq.]."

In 1965, the Assateague Island National Seashore was established. Under a memorandum of Understanding (MOU) completed in the summer of 1979 between the USFWS and NPS, NPS would provide and manage visitor contact and interpretive facilities and programs on a day-use basis for public recreation and interpretation including, but not limited to, swimming and associated beach uses. Also under that agreement, we would retain the primary responsibility for managing the wildlife resources within the "Assigned Area," with the understanding by both agencies that recreational use programs will be planned and carried out to minimize impacts on

wildlife resources. In 1990, an Interagency Agreement replaced the MOU, with the new agreement allowing for the same uses as the MOU. The Agreement was renewed and revised prior to release of the draft CCP/EIS in 2012.

Since the opening of a public beach in the early 1960s, visitation steadily rose during the 1960s, 1970s, and most of 1980s. In 1987 visitation peaked at over 1.5 million visits, with over 800,000 occurring during the summer season, June through August. Since then, the number of annual visits to the refuge has leveled off to between 1.2 and 1.4 million visits. From 2007 to 2011, 58 percent of the visits occurred during the months of June, July, and August. Recreational beach use tapers off quickly after early September and returns at the end of May.

Although not all summer visitation is associated with beach use, the parking patterns and anecdotal reports indicate that beach use is the primary use. The town of Chincoteague developed and distributed a "Beach Access Questionnaire" online and throughout the community in summer of 2010 that resulted in almost 3,000 responses. In the survey, 82 percent of respondents indicated that they primarily came to Chincoteague to go to the beach (Town of Chincoteague 2010b).

3.7.6 Other Recreational Uses

Other recreational uses on Chincoteague NWR include walking, bicycling, horseback riding, OSV use, boating, and commercial uses. All of these uses are limited to specific areas of land and/or times based on wildlife management and some have permits and fees, as described below. There are no campsites on Chincoteague NWR. Visitors are not allowed to feed wildlife and are not allowed to bring alcohol or pets onto the refuge, including in vehicles. Other restricted activities include use of skateboards, roller or in-line skates, or segways and the collection of plants, animals, or artifacts, except for 1 gallon per person per day of unoccupied shells. Motorized vehicles are not allowed on trails and mopeds are not allowed on Wildlife Loop.

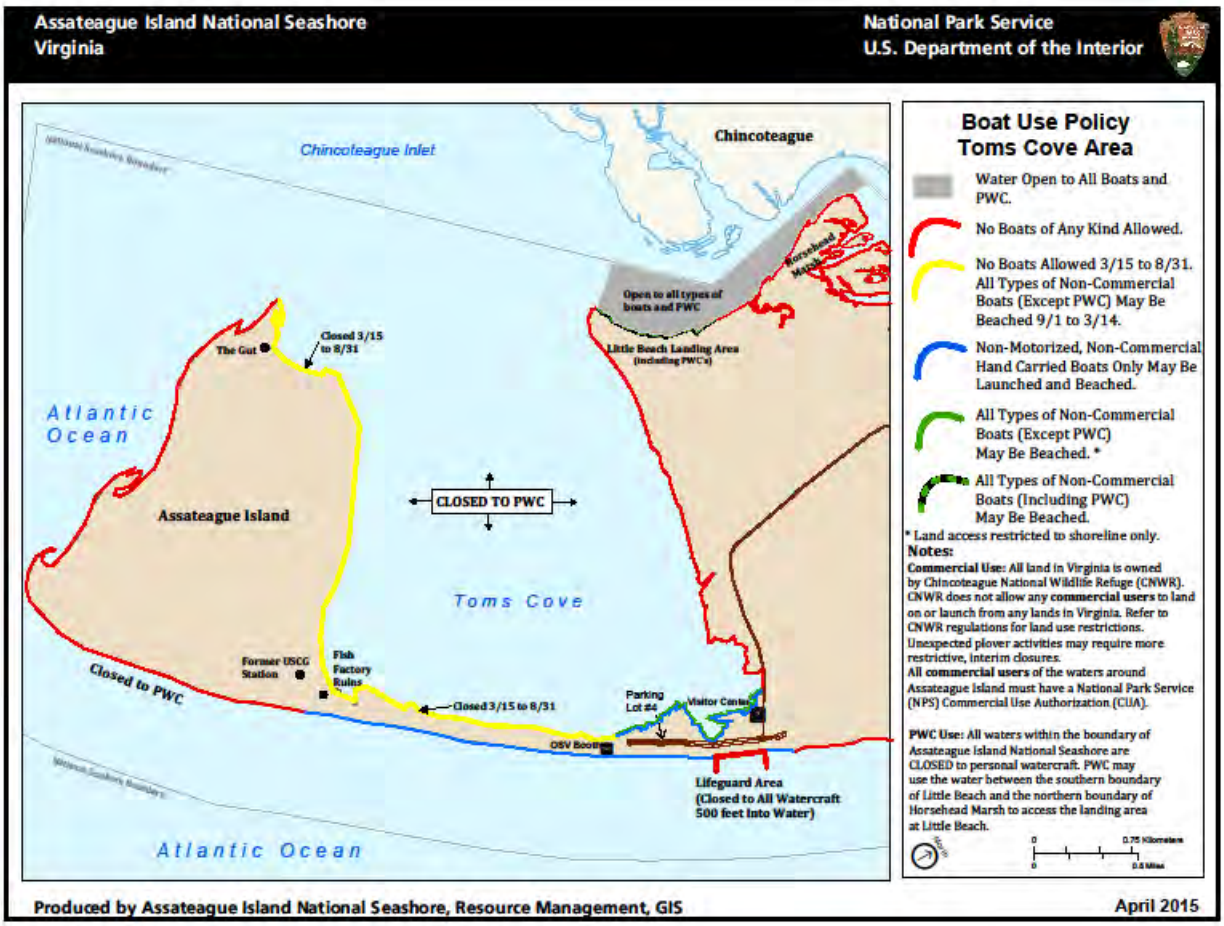
As described previously, bicycling is accommodated through a paved and gravel trail system beginning on Chincoteague Island and running along Beach Road and via the Wildlife Loop and Swan Cove Trail to the beach and to the Woodland Trail parking lot as well as the Woodland Trail itself. Bicycling is not allowed on the Service Road although walking is. Walking visitors make use of the bicycle trails as well as Lighthouse and Marsh Trails.

Horseback riding is limited to within the OSV zone from March 15 through August 31 or until the last shorebird fledges. Access can be further restricted based on wildlife management practices.

Motorized and non-motorized boats are allowed to beach at Toms Cove Hook between September 1 and March 14 but there are no boat ramps or docks available for public use at Chincoteague NWR. Boats and flotation devices are not permitted in the impoundments. Non-motorized, human-powered, hand-carried boats are allowed to access the water from the recreational beach in designated areas.

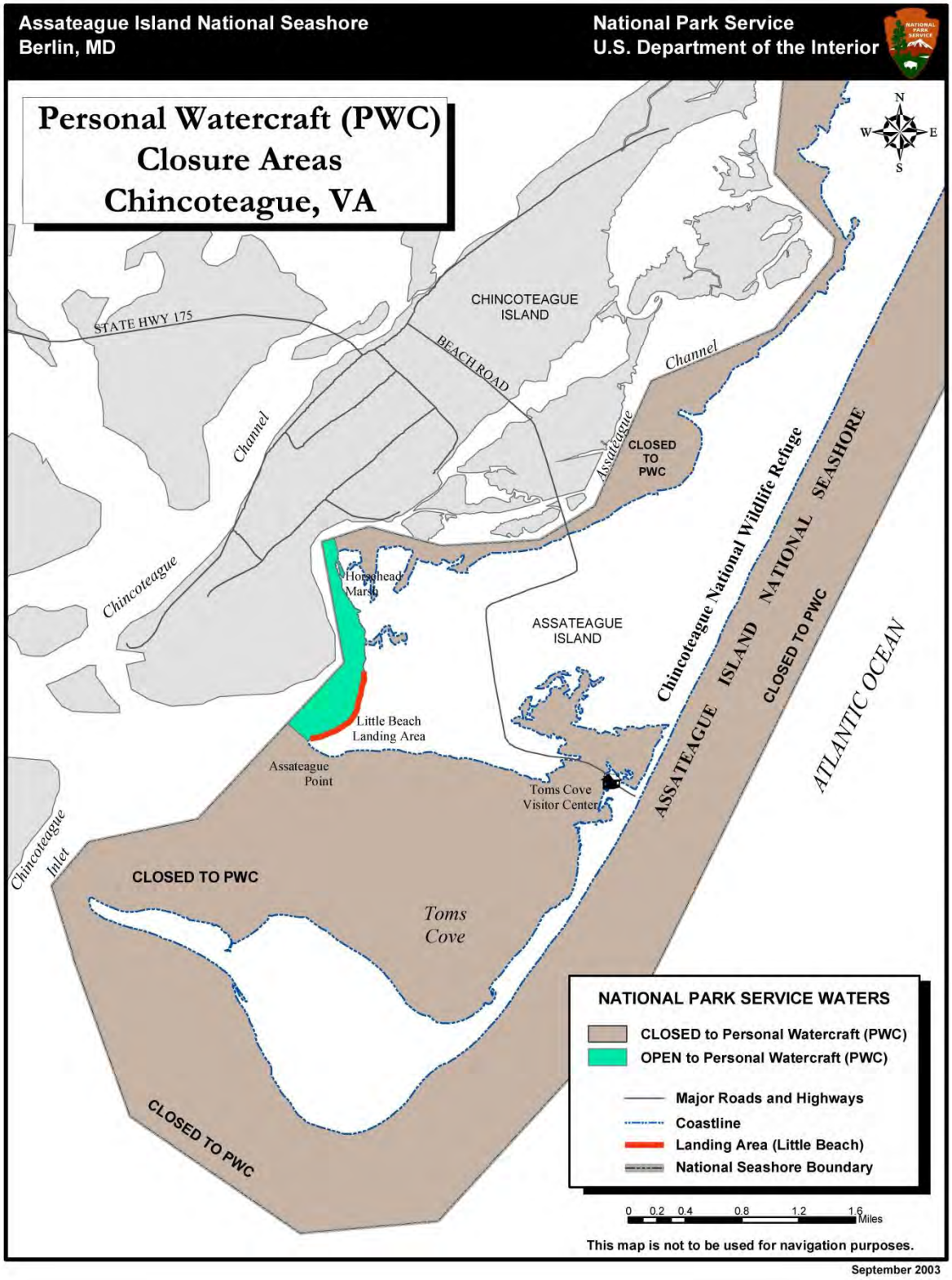
Figure 3-29 provides a summary of the boat policies, as developed by NPS. All waters within the boundary of Assateague National Seashore are closed to personal water crafts (PWCs)[5] except the water between the southern boundary of Little Beach and the northern boundary of Horsehead Marsh, as indicated in Figure 3-30. Visitors with kayaks or canoes may follow part of the 70-mile long Seaside Water Trail, which was developed by the Accomack-Northampton Planning District Commission in cooperation with Accomack County, Northampton County, the Town of Chincoteague, the Town of Wachapreague, and the Virginia Coastal Zone Management Program.

Figure 3-29. Boat Use Policy (NPS Seashore)



[5] PWCs are high performance vessels designed for speed and maneuverability and are often used to perform stunt-like maneuvers. PWC includes vessels commonly referred to as jet ski, waverunner, wavejammer, wetjet, sea-doo, wet bike and surf jet (NPS 2000).

Figure 3-30. Personal Watercraft Closure Areas (NPS Seashore)



3.8 Cultural Resources

This section provides chronological contexts for human settlement in the vicinity of Chincoteague and Wallops Island NWRs during the pre-Contact and post-Contact time periods. Consideration is given to the types of known and possible archaeological resources that may be found within the refuges.

Although a number of broader historical studies were produced around the time the Assateague Island National Seashore was established, and several of more limited scale have also been performed for individual projects on the refuge, a 1989 overview study of the refuge (Fehr et al. 1989) and a subsequent maritime-focused overview of the Seashore (Langley 2002) provide the most comprehensive summaries of current knowledge regarding cultural resources on Assateague Island. An overview study (URS Group, Inc. 2003) was later performed for the Wallops Island NASA facility, but did not cover the nearby refuge lands, and a study of shore erosion identified threatened and eroding sites on some of the other islands, but none are on current refuge lands (Lowery 2000, 2003).

3.8.1 Pre-Contact Period

The present refuge islands began forming around 8,000 years ago as landforms roughly similar in appearance to today, exhibiting beach and dune lines on the eastern face that protect a thin strip of grass and scrub, then a band of maritime forest on the larger islands, and much more extensive salt marsh to the west. However, the size and shape of individual islands undoubtedly differed from their current perimeters. There may also have been additional islands that vanished prior to the earliest mapping of the area.

The majority of local Native American settlements were concentrated at mainland river estuaries, but the islands were probably seasonally occupied from at least around 1,000 years ago to obtain a variety of maritime resources. The diet of those first occupants relied heavily on “the three sisters” (maize, beans, and squash) supplemented by various wild plants, shellfish, finfish, small game, deer, and a wide variety of waterfowl. In 1524, the explorer Giovanni da Verrazano reported that watercraft consisted of log canoes. Abundant marsh reeds were used for arrow shafts, but their points were usually made of bone due to local scarcity of suitable stone materials. Clothing appears to have been woven from Spanish moss and hemp, and mussel and clam shells were valued for manufacture of wampum beads (Wroten 1972).

During the early period of European contact, this area was occupied by several tribes whose names are still reflected in inlet, bay, and island nomenclature today: Metompkin, Kegotank, Chincoteague, and Assateague. They, in turn, were part of the larger Occohannock Confederation, with apparent linguistic and cultural ties to the Pokomoke tribe in Maryland. Serious disruption of Occohannock culture and rights to ancestral land began in 1620 with European settlement of the Eastern Shore, and accelerated very rapidly thereafter. The Metompkins, Kegotanks, and Chincoteagues appear to have merged with the Assateagues after a major smallpox epidemic decimated the Eastern Shore tribes in 1667. By 1686, most or all of the Assateagues had joined the Pokomokes on reservations in Maryland (Langley 2002 20).

At this time, the only confirmed evidence of Native American presence on either refuge is a single stone flake from an otherwise apparently historic period shell midden (Fehr 1989). The lack of additional evidence may partly be due to the fact that only one large-scale archaeological survey has been performed on Chincoteague NWR and no such studies have been done on the much smaller Wallops Island NWR; however, a more significant reason may be the dynamic nature of

island geomorphology. Coastal and wind erosion may be contributing to unobserved loss or burial of unrecorded sites, and sea level rise has also doubtlessly had an effect. Although it is possible that some islands have changed less in the last two centuries, the most obvious limit to pre-Contact site presence on Assateague is illustrated by the fact that all of that island south of Morris Island did not exist prior to 1693. Study of historic coastal maps shows that in 1820 Morris Island included the current area of the Farm Fields Impoundments. It and the Lighthouse Ridge area, then called "Piney Island" (not to be confused with today's island of that name) were the primary barrier islands that protected Chincoteague Island. By 1832, charts show the channels between those islands blocked, making the island continuous all the way down to the present Woodland Trail area. It seems likely that a hurricane driven tidal wave in 1821 was the primary cause of that dramatic change. Fishing Point, the beginnings of Tom's Hook, did not begin to grow until sometime between 1873 and 1882. As is the case with the majority of barrier islands, this growth and reshaping due to sand migration, coastal storms and rising sea levels continues today.

3.8.2 Historic Period Settlements

Local European settlement appears to have begun with a 1664 patent to John Wallop for land on the island that bears his name. Captain Daniel Jennifer obtained a patent to Chincoteague in 1671 and one to the Virginia portion of Assateague in 1687. He used both islands for seasonal livestock pasturing, employing 30 herdsmen to that purpose (Fehr 1989). Assawoman Island was also used for seasonal pasturing around this time, as were probably many others. It is likely that these activities mark the initial establishment of the famous "pony penning" tradition, which was also accompanied by a sheep round-up until the third decade of the 20th century. The herdsmen, and possibly their families, may have lived in huts rather than permanent dwellings.

Year-round settlement on Assateague appears to have begun in 1689 under the auspices of Maximilian Gore, whose 1696 will and testament reference dwellings occupied by tenants Thomas Milman and Alexander Gould, and also gives his son in law Thomas Smith the right to build a "40-foot tobacco house" on the island. By the early 18th century, several Gore and Smith family members appear to have lived near Ragged Neck, Smith Bay, and Smith Hammocks, along with some tenants and at least a few enslaved African Americans (Fehr 1989).

In 1764, there were still only 25 residents on Assateague, but population grew rapidly to 20 families by 1776, 70 by 1835, and 150 by 1860 (Fehr et al. 1989).

Although a substantial part of early islander income and diet was probably from fishing, shell-fishing, and water-fowling, farming appears to have also played a major role despite the extremely poor quality of soils on the island uplands. Place names such as Calf Pen Bay, Peach Creek, Cherry Tree Hill Bay, Farm Fields, Old Fields, and Sow Pond reflect a variety of agricultural activities. The name Wear Bay on an 1840 property map reflects the presence of a dike and weir near the current location of the Old Fields Impoundment. As in many similar areas along the coast, that weir was presumably installed to manipulate water level for production of salt meadow hay in what was then called Great Neck Marsh. Similar weirs for that purpose probably existed elsewhere on both Assateague (perhaps at Farm Fields, for example) and on other refuge islands. Besides the various farming structures, a tidal-powered mill was built by Daniel Gore sometime prior to 1750 and ran for at least two more decades, and John Lewis began a salt works in 1811 that operated until at least 1855 (Fehr 1989).

Maps from 1832 onward document the presence of the Assateague Lighthouse which was commissioned to be built in 1832. The lighthouse was constructed to a height of 45 feet and was

built on a 22-foot high sand dune. The lighthouse was put into service in 1833. However, from the very beginning this light was proved to be inadequate (Cherrix 2011).

Both the American Revolution and War of 1812 largely bypassed this area, and due to strongly loyalist sentiment and early occupation by U.S. forces, the Civil War was not nearly as disruptive and destructive as in the rest of Virginia. The only substantial local military engagement was the burning of the newly outfitted Confederate privateer schooner Venus by the crew of the U.S.S. Louisiana, off Wallops Island in the autumn of 1861 (Langley 2002).

In 1870 the focus of settlement on Assateague abruptly shifted southward to what became known as Assateague Village, shortening water travel to the even more rapidly growing village on Chincoteague. By this time a new much higher (142 feet) Assateague Lighthouse had been constructed on the site of the first lighthouse. The new first-order Fresnel lens provided a beacon for mariners much further out into the Atlantic Ocean.

Assateague Village boasted a population of 225 by 1920, and included two stores, lighthouse, a school, a church, and a cemetery. The population continued to raise livestock, though on a scale smaller than in the 18th century. Fishing, shell-fishing, and fowling continued to be major sources of food and had by now supplanted farming as major sources of income. Beginning in 1881, some residents worked in a series of short-lived fish oil processing factories on the ever-growing spit of land that later became Toms Cove Hook. The last of those plants closed in 1929 (Langley 2002). That year, most of the area south of the Light Station was purchased by an absentee landowner (Samuel B. Fields) whose caretaker (Cooper H. Oliphant) prevented all local residents from trespassing, thereby restricting access to fish in Toms Cove. The resulting hardship soon led to wholesale abandonment of the village. Most of its buildings were moved on rafts to Chincoteague, while the remaining buildings were left to deteriorate. In 1943, the Fields family sold their property to the U.S. Government for use as a national wildlife refuge, and the last village resident, William T. Scott, moved off the island in 1945 (Langley 2002). Today the village site is marked only by some building foundations and the cemetery, which contains only a few marked graves. However, recent ground penetrating radar surveys have identified several additional unmarked graves within the Assateague cemetery, and a new previously unknown family cemetery has been identified within the village confines. Considerable efforts have been made by a group of volunteers loosely associated with the Town of Chincoteague Cemetery Committee and the Chincoteague Natural History Association to clear undergrowth of the cemeteries and restore and maintain the grave markers.

A few small hunting and fishing camps were built on remote portions of Assateague and some smaller islands in the 1930s, but their periods of use appear to have been short. Aside from Coast Guard personnel at the light station and lifesaving stations, there were no longer any year-round residents on Assateague Island between the year of Bill Scott's departure in 1945 and the arrival of the first resident USFWS and NPS staff (Langley 2002).

Although precise sites of most 18th to early 19th century historic settlements on Assateague are unclear, they are probably fairly safe from looting due to their location within a large potential search area within a closed part of the refuge. As they are also probably closer to the marsh-protected bay side than the open ocean, immediate risk of erosion damage appears minimal. However, in light of the high potential of this unique group of sites to provide important information on the life-ways of early islanders, it would be advisable to locate and identify them as

the focus of a targeted follow-up to the 1989 cultural resource overview, then solicit a program of academic research on identified sites before sea level rise becomes a threat (Fehr 1989).

In contrast to those earlier historic sites, the location of Assateague Village is in an area more accessible to the public, has always been very well known to local inhabitants, and retains considerable surface evidence. Despite that visibility, there is little obvious evidence of recent looting. Erosion also does not appear to be an immediate risk. The research potential of the village is improved by the possibility of linking archaeological evidence to its rich local historic record, but for the immediate future it would be better to use that record for purposes of interpretation than to undertake a program of archaeology at such a complex site.

The sites of 20th century sportsmen's camps appear low in priority for research and are too remote and difficult to access for interpretation. The sites of the several fish oil plants on Toms Cove Hook appear to have all now eroded into the cove (Fehr 1989; Langley 2002), and with the westerly migration of Assateague Island the single remaining concrete pillar that was once part of the support structure for a factory will move forever into the Atlantic Ocean.

3.8.3 Wallops Island

The historical context of Wallops Island is best captured in the *Historic Resources Survey and Eligibility Report for Wallops Flight Facility – Accomack County, Virginia* completed by URS Group, Inc. and EG&G Technical Services, Inc., in 2004 for NASA. This document provides important historical context over the time period between 1607 and 2004 and identifies several historical items of interest within the 373-acre Wallops Island NWR. A family cemetery with three marked graves is located near the maintenance facilities. Efforts have been made by a group of local volunteers, NPS and USFWS employees, and the Chincoteague Natural History Association to clear undergrowth of the cemeteries and restore and maintain the grave markers. NPS and USDA currently both have a use agreement with USFWS for maintenance and storage activities on Wallops Island NWR. Two former Navy waste disposal sites are of interest to the Department of Defense and are currently being monitored and studied by the USACE.

Geographically Wallops Island is the next barrier south of Assateague Island. The known historic resources are a small cemetery dating from the late 1800s and the Wallop's Island Life-Saving Station (commissioned in 1884). The uses of the land were similar to that of other barrier islands. In 1947, the U.S. Navy began using the upper two-thirds of the island on a lease-rental basis for aviation ordinance testing. The National Advisory Committee for Aeronautics, fore-runner of the NASA, leased the lower 1,000 acres for rocket launching facilities. NASA eventually purchased the land and leased the fields for agricultural use. In addition, a small section of the property was designated as a dump and sanitary landfill area.

3.8.4 Shipwrecks

Shipwrecks form a significant part of the history and lore of these refuge islands. The first reliable account of a wreck on Assateague is the merchant ship Princess Anne, which broke up somewhere on the beach in 1698 (Langley 2002). Although there seem to be few additional vessel losses on refuge islands during the following century, that scarcity of record may reflect the sparseness of population and rarity of identifiable landmarks more than the actual number of wrecks.

The most famous vessel loss of the 18th century is the La Galga, a Spanish frigate that ran ashore near the Maryland line in 1750 with a loss of only three to five men. Although her survivors

remained unmolested, the dismasted frigate was quickly looted of its cargo of mahogany planks (Langley 2002). The ship was then partially cut up by local residents from both Virginia and Maryland, and then broke apart in another storm soon afterward (Langley 2002). Despite that documentary record, La Galga has been the object of several search and salvage attempts during the last half century, the most recent involving a lengthy case that resulted in a 2001 U.S. Supreme Court ruling awarding title of the vessel to the Spanish government (Langley 2002). Comparable to the situation of any U.S. Navy vessel that sank with loss of life while on duty, the government of Spain asserts legal title to La Galga and considers her a naval grave site. Therefore, under the Sunken Military Craft Act, prior Spanish permission would be required for any further search or salvage attempt.

Many other vessels have been lost offshore or wrecked on island beaches from that first report in 1698 to the present day. They vary considerably in size, design, cargo, and means of propulsion depending on the time period of their construction and use. As one might expect, most were British flagged prior to the American Revolution and most have been in U.S. ownership thereafter. Almost all were fishing or merchant craft rather than naval vessels; one notable exception is the loss in 1891 of the steamer U.S.S. Despatch, which briefly served as the first presidential yacht (Langley 2002).

A number of wrecks and parts of wrecks have been discovered in the intertidal sands of Assateague over the years. Some may be worthy of study as examples of type and time period, though both their changeable visibility and the difficulty of working in the surf zone make such studies very challenging. One relatively intact and exposed wreck of a late 18th to early 19th century sloop or schooner was proposed for detailed measurement by an East Carolina University graduate student some years ago, but when fieldwork was due to begin it was suddenly discovered that the wreck was once again covered by a layer of sand (Langley 2002).

A proposal has been made to establish a partnered interagency monitoring program that would record wreck fragments on the refuge beaches (with a view to discovering the location, type, age, and condition of wrecks), as well as to develop a team of maritime archaeologists and trained volunteers that could perform emergency recording of any relatively intact historic vessels that might appear.

3.8.5 Lighthouse

A lighthouse was first built near the southern tip of the island in 1833 at an elevation of only 43 feet, and a taller structure (142 feet) replaced it in 1867. That light station, listed on the National Register of Historic Places and still an active aid to navigation, is now under USFWS jurisdiction. Its tower and oil house are undergoing a major restoration that is now nearing completion. Only bricks of the foundation remain of the original light keepers' dwelling. However, the 1910 assistant keepers' dwelling which served as the refuge managers living quarters and is now used as a seasonal quarters for refuge employees still exist. That building appears to be eligible for National Register of Historic Places listing as an element of the light station. Over the years, the lighthouse has had a number of different lights. The first-order Fresnel lens that was at the Assateague lighthouse from 1867 to 1963 has been restored and is housed at the Museum of Chincoteague Island.

3.8.6 Lifesaving Stations

The increasingly recognized need for a system to rescue mariners and passengers of wrecked vessels resulted in establishment of the U.S. Lifesaving Service in 1848, but it was not until the early 1870s that a national system of fully manned and equipped stations began to be established. Dedicated surfmen lived with their families near the stations and patrolled the beaches regularly to signal warnings if ships came too close. They also rescued crews and protected ships and cargoes if disaster struck. The Life-Saving Service was abolished in 1915, when the U.S. Coast Guard took over responsibilities.

The earliest lifesaving station on these refuge islands was the Assateague Beach station, erected in 1875 on the north side of Toms Cove Hook, near the current Woodland Trail parking lot. The station site is overgrown and its surface remains are confusing and appear somewhat disturbed, probably by demolition of ruins after it burned during the 1940s. Its archaeological study would be a low priority when compared to earlier and more intact settlements on the island (Fehr 1989).

Another station was built in 1878 on the exposed beach near Pope's Island Inlet on Assateague Island near the Maryland-Virginia border. It closed in 1953 and was destroyed by arson in 1970. Slightly later stations also existed at Wallops Island and Metompkin Inlet; neither of those sites nor the location of the Pope's Island station are on current refuge land (Langley 2002).

3.8.7 U.S. Coast Guard Station

Although the sand spit on the southeast side of Assateague initially provided good shelter for launching surfboats, by 1920 the curving growth of that same spit into Toms Cove Hook forced the boats of Assateague Beach station to take an increasingly roundabout journey to the rescue of shipwreck survivors (Fehr et al. 1989). A new U.S. Coast Guard station was therefore constructed on the spit itself, near its end at that time. Closed in 1967, that station was later determined eligible for inclusion in the National Register of Historic Places and acquired by the NPS as a visitor facility (Langley 2002). In the 1980s the road down the length of Toms Cove Hook began to be washed out with increasing frequency, so a new visitor facility location was established at the north end of the hook. The old "Pony Restaurant" building was transformed into the NPS Toms Cove Visitor Center and has been moved twice since it was originally built, which is another testament to the ephemeral character of human presence on the barrier islands.

3.9 Refuge Administration

3.9.1 Facilities and Maintenance

Refuge facilities consist of buildings and transportation infrastructure, including roads, marine facilities, trails, intelligent transportation and traveler information systems, and parking areas. In addition to the refuge facilities, NPS maintains a visitor center, lifeguard-protected swimming beach, restrooms, bathhouses, parking areas, and boardwalk trail, and coordinates the OSV area, as detailed in a memorandum of understanding. NPS and USDA both have a use agreement with USFWS for shared facilities, mainly for storage, on Wallops Island NWR.

Buildings

Within Chincoteague NWR, buildings consist of a visitor center, staff offices, staff housing, maintenance facilities, and an environmental education pavilion, as well as the Assateague Lighthouse and light keeper's house. The Herbert H. Bateman Educational and Administrative Center, a green facility that opened in 2003, consists of two buildings, one for the visitor center

and one for administrative offices. The visitor center offers 5,000 square feet for interpretive natural history exhibits, educational programming, a 125-seat auditorium, and a classroom/wet lab.

Marine Facilities

The Assateague Lighthouse Landing is on the north side of refuge, on the Assateague Channel, and consists of a boat ramp, a fixed dock and a floating dock connected by a ramp. These facilities are not open to the public.

Roads

As mentioned previously in Section 3.6.2: Transportation and Access, Chincoteague NWR is accessed by a two-lane road, Beach Road, which extends from Maddox Boulevard across the bridge to the beach parking areas. The only other paved road open to the public is Wildlife Loop, which is approximately 3 miles in length and is open to vehicles after 3 p.m. each day. There are also two unpaved service roads that are not open to the public. One service road is approximately one-quarter mile long and leads from Beach Road to Assateague Lighthouse Landing, which has marine facilities on the Assateague Channel. The other service road extends north from the Wildlife Loop 7.5 miles, providing access to one of the areas where the Chincoteague ponies are kept. The entire length of that service road is open to private vehicles only during part of Waterfowl Week at the end of November, but the CNHA bus tour is allowed to use this same section throughout its season of operation.

Trails

Chincoteague NWR has the following paved trails, with round-trip distance:

- Main bicycle trail (0.5 miles from Maddox Boulevard traffic circle to bridge; 1.3 miles from bridge to end of trail; 1.9 miles along Beach Road to beach)
- Woodland Trail (1.6 miles)
- Black Duck Trail (1.0 miles)
- Swan Cove Trail (0.5 miles)

In addition, there is the Marsh Trail (0.6 miles boardwalk, 0.3 miles on Wildlife Loop road) and unpaved Lighthouse trail (0.3 miles) and Bivalve Trail (0.25 miles), which is only accessible from the Woodland Trail. All trails are shown in Figure 1-4 in chapter 1.

Parking

Chincoteague NWR has a number of parking facilities, as documented in Table 3-10. All of these, except for the parking at the recreational beach and NPS visitor center, are maintained by the refuge and require routine maintenance.

Table 3-10. Parking Facilities on Refuge

Location	*Paved, Marked Spaces*	*Handicapped Spaces (paved and marked)*	*Other spaces*	*Bus/Oversize Parking Spaces*
Recreational Beach	-	-	961 (unpaved, unmarked except for handicapped)	-
Herbert H. Bateman Educational and Administrative Center	52	4	23 regular; 6 for Government (unpaved, car stops)	Gravel area for oversized vehicles and bus parking
Wildlife Loop (Main lot)	38	1	5 (paved but unmarked)	3 paved
Woodland Trail	26	1	-	-
Lighthouse Trail	17	-	6 (paved, unmarked)	2 (paved, unmarked)
Wildlife Loop (Near boardwalk)	7	1	None	-
Boat ramp, west side	-	-	12 (paved, unmarked)	-
Light Keepers House	-	-	15 spaces (unpaved) – for handicapped	-
NPS Toms Cove Visitor Center	-	2 (unpaved but marked)	Approximately 50, both sides of road (unmarked, unpaved)	-
TOTAL	**140**	**9**	**1,078**	**Approximately 5**

NPS is the principal Federal agency charged with the restoration and rehabilitation of the recreational beach parking lots located at the Chincoteague NWR. NPS uses Assateague Island National Seashore base funding and supplemental Emergency Relief for Federally Owned Roads (ERFO) funds to perform emergency storm damage repairs and routine parking lot maintenance. Through an intra-governmental agreement between the NPS and USFWS, the refuge transfers $200,000 from its entrance fees to the Seashore for maintenance of the recreational beach, parking lots, visitor safety services (lifeguards), and law enforcement support.

Routine maintenance consists of raking the lot's surface and filling in ruts from ocean over-wash, hard rains, and vehicular traffic with crushed-shell. Maintenance generally occurs twice weekly April through November and weekly December through March. The estimated annual cost for this work is $7,200 in labor (assuming 4 hours per day at $20/hour), but there are also additional costs for the fuel and for the purchase and maintenance of a ¾-ton pick-up with drag attachment.

Repair of the beach parking from storm events varies based on the level of damage. The length of time needed for storm repairs varies from 2 weeks to 3 months and can consist of additional routine maintenance tasks or more significant replacement of sand and crushed shell and moving the parking areas westward (see Figure 3-31). There have been five storm events in the past 10 years that resulted in impacts to the beach parking that meet the definition of "totally destroyed." "Totally destroyed" refers to major portions of the Toms Cove recreational beach parking and visitor use infrastructure that were damaged so as to be unusable or inaccessible by the public. These storms were the following: Hurricane Isabel in 2003, Hurricane Ernesto and Nor'easter in

Figure 3-31. Damage and Clean-up of Parking Areas 2-4 (Patrick J. Hendrickson, Highcamera.com (9-30-08), provided to USFWS refuge staff)

Figure 3-32. Turn Circle at Chincoteague NWR Beach and Beach Road during Nor'easter Ida. November 2009 (USFWS refuge staff; James Fair, November 2009)

2006, Nor'easter Ida in 2009 (see Figure 3 32), Hurricane Irene in 2011, and Hurricane Sandy in 2012.

Table 3-11provides a summary of the expenses for the recreation beach parking for 2007 through 2011; at the time of publication of this document, USFWS was still working with NPS and the FHWA on final costs for repair of the beaching parking lots, Beach Road, and Service Road from damage sustained during Hurricane Sandy. In 2008, NPS received funding from the FHWA to rehab the asphalt parking lot leading to the beach parking lot. The other funding sources reflect storm-specific funding requests. In addition to those four storm events listed, there may have been some high-tide or overwash events that destroyed the parking lots, but USFWS and NPS do not have verifiable data on the dates, cost to repair, or extent of damage from those events.

To provide one example, for the Hurricane Irene repairs, approximately $151,300 (21 percent) of the total estimated repair cost of $724,112 was accomplished with existing NPS staff and equipment during normal working hours. All of the personnel, material, supply, and equipment

costs for repairing the roads and parking lots were funded through the ERFO Roads program. While the use of existing NPS staff to conduct storm damage repairs is cost effective, the additional workload detracts from the park's ability to conduct normal operational activities such as preventative maintenance and repairs to other visitor use facilities. Similarly, the use of NPS-owned equipment contributes to accelerated wear and tear that is not accounted for in normal replacement cycles.

Table 3-11. Record of Maintenance and Repair Costs for Recreational Beach Parking

Fiscal Year in which Funding Received	Storm (Year)	Routine Repairs and Storm Damage		Storm Damage		Total
		NPS Base Funding and FWS Reimbursable	Federal Highway Project - non emergency	Emergency Relief for Federally Owned Roads	NPS	
2007	Hurricane Ernesto (2006)			$746,213		$746,213
2008		$218,521	$39,226			$257,747
2009	Hurricane Hanna (2008)	$133,820			$196,931	$330,751
2010	Nor'easter Ida (2009)	$160,826		$343,771		$504,597
2011	Hurricane Irene (2011)	$275,036		$724,112		$999,148
2012	Hurricane Sandy					TBD
Total		$788,203	$39,226	$1,814,096	$196,931	$2,838,456

When a storm occurs, the following steps are taken:

- Secure funding. One main funding source has been the ERFO, which provides assistance to Federal agencies when their Federal roads that have sustained damaged from natural disasters.
- Define the wetland boundary. Each time a strong coastal storm hits Assateague Island, the island literally rolls over on itself, moving the island in a westward direction. This is a normal barrier island response to coastal storms and sea level rise. When this happens, the bayside wetlands immediately adjacent to the island are covered with sand that has washed across the island; this provides a new upland site on which to rebuild the parking lots. However, a new wetland/upland boundary has to be determined so the new parking lot is aligned with the new upland.
- Recover materials. In order to recycle and reuse as much of the old parking lot material as possible to reduce costs, the NPS reclaims old shell and clay material from the old parking lot, which requires heavy equipment such as bulldozers, graders, large high-flotation material hauling dump trucks, etc. The reclaimed materials are stockpiled on-site for reuse at a later time.
- Design the new parking areas. The new parking lots are laid out on the ground using a design best fitted to the new wetlands delineation provided by the regulatory agencies. To date, the NPS has always been able to fit 961 parking spaces for cars on the newly created uplands.
- Construct the parking areas. During the winter months, when visitation is low, the construction work can be accomplished in phases, which allows the NPS to complete one

parking lot and open it to the public in a safe manner. If the lots are lost during the summer months, i.e., the peak visitation period, the demand for any parking spaces will quickly exceed the capacity the NPS can provide and will thus create an unsafe environment for the public and equipment operators. Therefore, the parking lots are totally closed to public access until they are fully restored. When at all possible, the NPS will provide parking at the beach. For example, the total time needed to completely repair storm damages similar that those caused by Hurricane Irene is approximately three months.

- Reinstall infrastructure. The last stage of recovery is the replacement of shower stalls, pump houses, restroom facilities, lifeguard stands, displays, and informational and traffic signs, etc.

Refuge Revenues

Under the authority of the Federal Lands Recreation Enhancement Act (FLREA), which expires in December 2014 unless re-authorized, Chincoteague NWR charges an entrance fee per vehicle; Table 3-12 lists the 2012 fee amounts. The refuge introduced a daily fee in 2008 along with an increase to the weekly entrance fee and the addition of an expanded amenity fee for beach parking for the refuge annual pass and the Federal Duck Stamp program. Entrance fees are collected year-round 7 days a week, but the hours of operation for the entrance fee booth (Figure 3 33) vary throughout the year. Credit card machines were added to the fee booths in 2007. When the fee booths are unstaffed, the honor system is used. Visitors who need to pay the daily fee are expected to use the iron ranger, a self-serve pay station located outside the Herbert H. Bateman Educational and Administrative Center, by taking an envelope, inserting $8, and dropping the envelope into the vaulted iron ranger. The refuge is working on plans to install off-site pass purchase machines.

Total annual revenue from entrance fee dollars averages $750,000 to $850,000. Twenty percent of the total revenues collected are provided to the USFWS Region 5 (Northeast Region) Office to be used in a competitive grant program for field stations that provide visitor services, or maintenance projects that have a direct tie to the visitor. Additionally, each year, we transfer approximately $200,000 to the NPS for maintenance of the recreational beach parking lots, visitor safety services (lifeguards), and law enforcement support. The refuge retains approximately $400,000 to $450,000 annually. In compliance with FLREA, we allocate these funds for:

- Visitor services, visitor information, visitor needs assessments, interpretation and signs;
- Habitat restoration directly related to wildlife-dependent recreation limited to hunting, fishing, wildlife observation, or photography;
- Law enforcement related to public use and recreation;
- Repair, maintenance, and facility enhancement directly related to visitor enjoyment, visitor access, and health and safety. This includes annual or routine maintenance, deferred maintenance, and capital improvements. and
- Costs of collection – operating and capital.

Table 3-12. Chincoteague NWR Entrance Fees (as of 2012)

Type of Fee*	Description	New Fee Total
Daily Fee		$8
Weekly Pass		$15
Refuge Annual Pass		$30
Federal Duck Stamp	Annual pass to NWRs valid from July 1 to June 30 of the following year. Hunters over the age of 16 must purchase a Federal Duck Stamp each year if they want to hunt migratory waterfowl. Revenue from the Federal Duck Stamps goes directly to the Migratory Bird Conservation Fund, which uses $0.98 out of every dollar to purchase or lease wetland habitat for protection in the National Wildlife Refuge System.	$15 or $30**
America The Beautiful - The National Parks and Federal Recreational Lands Pass		$80
Senior Pass	Lifetime pass for U.S. citizens or permanent residents age 62 and over. Admits the pass holder and passengers in a non-commercial vehicle at per vehicle fee areas and pass holder +3 adults at per person fee areas	$10
Access Pass	Lifetime pass for U.S. citizens or permanent residents with permanent disabilities (documentation required). Admits the pass holder and passengers in a non-commercial vehicle at per vehicle fee areas and pass holder +3 adults at per person fee areas.	Free
Commercial Buses – 20 or fewer passengers		$40
Commercial Buses – 21 or more passengers		$100

* Entrance fees are per vehicle. Fee required for anyone over the age of 16.

** $15 Expanded Amenity Fee added in 2008 for beach parking maintenance. Visitors with Federal Duck Stamp pass must pay if such visitors want to park in the beach parking lots.

Figure 3-33. Chincoteague NWR Entrance Booths (USFWS refuge Web site)

3.9.2 Staffing

Chincoteague NWR shares its refuge manager with both Wallops Island NWR and the Eastern Shore of Virginia and Fisherman Island NWRs, which have their own designated staffing and CCP process. Since its creation in 1971, Wallops Island NWR has been otherwise unstaffed, with little to no monitoring or management, except by A&N Electric Cooperative, a utility company with a power line ROW that removes tall growing trees, primarily the non-native autumn olive, and some brush species.

Chincoteague NWR has 23 full-time positions and 10 to 20 part-time, student, or contractor positions in the areas of visitor services, law enforcement, biology, administration, fee collection, management, and maintenance (see Appendix K for current staff plan). Fee collection employees primarily work from May to September, although some work from March to November. In addition to refuge staff, NPS provides 6 permanent and 21 seasonal employees to provide lifeguard, law enforcement, maintenance, and interpretive services at Toms Cove and the recreation beach. The staffing breakdown is as follows: 1 permanent and 2 seasonal law enforcement staff, 1 permanent and 6 seasonal interpretation staff, 1 permanent visitor use assistant, 2 permanent and 7 seasonal maintenance staff, and 1 permanent and 6 seasonal lifeguards.

3.9.3 Volunteer Programs

Refuge staff is supplemented by year-round volunteers as well as from local and national youth and adult groups such as Service Road Scholar and the Student Conservation Association (SCA). These individuals and groups provide assistance with wildlife and habitat management programs, wildlife and habitat surveys, invasive species removal, trash pick-up, interpretive education, and other projects.

Chincoteague NWR also receives significant support from the CNHA, a non-profit association established in partnership with the USFWS. The purpose of the CNHA is to promote a better understanding and appreciation of the refuge, the Eastern Shore of Virginia NWR, and the natural history and environment of Virginia's Eastern Shore in general. The CNHA produces and

provides interpretive and educational material for refuge visitors and for local teachers, funds student interns, and enables both refuges to receive matching grants for workshops and programs. Proceeds from memberships and items sold at the retail store at the Herbert H. Bateman Educational and Administrative Center are used to support and enhance the interpretive programs, projects, and activities at both of the refuges. Under a cooperative agreement with USFWS since 2004, the CHNA owns and operates a small seasonal interpretive bus tour service, which they use to provide interpretive tours of Chincoteague NWR from April through November. CHNA also manages the visitation of the Assateague Lighthouse, and seeks grants for its restoration.

3.9.4 Management Units

Chincoteague NWR is a wildlife refuge comprised of over 14,000 acres administered by the USFWS with land spanning over five islands in Accomack County, Virginia. Within the refuge is a vast array of natural habitats that make up a barrier island ecosystem: Beach-Dune, Shrub-Early Successional, Forested Uplands, Wetlands, and Salt Marsh. All of these are described in greater detail in Section 3.3 Vegetation. For management purposes and to facilitate understanding of the descriptions of these habitats and biological resources, Chincoteague NWR is divided into two management units: the Assateague Island Unit and the Southern Islands Unit. The Assateague Island Unit consists primarily of the Virginia section of Assateague Island as well as adjacent Morris Island and Wildcat March and is comprised of beach, dune, salt marsh, freshwater impoundments, maritime forest, and shrub habitats. The Southern Islands Unit includes Assawoman, Metompkin, and Cedar Islands, and is made up mostly of beach-dune and salt marsh habitats.

3.9.5 Landscape Conservation Cooperatives

The refuge is located in the North Atlantic Landscape Conservation Cooperative (LCC), of which USFWS is an active participant. LCCs are public-private partnerships composed of states, tribes, Federal agencies, NGOs, universities, and others that were established by DOI Secretarial Order Number 3289, signed on September 14, 2009. The cooperatives are intended to address landscape-scale stressors, including climate change, and to work interactively with DOI Climate Science Centers to help coordinate regional adaptation efforts. There are 22 LCCs, covering all states and territories of the United States and adjacent areas of Canada, Mexico, and the Caribbean, and transcending political and jurisdictional boundaries to create a networked approach to conservation (see Figure 3-34). The geographic areas were developed by a team of USFWS and USGS scientists and experts by aggregating BCRs. Other frameworks, such as the Freshwater Ecoregions of the World, were also referenced. The LCC effort is coordinated with other partnerships, such as the National Fish Habitat Action Plan, Migratory Bird Joint Ventures and the State and Tribal Wildlife Grants Program.

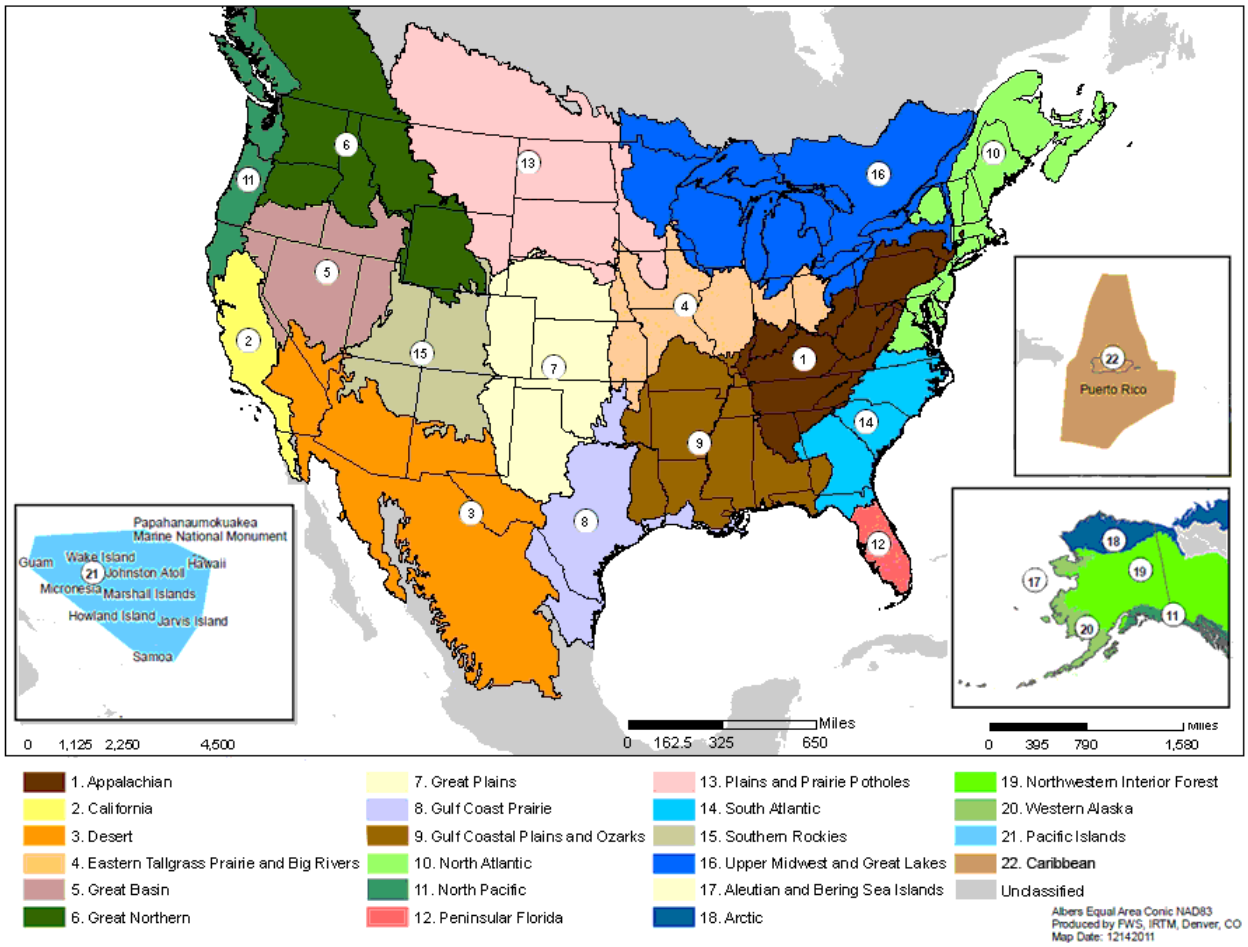
LCCs were developed with the recognition by the DOI and others that in order to ensure landscapes that are resilient and can sustain natural resources and cultural heritage into the future, conservation agencies and partners need to work together at landscape scales to address increasing land use pressures and widespread resource threats and uncertainties amplified by multiple effects of a rapidly changing climate including sea level rise and increased frequency and intensity of coastal storms.

There are three components to the LCC initiative: the LCC network, individual LCCs, and LCC partners. The LCC network provides a national forum for conservation planning and is intended

to integrate the efforts of 22 LCCs organized, governed and operated in a consistent manner that promotes landscape conservation. LCCs are self-directed, regional, science-management partnerships directed by a steering committee, supported by technical teams and facilitated by a small staff. The LCCs improve data sharing, communication and coordination across and within agencies; provide and leverage funding, staff and resources; develop common goals, tools, and strategies; link science to management; and facilitate information exchange (USFWS 2012f).

USFWS Region 5 is a member of the North Atlantic LCC steering committee and has the lead role for staffing and facilitating the partnership. The LCC has a science strategic plan, operations and development plan, and a number of collaborative active projects that are focused on providing science and information to guide conservation planning and actions in the face of change. These projects include regional habitat and species climate change vulnerability assessments, a project to forecast effects of accelerating sea level rise on the habitat of Atlantic Coast piping plovers (with an initial focus on Assateague); the Designing Sustainable Landscapes project that is assessing landscape changes including climate change and urban growth on species, habitats and systems in the LCC, and a research and decision support framework to evaluate sea level rise impacts in the northeastern United States.

Figure 3-34. Map of Landscape Conservation Cooperatives (USFWS 2012f)



Chapter 4

USFWS

Refuge wetlands

Environmental Consequences

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Chapter 4: Environmental Consequences

4.1 Introduction

This chapter describes the environmental consequences we predict from implementing management alternatives presented in chapter 2. Where detailed information is available, we provide a more analytic comparison between alternatives and their anticipated consequences. These consequences are described as impacts or effects. In absence of detailed information, we make comparisons based on professional judgment and strategies of the three alternatives: Current Management (alternative A); Balanced Approach (alternative B); and Reduced Disturbance (alternative C).

The chapter is organized by resource category, with the discussion focused on the direct, indirect, and cumulative impacts of both beneficial and adverse effects likely to occur over the 15-year life span of this CCP. Three tables are provided (Tables 4-1, 4-5, and 4-6) that show in which of the alternative(s) a management action is included, notes which of the resource categories would likely be affected by the action, and summarizes whether the impact is adverse or beneficial to that use. In the text, the actions that cause a particular impact are sometimes referenced by the number listed in the tables, as indicated by "(management action #)," where it is more efficient or clear to do so rather than to include a lengthy and repetitive description of the impact-causing action. At the end of this chapter, a matrix summarizes the impacts identified for each action alternative by resource topic and allows for a side-by-side comparison.

Consistent with the CEQ and USFWS regulations on implementing NEPA, we assessed the impacts of the alternatives based on their significance, which takes into account context and intensity of the proposed actions for the alternatives. The geographic scale of their context ranges from site-specific to local or region. Although the area of the refuge is only a small percent of the context of its ecosystem or region, we developed all management alternatives to contribute to the many conservation goals in those larger contexts.

We based evaluations of the intensity of the effects of the alternatives on these factors:

- expected degree or percent of change in the resource from current conditions;
- frequency and duration of the effect;
- sensitivity of the resource to such an effect or its natural resiliency to recover from such an effect; and
- potential for implementing effective preventive or mitigating measures to lessen the effect.

The duration of identified effects varies within the 15-year period of this plan, from those occurring only once for a brief period (e.g., the effects of construction for when facilities are expanded) to those occurring more frequently during a given season or year (e.g., observing wildlife from refuge trails).

This chapter does not separately evaluate the consequences of certain types of management actions described in chapter 2 because these actions often have impacts too trivial to matter, and would be categorically excluded if independently proposed, which would exclude them from further analysis or review. Such categorically excluded actions include but are not limited to:

- Conducting environmental education and interpretation programs (unless major construction is involved, or significant increase in visitation is expected);

- Conducting research, inventorying resources, or otherwise collecting resource information;
- Operating and maintaining infrastructure and facilities (unless major renovation or improvements are involved);
- Recurring, routine habitat management actions and improvements;
- Constructing small projects (e.g., fences, berms, interpretive kiosks) or developing access for routine management;
- Planting and restoring native vegetation; and
- Enforcing Federal laws or policies.

The most recent refuge comprehensive plan, the Chincoteague NWR Master Plan (1993), was created after completion of its own EIS, which included analysis of the refuge's current management for impacts under the NEPA process. Alternative A, Current Management, principally uses the 1992 EIS as the baseline for analyses in this document. This document identifies where impacts would remain consistent for alternative A from the assessment conducted for the 1992 EIS, and identifies management actions that have evolved or changed based on refuge needs since 1992. Previous land and wetland acquisition to ensure protection of important habitats for various birds and aquatic species was a high priority in the 1993 Master Plan. Protection and management of these acquired lands would continue to be a high priority for the refuge, making as much suitable habitat as possible available for the varied refuge wildlife.

There are additional actions proposed under the alternatives that are not fully analyzed in this CCP/EIS because they would require additional information and a level of analysis that is beyond the scope of this EIS. These larger actions would require further planning by the refuge. Federal agencies are encouraged to tier their NEPA analysis to avoid repetition of issues and to focus on the issues for decision at each level of review. Tiering is appropriate when the sequence of statements or analyses is from a plan EIS to a site-specific analysis. All necessary future NEPA analysis will tier to this EIS in accordance with 40 CFR 1508.28, and we will consider all conditions and environmental effects (temporary, long term, and cumulative) described in this EIS, and address any exceptions and whether the determinations are still valid. Once detailed proposals for these actions have been developed, the separate environmental analysis and associated environmental assessment document would be prepared, which would include public involvement and comment at that time. Where possible, we analyzed these alternative actions based on current information.

4.2 Geology and Soils

Geology and soil serve as a fundamental basis of the physical environment of all habitats, and make up an important resource of the refuge. Soil biotic communities consume the wastes and the remains of dead organisms and recycle their constituent materials that are incorporated into the soil for plant productivity. The primary component of the soils found on the refuge is sand and shell (base layer) with various amounts of organic materials forming the different soil types. The refuge must protect these soils to sustain the variety of wetland and upland habitats that would meet refuge goals for habitat and species management. Chapter 3, Affected Environment, provided a profile of soil types on the refuge. This section provides the results of the evaluation of the management actions each alternative proposes for impacts on geology and soils generally.

We reviewed visitor use activities (hunting, fishing and OSV use, recreational beach use, walking, biking, horseback riding) currently occurring on the refuge for impacts to soil. These activities

could disturb upper soil layers, thereby increasing the potential for erosion. However, the compaction of soil could result in minor effects to wildlife along heavily used access routes. For hunting, impacts to soil are not significant because the limited amount of hunters in a given season are not enough to cause any permanent impacts, especially since the routes used by hunters to stalk game are often sporadic. Hiking trails, wildlife observation areas, parking areas, and other high-use areas would continue to be well-maintained through distinct paths and areas where visitors are permitted to traverse, resulting in negligible soil impacts to areas outside specified areas. Soil erosion would not be anticipated; no significant impacts would result on the refuge from these visitor services, although monitoring efforts would continue.

We evaluated the management actions for each alternative for their potential to benefit or adversely impact refuge soil, including one or more of the following:

- Prescribed burning, disking, and mowing;
- Removal of vegetation;
- Visitor service activities; and
- OSV and horseback riding use.

Table 4-1 assesses the impact of management actions on soils; management actions are referenced throughout the text by a number and by a (b), (s), or (v) depending on whether they are dealing with biological, socioeconomic, or visitor services resources, respectively.

4.2.1 Impacts on Geology and Soils in Alternative A

As stated earlier, current management practices that occur on the refuge were analyzed for impacts in the 1992 EIS and would remain consistent for this document. Impacts on soil under alternative A ("Current Management") serve as a baseline for comparing and contrasting alternatives B and C to the refuge's existing management activities. Under alternative A, continuing current management practices will not result in any new or significant impacts to soils. We will continue to use best management practices in all activities that might affect refuge soils to ensure that we maintain soil productivity and do not contribute to erosion or sedimentation.

4.2.2 Impacts on Geology and Soils in Alternative B

Proposed management actions in alternative B that would affect soils include three primary changes from alternative A: change in management for the NWF (management actions 22b and 23b), moving of the recreational beach and parking (management action 52b), and widening of the Service Road to permit access to the new recreational beach.

Alternative B proposes changes to visitor services (specifically hunting). These visitor service actions have been analyzed and found to have no significant adverse impacts to soils (management action 68b). The current refuge big game hunting program (deer and sika elk only) would see a slight change in services (but there would be no significant increase in visitation related to hunting). New hunting opportunities under alternative B, including mourning dove and light goose hunting as well as the addition of turkey hunting (big game) would likely result in a negligible increase in visitors related to hunting (management actions 69b, 70b, 71b, 72b). These hunt programs would also be regulated as the current hunt programs are, only allowing a limited amount of permits to be awarded.

Current management of the NWF removes natural scrub shrub vegetation to create more suitable habitat for coastal nesting shorebirds, such as piping plover and American oystercatcher. Alternative B would cease the vegetation removal and allow for the natural vegetation to grow

back in the 300-acre area (management actions 22b and 23b), improving the habitat for spring and fall neotropical migratory birds. This increased amount of natural vegetation would create a significant beneficial impact for the habitat and soil. Increased vegetation in an area would help to prevent soil erosion and disturbance, as well as improve the soils structure and microbial communities by returning nutrients into the ground.

Negative impacts to soil would result from the construction of the new recreational parking as well as the widening of the new beach access road (management actions 49b and 52b). Alternative B provides for 8.5 acres of parking in a new location, for which soil would be impacted. Approximately 18 acres of soil would be impacted from the expansion of the current Service Road to access the new beach parking. Although no soil in either case would be removed from the refuge, leveling and grading practices would be used, with the need to use fill in some areas. If this were to occur, the current soil may be moved or covered with fill. Furthermore, the increased area of hard compact surface (i.e., new road and increased parking) would increase the potential for erosion in those areas during heavy storm and rain events. Mitigation for these impacts would include allowing the natural growth of vegetation around these areas, which would aid for the capture of soil and decreased erosion. Best construction practices would be followed during the parking and road expansions, and mitigation measures such as erosion prevention screens would be employed to minimize impacts. Since the proposed actions associated with the relocated beach parking and road expansion are conceptual and not finalized, specific details for these actions are currently unknown. Recontouring dunes and topography in the area of the proposed recreational beach, and adjacent lands, would have impacts to many resources including geology and soils. Although we will work closely with NPS and the USACE in designing these future changes, further environmental assessments and analysis for impacts on soils would need to be completed prior to construction. Allowing the existing parking site (8+ acres) to revert to natural conditions would result in a positive impact to soils.

Negative impacts to soil would occur from the construction of the 1-acre horse trailer parking at the entrance of Mallard/C Dike (management action 64b). These impacts would not be significant because there would be no removal of soil. The effects of the parked vehicles would be soil compaction, which would result in limited increased runoff and could not be considered significant as the horse trailer parking area is extremely small compared to the overall refuge lands.

OSV users would only be permitted to travel in the intertidal zone, limiting soil disturbance to non-vegetated compact sand. Closures would continue to be instituted during the coastal bird nesting season.

4.2.3 Impacts on Geology and Soils in Alternative C

Beneficial impacts to soils would result from the elimination of OSV use and horseback riding (management actions 62b and 65b). This action would allow pioneer beach and dune vegetation growth, consequently encouraging beach ridge and dune development on a currently disturbed barrier island beach. This alternative would virtually eliminate motorized travel on the Overwash and Toms Cove Hook and its negative impacts to beach and dune sand stability. Management access to the Hook would occur via the intertidal zone, limiting soil disturbance to non-vegetated compact sand and not in the sensitive high beach zone.

Negative impacts to soils would occur from the creation of beach parking at the new recreational beach (management actions 49b and 52b). These impacts would be similar as those assessed for the relocated beach parking and widened beach access road in alternative B; however, the extent of the impacts to soils under alternative C would be decreased since the parking area would be

approximately half the size. Since the proposed actions associated with the relocated beach parking and road expansion are conceptual and not finalized, specific details for these actions are currently unknown. Further environmental assessments and analysis for impacts on soils would need to be completed prior to construction. All other soil impacts resulting from alternative C would be similar to alternative B.

4.3 Air Quality

Chapter 3, Affected Environment, discusses the status of air quality on and near the refuge. This section provides the results of the evaluation of the management actions each alternative proposes for impacts on air quality. Table 4-1 assesses the impact of management actions on air quality; management actions are referenced by number throughout the text.

4.3.1 Impacts on Air Quality in Alternative A

With the exception of continued high visitation by vehicles, current management activities neither substantially benefit nor adversely affect local and regional air quality. There are no changes as a result of the No Action Alternative and therefore, no impacts. Continuing current management practices as proposed under alternative A will not result in any new or significant impacts to air quality.

4.3.2 Impacts on Air Quality in Alternative B

Alternative B would relocate the beach parking north approximately 1.5 miles from its current location (management actions 49b and 52b). The final location of the relocated beach parking lots may result in an overall decreased VMT (vehicle miles travelled) of passenger vehicles, a positive outcome. However, new uses such as space tourism and separation of existing uses (recreational beach from crabbing and clamming areas) could cause additional vehicle use by visitors and create seasonal or temporal decreases in air quality from increased VMT.

The main source of emissions at Chincoteague NWR is from gasoline operated passenger cars and trucks, from which the main pollutant is carbon monoxide (management action 48b). Alternative B would not have a significant impact on air quality due to the minor changes in vehicle activity and because the area surrounding Chincoteague NWR meet the National Ambient Air Quality Standards set by EPA as required by the Clean Air Act. Localized increases in emissions from visitors' vehicles would be negligible compared to current off-refuge contributions to pollutant levels and likely increases in air emissions in the Accomack County airshed from land development over the next 15 years. Any adverse effects on air quality from refuge activities would be more than offset by the benefits of maintaining the refuge in natural vegetation.

4.3.3 Impacts on Air Quality in Alternative C

Alternative C would move the beach parking area approximately 1.5 miles north from its current location (management actions 49b and 52b) and would maintain 480 parking spaces, half the number under alternative B (management action 51b). Similar to alternative B, the final location of the relocated beach parking lots may result in an overall decreased VMT of passenger vehicles, a positive outcome. Additionally, institution of a shuttle service during peak visitation (management action 50b) would have a slight negative impact on air quality, but the increase in emissions associated with a shuttle vehicle would be partially if not completely offset with the reduction in passenger vehicles and their associated VMT, which would be greater than that under alternative B. OSVs would be discontinued (management action 62b), thus further reducing VMT and resulting in a positive impact on air quality.

4.4 Hydrology/Water Quality

We evaluated the alternatives for their potential to help maintain or improve the hydrology and water quality of the Delmarva coastal area watershed and identify any impacts to water quality. The area of primary focus would extend from Chincoteague Bay south through the coastal bays and waterways to the southern end of Cedar Island and to the Atlantic Ocean fronting the coastal barrier islands.

The refuge manages 13 impoundments totaling 2,650 acres that are designed to hold freshwater of which the sole water source is precipitation. Precipitation is relatively unpredictable, and each spring and summer managers must weigh the benefits and disadvantages of releasing this water to tidal waters, thereby lowering water levels in the impoundments. Low soil moisture due to insufficient precipitation negatively impacts the growth of moist soil plants with possible consequences to the production of wildlife food and cover. Inadequate late summer and fall precipitation limits the ability to capture fresh water within the impoundments for wintering waterfowl, the primary purpose for which the impoundments were built.

None of the proposed refuge management activities in any alternative should adversely affect local or regional hydrology and water quality. None would violate Federal or state standards for contributing pollutants to water sources, and all three alternatives would comply with the Clean Water Act.

The SLAMM analysis suggests that within the next 100 years, significant marsh loss with subsequent gains in open water would be very likely to occur (Nieves 2009). For example, a modeled scenario of one meter sea level rise and a marsh accretion rate of 3.1 mm/year could result in a projected 20 percent loss of upland habitats, 14 percent loss in forested wetlands and scrub-shrub habitats, with an increase from current open water component of 15 percent to 88 percent of the entire refuge, over the next 100 years.

Table 4-1 assesses the impact of management actions on hydrology and water quality; management actions are referenced by number throughout the text.

4.4.1 Impacts on Hydrology/Water Quality in Alternative A

Existing management activities do not adversely affect local or regional hydrology and water quality. Continuing current management practices as proposed under alternative A will not result in any new or significant impacts to hydrology or water quality.

4.4.2 Impacts on Hydrology/Water Quality in Alternative B

Alternative B proposes changes to the hunting program (management actions 69b, 70b, 71b, 72b, and 73b). These visitor service actions have been analyzed and found to have no significant adverse impacts to hydrology or water quality. Current big game hunting programs on the refuge would see a slight change in services (increased hunting outreach events), but there would be no significant increase in visitation related to hunting. Since there would not be a significant increase in visitor use, then there would not be an increase in visitor pollution or vehicle run-off which could negatively impact water quality. Other new visitor services, such as light goose hunting, would be added to the refuge hunting opportunities and result in a slight potential increase in visitors related to hunting.

The management of the Beach Road causeway, which would be restricted from year-round routine visitor use, and the eventual modification of that area, would have a positive impact on tidal flow

and water quality for Swan Cove Pool (F Pool) (management action 15b). The increased tidal rhythm through impoundment culverts would now be allowed to mimic the natural tidal rhythm of Toms Cove, which would lead to improved water quality, dissolved oxygen, pH, and salinity levels for the new flow area. Improvements to tidal flow will require additional consultation with partners (e.g. USACE, Town), an additional environmental analysis.

The disturbance of Mallard and Pintail Pools (C and D Pools) (management action 22b), as part of construction of new recreationalc beach parking, could have negative impact on water quality for all impoundments to the south (management action 52b). Since impoundment flow is connected from north to south by culverts, anything that occurs in upper watershed beginning at Pintail Pool (D Pool) would flow though the impoundments south of them. Pollutants from vehicle emissions, oils, and coolants that leak out and collect in the parking area could eventually be washed into the adjacent water systems, which would flow south to Toms Cove. This occurrence would be largely confined to the summer months when beach traffic would be at its highest, and would be mitigated through best engineering practices such as the creation of catch basins around the parking area, as well as new culvert containments that would trap pollutants. Future applicable activities under this plan shall be consistent with Section 438 of the Energy Independence and Security Act, and Executive Order 13148 regarding stormwater runoff from development.

General construction practices associated with parking lot building (management action 52b), road expansion, and the improvement of water control structures along the refuge (management action 15b) including site grading, top soiling, and fertilizing could cause erosion, nutrient runoff, and a potential decline in surface and shallow groundwater quality, until development is completed. These impacts would be temporary and best management practices would be followed to help mitigate.

4.4.3 Impacts on Hydrology/Water Quality in Alternative C

Impacts to hydrology and water quality under alternative C would be nearly the same as alternative B, but likely less due to the reduced parking lot size (management action 51b).

4.5 Vegetation

We evaluated the management actions for each alternative for their potential to benefit or adversely impact vegetation on the refuge, including one or more of the following:

- Water level and habitat management for impoundments;
- Construction impacts due to the building of new facilities;
- Management strategies that allow natural succession and dynamic coastal processes to proceed unimpeded along undeveloped barrier island areas of the refuge;
- Change in OSV and horseback riding management; and
- Invasive species management.

Table 4-1 assesses the impact of management actions on vegetation; management actions are referenced by number throughout the text.

Regardless of the alternative selected, impacts on vegetation would be influenced by climate change and sea level rise as increased weather extremes and more severe coastal storms would introduce greater frequency and duration of salt water intrusions in freshwater wetland and upland habitats. These impacts can be seen in detail in the SLAMM analysis (Nieves 2009).

4.5.1 Impacts on Vegetation in Alternative A

Current management practices, as proposed to continue under alternative A, will not result in any new or significant impacts to vegetation.

4.5.2 Impacts on Vegetation in Alternative B

Proposed management actions in alternative B that would affect vegetation include three primary changes from alternative A: change in management for the NWF (management actions 22b and 23b), relocation of the recreational beach and parking, and widening of the new beach access road to permit public access to the new recreational beach (management action 52b).

Alternative B also proposes changes to the hunting program (management actions 69b, 70b, 71b, 72b, and 73b). These visitor service actions have been analyzed and found to have no significant adverse impacts to vegetation. Current big game hunting programs on the refuge would see a slight change in services (increased hunting outreach events), but no anticipated increase in visitation related to hunting , and thus, no increase in visitor trampling potential or vegetation habitat disturbance. Other new visitor services, such as turkey and light goose hunting, would be added to the refuge hunting opportunities which would result in a potential increase in visitors related to hunting. However, the total number of hunters on the refuge at any time would be limited.

Impacts from new or expanded visitor uses would be minimal since visitors use pre-selected paths and hiking trails which the refuge created to traverse through habitat, and avoid future vegetation impacts. For hunters, impacts to wildlife habitat would be minimal as most species impacted would have already undergone senescence (aging or dying process) or become dormant during the hunting seasons. Further impacts are minimized by not permitting hunters to cut vegetation for shooting lanes or camouflage, and by not permitting the use of permanent hunting structures attached by nails, wire, and other materials that could adversely affect vegetation. No significant impacts would result on the refuge from these visitor services, but current monitoring efforts would continue (USFWS 2007b).

The relocation of the recreational beach boundaries and parking areas, along with the expansion of the beach access road, would result in negative impacts to approximately 27 acres of vegetation (management action 52b). The creation of new recreational beach parking would negatively impact approximately 8.5 acres of a mixture of scrub shrub, wetland, and forested habitats, with their associated vegetation (see chapter 3). We concur with comments received from NPS during the public comment period that "...8.5 acres is not a limit, but a guideline, that can be changed as needed with the actual design of a facility that provides the required 961 spaces and related facilities as part of a well-thought-out plan." The 8.5 acres related to the current parking lot size, the 961 car spaces, and the 1-mile recreational beach, are all necessary in this EIS at this point to effectively compare and contrast the potential impacts of the no action alternative to the other alternatives. These numbers allow us to determine that if the beach is relocated, how many acres at the current site we can expect to reclaim as habitat (rather than as parking lots), and what is the potential footprint of impacts at the proposed site. Because USFWS is committed to working with NPS and others to future design, refine and analyze beach relocation infrastructure in a separate NEPA document, if the actual footprint becomes larger, then it can more appropriately be considered at that stage.

Vegetation would be altered and/or removed from the vicinity of Mallard Pool (C Pool) and Pintail Pool (D Pool) resulting in a loss of that habitat, mostly myrtle/bayberry shrub (management action 22b). Mitigation for these adverse impacts would result from management of the NWF (management action 23b), as outlined in the section on Soils, that would cease vegetation removal and allow for the natural vegetation to grow back in an area of approximately 300 acres, improving the habitat for spring and fall migratory neotropical birds. In other words, while 8.5 acres of this habitat type would be negatively impacted by construction of the parking lot, 300 acres would be allowed to grow back naturally and improve the overall habitat on the refuge for the native species. The impacts to vegetation resulting from the expansion of the beach access road would result in removal of approximately 18 acres of scrub shrub and forest vegetation. As discussed with the new parking lot area earlier, the exact footprint and design of the expanded beach access road is unknown at this time, although the amount of impact is a conservative estimate; it accounts for the existing roadway at this location and acknowledges that road construction would be an expansion of a current footprint. Further environmental analysis would be required for the beach access road expansion prior to construction. The removal of vegetation would be mitigated by expanding the road in currently impacted areas as much as possible (i.e., expansion into the current man-made borrow ditches that were created to build the road originally), and where not possible, only impacting minimal scrub shrub or forest vegetation where no threatened or endangered species are known to occur.

Impacts of OSV and horseback riding would not be significant because access would continue to be limited throughout the season, and vehicles would still be required to stay within the intertidal zone.

The opening of the OSV zone from September 16 to March 14 creates negative impacts by exposing the area to potential vegetation trampling and habitat alteration. The closing of the zone to protect nesting shorebirds from March 15 to September 15 has beneficial impacts for vegetation; decreasing the amount of time that trampling would be possible (management action 57b). All of these impacts would not be significant due to the restricted area in which these activities are permitted, and the lack of vegetation that occurs on the beach.

Horseback riding would take place along the Atlantic Ocean beachfront below the high tide zone between September 16 and March 14 (management action 63b). This area is devoid of vegetation. It is anticipated however, that allowing this use would have minimal impact to vegetation near parking area assigned for horse trailer parking. Current plant communities that occur in these areas are not rare or highly sensitive to disturbance based on available information. Through the development of brochures, maps, and established travel corridors we would minimize the impacts to vegetation along the entire horseback riding/OSV zone.

New horseback riding parking would have a negative impact on approximately 1-acre of forested upland vegetation at the corner of Mallard/C Dike and the new beach access road (management action 64b). This adverse impact would be mitigated by using best management practices and construction where the least amount of vegetation would be removed. The parking lot would not be paved. This would allow for the minimal amount of disturbance, causing only the compaction of underbrush and small vegetation, with no large removal needed.

The improvement or replacement of all water control structures would have beneficial impact on all freshwater impoundments into Toms Cove and Chincoteague Bay (management action 15b).

By updating flow capabilities, of Mallard Pool (C Pool), Shoveler Pool (B-North Pool), and Snow Goose Pool (B-South Pool), water could drain freely into Toms Cove through Swan Cove (F Pool) more efficiently. This would maintain low salinity levels and improve water quality for moist soil vegetation and associated wildlife.

Opening non-migratory (resident) Canada goose and light goose hunting on Assateague Island would have a slight beneficial impact to wetland vegetation in the impoundments (management action 69b). Any decreased amount of these species would result in less grazing effects that deteriorate native vegetation.

The construction of new lifeguard housing facilities and a boardwalk at or near Wallops Island NWR would result in an adverse impact for forested vegetation such as loblolly pine (management action 66b). This impact would be minimal due to the small size of the facilities and the boardwalk, but further investigations and environmental analysis to assess impacts would need to be conducted prior to construction. Efforts would be made to ensure minimal vegetation would be impacted.

We will consider all appropriate regulations to protect aquatic resources and sensitive buffer areas, and we will avoid and minimize impacts to refuge wetlands and other natural resources whenever possible. The USFWS remains committed to working closely with Federal and State resource agencies, prior to and during any future project construction associated with this CCP, to continue monitoring and collection of additional environmental data, provide relevant supplemental information as needed, and to apply adaptive management and best management practices as appropriate.

4.5.3 Impacts on Vegetation in Alternative C

The creation of new recreational beach parking would negatively impact approximately 4.25 acres of a mixture of scrub shrub, wetland, and forested habitats, with their associated vegetation (see Chapter 3) (management action 51b). Vegetation would be altered and/or removed from the vicinity of Mallard and Pintail (C and D Pools) impoundments resulting in a loss of that habitat, mostly myrtle/bayberry shrub (management action 22b). Impacts associated with the recreational beach relocation, and the expansion of the new beach access road would be consistent with alternative B (management action 52b).

The elimination of OSV use and horseback riding on the refuge would have a positive benefit to vegetation along approximately eight linear miles of the beach, by eliminating the risk of trampling, compaction, or other degrading possibilities to the native plants (management actions 62b and 65b) if visitors stray from the designated routes of travel.

Currently the population of the Chincoteague pony herd on Chincoteague Island is approximately 125 to 135, with slight fluctuations depending on the time of year and whether or not it is breeding season. The current management of allowing 150 potential ponies would be reduced to only allowing a population of 125 ponies, with no potential to increase the herd size. This change in management would reduce the pony population, which would likely decrease the effects of grazing and trampling that the ponies currently have on vegetation on the refuge (management action 17b).

Phasing out of the exotic sika population on the refuge over the next 15 years would have a beneficial impact for vegetation, especially for the endangered seabeach amaranth, of which sika is a documented herbivore (management action 37b). The grazing habitats of sika have led to an overgrazing of certain habitat types on the refuge, mainly in the impoundments and forested areas. These areas have been documented as overbrowsed areas of vegetation, which would see a positive increase in regeneration if sika were phased out.

There would be no new construction of a bicycle or pedestrian trail in alternative C. The impacts described for the building of a new bicycle trail in alternative B would, therefore, be avoided. All other impacts to vegetation would be the same as alternative B.

4.6 Federally Threatened and Endangered Species

Piping plover, loggerhead sea turtle, Delmarva Peninsula fox squirrel, red knot, and seabeach amaranth are the current federally threatened or endangered species managed on the refuge. We analyzed the alternatives for impacts to these five endemic focal species, which would exemplify the impacts for all other listed species that may be found on the refuge. Red knot, a shorebird species, was proposed to be listed as threatened under the ESA during the planning process, and was finally listed as threatened in December 2014. The species uses refuge beaches during spring and fall migration.

Table 4-1 assesses the impact of management actions on threatened and endangered species; management actions are referenced by number throughout the text.

4.6.1 Impacts on Federally Threatened and Endangered Species in Alternative A

Current management adheres to guidelines set forth in previous recovery plans and biological opinions. Under alternative A, continuing those current management practices will not result in any new or significant adverse impacts to threatened or endangered species.

4.6.2 Impacts on Federally Threatened and Endangered Species in Alternative B

Allowing natural vegetation to grow within the NWF to improve habitat for spring and fall migratory birds, waterfowl, and neotropical birds would result in an initial negative impact for piping plovers (management action 23b) at that location. Current management of the NWF area has vegetation adjacent to open mudflats being annually cut back to create a more suitable habitat for coastal nesting shorebird populations. Allowing natural scrub shrub vegetation to grow in adjacent to the open mudflats, would transform the area into habitat that is not commonly used by coastal nesting shorebirds, altering approximately 300 acres of habitat. However, this negative impact would be offset and even surpassed as a beneficial effect from relocating the current recreational beach (management actions 2b and 3b).

The existing 1-mile beach area and 8.5 acres of beach parking on the southern end of the refuge is determined to be prime coastal shorebird and seabeach amaranth habitat. By moving the recreational beach and accompanying facilities north (management action 52b), this area would be allowed to revert back to coastal nesting shorebird and amaranth habitat by natural processes (management actions 2b and 3b). Piping plovers and amaranth favor areas with frequent overwash events, which occur currently where the recreational beach is located. Areas adjacent to the recreational beach exhibit high density of piping plovers nesting. This area has the potential to support a higher number of species than what is currently supported in the NWF. Sea turtles exist in the same types of habitats as piping plovers, and the increase in habitat quality coming

from the allowance of natural processes to take over would see a beneficial impact for both (management action 8b), as well as the benefits from the general decrease in human disturbance.

Through the creation of the year-round OSV access area, all day and nighttime OSV use south of this area would be discontinued between March 15 and September 15 (management actions 9b, 10b, 60b, 61b). This would eliminate the potential for OSV users to run over nests, hatchlings or plants, or otherwise disturb the nesting process. From September 16 to March 14, negative impacts would be minimized in the OSV zone since OSV users would only be permitted to travel in the intertidal zone, and by management action conducted by refuge staff, usually in the form of exclosures and signs.

Mowing would occur on various roads within the refuge to benefit the Delmarva Peninsula fox squirrel. Alternative B's (and C's) actions for mowing would result from the change in the access to and relocation of the recreational beach. Although this management action (mowing) is similar to alternative A's, the location of the mowing would shift to the areas where refuge traffic would be the highest due to the new access routes for the new recreational beach.

4.6.3 Impacts on Federally Threatened and Endangered Species in Alternative C

The phasing out of OSV and horseback riding on the refuge would have a beneficial impact to threatened and endangered species on the refuge (management actions 62b and 65b). Currently, OSV and horseback riding is managed to minimize disturbance to threatened and endangered species, but a complete elimination of the activities would eliminate the threat of disturbance. Other impacts to federally threatened and endangered species under alternative C would be the same as under alternative B.

4.7 Birds

Habitat conservation and management is the highest priority of the refuge, consistent with the original establishment purposes for the protection of migratory birds. More than 320 species of birds are known to use the refuge regularly for nesting and brood rearing, feeding, resting and staging during migration, or wintering.

We evaluated the management actions for each alternative for their potential to benefit or adversely impact the various bird species on the refuge, including one or more of the following:

- management of the recreational beach and parking;
- change in impoundment management;
- OSV management;
- access to Assawoman Island; and
- hunting.

Visitor use activities (hunting, fishing, recreational beach use, walking, biking, horseback riding, OSV use) currently occurring on the refuge have been analyzed for impacts to birds. As analyzed for the 1992 EIS, such activities are expected to have a negative short term impact on birds. These activities are known to create disturbance to migratory and breeding birds and can cause alteration of habitats by trampling vegetation, compacting soils, and increasing the potential of erosion. For other visitor use activities, impacts would be minimal since visitors are required to use pre-selected paths and hiking trails which the refuge created to traverse through habitat, and avoid future vegetation impacts. No significant impacts would result on the refuge from these visitor services, but current monitoring efforts would continue.

Table 4-1 assesses the impact of management actions on birds; management actions are referenced by number throughout the text.

4.7.1 Impacts on Birds in Alternative A

Previous land and wetland acquisition to ensure protection of important habitats for various birds and aquatic species was a high priority in the previous master plan and EIS. Protection and management of these acquired lands have continued to be of the highest priority for the refuge, making as much suitable habitat as possible available for the varied refuge wildlife. Existing management activities do not adversely affect birds or bird populations. Under alternative A, continuing current management practices will not result in any new or significant adverse impacts to birds.

4.7.2 Impacts on Birds in Alternative B

Alternative B proposes changes to the hunting program (management actions 69b, 70b, 71b, 72b, and 73b). These visitor service actions have been analyzed and found to have no significant, overall adverse impact to the bird population. Current big game hunting programs on the refuge would see a slight change in services (increased hunting outreach events), but there would be no significant increase in visitation related to big game hunting.

Light goose, resident Canada goose, and mourning dove hunting would be added to the refuge hunting opportunities which would result in a potential increase in visitors related to hunting (management action 69b). Additional impact analysis for any new hunts will be addressed in hunts plans that will include environmental compliance. These hunt programs would be regulated as the current hunt programs are, with a limited amount of permits awarded. Any increase in hunting will likely have adverse impacts on individual waterfowl, but at the population level no significant impact is expected.

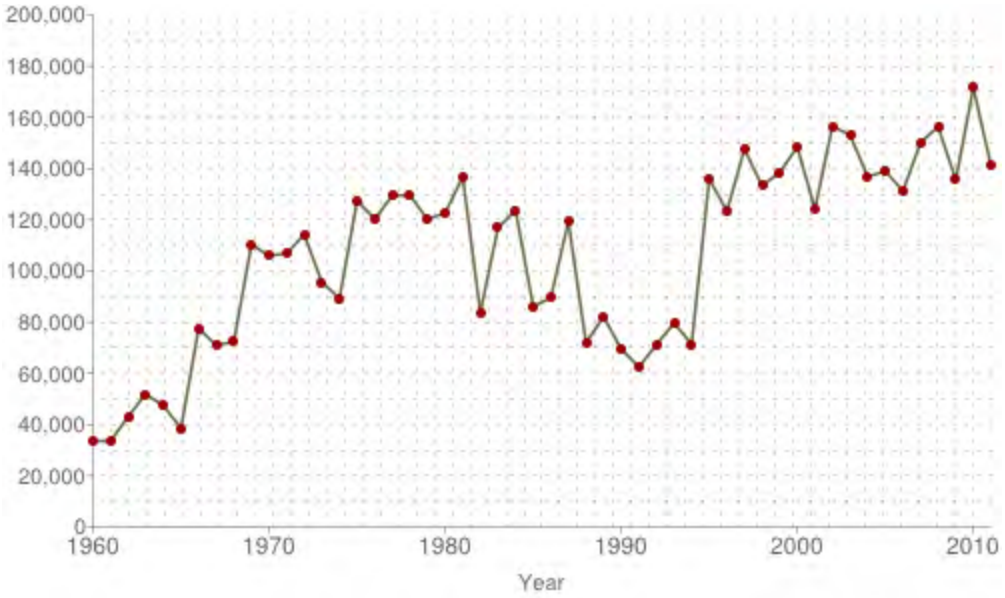
Net positive impacts from the refuge hunt program are expected. We expect that the harvest of local resident Canada geese would have the following beneficial effects on other resources:

- Increase natural seed regeneration within refuge impoundments thereby increasing fall/winter food availability for migrating ducks, geese and swans.
- Reduce fecal contamination in the refuge impoundments. Excessive fecal matter also changes the nitrogen and oxygen levels in the refuge waters resulting in algal blooms and death of aquatic organisms. (Source: USDA-APHIS. 1999. Environmental Assessment for the management of conflicts associated with non-migratory Canada geese, migratory Canada geese, and urban/suburban ducks in the Commonwealth of Virginia. 77 pp.)
- Reduce the possibility of transmitting disease to susceptible populations of migrating birds as they over-winter at the refuge or pass through.
- Reduce negative interactions (aggressive behavior) with refuge visitors on roads and trails during spring breeding season.

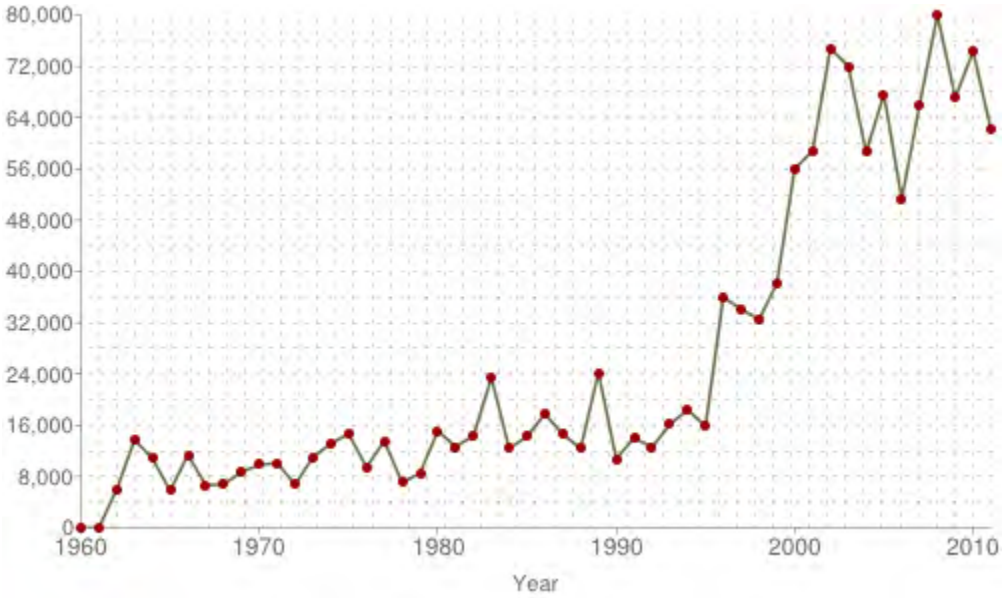
Harvest and disturbance of light geese under the authority of the light goose conservation order would have the following beneficial effects:

- Reduce damage caused by light geese to sensitive arctic breeding habitats. This would have the additional benefit of reducing negative impacts to other bird species nesting within that same arctic habitat.
- Reduce damage to wintering habitats within the Atlantic Flyway.

Total number of ducks harvested in Virginia



Total number of geese harvested in Virginia



http://www.flyways.us/regulations-and-harvest/harvest-trends

The resident Canada goose population increased significantly during the 1980s and early 1990s. The population peaked at over 260,000 geese in the mid-late 1990s in Virginia and has been steadily reduced by specific management programs since that time. The current population estimate is 158,267 (+/- 28 percent) in Virginia and over 1 million in the Atlantic Flyway. For migrant Canada geese, the breeding population estimate for 2012 (190,340) is similar to the past 3-year average (189,317).
http://www.dgif.virginia.gov/hunting/va_game_wildlife/waterfowlfactsheets.pdf

Liberal duck seasons (60 days, 6 bird bag limit) and resident goose seasons have resulted in higher waterfowl harvests in Virginia during the past 10 years. Harvest has averaged approximately 150,000 ducks and 60,000 geese from 2000 to 2011, compared to 114,770 ducks and 25,000 geese during the 1990s. The long season length and liberal bags offer greater opportunity and a greater cumulative harvest over the course of the season.

Waterfowl hunter numbers in Virginia have been generally stable since the late 1990s, and Federal Duck Stamp sales have averaged 23,390 in Virginia (for 5-year period, 2006-10). Since 1999, the HIP has been used to estimate hunter effort and harvest. The average number of duck and goose hunters over the past 3 years, as measured by HIP, was 13,618 and 12,360 respectively. In 2011, only 99 visits occurred on the refuge for migratory bird hunting, possibly because the hunt areas are only accessible by boat.

Chincoteague Waterfowl Harvest (self-reported, 2008 to 2013)
2008/2009 - 212
2009/2010 - 65
2010/2011 - 53
2011/2012 - 67
2012/2013 - 69

Given the exceptionally low numbers of waterfowl harvested from the refuge in respect to the total Statewide harvest and waterfowl population, no cumulative impacts to local, regional, or Statewide populations of ducks or geese are anticipated from hunting on the refuge.

Disturbance to wintering waterfowl can be significant particularly from human activity within feeding and loafing areas. Hunting occurs only on the Wildcat Marsh and on Morris, Assawoman, and the north end of Metompkin islands. Morton (1986) found that the increased presence of humans associated with the refuge big game hunting program can contribute to significant movements of ducks, particularly black ducks, off the refuge. These disturbances are at a time when these birds need the isolation of the refuge to feed and rest. Paulus (1984) and Belanger (1989) found that hunting activity (gun shots or hunter movements) caused waterfowl to move to less disturbed areas and avoided some areas until after the hunting season. Laskowski et al (1993) documented human disturbance to a representative species of waterfowl by the visiting public on Back Bay NWR, Virginia. Disturbance elicited behavioral changes ranging from increase alertness to flying to other parts of the refuge. McNeil et al. (1992) found that many waterfowl species avoid human disturbance by feeding at night instead of the day.

Waterfowl and other migratory bird hunting would continue to be limited to specific areas on the refuge in order to reduce potential disturbance. Migratory game birds are those bird species so designated in conventions between the United States and several foreign nations for the protection and management of these birds. Under the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Secretary of the Interior is authorized to determine when “hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any bird, or any part, nest, or egg” of migratory game birds can take place, and to adopt regulations for this purpose.

Changes in hunt management would have net positive impacts for bird species on the refuge, mostly by the elimination of predation and competition. Adding new hunting opportunities and developing a trapping program would add to the beneficial impacts of the current predator management program (management actions 69b, 70b, 71b, 72b, and 73b). These new hunting and trapping programs would further reduce mammalian predators of coastal nesting birds. Further, adding resident Canada goose and light goose hunting on Assateague Island would reduce their negative impact to habitat on the refuge.

Impacts to shorebirds from human activity have been well documented. Pfister et al. (1992) investigated human disturbance as a factor that might limit the capacity of appropriate staging areas to support migrating shorebirds. Results indicate that adverse impacts from human disturbance would be greater on shorebird species using the front side of beach habitats, and because of these impacts the local abundance of species may be reduced by 50 percent. Such disturbance is implicated as a potential factor in long-term declines in shorebird abundance during migration periods at disturbed sites.

Based on past observations of impacts on shorebirds by refuge staff, disturbance by refuge hunters to shorebirds is expected to be negligible since most shorebird species have completely passed through Virginia by peak hunting season in November through January. Some hunting occurs when these species may be migrating before and after this peak hunting time. In addition, hunters are restricted from prime shorebird use areas.

The new recreational beach area was chosen through a SDM analysis (USFWS 2011b).[1] Through this SDM process, a 1-mile segment of beach was identified as having the least impacts to refuge habitat and wildlife. This general area would be the location for the new recreational beach in alternatives B and C (management action 52b). Human disturbance to coastal nesting birds would be greatly diminished since the recreational beach would be relocated north, and OSV use would be limited to September 16 to March 14 (management action 60b). Natural processes would allow for overwash to occur in the location of the existing recreational beach, resulting in fresh sand and shell which is prime habitat for coastal nesting birds, turtles, and seabeach amaranth (management actions 2b, 3b, 6b, 8b, and 13b).

The moving of the recreational beach and parking areas, along with the expansion of the beach access road, would result in removal to approximately 27 acres of migratory bird habitat, but the initial negative impacts would be alleviated (management action 52b) with restoration of other areas. The creation of new recreational beach parking would negatively impact approximately 8.5 acres of a mixture of scrub shrub, wetland, and forested habitats, with their associated vegetation (see chapter 3). Vegetation would be altered and/or removed from the vicinity of Mallard Pool (C Pool) and Pintail Pool (D Pool) resulting in a loss of that feeding and nest habitat, mostly myrtle/bayberry shrub (management action 22b). Pintail Pool (D Pool) has received very low waterfowl and shorebird use over the past 20 years, so minimal impact is expected.

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[1] The Chincoteague refuge staff conducted a workshop with the following attendees to arrive on a consensus on the problem statement and findings of the document: the town of Chincoteague (town planner), FWS Regional Biologist, FWS Assistant Regional Biologist, FWS Inventory and Monitoring Coordinator, NPS Assateague Island National Seashore, Virginia Division of Game and Inland Fisheries, FWS Coastal Delaware NWR Complex Manager, Chincoteague refuge staff, Eastern Shore of Virginia Refuge Manager. (Accomack County was invited but not in attendance).

The proposed new management of the NWF under alternative B would help to mitigate initial adverse impacts as outlined in the Soils and Vegetation sections (management action 23b). Proposed management at the NWF would cease vegetation removal and allow for the natural succession of vegetation to occur in this 300-acre area, improving the habitat for spring and fall migratory neotropical birds.

OSV impacts would not be significantly adverse because the use is now only allowed in support of priority public uses like surf fishing, and the driving limitations to the intertidal zone. The ½-mile fishing zone south of the relocated recreational beach would have a negligible impact on coastal nesting birds, primarily because of its location (management action 61b). The specific area highlighted for fishing was chosen because of its current lack of use by coastal nesting birds, and its close proximity to the new recreational beach.

Assawoman Island would see beneficial impacts to birds as the area would be closed to all visitor use during the nesting season (management action 41b). Additionally, beneficial impact for migratory waterfowl is expected as this management strategy would: increase thermal cover for waterfowl in the winter; increase the food sources for water birds of conservation concern such as snowy egret, glossy ibis, Forster's and gull-billed terns; and improve shorebird migratory stopover habitat for many species of conservation concern, including short-billed dowitcher, dunlin, and semipalmated sandpiper.

4.7.3 Impacts on Birds in Alternative C

The phasing out of OSV and horseback riding on the refuge would have a positive benefit for coastal, migratory, and wintering shorebird species (management actions 62b and 65b). As analyzed under alternative A, current OSV and horseback riding use does not pose a significant impact for birds in that area, but the complete phase out of these activities would further diminish the possibility for trampling or general human disturbance. All other impacts to birds in this alternative would be similar as under alternative B.

4.8 Fish and Other Aquatic Species

The refuge has a minimal assemblage of fish species in the freshwater impoundments. The refuge currently manages the impoundment habitats for birds, and not necessarily for fish, but impacts that occur in this habitat for birds would potentially affect fish as well. Since the impoundments are managed annually and on a strict regime through water control structures, the habitat remains a beneficial area for all aspects of the fish lifecycle.

The horseshoe crab is an endemic species found on the east coast of the United States, with the center of abundance between New Jersey and Virginia. This species spawns in the spring during new and full moon periods starting the end of April and lasting into June. This period of time coincides with the spring migration of shorebirds. Migration is an extremely energetic undertaking for these birds and their success or failure is dependent upon finding sufficient energy (food) to complete migration and then to breed. Studies have shown that horseshoe crab eggs that wash up on beaches after a spawning cycle are known to supply some or the entire energy requirement to complete migration.

Table 4-1 assesses the impact of management actions on aquatic species; management actions are referenced by number throughout the text.

4.8.1 Impacts on Fish and Other Aquatic Species in Alternative A

Existing management activities do not adversely affect fish or fish populations. Under alternative A, continuing current management practices will not result in any new or significant adverse impacts to fish.

4.8.2 Impacts on Fish and Other Aquatic Species in Alternative B

Improvements to the tidal flow of Swan Cove (F Pool) resulting from modification and replacement of water control structures within Beach Road causeway would have a positive impact on fish and other aquatic species (management action 15b). Increased water flow and tidal rhythm would allow fish and aquatic invertebrates such as crabs and mollusks passage into this restored salt marsh.

4.8.3 Impacts on Fish and Other Aquatic Species in Alternative C

Impacts to fish and other aquatic species under alternative C would be the same as under alternative B.

4.9 Mammals

The refuges support populations of mammalian species common to habitats of the Delmarva Peninsula (plus the Delmarva fox squirrel, which is endemic to the area and rare). As a taxonomic group, mammals would benefit from the refuge land protection and management of riparian habitats, forests, grasslands, shrub, and wetlands proposed for listed species, waterfowl, and migratory birds. Likewise, refuge habitats would benefit from careful attention to the impacts on mammals resulting from any of its activities. We evaluated management actions and visitor uses for alternatives for their potential to beneficially or adversely affect large and small aerial, terrestrial, or wetland mammals. Table 4-1 assesses the impact of management actions on mammals; management actions are referenced by number throughout the text.

4.9.1 Impacts on Mammals in Alternative A

Current management practices that occur on the refuge were analyzed for impacts in the 1992 EIS, and largely remain consistent for this alternative. In general, the presence of humans disturbs most mammals, typically resulting in indirect short-term adverse impacts considered negligible since they would not cause any long-term effects on individuals or populations. Continuing existing management activities will not result in any new or significant adverse impacts to mammals.

4.9.2 Impacts on Mammals in Alternative B

Refuge strategies for conserving and maintaining biological integrity, diversity, and environmental health, restoring native plant communities, improving habitat conditions for the endangered Delmarva Peninsula fox squirrel, and controlling invasive or nuisance species would be management actions that have net beneficial impacts to mammals. The actions would directly or indirectly benefit mammalian populations over the long term by ensuring the continuation of quality natural habitats for resident mammalian wildlife.

Controlling invasive plant species, particularly those that quickly colonize an area and form dense, monotypic stands such as phragmites, would benefit mammals by maintaining the balance of food resources and native vegetative communities with which they evolved or adapted to for cover, nesting, and diverse food resources. For smaller, insectivorous mammals, maintenance of native plant diversity and structural integrity by controlling invasive species would have a positive

impact as those species rely on biodiversity and availability of invertebrate food resources that are only associated with native floral assemblages.

UFWFS recognizes USDA-APHIS as the expert in reducing mammalian predation on natural resources. Chincoteague NWR and APHIS agree to work together and with other interested parties to benefit threatened and endangered wildlife, bird species of management concern, and wildlife nesting habitat. The objective of the project is to: (1) conduct avian and mammalian predator management throughout the refuge complex to support the refuge's effort to enhance migratory bird populations of selected bird species, and to carry out wildlife management objectives of the complex; (2) assist the complex with the management and eradication of invasive species such as nutria; and (3) assist the complex with the monitoring and management of wildlife disease surveillance and outbreaks.

APHIS will conduct predatory mammalian and avian species management efforts on the refuge complex upon request by refuge staff and approved by the refuge manager. The strategy used will include preventative control and corrective control. Preventative control will include the removal of red fox, coyote, raccoons and mink as requested on Assateague Island, Assawoman Island, Eastern Shore of Virginia, Fisherman Island and other designated units (Cedar, Metompkin, Morris Islands and Wildcat Marsh) within the refuge complex from February through August and continue until predator management goals for red fox, gray fox, raccoons, coyote, mink and opossum are met for individual complex units.

Hunting is an important visitor use activity that results in a net positive impact for mammals by helping control the current sika elk and white-tailed deer populations. Overall it serves both a wildlife-dependent recreational use and a method of population control that would benefit other non-hunted mammals, conserve migratory bird habitats, reduce vehicle/deer collisions, and reduce overbrowsing of vegetation.

VDGIF has primary responsibility for managing white-tailed deer in Virginia. The Virginia Deer Management Plan, first completed in 1999 and revised in 2006, guides management of deer habitat, deer populations, damage caused by deer, and deer-related recreation in the Commonwealth. In 2012, 213,597 deer were reported killed by hunters in Virginia. This total included 96,712 antlered bucks, 18,061 button bucks, 98,781 does (46.3 percent), and 43 “unknown” deer. It is also 8 percent below the last 10-year average of 232,573. In Accomack County, an average of 3,056 deer per year are killed (see Table, 2008-2012 data).

Accomack County Deer Kills, 2008 to 2012

Year	Antlered Males	Male Fawns	Females	% Female	Unknown	Total Kill
2008	1412	371	1924	51.9%	0	3707
2009	1225	249	1614	52.3%	0	3088
2010	1246	307	1740	52.8%	0	3293
2011	1007	263	1535	54.7%	2	2807
2012	923	212	1249	52.4%	0	2384

http://www.dgif.virginia.gov/wildlife/deer/harvest/index.asp

Population reconstruction computer models indicate that Virginia's statewide deer population has been relatively stable over the past decade, fluctuating between 850,000 and 1,050,000 animals (mean = 945,000). http://www.dgif.virginia.gov/wildlife/deer/management-plan/virginia-deer-management-plan.pdf

Hunting resident game species, such as deer, on Chincoteague NWR and Wallops Island NWR will result in negligible impacts on their populations because of their restricted home ranges. The refuges also contribute negligibly to the state's total harvest for resident game species.

Chincoteague NWR white-tailed deer harvest
2008/2009 - 23
2009/2010 - 20
2010/2011 - 15
2011/2012 - 27
2012/2013 - 26

Wallops Island NWR white-tailed deer harvest
2008 - 13
2009 - 15
2010 - 15
2011 - 8
2012 - 11

The refuges harvested a total of 173 white-tailed deer over the past 5 years, with 37 in 2012. Given the exceptionally low numbers of animals harvested from the refuges in respect to the total statewide harvest and deer population, no cumulative impacts to local, regional, or statewide populations of white-tailed deer are anticipated from hunting of the species on the refuges.

Aggressive management of the non-native sika population would have a beneficial impact on native white-tailed deer. As white-tailed deer compete with sika for habitat and food sources, the decreased sika population would reduce this competition. Deer impacts to ecosystems (e.g., forest regeneration, ground-dwelling birds) are a concern in certain areas with poor habitat and high deer populations. VDGIF has implemented innovative programs such as the Deer Population Reduction Program (DPOP). The refuge manages sika population with DPOP. Approximately 150 to 200 sika are taken each year, from an estimated populated of 600 to 800.

At Wallops Island NWR, hunting would be used primarily as a management tool for reducing the impacts of white-tailed deer on forested habitats important to migratory birds and other wildlife.

The public hunt would also reduce the threat of deer-aircraft strikes at the adjacent NASA/Goddard Space Flight Center/Wallops Flight Facility, and deer-automobile strikes on the adjacent Virginia State Highway Route 175. Finally, the hunt would provide limited public hunting opportunities on Wallops Island NWR.

Negative impacts from hunting on non-hunted mammals, such as voles, moles, mice, shrews, and bats, are expected to be negligible. Except for some species of migratory bats, these species have very limited home ranges and hunting would not affect their populations regionally. Impacts of hunting to migratory bat species would be negligible. These species are in torpor or have completely passed through Virginia by peak hunting season in November through January. Vehicles are restricted to roads and harassment or taking of any wildlife other than legal game species is not permitted.

4.9.3 Impacts on Mammals in Alternative C

Impacts for alternative C would be the similar to those of alternative B, except that, in addition, the refuge would work towards the eventual phasing out of the entire sika population (management action 37b). This phasing out of the exotic species would further diminish the competition with the white-tailed deer for food and habitat.

4.10 Reptiles and Amphibians

Other than the Federal listed species of turtles, 20 other amphibian and reptile species have been recorded on the refuge. Although no specific management policies are set in place for these species, the management of other species and habitats where these 20 species have been recorded would have direct impacts on these species. These species are commonly found in areas of the refuge with very limited visitor use, such as forest, vernal pools, refuge impoundments, and salt marsh areas. Impacts from visitor use actions such as hunting would not be significant due to the hibernation or torpor actions by cold-blooded reptiles and amphibians that limit their activity during the current hunting season when temperatures are low. Research is conducted on island dwarfisms in toads, a phenomenon common on mid-Atlantic barrier islands, and what possible variables could cause this trait (Hranitz 2010).

Incidental mortality of reptiles and amphibians occurs on refuge roads between March and October. However, this is mortality is negligible and the impact is not expected to affect the overall populations. Illegal harvest of reptiles and amphibians for the pet trade and/or consumptive use can and could have a negative impact on these populations.

The dewatering of the impoundments from May through August concentrates fish, amphibian and reptile species in deeper channels. Waterbirds such as snowy egrets, glossy ibis, terns, and herons take advantage of this abundant food supply. Table 4-1 assesses the impact of management actions on reptiles and amphibians; management actions are referenced by number throughout the text.

4.10.1 Impacts on Reptiles and Amphibians in Alternative A

Existing management activities do not adversely affect reptiles or amphibians. Continuing current management practices as proposed under alternative A will not result in any new or significant impacts to reptiles and amphibians.

4.10.2 Impacts on Reptiles and Amphibians in Alternative B

Increased incidental mortality of reptiles and amphibians may occur on newly created refuge roads between March and October (management action 52b). However, we expect negligible impacts since best management practices would be implemented in the design and engineering of the roads and parking lots. For example, underground crossings, culverts, and timing of construction could be viable options to mitigate potential adverse impacts. Therefore, it would not affect their overall populations.

4.10.3 Impacts on Reptiles and Amphibians in Alternative C

Impacts to reptile and amphibian species under alternative C would be the same as under alternative B.

4.11 Invertebrates

Chapter 3, Affected Environment, discusses the valuable role that invertebrates play on the refuge. This section provides the results of the evaluation of the management actions each alternative proposes for impacts on invertebrates. Table 4-1 assesses the impact of management actions on invertebrates; management actions are referenced by number throughout the text.

4.11.1 Impacts on Invertebrates in Alternative A

Prescribed burning, disking, and mowing would continue on or around impoundments to manipulate vegetation for the benefit of wildlife. Consideration of invertebrate species would be included in these management practices under all alternatives. No significant impacts to invertebrates would be anticipated to occur on the refuge from visitor services, and current monitoring would be continued. Continuing existing refuge management activities will not result in any new or significant adverse impacts to invertebrates.

4.11.2 Impacts on Invertebrates in Alternative B

Invertebrate species (emergent grazers and algal-detrital feeders) commonly found in salt marshes within coastal Virginia include fiddler crabs, ghost crabs, mole crabs, saltmarsh snail, periwinkle, mud snail, mussels, and isopods (Mitsch and Gosselink 1986). Impacts to the above mentioned and other invertebrates such as butterflies, moths, other insects, and spiders would not be significant. While beach use, OSV use, surf fishing, and horseback riding can occur in areas where intertidal invertebrates (i.e. species such as coquina clams, ghost crabs and mole crabs) are located, impacts from these uses are thought to be minimal (Wolcott & Wolcott, 1984). Invertebrates are not active during the majority of the hunting season and would have few interactions with hunters (USFWS 2007b).

The alteration of Mallard and Pintail Pools (C and D Pools) from the refuge impoundment management in order to allow the building of approximately 8.5 acres of recreational beach parking would have a negative impact on invertebrates, mainly monarchs (management action 22b). This area is known habitat for Bidens, a type of vegetation that monarchs use for nectaring during their migration. Although this would be a permanent negative impact, it would not be a significant impact because of the small acreage that would be affected, and because there are several nearby habitats where monarchs could nectar, including Shoveler and Snow Goose Pools (B Pools). Monarch numbers are relatively low overall on the refuge, as compared to other regions (Gibbs 2008), and the removal of this vegetation would not be detrimental to their life cycle. The planting of seaside goldenrod seedlings along small dunes in the vicinity of the former recreational beach, as well as on the backsides of dunes along Wild Beach and Toms Cove Hook would have a beneficial impact towards monarchs, and could work to mitigate the negative effects of Bidens

removal (management action 32b). Seaside goldenrod is the most important nectar source for monarchs on the refuge, and also acts a nesting location.

Improvements to the tidal flow of Swan Cove (F pool) resulting from modification and replacement of water control structures within Beach Road causeway would have a positive impact on aquatic invertebrates and fish species (management action 15b). Increased water flow and tidal rhythm would allow fish and aquatic invertebrates such as crabs and mollusks passage into this restored salt marsh.

Under alternative B, the new location of the recreational beach and parking lot would include management actions to control mosquitoes through water manipulation, insect traps, and best management practices. Control of mosquitoes would have the potential for an impact on other invertebrates in the area not being managed (management action 52b). The loss of mosquitoes may have adverse impacts on birds, fish, amphibians, bats, and other wildlife since they are known food source for these species. This impact would not be significant because it only occurs in a small area of the refuge focused around the recreational beach and parking, and would not expand out into habitats for the above mentioned wildlife.

4.11.3 Impacts on Invertebrates in Alternative C

Impacts under alternative C would be the same as under alternative B, except that the negative impacts from removal of Bidens at the new recreational beach parking would be reduced to only 4.25 acres (management action 51b).

Table 4-1 Beneficial and Adverse Impacts on Biological Resources by Management Action

● = benefits only; ○ = adverse impact only; ◐ = adverse impacts and benefits

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
1. Protect and enhance refugewide suitable coastal habitat for piping plovers which allows for the reduction of mortality factors; keep the fledge rate between 1.2 and 1.5 chicks per pair.	X	X	X				●	●	●			●	
2. Allow natural geologic processes to restore overwash to the former recreational beach and parking areas on Assateague Island in order to increase nesting habitat for plover, least terns, sea turtles, and other nesting shorebirds.		X	X				●	●	●			●	
3. Improve the beach nesting habitat at the former recreational beach parking area (8.5 acres); for example, removal of infrastructure and other man-made structures.		X	X				●	●	●			●	
4. Return footprint of current public beach parking area to wildlife habitat and reduce parking impact on habitat by reducing the size of public beach parking and relocating it to areas less sensitive for wildlife habitat and more stable to the forces of the tides and storms.			X	◐			◐	◐	◐			◐	◐
5. Protect and enhance 16.8 linear miles of Assateague Island and Toms Cove to benefit migrating and wintering shorebirds.	X	X	X				●	●	●			●	●
6. Improve the migratory and wintering habitat at the former recreational beach parking area (8.5 acres); for example, removal of infrastructure and other man-made structures.		X	X				●	●	●			●	●
7. Protect a minimum of 16.8 linear miles of sandy beach habitat on Assateague Island for nesting loggerhead sea turtles.	X	X	X				●	●	●			●	●

[2] The (b) represents management actions relating to biological resources.

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
8. Improve beach/dune habitat for turtle nesting areas at the former recreational beach parking area (8.5 acres); for example, removal of infrastructure and other man-made structures.		X	X				●	●	●			●	●
9. Restrict nighttime permitted beach driving in September and October, when the OSV zone is open but the sea turtle nesting season (June through October) is still ongoing.		X	X		●		●	●	●			●	●
10. Limit night use of the beach by official vehicles during the plover and sea turtle breeding season to the greatest extent possible.		X	X		●		●	●	●			●	●
11. Continue in situ nest protection for loggerhead sea turtles.	X	X	X					●					
12. Increase the number of Federal endangered seabeach amaranth plants by maintaining and enhancing coastal habitat along Assateague Island shoreline by allowing natural processes to occur.	X	X	X				●	●	●			●	●
13. Improve beach/dune habitat for seabeach amaranth at the former recreational beach parking area (8.5 acres); for example, removal of infrastructure and other man-made structures.		X	X				●	●	●			●	●
14. Refugewide, maintain 3,070 acres of salt marsh habitat for nesting, migrating and wintering birds.	X	X	X						●	●			
15. In cooperation with USACE and other partners develop strategies that will improve tidal flow to Swan Cove (F Pool).		X	X			◐				●			●
16. Work with USDA to reduce non-migrant Canada goose population through addling, firearms, and round-ups.		X	X				◐		◐				
17. Within 15 years, phase in requirement for Chincoteague pony population to consist of no more than 125.			X	●			●						
18. Remove ponies from the proposed wilderness area.			X	●			●						
19. Protect the integrity of Lucky Boy Fen.	X	X	X			●	●					●	

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
20. Protect the ecological integrity of tidal creeks, estuaries, mudflats, and nearshore marine waters.	X	X	X			●			●	●			
21. Provide approximately 2,650 acres of quality wetland habitat to support wintering waterfowl, spring migrating shorebirds, breeding shorebirds and waterbirds, and fall migrating shorebirds and waterfowl.	X	X	X	●		●	●	●	●				●
22. Remove Pintail (D Pool) from impoundment management capabilities.		X	X			◐	◐		◐				◐
23. Since the NWF would no longer be needed as a piping plover mitigation area due to the relocation of the recreational beach, pumping operation would no longer be required to create additional piping plover nesting habitat. Management of the NWF would be improved for spring and fall migratory shorebirds and waterfowl.		X	X	●	●		●	◐	●				●
24. Enhance or restore at least 100 acres to meet the habitat needs of black ducks.	X	X	X						●				
25. Manage at least 40 acres in the refuge impoundments each fall with the goal of providing 50 percent cover of Bidens to benefit monarch butterflies.	X	X	X	●			●		●				●
26. Annually maintain 35 nest boxes located in or adjacent to impoundments for tree swallows (as a citizen science project).	X	X	X						●				
27. Discontinue maintaining wood duck nest boxes.	X	X	X						○				
28. Maintain 2,500 acres of coastal shrubland to provide forage and cover habitat for fall landbird migrants, and breeding, and wintering landbirds.	X	X	X	●			●		◐				
29. Manage a minimum 500-foot wide continuous strip of 10- to 12-foot tall myrtle/bayberry shrub, free of trees, parallel to (and behind the) dunes on eastern side of the NWF impoundment.		X	X	●			●		◐				
30. Maintain, through rotational mowing, a minimum of 80 percent of the reliable monarch roosting locations and 50 percent of the preferred nectar source locations during mid-September through mid-October.	X	X	X	○	○		○						●

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
31. Restore and enhance preferred nectaring plants (seaside goldenrod, Bidens laevis) in areas where they already grow or other suitable areas.	X	X	X				●						●
32. Use volunteers to plant seaside goldenrod seedlings in spring or fall on Toms Cove Hook, small dunes that dot the Overwash area, the north end of Toms Cove (including the causeway west of the NPS Toms Cove Visitor Center), and the backsides of dunes along Wild Beach.		X	X				●						●
33. Manage mowing on refuge roadsides, cross-dikes and fence lines in order to minimize Delmarva Peninsula fox squirrel vehicle mortality.	X	X	X	○	○		○	●					
34. Manage mowing on refuge roadsides, cross-dikes, and fence lines in order to minimize Delmarva Peninsula fox squirrel vehicle mortality, making necessary changes to incorporate the relocation of the recreational beach and access.		X	X	○	○		○	●					
35. Manage mowing on refuge roadsides, cross-dikes, and fence lines in order to maximize nesting opportunities for northern bobwhite and brown thrasher.	X	X	X	○	○		○		●				
36. Manage 1,600 acres of predominantly mature loblolly pine habitat to support a population of 200 Delmarva Peninsula fox squirrel, brown-headed nuthatch, and eastern towhee.	X	X	X				●	●	●				
37. Reduce, and eventually phase out, sika and resident, non-migratory Canada goose population through continued recreational hunt and professional means of elimination.			X	●			●	●	●		●		
38. Delineate the boundaries of the maritime upland forest and maritime dune forest community types, and develop appropriate conservation measures.	X	X	X				●						
39. Maintain and restore 178 acres of pine/mixed hardwood forest for the benefit of migrating/nesting landbirds, bobwhite, and woodcock.	X	X	X				●		●				
40. Continue to work with partners that manage other Virginia barrier islands to prevent human disturbance to nesting focal species.	X	X	X				●	●	●			●	

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
41. Implement a complete closure on Assawoman Island, including fishing, from March 15 through September 15 or thereafter, until the last shorebird fledges.		X	X		●	●	●	●	●			●	
42. Conserve sandy beach and overwash habitat along Assawoman Island, and northern end of Metompkin Island, Cedar Island, and the tidal marshes on the backside of the islands to benefit migrating and wintering focal species and other shorebirds of conservation concern.	X	X	X				●	●	●			●	
43. Allow and advocate for natural coastal processes as the primary force that shapes the southern barrier islands habitats and species composition.	X	X	X				●	●	●			●	
44. Complete a habitat management plan and continue to manage habitats and management structures.	X	X	X	◐	◐	◐	●	●	●	●	●	●	●
45. Provide protective conservation measures for federally listed species and their habitats.	X	X	X	◐	◐	◐	●	●	●	●	●	●	●
46. Work with partners toward regional conservation to protect estuarine, coastal, and marine habitats and substantial populations of migratory and breeding shorebirds, colonial waterbirds, landbirds, and raptors.	X	X	X	●			●	●	●	●	●	●	●
47. Work with the town of Chincoteague and other local, State, and Federal agencies to address hazard mitigation and sustain the resiliency of this unique barrier island system in the face of dynamic coastal processes and climate change.	X	X	X			●	●	●	●	●	●	●	●
48. Maintain personal motor vehicle access to Assateague Island and work with the town of Chincoteague to allow golf carts and allow a variety of modes of transportation to and in the refuge.	X	X	X	○	○	○	○	○	○			○	○
49. Continue to allow NPS to manage a 1-mile recreational beach.	X	X	X	◐	◐	◐	◐	◐	◐			◐	◐

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
50. Continue to allow NPS to maintain 8.5 acres of land (and preserve the capacity of 961 spaces) for parking at the existing recreational beach as long as suitable land base directly behind the recreational beach remains.	X			◐	◐	◐	◐	◐	◐			◐	◐
51. Reduce beach parking to 480 spaces (approximately 4.25 acres).			X		◐		◐	◐	◐			◐	◐
52. Relocate recreational beach, beach parking, access, and associated facilities approximately 1.5 miles north of current area.		X	X	◐	◐	◐	◐	●	●			◐	◐
53. Pursue shuttle from off-site parking to supplement reduced beach parking.	X		X		◐								
54. Remove Swan Cove Trail.			X			●	●						
55. Continue pursuit of bicycle trail development via Beach Road to recreational beach.	X					◐	◐						
56. Replace Swan Cove Trail with an alternative bicycle trail from Wildlife Loop north to the south end of the relocated recreational beach, near the OSV zone entrance. *ACTION ELIMINATED*													
57. Maintain current access and closures for OSV and horseback riding.	X	X		◐	◐	◐	◐	◐					◐
58. *ACTION ELIMINATED.*													
59. Expand the OSV zone from the new recreational beach to Toms Cove. *ACTION ELIMINATED*													
60. Keep the OSV zone open from approximately September 16 to March 14 and close the OSV zone to public access March 15 through September 15 or thereafter, until the last shorebird fledges.		X		◐	◐	◐	◐	◐					◐
61. Develop a designated area for fishing from south of the recreational beach for ½-mile that would include OSV parking.		X		◐	◐	◐	◐	◐					◐

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
62. Discontinue OSV use.			X	●	●	●	●	●	●				●
63. Allow horseback riding in OSV zone.	X	X		○			○	○	○				○
64. Designate separate parking for horse trailer parking.		X		○			○						
65. Discontinue horseback riding.			X	●			●	●	●				●
66. Work with NASA to develop a boardwalk, observation tower, and kiosk from the NASA Visitor Center to an area at or near Wallops Island NWR.		X		○			○						
67. Re-establish an interagency non-exclusive use agreement/MOU with NASA to support wildlife and habitat management for marshlands and uplands not impacted by facilities (3,000 acres).		X		●			●	●	●		●		
68. Maintain current hunting policy on Chincoteague NWR and Wallops Island NWR.	X	X	X	◐			◐	◐	◐		◐	◐	◐
69. Introduce non-migratory Canada goose and light goose hunting within Assateague Island impoundments.		X	X	○		○	◐		◐				
70. Add mourning dove hunting to areas outside of Assateague Island.		X		○		○	○		○				
71. Add turkey to big game for youth hunting.		X		○			○						
72. Open refuge for migratory bird hunting on Federal holidays in designated areas of the refuge within Wildcat Marsh, Morris Island, Assawoman Island and Metompkin Island divisions, that occur outside of the current hunting days of Thursday, Friday, and Saturday.		X		○		○	○		◐				
73. Pursue opening for fox and raccoon hunting as well as fur-bearer trapping on Assateague Island.		X	X	○			○	●	●			●	
74. Maintain current public access by foot to the Service Road.	X	X					○						

Management Action (b)[2]	Element Included in Alternative			Soils	Air Quality	Hydrology/Water Quality	Vegetation	Federal T&E Species	Birds	Fish and other Aquatic Species	Mammals	Reptiles and Amphibians	Invertebrates
	A	B	C										
75. Close Service Road to all public access north of relocated parking except by special use permit or special day use privileges/openings.			X				●						
76. Maintain 23 full-time positions and 10 to 20 part-time, student, or contractor positions.	X	X	X	●	●	●	●	●	●	●	●	●	●
77. Add 8 full-time staff positions.		X	X	●	●	●	●	●	●	●	●	●	●

4.12 Socioeconomics

Similar to Chapter 3, Affected Environment, this section provides a summary of information from the report, *Chincoteague National Wildlife Refuge Economic Analysis in support of Comprehensive Conservation Plan* (USFWS 2012e), a full version of which is in Appendix M. Table 4-5 assesses the impact of three management actions for which information is available on socioeconomics; these management actions are referenced by number throughout the text.

All alternatives would maintain access to a recreational beach, incorporate ADA standards and universal access into new buildings, and develop bilingual/multilingual materials. These commonalities serve to either maintain or increase the beneficial economic impacts of tourism for the region by improving the accessibility of the refuge.

4.12.1 Impacts on Socioeconomics in Alternative A

Alternative A, the no action alternative, assumes that the refuge would lose a significant number of beach parking spaces due to the projected intensity and frequency of coastal storms and sea level rise. The NPS surveyed the current recreational beach and determined that there will likely be sufficient area to provide for 400 parking spaces over the next 15 years, but the remaining 561 spaces currently available may lose their land base over time (management action 1s).

Due to an inability to predict when that land base may be lost and whether all 561 spaces would be taken away, a conservative estimate can be made comparing a situation in which all 561 are lost to the base year of 2009. The estimate does not include any mitigating effects of alternative parking solutions or shuttle service. It assumes, given survey data, that 10 percent of visitors come in the very early morning hours and 10 percent come in the evening hours, while the remaining visitors come during the prime beach hours of 10 a.m. to 5 p.m. The estimate shows that a maximum of 1,904 vehicles could be denied entrance to the recreational beach daily in the busiest month under the 400-car parking lot scenario of the no-action alternative. Table 4-2, taken from the economic alternatives analysis performed by the USFWS Economics Division, shows the number of vehicles denied access during the busy visit times.

Table 4-2 Vehicular Visits and Number of Vehicles Denied Access

Month	Average Daily Visits	Average Daily Visits During Peak Hours	Parking Available	Assumed Length of Stay (hours)	Vehicles Denied Access	Percent(%) of Day-long Beach Use Visits Affected
Memorial Day weekend	2,186	1,749	400	8	1,349	77
June	1,505	1,204	400	8	804	67
July	2,881	2,304	400	8	1,904	83
August	2,542	2,033	400	8	1,633	80
Labor Day weekend	2,843	2,275	400	8	1,875	82

Assuming that vehicles denied access to the beach choose not to visit the region at all and that each vehicle represents approximately $268 dollars in lost regional expenditures per day, the loss of 561 parking spaces would result in a total economic impact per year of $38.4 million, roughly 34 percent of annual total direct regional expenditures. Table 4-3 breaks the impact down by the popular visit times.

Table 4-3 Economic Impact of Loss of Parking under Alternative A

Month	Daily Vehicles Denied Access	Associated Number of Daily Visitors Affected	Economic Impact Per Day	Economic Impact per Month/Holiday Weekend
Memorial Day weekend	1,349	4,317	$ 361,073	$ 1,083,219
June	804	2,573	$ 215,185	$ 6,455,560
July	1,904	6,094	$ 509,720	$ 15,801,328
August	1,633	5,227	$ 437,155	$ 13,551,794
Labor Day weekend	1,875	5,999	$ 501,748	$ 1,505,243
Total				$ 38,397,143

4.12.2 Impacts on Socioeconomics in Alternative B

Alternative B would maintain approximately 8.5 acres of land for beach parking and relocates the beach approximately 1.5 miles north of the current area (management action 2s). USFWS assumes that visitation would not change as a result of the relocation, as the same number of spaces would be available, and the short-term transition between the locations would be carefully managed outside the peak visitation period. The alternative includes several expanded visitor services, such as hunting, but no significant increase in visitation would be expected, as hunting is limited by permits and other changes are aimed at benefiting current visitors. Therefore, USFWS assumes that there would not be any negative economic impact per year resulting from alternative B compared to the base year of 2009.

Enforcement of Federal laws that would effectively eliminate illegal horseshoe crab harvesting in the Toms Cove area would likely result in a negative impacts to some commercial watermen. According to Virginia Marine Resources Commission (VMRC), over 330,000 pounds of horseshoe crabs were harvested within the entire Commonwealth of Virginia in 2012, at a value of $276,305. In 2011, these numbers were almost 254,000 pounds and $166,094 statewide. VMRC estimates that approximately 20 percent of the annual harvest is done by hand; thus, assuming that all hand harvesting is done in the Toms Cove area, the annual value of horseshoe crab harvesting on the refuge is, at most, approximately $55,261. For the waters of Accomack County, 361,072 pounds of horseshoe crabs at a value of $208,407 were reported from 1993 through 2010 (appendix M, section 3.3).

4.12.3 Impacts on Socioeconomics in Alternative C

Alternative C would reduce beach parking to 480 spaces, close the Beach Road causeway and the Service Road, and discontinue OSV use and horseback riding, all of which could have negative impacts on the number of visitors coming to the refuge. The negative impact could be mitigated somewhat by the implementation of a shuttle system to compensate for lost parking, and the implementation of hunting and trapping for certain species. Of these potential impacts, the only one for which an economic impact estimate is available is the loss of 481 parking spaces (management action 3s). Following the same methodology as alternative A, Table 4-4 estimates

the economic impact of the lost visits. This analysis does not account for the institution of a shuttle from off-site parking.

The impact is less than that of alternative A. While the no action alternative would result in a loss of $38.4 million in a year, alternative C would result in a loss of $36.3 million, or 32 percent of the current annual baseline expenditures in Accomack and Worcester Counties. Impacts from elimination of horseshoe crab harvesting would be the same as described under alternative B.

Table 4-4 Economic Impact of Loss of Parking under Alternative C

Month	Daily Vehicles Denied Access	Associated Number of Daily Visitors Affected	Economic Impact Per Day	Economic Impact per Month/Holiday Weekend
Memorial Day weekend	1,269	4,061	$339,661	$ 1,018,983
June	724	2,317	$193,774	$5,813,208
July	1,824	5,838	$488,309	$15,137,565
August	1,553	4,971	$415,743	$12,888,031
Labor Day weekend	1,795	5,743	$480,336	$ 1,441,008
Total				$36,298,795

Table 4-5 Beneficial and Adverse Impacts on Socioeconomics by Management Action

● = benefits only; ○ = adverse impact only; ◐ = adverse impacts and benefits

Management Action (s)[3]	Element Included in Alternative			Socioeconomic
	A	B	C	
1. Continue to allow NPS to maintain 8.5 acres of land (and preserve the capacity of 961 spaces) for parking at the existing recreational beach as long as suitable land base directly behind the recreational beach remains, but maintain 400 spaces at a minimum over the 15 years.	X			○
2. Maintain 8.5 acres of land for parking (approximately 961 spaces).		X		●
3. Reduce beach parking to 480 spaces (approximately 4.25 acres).			X	○

[3] The (s) represents management actions relating to socioeconomic resources.

4.13 Visitor Use and Access

The refuge is a major attraction for outdoor enthusiasts and a popular destination for visitors who participate in a range of activities, including the six wildlife-dependent priority activities (hunting, fishing, environmental education, interpretation, wildlife observation, photography), other recreational uses (e.g., bicycling, horseback riding, and OSV use in support of surf fishing and hunting) and use of the recreational beach. Each alternative evaluated in this document is comprised of a series of management actions. This section addresses the impacts on visitor use and access of the proposed management actions included in each alternative. These management actions broadly include:

- changes in visitor facilities or infrastructure;
- changes in approved public access, wildlife-dependent activities and other visitor uses;
- collaborations and partnerships with local, regional, and state recreation interests; and
- improvements in outreach and USFWS visibility.

This section considers the potential short- and long-term direct and indirect, and cumulative impacts on visitor use and access that could result from the actions above. The impacts include:

- conflicts among users—both actual (e.g., conflicts about safety and access) and perceived (e.g., outreach for one activity may deter the interest of other users);
- changes in visual landscape;
- a more informed public (e.g., about species, their habitats, and their conservation);
- a more supportive public (e.g., of the refuge, the refuge system, and the USFWS).

The discussion of impacts on visitor use and users is organized similar to other sections in this chapter, with some adjustment to reflect the fact that there are multiple uses and the impact of the same management action may be different on the various uses. First is a discussion of the impacts that do not vary by alternative and that generally affect all or most of the visitor uses. These impacts are the result of management actions that are included in all of the alternatives, and most of them are current management practices that that would remain the same for the next 15 years. Next, instead of dealing with all visitor uses by alternative, to make the comparison between alternatives more transparent, the impacts of each alternative are discussed by use and impacts to that use and subsequently to users (e.g. to hunting and hunters). Table 4-6 assesses the impact of management actions on visitor use and access; management actions are referenced by number throughout the text.

In general, there are both beneficial and adverse impacts to all visitor uses that would result from elements that are common to all of the alternatives. In all alternatives, the refuge would promote wildlife-oriented recreational opportunities that are compatible with the purpose for which the refuge was established, and would also maintain a recreational beach and many of the other recreation uses that are currently available at the refuge. The benefits of providing these activities would include helping to meet existing and future demands for outdoor recreation, interpretation, and education in the region. Visitors that are interested in these uses would benefit from high quality opportunities to engage in them. Another action that would likely benefit all users is the proposed implementation of a visitor survey every 5 years, which would allow visitors to share feedback on visitor use activities and to indirectly benefit from that information shaping refuge management over time. In addition, identifying and removing old abandoned structures on the refuge would enhance public safety and views.

Under all alternatives, visitor use and access, in terms of timing and location, would continue to be regulated to protect federally listed species and their habitats, such as the piping plover, tern, and shorebird habitat on Toms Cove Hook. As a result, potential users of this area would be adversely affected by the closures. The main visitor use constraints would occur from the continued closure of Toms Cove Hook and the Overwash area from March 15 through August 31 or thereafter, until the last shorebird fledges for alternative A, and through September 15 for alternative B. Conversely, management actions to sustain and increase wildlife populations, in coordination with partners, could provide additional opportunities (benefits) for all six of the wildlife-dependent uses.

Coordination with the town of Chincoteague and other local, state, and Federal agencies to address hazard mitigation and resiliency in the face of dynamic coastal processes and climate change under all alternatives would benefit all uses on the refuge. In addition, as a result of these efforts, visitors would have the opportunity to learn about climate change at both local and global levels.

Under all alternatives, visitors would experience continued access to the refuge by bicycle, foot, and private vehicle. Access to several areas of the refuge, including the Woodland Trail, Lighthouse Trail, Herbert H. Bateman Educational and Administrative Center, and Wildlife Loop and associated trails, would be maintained under all alternatives. Access to other areas is addressed elsewhere in this section. Private motor vehicle access to Assateague Island would be maintained and the refuge would work with the town of Chincoteague to allow golf carts on the refuge and public roads, in order to provide a variety of modes of transportation to and in the refuge, thereby enhancing overall access to the refuge. Visitors would benefit directly from having multiple access options (walking, biking, shuttle system, and automobiles) from the pursuit of a well-planned transportation system by the refuge, in partnership with the town of Chincoteague. All visitors would benefit, because even those that still use automobiles would benefit from reduced roadway congestion and more available automobile parking.

Visitors would experience continued communication and outreach, which would have educational benefits and let them be aware of different visitor service restrictions or opportunities; continued access to the Assateague Lighthouse; and continued staffing of visitor programs as well as wildlife and maintenance programs that provide visual, safety, and other benefits to visitors.

4.13.1 Impacts on Hunting and Trapping Opportunities

All of the alternatives would maintain current hunting policies (management actions 41v and 42v) and as a consequence, would allow people to continue to enjoy hunting as a wildlife-related visitor use.

Under alternative A, opportunities for hunting are limited to big-game (white-tailed deer and sika elk) and migratory game bird hunting (waterfowl and rail).

Under alternative B, the expansion of hunting opportunities for new species (see management actions 43v, 44v, and 45v) and opening of additional hunting days (management action 46v) would benefit hunters. The relocation of the recreational beach (management action 12v) could change access to hunting zones, as hunting zones currently further away would have the benefit of being more convenient for hunters to access from the improved Service Road and other facilities.

Under both alternatives B and C, the expansion of hunting areas and hunting for new species (management actions 44v and 45v) and introduction of fur-bearer trapping (management action 48v) would benefit hunters and trappers by providing new and expanded opportunities for these activities.

Under alternative C, the increase in sika hunting to achieve the species' removal (management action 49v) would be a short-term benefit to hunters as it could increase the number of hunters able to experience the hunt, but the eventual elimination of the sika population would mean over the long term, hunters would not be able to hunt sika and there would be fewer hunting permits available, an adverse impact. While OSV use would be discontinued (management action 37v), use of 4x4 vehicles would be permitted to access the Toms Cove Hook area for sika hunting.

If alternative B or C is selected for implementation, a new hunt management plan and other documentation would be developed to reflect changes. The plan would provide additional details, such as exact locations, time periods, and number of permits, and would be assessed through a separate NEPA process.

4.13.2 Impacts on Fishing Opportunities

Under all alternatives, users would continue to enjoy fishing, with the same areas available for surf fishing, crabbing, clamming and oyster harvest on Assateague Island, but with changes in access to those areas. Users would also continue to have restricted access to fishing near Assawoman Island from March 15 through August 31 or thereafter, until the last shorebird fledges for alternative A (management action 32v), and through September 15 for alternative B. For all alternatives, continued pedestrian access north and south of the recreational beach (management actions 21v and 23v) would allow for continued access to surf fishing areas and thus, reduced crowding along the beach.

Under alternative A, visitors would continue to have access to crabbing, clamming and oyster harvest areas; however, some of these areas could suddenly become inaccessible, an adverse impact, if parking/access to the recreational beach is lost due to natural causes (management action 10v).

Under alternative B, OSV use would be limited to those visitors who are engaged in wildlife-dependent recreational activities. This may result in an adverse impact to some users, but visitors that are fishing may benefit from reduced crowding within the OSV zone. A benefit of the designated ½-mile OSV parking area for fishing (management action 36v), is that visitors would have more convenient access to surf fishing when other portions of the OSV zone are closed and an extended time period for fishing using OSV access. Visitors would benefit from improved communication and coordination of the permit process throughout the region under this alternative (management action 31v) by saved time, reduced confusion, and raised awareness of rules and opportunities.

Under alternatives B and C, the relocated beach and change in Beach Road causeway access (management actions 12v and 26v, respectively) would result in improved experience for visitors interested in crabbing, clamming and oyster harvest in Swan Cove (F Pool) and Toms Cove. However, under alternative B, a new crabbing dock at the new Beach Road/South Pony Corral site (management action 28v) would create a new facility that would substitute for current inconvenient sites and be more accessible to visitors with disabilities and family groups, resulting

in a net benefit from alternative B for this recreational activity. Under alternative C, visitors would not experience this improved amenity.

Under alternative C, OSV use would be discontinued (management action 37v) and there would an adverse impact to visitors who come to the refuge to surf fish. Visitors who want to surf fish would experience greater inconvenience in taking their gear to surf fishing locations and surf fishing activities would be concentrated at points along the beach closer to the recreational beach so visitors would experience increased crowding. As a result, some visitors would continue to fish and carry gear by foot, some visitors would not choose to walk with gear down the beach, and others would choose not to visit the refuge.

4.13.3 Impacts on Environmental Education and Interpretation Opportunities

Under all alternatives, students able to travel to the refuge would continue to receive programming and experience the refuge. Visitors who stop by the exhibits and kiosks at the USFWS and NPS visitor centers and throughout the refuge would continue to learn about the agencies and the natural environment. The development of bilingual/multi-lingual information would enhance interpretation and environmental education opportunities for non-English speaking public and would also enhance compliance with hunting, fishing and other refuge laws and regulations. This is a benefit to non-English speakers and also to other uses because it would result in reduced violations and enhanced public safety. The replacement of existing exhibits with ones dedicated to climate change would benefit the public in raising awareness of the issue but could also lessen their awareness of other issues that could otherwise be covered in the same area.

Under alternative B, as communication in the "interconnected age" requires new approaches and changes in our communication culture, visitors would have new visual and interpretive experiences both online and on the refuge (management action 56v). Visitors would also benefit from improved organization and increased programming with the addition of an Education Program Specialist on staff (management action 61v). All of these would result in a more informed public and increased stewardship, and for Wallops Island NWR in particular, development of on-site interpretative opportunities with NASA would lead to increased visitation and awareness (management action 54v).

Under alternatives B and C, there are a number of common benefits to visitors involved in environmental education and interpretation. Students and others not able to travel to the refuge would be able to experience and learn about the refuge through the virtual exhibits. Enhanced opportunities would provide for a more informed public and increased stewardship. With the relocation of the recreational beach and change in access (management action 12v), beachgoing visitors would no longer pass by the Herbert H. Bateman Educational and Administrative Center en route to the beach and therefore, may be less inclined to visit, resulting in an adverse impact. However, the new visitor contact station at the recreational beach (management action 22v) would have information on both NPS and USFWS and would result in USFWS information being more directly accessible by beachgoing visitors, which would result in a net benefit to beachgoers. Despite the relocation of the recreational beach and the seasonal closure of Beach Road causeway (management action 26v), visitors would continue to benefit from NPS and CBFS canoe/kayak programs, which would have access to Toms Cove.

Under alternative C, some beachgoing visitors who previously had not learned about the refuge would benefit from interpretation provided on the beach shuttle.

4.13.4 Impacts on Wildlife Observation and Photography Opportunities

For all alternatives, there are common adverse and beneficial impacts to visitors pursuing wildlife observation and photography due to resource management and continuation of other uses. Measures that are proposed to manage habitats could have short-term adverse impacts and long-term benefits to wildlife observation and photography. For example, visitors may be exposed to visual impacts of the removal of invasive species. These activities may be perceived as disturbing the natural character of the landscape and could temporarily decrease wildlife observation and photography opportunities. However, these vegetation management activities would be limited and temporary, and would result in long-term aesthetic and habitat benefits as native species replace the invasive species. The long-term result would be enhanced diversity and abundance of species that would be available for wildlife observation and photography, and could also result in enhanced opportunities for interpretation and education.

Under all alternatives, the continued allowance of hunting (management actions 41v) on the refuge would have adverse impacts on other users, including those pursuing wildlife observation and photography, by causing some noise and resulting in temporary access restrictions to certain areas, such as the Woodland Trail, on specific days while hunting is taking place. However, hunting also helps keep wildlife populations at healthy levels, which results in better opportunities for viewing of a variety of wildlife, a benefit to wildlife observers and photographers. For all alternatives, the continued parking access to the beach (management actions 8v, 9v, 11v) and continued pedestrian access north and south of the recreational beach (management action 21v and 23v) would be a benefit to wildlife observers and photographers by allowing continued access for wildlife observation and photography along the full length of the beach. The removal of Swan Cove Trail (management action 18v) would be an adverse impact, as it would reduce access to wildlife observation and photography opportunities along the trail and at the beach area that the trail accesses which currently provides a more remote, isolated experience. However, based on public comments, this action has been removed from the preferred alternative B.

Under alternative A, the limited level of hunting (management action 41v) would allow visitors to continue to enjoy wildlife observation and photography with minor noise and visual disturbance. Continued vehicular parking and access to the beach (management action 10v), while available, would facilitate visitors having convenient access to observe shorebirds and other coastal wildlife and for beach-related photography opportunities, including a vista with water on both sides. When the parking is reduced by natural processes, there would be a short-term disruption and then increased inconvenience in access to these opportunities (management action 10v and 13v). Under alternative A, visitors would continue to be able to access the Service Road by foot (management action 25v), thus providing for wildlife observation and photography opportunities to the north, including viewing of the northern pony herd.

Under alternative B, the continuation of Swan Cove Trail to the beach (management action 20v) would provide visitors with a benefit in the form of access to an area for wildlife observation and photography and continue to facilitate such access to the beach. This would be part of the new assigned area. The expansion of hunting opportunities for new species (management action 43v, 44v, and 45v) and opening of additional hunting days (management action 46v) would mean that other visitors would be more likely to see or hear signs of hunting from adjacent areas, which could adversely affect their wildlife observation and photography. However, this impact would be minimized because hunting would occur during off-peak visitation times. Hunting of new species (management action 43v and 44v) would reduce the number of those species that visitors could

see; however, these species are being identified because of their overabundance and impacts on other species. Thus, in the long term, increased hunting could enhance the opportunity for wildlife observation and photography. Under alternative B, a benefit of the new observation tower at or in the vicinity of Wallops Island NWR (management action 55v) is that it would provide new photography/wildlife observation opportunities in a new location, which would reduce crowding elsewhere and increase awareness of the refuge. Other improvements, such as the pursuit of photography blinds, could attract more visitors, which would increase crowding and disturbance, but would also provide new experiences for existing visitors and bring new visitors to the refuge.

Under alternative B and C, the relocation of the beach (management action 12v) and closure of beach causeway (management action 26v) would be an adverse impact because it would reduce opportunities for wildlife observation and photography in Swan Cove (F Pool), Toms Cove, and the southern end of the island, as parking and foot access to these sites would be more difficult and inconvenient. The relocated recreational beach would change the beach viewshed such that water would not be visible on both sides; however, the viewshed at the relocated recreational beach would also have reduced views of parking. A benefit is that the new wildlife viewing tower at new Beach Road/South Pony Corral site (management action 27v) would provide a new opportunity for wildlife observation and photography and alternative access to viewing Toms Cove.

The relocated recreational beach would make it inconvenient to drive by the viewing area for the Chincoteague ponies; however, the planned relocation of some of the ponies would ensure continued convenient visual access, mitigating this impact. Relocation of the beach would change the use of part of the Wildlife Loop such that there may be increased disturbance to wildlife that would reduce wildlife observation and photography opportunities along the Loop; however, the stretch of road to be used is already well shielded and separate from most of the Loop habitat; lessening this impact. Maintaining existing access of the Service Road north of the recreational beach (management action 25v) would keep opportunities to view the northern pony herd and access to that landscape for photography, and alternative pony viewing opportunities would be pursued and some of the previous area would still be accessible as well.

Under alternative C, there would be an increase in noise and visual disturbance from increased sika hunting (management action 49v), and as this species is removed, sika would no longer be available to observe and photograph. Expanded hunting and trapping opportunities (management actions 43v, 47v, 48v) under alternative C would result in increased noise and visible signs of hunting, disturbing users engaged in wildlife observation and photography and disturbing wildlife. In general, while the increase in hunting could adversely affect wildlife observers and photographers, because the hunts would take place mostly outside of the primary visitor use areas, the impact would be minimized. The limit on Chincoteague pony population to 125 (management action 52v) could reduce viewing opportunities; however, the current population is between 125 and 135 so no significant impact would be anticipated. Views of parking from the recreational beach would be reduced due to the reduction in parking (management action 11v), which would be a benefit.

4.13.5 Impacts on Recreational Beach Use Experience

Under all of the alternatives, beachgoing visitors would continue to benefit from access to a 1-mile recreational beach with at least 480 adjacent parking spaces (there are currently 961 parking spaces).

Under alternative A, the recreational beach would remain in its current location and as a result, visitors would continue to enjoy beach activities, view of water on both sides of the beach, access to both oceanside and bayside beaches, nearby clamming, crabbing and oyster harvest areas, and beach access within approximately 100 feet of parked vehicles. However, beach parking would only be maintained at the existing 961 spaces as long as the land base allows (management action 10v). Under alternative A, beachgoers would benefit from the new Beach Road bicycle connection to the recreational beach (management action 19v), which would provide a safer option than riding on the shoulder and could result in lower demand on beach parking.

As described elsewhere, NPS and USFWS expect that natural forces (wind, tidal flooding, strong coastal storms and sea level rise) will result in the partial or full loss of the existing beach parking lots over the next 15 years. These factors will combine to reduce the capacity of the land base to support 961 spaces of parking. This probability is supported by USGS in its vulnerability modeling. Additionally, the likelihood of the NPS continuing to obtain funding to rebuild the lots in the same location is uncertain.

The reduction in parking would have a significant adverse impact on beachgoers. It is possible that the land base would be able to continue to sustain the current parking areas; if not, the NPS has determined that they may be able to maintain a core parking area of 400 parking spaces between two significant overwash areas, over the next 15 years. NPS and USFWS realize that 400 parking spaces would not meet the current level of visitation to the recreational beach during peak season. Under this alternative, the parking reduction would mimic the loss of the land base, which is dependent on natural forces and other uncertainties as described above.

In addition to losing the parking areas under this approach there would not be infrastructure in place to start a shuttle system immediately, the shuttle implemented may not meet all visitor requirements, and the request for funds may be less competitive because other facilities are experiencing similar impacts. All of this could result in a significant adverse impact until such time that the shuttle system could meet all visitor requirements.

Based on visitation data, USFWS made a number of assumptions to calculate that if the number of parking spaces is reduced to 400, an estimated 67 to 83 percent of summer visitors (Memorial Day weekend through Labor Day weekend; 57 percent of total visitation) could eventually not have access to parking under alternative A (see Appendix M). In the short-term, these visitors could be adversely affected in a significant manner by the insufficient transit services until adequate services are provided.

Under alternatives A and C, the introduction of a shuttle (management actions 14v and 16v) would have both adverse and beneficial impacts. NPS and USFWS realize that some visitors may be reluctant to use transit. Visitors dependent on transit would experience some adverse effects. They would lose some beach time in using the shuttle and would be inconvenienced if bringing a lot of recreational beach gear. Visitors would not have the same level of flexibility in coming and going from the recreational beach. Visitors accessing the beach by shuttle would experience delays and risk exposure if everyone left at the same time due to a storm; however, the refuge and NPS would provide shelters and develop an evacuation plan. A benefit of the shuttle is that some visitors would gain time at the beach from not having to wait in traffic or wait for a parking space at the beach. The shuttle would also increase the number of visitors who could access the

recreational beach, which would mean new beachgoing experiences but also potential overcrowding of the recreational beach.

Under alternative B, beachgoers would benefit from the ongoing provision of the same number of parking spots as there are currently at the existing beach without disruption. However, they could also experience the adverse impacts of traffic and waiting for parking as they currently do.

Beachgoers would benefit from the new bicycle lane to the recreational beach (management action 20v), which would provide a safer transportation option and could result in lower demand on beach parking.

Under alternatives B and C, the relocation of the beach (management action 12v) would have significant adverse impacts, as well as some beneficial impacts, on beachgoing visitors. Beachgoers would be able to continue the same type and level of beach activities on the ocean-side. Visitors would not have access to the bayside and thus would not be able to pursue bayside activities, such as clamming, crabbing, and swimming with young children. Due to the reduced points of access to the beach, visitors would experience the adverse impact of more crowding at access points, as some people would not want to carry recreational beach gear further up or down the beach. Visitors would experience increased exposure to mosquitoes in the relocated parking areas; however, the refuge would take measures to reduce the mosquito population, avoiding or minimizing this impact to the extent possible. Under both alternatives, the facilities would be constructed such that visitors would have continuous access to the refuge and recreational beach throughout the transition from the current to the new location of the recreational beach, and would receive communication on the timeline for relocation, reducing any significant disruption in visitor use.

Under alternatives B and C, the seasonal closure of Beach Road causeway (management action 26v) would eliminate some access to the current recreation beach and its particular characteristics, such as water on both sides and easy access to clamming, crabbing, oyster harvest and other bayside activities.

Under alternative C, the reduction in beach parking (management action 11v) and introduction of a shuttle (management action 16v) would have significant adverse impacts on beach going visitors. Some beachgoers would choose not to visit and instead go elsewhere. Based on visitation data, USFWS made a number of assumptions to calculate that if the number of parking spaces is reduced to 480, an estimated 60 to 79 percent of summer visitors (Memorial Day weekend through Labor Day weekend; 57 percent of total visitation) would eventually not have access to parking under alternative C (see Appendix M). However, visitors would be able to access the beach by shuttle, which would accommodate some visitors but may discourage others.

4.13.6 Impacts on Other Uses

Under all alternatives, similar to impacts on wildlife observation and photography, the continued allowance of hunting (management actions 41v and 42v) on the refuge would have adverse impacts on other bicyclists, walkers and other users by causing some noise and resulting in temporary restrictions to access to certain areas during the hunting season, such as the Woodland Trail, on specific days while hunting is taking place. The removal of Swan Cove Trail (management action 18v) would be an adverse impact that reduces access to an area that provides a more remote, isolated experience away from the recreational beach. Based on feedback during the public comment period, this action has been removed from the preferred alternative B.

Under alternative A, the replacement of Swan Cove Trail with a bicycle trail along Beach Road to the recreational beach (management action 19v) would provide a beneficial impact. It would provide safer access that would reduce safety incidents, and increase the likelihood that visitors, in particular those with families, would access the recreational beach by bicycle. This could result in fewer demands on beach parking, thus increasing the capacity for visitors. However, this trail would be dependent on the extent of erosion that Beach Road may experience. Additionally, visitors would continue to have non-motorized boat access at the current beach, horseback riding in the existing OSV zone, and bicycle access on the Wildlife Loop and existing trails.

Under alternative B, the relocation of the recreational beach (management action 12v) and seasonal closure of the Beach Road causeway (management action 26v) would result in reduced access to Toms Cove for non-motorized boats; however, this would be offset because refuge would develop a launch point at new Beach Road/South Pony Corral site (management action 28v). In addition, relocation of the recreational beach would benefit bicyclists' access and beach access via bicycle, with introduction of new on-road bicycle lanes that would provide improved, safer, and more direct access and could result in an increase in overall beach visitation, and reduced beach parking demand. However, this may be offset by more visitors choosing to bike to the beach, resulting in more crowded bicycle trails.

Under alternatives B (management actions 43-48v) and C (management actions 43v, 47v, 48v), the increase in hunters due to new hunting opportunities could result in increased violations and safety concerns for other visitors. However, the use by hunters occurs during the off-season for the majority of visitation and, the increase in hunter education and the introduction of bilingual hunting regulations would help mitigate such violations and concerns. Relocation of the beach (management action 12v) would change the use of part of the Wildlife Loop such that Loop non-motorized traffic would need an alternative or to share the right of way with beach traffic. This could result in adverse impacts in the form of increased crowding, discomfort, and safety incidents.

Under alternative C, there would be adverse impacts to users who horseback ride, which would be discontinued (management action 40v), or who smoke, which would be banned on the beach. The relocation of the beach and lack of access at the terminus at Beach Road would result in reduced access to Toms Cove.

Table 4-6 Beneficial and Adverse Impacts on Visitor Uses by Management Action

● = benefits only; ○ = adverse impact only; ◐ = adverse impacts and benefits

Management Action (v)[4]	Element Included in Alternative			Hunting	Fishing	Environmental Education and Interpretation	Wildlife Observation / Photography	Recreational Beach	Other Recreation
	A	B	C						
1. Complete a habitat management plan and continue to manage habitats and management structures.	X	X	X	◐	◐	◐	◐	◐	◐
2. Provide protective conservation measures for federally listed species and their habitats.	X	X	X	◐	◐	◐	◐	◐	◐
3. Work with partners toward regional conservation to protect estuarine, coastal, and marine habitats and substantial populations of migratory and breeding shorebirds, colonial waterbirds, landbirds, and raptors.	X	X	X	●	●	●	●		
4. Work with the town of Chincoteague and other local, state, and Federal agencies to address hazard mitigation and sustain the resiliency of this unique barrier island system in the face of dynamic coastal processes and climate change.	X	X	X	●	●	●	●	●	●
5. Maintain personal motor vehicle access to Assateague Island and work with the town of Chincoteague to allow golf carts and allow a variety of modes of transportation to and in the refuge.	X	X	X				●	●	●
6. Include the development of bilingual/ multilingual information for regulations and environmental education.	X	X	X	●	●	●	●		●
7. Incorporate universal access and ADA standards into all new facilities.	X	X	X	●	●	●	●	●	
8. Continue to allow NPS to manage a 1-mile recreational beach.	X	X	X				●	●	
9. Maintain 8.5 acres of land for parking.		X					●	●	
10. Continue to allow NPS to maintain 8.5 acres of land (and preserve the capacity of 961 spaces) for parking at the existing recreational beach as long as suitable land base directly behind the recreational beach remains.	X						●	◐	

[4] The (v) represents management actions relating to visitor use resources.

Management Action (v)[4]	Element Included in Alternative			Hunting	Fishing	Environmental Education and Interpretation	Wildlife Observation / Photography	Recreational Beach	Other Recreation
	A	B	C						
11. Reduce beach parking to 480 spaces (approximately 4.25 acres).			X				◐	○	
12. Relocate recreational beach, beach parking, and associated facilities approximately 1.5 miles north of current area.		X	X	◐	◐	◐	◐	◐	◐
13. Continue to coordinate with NPS and the town of Chincoteague to identify a suitable off-site beach parking area for future use once existing beach parking is lost due to lack of suitable land base behind the recreational beach.	X							◐	
14. In being consistent with the 1993 Master Plan, as storms and other natural forces eliminate parking spaces adjacent to the beach, implement an alternate means of transportation such as a shuttle system.	X							◐	
15. Work with the town of Chincoteague to develop a response plan for beach access during periods when existing beach parking is unavailable due to storm events, and during peak periods when existing beach parking is inadequate to meet demand. The response plan would include designated parking areas which may be on or off-refuge, and would include alternative means of transportation from the parking areas to the beach.	X	X	X					●	
16. Coordinate with NPS and the town of Chincoteague to identify a suitable off-site beach parking area, as close to the beach as possible, and facilitate a shuttle service from off-site parking to recreational beach for use during specific times of the year when parking capacity exceeded (anticipated to be every weekend in May and September and every day from Memorial Day weekend through Labor Day weekend).			X					●	
17. Work with NPS to install shelters for transit users, bicyclists, and walkers.	X	X	X					●	
18. Remove Swan Cove Trail.	X	X	X	●				○	○
19. Continue pursuit of bicycle trail development via Beach Road to recreational beach to replace Swan Cove Trail.	X							●	●
20. Replace Swan Cove Trail with an alternative bicycle trail from Wildlife Loop north to the south end of the relocated recreational beach, near the OSV zone entrance. *ACTION ELIMINATED*									
21. Allow pedestrian access in intertidal zone access north of recreational beach.	X	X	X		●		●		

Management Action (v)[4]	Element Included in Alternative			Hunting	Fishing	Environmental Education and Interpretation	Wildlife Observation / Photography	Recreational Beach	Other Recreation
	A	B	C						
22. Develop joint NPS and USFWS Visitor Contact Station near the new recreational beach.		X	X			●	●		
23. Allow pedestrian access south of recreational beach outside of breeding season, between approximately September 16 and March 14.	X	X	X		●		●		
24. Maintain current public access by foot to the Service Road.	X	X					●		
25. Close Service Road to all public access north of relocated parking except by SUP or refuge event.			X				○		
26. Close Beach Road causeway to all public access.			X		○		○	○	○
27. At new road terminus, build a vehicle turn around.		X	X				●		
28. At new road terminus, build a wildlife viewing tower, crabbing dock, and new launching area for small non-motorized vessels.		X			●				●
29. Allow canoe/kayak access from road terminus for environmental education and interpretation programs by NPS and the CBFS.		X	X			●			
30. Maintain current access and closures for OSV.	X	X			◐				
31. Improve signage, promotion, and coordination concerned barrier islands access and permitted activities throughout the refuge and Virginia's Eastern Shore.		X			●		●		
32. Close Assawoman Island to fishing during breeding season from March 15 until September 15 or thereafter until the last shorebird fledges.	X	X	X		○				
33. Allow OSV for priority uses, like wildlife observation, fishing and to access hunting zones, and restrict nighttime OSV use during September and October, when OSV zone is open but sea turtle nesting season (June through October) is still ongoing.		X		●	●				
34. Expand the OSV zone from the new recreational beach to Toms Cove. *ACTION ELIMINATED*									
35. Keep the OSV zone open from approximately September 16 to March 14 and close the OSV zone to public access March 15 through September 15 or thereafter, until the last shorebird fledges.		X			◐		◐		
36. Develop a designated, year-round area for fishing from south of the recreational beach to the point of closure that would include OSV parking.		X			●				
37. Discontinue OSV use.			X		○		◐		

Management Action (v)[4]	Element Included in Alternative			Hunting	Fishing	Environmental Education and Interpretation	Wildlife Observation / Photography	Recreational Beach	Other Recreation
	A	B	C						
38. Allow horseback riding in OSV zone.	X	X		○			◐		●
39. Designate separate parking for horse-trailer parking.		X						●	●
40. Discontinue horseback riding.			X	●			◐		○
41. Maintain current hunting policy of big game and migratory bird on Chincoteague NWR.	X	X	X	●			◐		○
42. Maintain current hunting policy of big game on Wallops Island NWR.	X	X	X	●					
43. Introduce non-migratory Canada goose and light goose hunting within Assateague Island impoundments.		X	X	●			◐		
44. Add mourning dove hunting in areas outside of Assateague Island.		X		●			◐		
45. Add turkey to big game for youth hunting.		X		●			◐		
46. Open refuge for migratory bird hunting on Federal holidays in designated areas of the refuge within Wildcat Marsh, Morris Island, Assawoman Island and Metompkin Island divisions, that occur outside of the current hunting days of Thursday, Friday, and Saturday.		X		●			◐		
47. Pursue opening for fox and raccoon hunting on Assateague Island.		X	X	●			◐		
48. Pursue opportunity for fur-bearer trapping on Assateague Island.		X	X	●			◐		
49. Work to eliminate sika and non-migratory Canada goose populations.			X	◐			◐		
50. Continue to allow current Chincoteague pony population of up to 150.	X	X					●		
51. Implement revised Chincoteague pony management plan.	X	X	X				●		
52. Within 15 years, phase in requirement for Chincoteague pony population to consist of no more than 125.			X				◐		
53. Continue to protect the wilderness character of the proposed wilderness area.	X	X	X						
54. Work with NASA to develop a boardwalk, observation tower, and kiosk from the NASA Visitor Center to an area at or near Wallops Island NWR.		X				●	●		
55. Maintain the restored Assateague Lighthouse and continue to allow the CNHA and refuge volunteers to conduct tours of the Assateague Lighthouse.	X	X	X			●	●		

Management Action (v)[4]	Element Included in Alternative			Hunting	Fishing	Environmental Education and Interpretation	Wildlife Observation / Photography	Recreational Beach	Other Recreation
	A	B	C						
56. Restore the light keeper's house and historic landscaping at Assateague Lighthouse. Develop new cultural resource and interpretation amenities, including a virtual tour of the lighthouse and museum property. The refuge would allow access to the cemetery near Beach Road and develop tours and controlled access opportunities for Assateague Village.		X				●			
57. Continue public outreach activities (Web site, press releases, radio outreach, Community Leaders meetings, etc.), including implementation of fiber optics capacity and Intelligent Traffic System and the pursuit of mobile trailer for outreach/education and acquire by 2015.	X	X	X	●	●	●	●	●	●
58. Develop new outreach strategies, including technology-based outreach, and develop a communication plan and emergency infrastructure for the relocated recreational beach.		X	X	●	●	●	●	●	●
59. Maintain 23 full-time positions and 10 to 20 part-time, student, or contractor positions.	X	X	X	●	●	●	●	●	●
60. Add 8 full-time staff positions.		X	X	●	●	●	●	●	●
61. Add Education Program Specialist.		X				●			

4.14 Cultural and Historic Resources

Chapter 3, Affected Environment, discusses the status and location of cultural and historic resources on the refuge. This section provides the results of the evaluation of the management actions each alternative proposes for impacts on these resources, although nearly all known impacts would not vary by alternative.

An impact to cultural resources would be considered significant if it adversely affects a resource listed in or eligible for listing in the National Register of Historic Places. In general, an adverse effect may occur if a cultural resource would be physically damaged or altered, isolated from the context considered significant, or affected by project elements that would be out of character with the significant property or its setting. Title 36 CFR Part 800.5(2) provides the following examples of adverse effects on historic properties:

- Physical destruction, damage, or alteration of all or part of the property;
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;
- Removal of the property from its historic location;
- Change of the character of the property's use or of physical features within the property's setting that contributes to its historic significance;
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- Neglect of a property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

Refuge lands are protected from development or destructive land uses that may result in substantial impacts on cultural and historic resources. Regardless of which alternative we select, we would protect known cultural and historic resources. USFWS has a regular process for ensuring protection of archaeological sites and historic structures from activities. The process includes review of projects by professional archaeologists in the USFWS Regional Office and consultation with the Virginia Department of Historic Resources (the Virginia State Historic Preservation Office, or SHPO). Project leaders submit descriptions of their proposed projects, maps, and plans to the Regional Historic Preservation Officer (RHPO), who determines what is needed to identify archaeological sites in the project area and helps the refuge avoid sites when called for. Rarely, the USFWS will mitigate an unavoidable impact to a site, in consultation with the SHPO and interested parties. Any future ground disturbing activities would go through this process. Activities such as shoreline modification, development of infrastructure for roads or parking, and wetland restoration will require RHPO review and SHPO consultation under this process.

4.14.1 Impacts on Cultural and Historic Resources in Alternatives A, B, and C

We expect that our routine process for compliance with the NHPA (review of projects by the RHPO, identification of as yet unknown sites, consultation with SHPOs, Tribes, and other interested parties, archaeological site avoidance at the planning stage, and mitigation of any

impacts that are unavoidable) will address any unanticipated potential impacts of implementation of the CCP on cultural resources. We foresee no particular cumulative impacts to archaeological sites from the implementation of the plan. We will continue to protect the refuge's archaeological sites from our activities through our routine compliance process including RHPO review, site location surveys or evaluations, redesign of projects to avoid sites, consultation with SHPO, and mitigation of impacts when necessary. Current management adheres to guidelines set forth in previous coordination with SHPO. Under alternative A, continuing those current management practices will not result in any new or significant adverse impacts to cultural and historic resources.

In regard to the potential development in alternatives B and C, a refuge volunteer, under the guidance of refuge staff, compared findings in the report, "Archaeological Reconnaissance of the Chincoteague National Wildlife Refuge, Accomack County, Virginia and Worcester County, Maryland" (Goodwin & Associates, Inc. 1989) with the potential development in alternatives B and C. Intended as a "fatal flaw" test, the volunteer prepared a brief summary memo concluding that nothing in the Goodwin report indicated we would be impacting cultural resources based on the previous findings. Since the proposed actions associated with the relocated beach parking and road expansion are conceptual and not finalized, specific details for these actions are currently unknown. Further environmental assessments and analysis for impacts on cultural resources would need to be completed prior to construction.

4.15 Refuge Administration

Refuge administration consists of staffing, fee administration, communications, and facility management, among other functions. This section evaluates the following management actions for their potential beneficial or adverse impacts on refuge administration:

- changes in staffing;
- increased coordination or other administration requirements; and
- changes in visitor use activities that would require increased or decreased administration and law enforcement.

This section considered the following potential short- and long-term direct, indirect, and cumulative impacts on refuge administration that could result from the actions above:

- conflicts among resources (staff, time, funding);
- ability to meet requirements and administer the elements under each alternative; and
- ability to meet short-term and long-term agency goals and objectives, such as environmental education and fiscally responsible and environmental sustainability.

Having well-maintained visitor facilities is important for encouraging and welcoming visitors to Federal lands. It reflects on USFWS's responsibility to spend taxpayer dollars effectively and efficiently. It is also important to protect public safety and refuge resources, both of which can be directly impacted or compromised when facilities deteriorate. In addition, the refuge is committed to incorporating universal access and ADA standards into all new facilities.

Regional conservation, economic, and resiliency/hazard mitigation efforts would require refuge staff to coordinate with other Federal, State, regional, and local agencies but may also provide access to additional funding or in-kind support.

4.15.1 Impacts on Refuge Administration in Alternative A

Under alternative A, the existing level of staffing and volunteer support would likely be sufficient for the refuge to meet most of its major commitments. However, lack of designated staffing for Wallops Island NWR could result in competing demands on Chincoteague NWR staff time, in particular for biology, which may limit the ability of staff to fulfill future strategies.

4.15.2 Impacts on Refuge Administration in Alternative B

Under alternative B, new activities and programs would result in staffing needs and infrastructure investment. The focus on use of social media/technology would require new technical knowledge and some infrastructure investments (i.e., fiber optics). The expansion of hunting and trapping opportunities would require a follow-up hunt management plan, with a short-term impact on staff time. Subsequent increase in hunting permits and need for new materials and maps would require additional staff and funding to administer permits, patrol hunting zones, and provide orientation for new hunters. This would be a long-term impact, as such administration is year-round. The relocation of the recreational beach and related facilities would require staff to develop a transition and communication plan, as well as participate in design, further environmental assessment, and other planning efforts. New staffing would better address Wallops Island NWR needs and the needs created by strategies for resource management (biology), visitor services, maintenance, law enforcement, and coordination with NASA.

4.15.3 Impacts on Refuge Administration in Alternative C

Under alternative C, new activities would require staff time while the removal of some activities would lessen the administrative burden. Similar to alternative B, the expansion of hunting and trapping opportunities and the relocation of the recreational beach would have long and short term administrative impacts. The removal of the OSV and horseback riding zone would reduce the administrative and enforcement burden on NPS and refuge staff. Such staff would then be able to devote more time to other resource management needs. New staffing would better address Wallops Island NWR needs and the needs created by strategies for resource management (biology), visitor services, maintenance, law enforcement, and coordination with NASA.

4.16 Cumulative Impacts

CEQ defines cumulative effect as the "impact on the environment which results from the incremental impact of the action(s) when added to other past, present and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). The purpose of cumulative effects analysis (CEA) is to determine if, when they are added together, the adverse impacts would be significant. Therefore, cumulative effects can result from individually minor but cumulatively significant adverse effects.

As noted elsewhere in this CCP/EIS, there are management actions proposed by the alternatives for which the details are not available at this time, and will therefore be addressed in a separate NEPA analysis, including relocation of the recreational beach (alternatives B and C) and relocation of parking at an offsite location (alternatives A and C). The potential cumulative impacts of these actions are addressed conceptually in this section.

4.16.1 Resources Evaluated

CEQ's guidance on CEA says that "Determining thresholds beyond which cumulative effects significantly degrade a resource, ecosystem and human community is often problematic. Without a definitive threshold, the NEPA practitioner should compare the cumulative effect with

appropriate national, State, or community goals to determine if the total effect is significant" (CEQ 1997). Following the guidance, the scope of the CEA should be related to the magnitude of the environmental effects of the proposed actions only for those resource areas upon which the proposed actions, when combined with other actions, may be significant. For this CEA, the following resources areas are evaluated:

- air quality;
- hydrology/water quality;
- vegetation, wildlife, and habitat;
- birds;
- threatened and endangered species;
- socioeconomics; and
- soils.

4.16.2 Actions Included

CEA is framed by geographic and temporal (time) boundaries based on the magnitude and the nature of the proposed action, with boundaries for actions that constitute major changes in management of the refuge or that result in many significant impacts compared to other actions.

The geographic boundary for CEA in this CCP/EIS includes the Southern Delmarva Peninsula (in particular Accomack County) and all coastal NWRs in the area of the Chesapeake Bay and Delmarva Peninsula. Although our analysis is done resource by resource, we have chosen a large geographic boundary to include all possible cumulative effects, including possible additive effects of strategies within this CCP on others' actions. The other NWRs are included because past and future management actions and resources at these refuges could be similar to the actions proposed in this CCP. These include the Eastern Shore of Virginia/Fisherman Island NWRs, Eastern Neck NWR, Back Bay NWR, Prime Hook NWR, Bombay Hook NWR, and the Chesapeake Marshlands NWR Complex (NWRC), which includes Blackwater, Martin, and Susquehanna NWRs. The total land area of these refuges, including Chincoteague and Wallops Island NWRs, is approximately 87,500 acres. For these other refuges, this CEA includes only the adverse effects of each refuge CCP's selected alternative. Bombay Hook is in the process of developing its CCP/EA and therefore, no information impact information is available to include in this analysis.

Temporal boundaries are often more challenging to define than geographic boundaries. The period from the last refuge master plan through the 15-year CCP planning period (1993 to 2028) is a logical study period for this CEA. However, the availability of data often determines how far back past effects are examined. Because data on past conditions are usually scarce, the analysis of past effects is usually qualitative. Identifying the effects of fairly recent past actions and actions presently underway is easier than identifying past or future actions, but is by no means simple (CEQ 1997). Identifying future actions requires determining what is reasonably foreseeable, rather than what is speculative and requires using the best available information, which generally results in an analysis that is both quantitative and qualitative.

The 1997 CEQ guidance states that identifying future actions requires investigating the planning documents of other agencies. Accordingly, the following sources were consulted in this CEA: the 1992 Chincoteague NWR Master Plan EIS; CCPs/EAs covering the NWRs in the CEA study area; the Town of Chincoteague (2010) and Accomack County (2008) comprehensive plans; the 2005 Wildlife Action Plan (2005),the Virginia Outdoors Plan (2007); Federal and State data on

economic activity and labor force data; other relevant documents on the Delmarva Peninsula; and 15 NEPA documents completed between 1997 and 2013 for actions on the Wallops Flight Facility (WFF) site and one on the Assateague Island National Seashore (National Seashore), which are major Federal land facilities that abut the refuge.

4.16.3 Results of Cumulative Effects Analysis

Because information on past actions is limited, this section provides background on the CEA study area to frame the analysis. It contains a summary of data available from the sources listed above as an overview of the CEA study area to supplement information provided in chapter 3.

At some point in the past, much of the CEA study area was undeveloped. Due to its isolated location, the Delmarva Peninsula developed more slowly than the rest of the eastern seaboard, but human habitation changed the natural state of the CEA study area as it was subsequently settled. While Accomack County is the largest in total area in the Commonwealth of Virginia, nearly 65 percent of the area is water and the population is 0.4 percent of the Commonwealth's population (U.S. Census 2010). The WFF facility was initially developed by the U.S. Navy in the 1930s, followed by the establishment of the refuge in 1943 and the National Seashore in 1965. Over 47,000 acres (about 5 percent) of Accomack County remain in conservation and some of the remaining land is undevelopable as wetlands or marsh (Accomack County 2008).

While the particular impacts of the area's early development and the early management actions at the refuge are not documented, the existing conditions documented in the various state and local plans consulted provide an overview of the cumulative effects of past actions, just as chapter 3 of the CCP/EIS represents the cumulative effects of past actions on the refuge. Population in the county grew at an average rate of approximately 10 percent each decade between 1930 and 1990, and then grew just one percent between 1990 and 2000 (Accomack County 2008). Consistent with the national economy and its position as a tourist economy, Accomack County lost 13 percent of its population between 2000 and 2010 (Virginia Employment Commission 2013), reflecting the tendency of tourist economies to experience greater swings when the national economy changes. There are few large employers in the County; only 5 percent of them employ more than 50 people and 58 percent of all employers have less than 5 employees (Virginia Employment Commission 2013). As a result, we were unable to identify proposed actions for inclusion the CEA other than those in the other refuge CCPs and Federal agency NEPA documents. The Town of Chincoteague's Comprehensive Plan (2010) identifies some economic development opportunities; however, these opportunities are not sufficiently developed or detailed to determine the adverse environmental impacts for this CEA.

Past and future actions by relevant Federal agencies are less speculative because they are described in detail in long-term planning documents. With regard to past actions on the refuge, according to the EIS on the 1993 Master Plan, construction of the Herbert H. Bateman Educational and Administrative Center, and the associated access road and parking lot, resulted in loss of habitat, especially pine forest. The visitor center and its related uses also introduced more signs of human presence in the refuge landscape, and along with the new bicycle trail, reduced pervious surface thereby increasing storm water runoff. However, stormwater runoff percolates trough the sandy soil and is captured in the freshwater lens. Other impacts of the facilities were largely mitigated by the removal of the existing visitor contact station site and old administrative area, which were allowed to succeed to native habitat.

Each of the nearby NWRs developed a CCP in the past several years and the impacts of each of the management actions in those CCPs have been evaluated in detail in an EA, as shown in the sources notes to Table 4-7. Some of the actions have been implemented and others are programmed to occur in the next several years. In accordance with the mission of the Refuge System, most of the management actions undertaken and proposed at NWRs result in benefits, rather than adverse impacts, to natural resources and wildlife-dependent uses. However, some of the actions result in minor unintended adverse effects that can be mitigated. These are listed in Table 4-7 and considered in this CEA. Table 4-7 also includes the effects of past and proposed actions at the WFF and the National Seashore. Information on future actions is limited, however, because both NPS and NASA are in the process of updating their long-term plans: NPS is in the process of preparing a new General Management Plan (GMP) and EIS for the Seashore. A site-wide Programmatic EIS for expanding operations at WFF is currently being developed.

Air Quality

Air quality is addressed here as it is an issue typically evaluated on a regional basis. All of the refuges would undertake prescribed burning on a periodic basis, and most of them expect to experience at least a minor increase in visitation as a result of improved facilities. Several planned construction projects at WFF would generate dust and emissions. In a 2003 Final EA for rocket operations at WFF (NASA 2003), air quality impacts were assessed cumulatively with other projects and operations in the surrounding area. Although increased rocket operations would increase the amount of hazardous constituents and emissions, the overall impact to air quality would be negligible and the cumulative impact would not be significant to the surrounding environment when combined with other projects and operations. More recently, a 2012 Draft EIS for WFF (NASA 2012) analyzed rocket operations and its cumulative impacts towards air quality and climate change. The impacts to the global atmosphere from emissions of greenhouse gases related to the project would be global, negligible, and long-term; and when combined with the existing air quality impacts in the surrounding area, little air pollution concentration change was expected, with levels expected to continue below ambient standards. However, all of these impacts are considered negligible and therefore, the cumulative impact is expected to be negligible.

Hydrology/Water Quality

At Chincoteague NWR, potentially significant effects to uplands and wetlands would result from the construction of a new recreational beach parking lot and expansion of the Service Road under alternatives B (approximately 27 acres) and C (approximately 22 acres), including clearing, site preparations, and earth moving. This action would also potentially disturb Mallard and Pintail Pools (C and D Pools). These activities could cause erosion, runoff, and a potential temporary decline in surface and shallow groundwater quality until development is completed. However, the proposed action (relocated beach parking and road expansion) is conceptual and further environmental evaluations would be completed prior to construction. All other activities are relatively minor with negligible impacts and therefore, the cumulative impact that we can evaluate at this time would not be significant.

Vegetation, Wildlife, and Habitat

The other refuges considered seem to experience different and fewer impacts to vegetation, habitat, and wildlife than Chincoteague NWR does, probably because Chincoteague NWR is one of the most intensely visited refuges in the nation. The other refuge EAs are concerned primarily with the impacts to wildlife from hunting and human interaction and with specific actions that require vegetation clearing. Minor adverse effects to vegetation and wildlife as a result of human

contact and trampling from various public activities are reported at the refuge under all alternatives, as well as at Eastern Shore of Virginia/Fisherman Island NWRs and the Chesapeake Marshlands NWRC. Although this is a cumulative effect, in all cases it is temporary and partially mitigated for by education and management activities. Both Chincoteague NWR and Prime Hook NWR experience impacts from overgrazing of certain overpopulated wildlife species (e.g. light geese); this will be mitigated through hunting. As shown in Table 4-7, actions on all of the refuges, at the Seashore, and on the WFF have identified vegetation clearing projects. At WFF most of the effect of a very large vegetation clearing project will be mitigated by replanting with lower-growing vegetation. The estimated total effect of these actions (excluding the mitigated areas at WFF), and the clearing associated with the beach parking and access for alternatives B and C at Chincoteague NWR, is approximately 27 acres. This is less than 0.01 percent of the total area of these sites and most of the impacts would be mitigated. Selective cutting of forest vegetation through silviculture practices at both Chincoteague NWR and Prime Hook NWR would have temporary adverse impacts, but beneficial long term impacts to vegetation and wildlife habitat. The spraying of herbicides and pest control chemicals could result in cumulative effects to invertebrates at Chincoteague NWR and Prime Hook NWR.

Birds

Minor adverse effects to shorebirds as a result of human contact from hunting, fishing, hiking, and walking are reported at the refuge under all alternatives, as well as at Eastern Shore of Virginia/Fisherman Island NWRs and the Chesapeake Marshlands NWRC. At Eastern Shore of Virginia NWR, additional human contact would increase over the existing condition by adding canoeing and kayaking opportunities and from the loss of beneficial foods when an impoundment complex is allowed to revert to scrub-shrub and natural emergent marshes. At Chesapeake Marshlands NWRC, an adverse effect would result from permitting hunting on an additional 200 acres. While alternatives B and C would have minor impacts of their own, these would be offset by relocation of the beach and beach parking area and allowing natural processes to occur, which is beneficial to shorebirds, and also by allowing for natural succession of vegetation to occur in the 300-acre NWF. While a cumulative adverse effect would result from actions at these three refuges, the net effect, when considering the beneficial impact of management actions at the three refuges, is negligible.

Threatened and Endangered Species

None of the protected wildlife or plant species that would be adversely affected at the refuge would be adversely affected by actions that have been taken or are proposed at other NWRs in the CEA study area. Some past actions at the WFF have had an adverse effect on piping plover habitat; however, all of these actions have been subject to Section 7 consultation and the impacts have been mitigated. Therefore, there are no adverse cumulative impacts to threatened and endangered species.

Socioeconomic Effects

As reported in Section 4.12, alternatives A and C would result in adverse socioeconomic effects in the form of reduced expenditures in Accomack and Worcester counties by visitors. The economic impact to the region would be a loss of direct expenditures from tourists of $38.4 million for alternative A and $36.3 million for alternative C. Acquisition of several thousand acres (cumulatively) is proposed at Back Bay NWR, Chesapeake Marshlands NWRC, and the Eastern Shore of Virginia/Fisherman Island NWRs. Some of this land is farmland and this property acquisition would result in reduced local tax revenue. Adverse economic effect to farmers is not

expected, as all acquisitions would be voluntary, however there may be some adverse effects to agricultural support businesses. However, the tax revenue impact would be partially offset by payment in lieu of taxes and the acquisitions would be made only from willing sellers and would occur over a 15-year period. Although it would partially be mitigated by the fact that each of these effects would be located in different counties, there would be a cumulative adverse effect to socioeconomics as a result of these actions.

Soils

Increased public use at all refuges would result in temporary minor impacts due to soil compaction. This effect would not be considered cumulative because it only occurs locally at all refuges, and does not contribute to an additive effect of other actions.

4.16.4 Climate Change

The lower Delmarva Peninsula is an area of recognized global ecological significance for its remarkable estuarine, coastal, and marine habitats and substantial populations of migratory and breeding shorebirds, colonial waterbirds, landbirds, and raptors. The coastal lagoons and barrier islands represent what is arguably the most significant remaining wilderness on the Atlantic coast. Located across the peninsula from Chincoteague NWR, Pocomoke Sound, Beasley Bay, and smaller tidal creeks to the south along the western margin of the peninsula provide some of the most significant wetlands and largest beds of submerged aquatic vegetation in the Chesapeake Bay. Bisecting the peninsula, the Pocomoke River and its watershed are a recognized biodiversity hotspot and contain critical habitats for a number of rare, threatened, and endangered plants and animals. The Smithsonian Institution named the Pocomoke River and its bottomland forests as one of the most important sites for natural diversity on the east coast. Collectively, the focus area for the CCP provides globally significant habitat for a wide diversity of species, especially shorebirds, waterfowl, and migratory and breeding songbirds.

Fortunately, the conservation importance of area within the Atlantic Flyway has been long recognized by the USFWS and its Federal, state, local, and non-profit partners. All have worked together to protect over 27.6 percent of the land within the 987,000-acre focus area.

Unfortunately, several real and growing challenges threaten the area's rich and diverse natural heritage and the many benefits humans derive from the region's intact habitats and natural systems. The greatest of these is global climate change and its associated effects including sea level rise, land subsidence, changing frequency and intensity of storms, warming air and water temperatures, increasing variability in seasonal and annual precipitation, and increases in ocean acidity. Vulnerability of natural systems to global climate change, especially sea level rise, will be exacerbated by incompatible land uses and land management activities such as plasticulture, industrial pine plantations, conversion of natural habitats to residential development, shoreline armoring, increased pumping of ground water for agricultural irrigation, commercial, and residential uses, and the continued ditching of wetlands. Fifty-one (51) percent of protected lands within the proposed project area currently lie one meter or less above sea level, compared to only 30 percent of the project's overall area. While complex sediment dynamics and marsh migration processes mean that not all of these acres will actually be submerged by rising waters, it is clear that, unless steps are taken, sea level rise will have profound effects, often negative, on the region's coastal habitats and that impact will be disproportionately severe on existing protected lands. While decades of investment and conservation work by the USFWS and its many partners in Maryland and Virginia have yielded real, tangible, and significant results, there is a conspicuous

lack of connectivity among existing protected lands along the gradient from estuary to uplands. This lack of connectivity magnifies impact of existing threats and represents a real impediment to building resilience into the ecological systems so that they can adapt and migrate in response to sea level rise, increased frequency of droughts, and other climate change effects.

Table 4-7. Summary of Adverse Effects of Actions at Other Major Facilities in the CEA Study Area

Resource	Back Bay NWR	Chesapeake Marshlands NWRC[5]	Eastern Neck NWR	Eastern Shore of Virginia & Fisherman Island NWRs	Prime Hook NWR	Assateague Island National Seashore	Wallops Flight Facility
Air Quality	Minor impacts from prescribed burning (every 1 to 3 years).						Negligible air quality impacts from increased rocket operations. Negligible impacts to climate change from WFF operations.
	Minor increase in vehicle emissions from increase in visitation.						
Hydrology/ Water Quality	Potential negligible impacts from select use of low-toxicity herbicides.				Increased erosion, bottom sediments stirred up, and/or pollutants introduced to waterways from recreational use.	Increase in runoff from minor increase in impervious surface surfaces (2.2 acres).	4.6 acres wetlands fill from several projects (mitigated). Increase in runoff from minor increase in impervious surfaces. Minor changes to drainage patterns and potential to alter drainage patterns to Little Mosquito Creek.
	Potential negligible increased leaking oils and antifreeze from vehicles associated with increased visitation.						
		Potential minor sedimentation associated with from shrub and tree clearing.					
		Increase in runoff from minor increase in impervious surfaces.		0.33 acres wetlands fill (mitigated).			

[5] Includes Blackwater, Martin, and Susquehanna NWRs.

Vegetation /Habitat /Wildlife	Effects to wildlife and vegetation from human activity					2.5 acres of vegetation disturbance.	8 to 100 acres of vegetation clearing (60 to 92 acres mitigated by planting lower-growing vegetation). 2.3 acres rare maritime dunes altered.
	Slight risk of increase in distribution on non-native plant species from increased visitation and hunting.				Effect from routine maintenance (prescribed burn, moving, and forest management). Vegetation and habitat impacts from overgrazing by light geese, Canada geese, and white tailed deer.		
	Elimination of most impoundment populations of rare Carolina grasswort. Effect on habitat from clearing vegetation for trail, canoe/kayak parking areas boat launch, and eight acres for Headquarters/ Visitor Center/ maintenance compound. Vegetation	Increased visitation results in additional disturbance to wildlife and vegetation. Prescribed burning could increase amount of sunlight and/destroy food sources in forest for fox squirrel.	Tree cutting of 17 acres.	Vegetation disturbance from for 3 to 6 new bike /walk trails on existing old roads and rail right of way on 6,000-acre additional parcel to be acquired(725-acre tidal marsh and 120 acres open water).	Minor impacts to piping plovers and horseshoe crabs could result from improper sand sources (i.e., incorrect sediment grain size). Disturbance of vegetation and wildlife from selective cutting on forest vegetation. Active salt marsh restoration		

	clearing for footpath, bridges, and boardwalk that could create some barriers for wildlife.				strategies could disturb habitat and temporarily disturb wildlife (mostly birds). Hypersaline soil conditions that persist during the summer will have moderate and potentially long-term impacts to wildlife and habitat. Spraying of pest control chemicals could affect wildlife, specifically invertebrate species.		
Birds	Effect on shorebirds from human contact, adding canoeing/ kayaking opportunities. Loss of beneficial foods when impoundments revert to scrub-shrub and emergent marsh.			Effects on water fowl hunting on 200 additional acres.	Same as above.		

Socio-economics	Reduced local tax revenue as a result of proposed land acquisition partially offset by payment in lieu of taxes. Minor adverse economic effect on agricultural support businesses from taking farmland out of production.	Reduced local tax revenue as a result of proposed land acquisition, partially offset by payment in lieu of taxes. Minor adverse economic effect on agricultural support businesses from taking farmland out of production.					
Soil	Compaction from increased public use.						
					Siltation and erosion effects from salt marsh and upland forest restoration.		

Sources:
USFWS, Back Bay NWR Draft CCP and EA (March 2010)
USFWS, Chesapeake Marshlands NWR Complex CCP and EA (September 2006)
USFWS, Eastern Neck NWR CCP and EA (September 2010)
USFWS, Eastern Shore of Virginia and Fisherman Island NWRs CCP and EA (September 2004)
USFWS, Prime Hook NWR CCP and EIS (December 2012)
NPS, Assateague Island National Seashore. Improvements to Island Facilities Environmental Assessment (February 2006)
NASA and U.S. Navy, Wallops Flight Facility, various NEPA documents (1997-2013), http://sites.wff.nasa.gov/code250/documents.html

4.17 Relationship Between Short-term Uses of the Human Environment and the Enhancement of Long-term Productivity

This section considers the relationship between local, short-term uses of the human environment and maintaining the long-term productivity of the environment. Long-term is considered for impacts that would extend beyond the 15-year period of this CCP/EIS. Under all alternatives, the primary aim is to maintain or enhance the long-term productivity, resiliency, and sustainability of natural resources on the refuge, the southern Delmarva Peninsula, and the Commonwealth of Virginia, along with migratory birds and inter-jurisdictional fish and other far-ranging wildlife species, across their whole range.

Habitat protection and restoration actions across all alternatives may entail short-term negative impacts to ensure the long-term productivity of the refuge. Many of the cyclic management actions in the alternatives, namely, prescribed burning, controlling invasive plants and animals, proactively managing habitats, and restoring native plant communities can have dramatic short-term impacts. These include direct mortality of some plants and animals, displacement of species, and temporary displacement or cessation of certain types of visitor use. However, the long-term benefits of those actions generally offset their short-term impacts. Habitat management practices that mimic ecological and sustainable processes optimize the maintenance and enhancement of the biological diversity, integrity, resiliency, and environmental health of those habitats for the long term. Long-term productivity is especially enhanced when the ecological and sustainable management actions that are proposed in the alternatives would best support and improve links between nutrient cycling, ecological processes, and ecosystem function.

The nutrient cycling of the refuge's habitats is closely linked to other ecological processes discussed in this document. Vegetative structural diversity in the forms of dead wood, leaf litter, senesced wetland vegetation, and detritus contributes to terrestrial and aquatic invertebrate resources that maximize sustainable nutrient recycling which in turn enhances the long-term productivity of the refuge's natural resources to people and wildlife.

Diverse and wide-ranging wildlife recreational opportunities for visitor use should provide the best long-term positive economic impacts to local communities. That mirrors the widely accepted premise that maintaining biological diversity in natural ecosystems helps ensure their long-term resiliency. The visitor use programs under each alternative heavily rely on outreach and environmental education to explain management actions to visitors and the public that would encourage everyone to be better stewards of our natural environment.

Climate change is a growing concern for the refuge and the nation. Within the 15-year horizon envisioned by this document, we can expect repeated weather events that will cause coastal flooding and overwash of Assateague Island and the other barrier islands on Virginia's Eastern Shore. However, over the longer term (20 to 80 years) rising air and water temperatures, intense precipitation events, drought, sea level rise, strong coastal storms, and intense wind events will significantly alter the shape and character of these islands and the coastal marshes behind them. We fully recognize the conservation importance of the southern Delmarva Peninsula and the challenges it faces due to a changing climate. Adapting to a changing coastal environment will require a landscape-level approach to conservation, management, protection and where appropriate restoration of lands and waters, for the good of wildlife and people.

In summary, the alternatives would contribute positively to maintaining and enhancing the long-term productivity of the refuge's natural resources, with sustainable beneficial cumulative and

long-term benefits to the environment surrounding the refuge with minimal inconvenience or loss of opportunity for the American public.

4.18 Unavoidable Adverse Effects

Unavoidable adverse effects are the effects of those actions that could cause harm to the human environment and cannot be completely avoided, even with mitigation measures. All alternatives would result in some minor, localized, unavoidable adverse effects. For example, any new construction, burning of prescribed fires, or control of invasive species would produce minor, short-term, localized adverse effects. However, none of those effects would rise to a significant level. Furthermore, all of those impacts would be mitigated with best management practices, so none of the alternatives would cause significant, unavoidable cumulative impacts.

As previously noted, many of the habitat and facility construction projects in the alternatives have a certain level of unavoidable adverse effects, especially during the actual construction. Those effects are mitigated to some degree by the use of practices and precautions that safeguard water quality, avoid sensitive or irreplaceable habitats, and by timing activities or including actions to avoid or minimize impacts on fish and wildlife. The adverse effects generally are short-term and more than offset by the long-term gains in habitat quality and fish, wildlife, and plant productivity.

All these unavoidable adverse effects on the physical and biological environment would be relatively local and more than offset by the long-term benefits of cleaner air, cleaner water, and making rare wildlife species more common across the landscape, while providing quality wildlife-dependent recreation.

All the alternatives, in varying degrees, would have adverse impacts to a certain segment of the public that does not desire any change to current habitat management or visitor use programs, or that may have differing views on the course of action to be taken. Some may be concerned about decreased visitation to the refuge or restraints for certain uses, such as horseback riding or OSV use. These impacts to individuals or groups are unavoidable given the need to follow current law and policy, the diversity and number of publics, conflicts between and within user groups due to preferences, continued increase in use numbers, and relatively finite nature of land available on the refuge for public recreation. It is the refuge's responsibility to provide equal opportunities to the American public and seek a fair balance in minimizing and mitigating adverse impacts while optimizing wildlife conservation and providing excellent recreational opportunities to the public.

4.19 Potential Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be reversed, except perhaps in the extreme long term or under unpredictable circumstances. One example is an action that contributes to a species' extinction. Once extinct, it can never be replaced.

By comparison, irretrievable commitments of resources are those that can be reversed, given sufficient time and resources, but represent a loss in production or use for a time. An example of an irretrievable commitment is relocating the recreational beach parking and related facilities in alternative B and C. Small visitor facilities, such as information kiosks, are not considered irretrievable commitments of resources. Those facilities could be dismantled and restored at a more suitable site if resource damage is occurring.

4.20 Environmental Justice

EO 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed by President Bill Clinton on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations. The EO directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The EO is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income communities' access to public information and participation in matters relating to human health or the environment.

We evaluated alternatives in this CCP to determine if low-income and minority communities would bear a disproportionate burden from negative impacts resulting from the any of the alternatives in this CCP. Burdens that have a disproportionate effect on low-income and minority communities either target the geographic areas where the communities are based, or burdens are due from imposed fees to access resources. Agencies should also make every effort to include low-income and minority communities in the planning process. To address the latter, outreach for the CCP/EIS process hosted meetings in multiple locations, including in the lower income portions of Accomack County, and held meetings at various times throughout the day to accommodate different work schedules. For more information on public outreach, see chapter 5.

As described in chapter 3, within the study area, low-income and minority communities reside outside of the town of Chincoteague in the more rural areas of Accomack County. Given the distance between the refuge and environmental justice communities, they would not be affected as residents, for the most part, but these communities were evaluated for environmental justice impacts as visitors to the refuge and as employees of town businesses. According to the Springsted Report referred to in the Economic Analysis section, 85 percent of travel related expenditures in Accomack County occur in Chincoteague, and it has nearly 600 jobs supported by refuge-related visits. Given the importance of the town of Chincoteague to the county economy, the economic impacts to the town described in the economic impacts section can be considered to be felt more broadly within the county as a whole. Economic impacts resulting from any of the alternatives would not disproportionately affect low-income communities.

The refuge maintains a commitment to develop bilingual/multilingual materials for use in the refuge. Such materials increase the enjoyment and educational benefit of the refuge for non-English speaking populations and as such provide positive environmental justice benefits.

Each of the alternatives also maintains access to a 1-mile recreational beach. The variation among the alternatives in parking location and availability and the provision of shuttle service do not have differential environmental justice impacts as long as the vehicle entrance fee for the beach remains the same regardless of whether it is accessed via shuttle or private vehicle. As the bicycle entrance to the refuge is currently free, bicycle trail construction under all alternatives would have positive impacts for low-income communities.

Impacts to horseback riding, OSV use, and hunting and trapping among the various alternatives could benefit or burden those user groups irrespective of income or minority status, and there is no evidence that such groups are disproportionately low-income or minority.

4.20.1 Impacts on Environmental Justice in Alternative A

There are no specific impacts on environmental justice in alternative A.

4.20.2 Impacts on Environmental Justice in Alternative B

Alternative B would restrict Service Road access north of the new recreational beach to those on foot or with a special permit. The time and effort required to obtain a permit would have a small negative impact on all users, and any fee involved would have a small but disproportionate effect on low-income users.

4.20.3 Impacts on Environmental Justice in Alternative C

Alternative C would restrict Service Road access north of the new recreational beach to those with a special permit. The time and effort required to obtain a permit would have a small negative impact on all users, and any fee involved would have a small but disproportionate effect on low-income users.

4.21 Environmental Consequences Comparison Matrix by Alternative (Table 4-8)

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
Soils	Beneficial impacts would result from the shift in management of the NWF. Negative impacts to approximately 27 acres of soil would result from the creation of new recreational beach parking, including new horse-trailer parking, and from the expansion of the new recreational beach access road. Negative impacts, compaction and increased erosion, would result from any increase of use in the OSV zone.	Beneficial impacts would result from the elimination of OSV use and horseback riding, greatly reducing soil compaction and increasing beach and dune sand stability. All other impacts to soil would be the same as alternative B; however, the area negatively impacted would be approximately 22.5 acres.
Air Quality	Alternative B would relocate beach parking north approximately 1.5 miles from its current location. Final location of the relocated beach parking lots is expected to be closer than the current recreational beach, which may result in a decreased VMT of passenger vehicles, a positive outcome. However, new uses such as space tourism and separation of existing uses (recreational beach from crabbing and clamming areas) would cause additional vehicle use by visitors which would create seasonal or temporal decreases in air quality.	Positive impacts would result from the reduction of passenger vehicles on the refuge through the decreased amount of parking, as well as the discontinuation of OSV use.

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
Hydrology/Water Quality	Management of the Beach Road causeway, which would restrict it from year-round routine visitor use, and eventual modification of that area would have a positive impact on tidal flow and water quality for Swan Cove Pool (F Pool). The increased tidal rhythm through impoundment culverts would now be allowed to mimic the natural tidal rhythm of Toms Cove, which would lead to improved water quality, dissolved oxygen, pH, and salinity levels for the new flow area. The disturbance of Mallard and Pintail (C and D Pools) to allow for the construction of new public beach parking could have negative impacts on water quality for all impoundments to the south. Since impoundment flow is connected from north to south by culverts, anything that occurs in upper watershed beginning at Pintail Pool (D Pool) would flow though the impoundments south of them.	Impacts to hydrology and water quality under alternative C would be the same as alternative B but perhaps less due to reduced parking lot size.
Vegetation	Negative impacts to approximately 27 acres of vegetation would result from the moving of the recreational beach, associated parking, and the expansion of the new Beach Road. Beneficial impacts through better water flow and salinity levels would result from the improvement of water control structures throughout refuge impoundments. The reduction of non-migratory (resident) Canada geese and light geese on the refuge through hunting would create benefits by decreasing the amount of grazing by these species that currently impact native plant species. The construction of new lifeguard housing facilities and a boardwalk at or near Wallops Island NWR would have a negative impact on forested vegetation such as loblolly pine.	Adverse impacts resulting from the movement of the recreational beach, associated parking, and the expansion of the new beach access road would be the same as alternative B, except impacts would be limited to approximately 22.5 acres. The discontinuation of OSV and horseback riding would have a beneficial impact by eliminating potential trampling and compaction of native plants. It would also reduce the possibility that vehicles or horses could bring invasive species to the refuge. The phasing out of the exotic sika population, resulting in the elimination of associated grazing, would have a beneficial impact on native vegetation including the endangered seabeach amaranth. All other vegetation impacts would be the same as alternative B, except there would be

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
		no new construction of a bicycle trail in alternative C. All other impacts to vegetation would be similar as B.
Federal Threatened and Endangered Species	Negative impacts would occur for piping plovers on the refuge resulting from the shift of habitat management by allowing natural vegetation to grow back in the NWF impoundments area. However, this impact would be off-set and even surpassed as a result from relocating the current recreational beach. Through the creation of the ½-mile OSV access area, all day and nighttime OSV use south of this area would be discontinued between March 15 and September 15. This would eliminate the potential for OSV users to run over nests, hatchlings or plants, or otherwise disturb the nesting process, which would be a beneficial outcome. From September 16 to March 14, negative impacts would be minimized since OSV users would only be permitted to travel in the intertidal zone and by management actions usually in the form of exclosures and signs.	The elimination of OSV and horseback riding would have beneficial impacts on threatened or endangered species (piping plover, seabeach amaranth, and loggerhead sea turtle). All other impacts would be the same as alternative B.
Birds	Human disturbance to coastal nesting birds would be greatly diminished since the recreational beach would be relocated north, and OSV use would be limited to September 16 to March 14. The moving of the recreational beach and parking areas, along with the expansion of the beach access road, would result in negative impacts to approximately 27 acres of migratory bird habitat, but the impacts would be mitigated. This management strategy would cease vegetation removal from the NWF and allow for natural succession improving habitat for spring and fall migratory neotropical birds. Beneficial impacts for migratory waterfowl are also expected as this management strategy would increase thermal cover for waterfowl in the winter, increase the food sources for water birds and improve shorebird migratory stopover habitat. The change in hunt management would have positive impacts for bird	The elimination of OSV and horseback riding on the refuge would have a positive benefit for coastal, migratory, and wintering shorebird species. As analyzed under alternative A, current OSV and horseback riding use does not pose a significant impact for birds in that area, but the complete phase out of these activities would further diminish the possibility for trampling or general human disturbance. All other impacts to birds in this alternative would be the same as under alternative B.

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
	species on the refuge, mostly by the elimination of predation and competition. Further, adding resident Canada goose and light goose hunting on Assateague Island would reduce their populations on the refuge and their negative impact to habitat.	
Fish and Other Aquatic Wildlife	Improvements to the tidal flow of Swan Cove Pool (F Pool) resulting from modification and replacement of water control structures within Beach Road causeway would have a positive impact on fish and other aquatic species. Increased water flow and tidal rhythm would allow fish and aquatic invertebrates such as crabs and mollusks passage into this restored salt marsh.	Impacts would be the same as alternative B.
Mammals	The refuge would implement new hunting and trapping programs for raccoon and red fox populations. These new programs would minimize predation on nesting piping plovers and other coastal birds, which would be a beneficial outcome for birds, yet adverse for mammals.	Impacts for alternative C would be the same as alternative B, except that, in addition, the refuge would work towards the elimination of the entire sika population on the refuge. This elimination of the exotic species would further diminish the competition with the white-tailed deer for food and habitat.
Reptiles and Amphibians	Increased incidental mortality of reptiles and amphibians could occur on newly created refuge roads between March and October. However, we expect negligible impacts since best management practices would be implemented in the design and engineering of the roads and parking lots. Therefore, it would not affect their overall populations.	Impacts to reptile and amphibian species under alternative C would be the same as under alternative B.

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
Invertebrates	The alteration of Mallard and Pintail (C and D Pools) in order to allow the building of approximately 8.5 acres of recreational beach parking would have a negative impact on invertebrates, mainly monarchs, due to the removal of Bidens. Although this would be a permanent negative impact, it would not be a significant impact because of the small acreage that would be affected, and because there are several nearby habitats where monarchs could nectar, including Shoveler and Snow Goose (B Pools). Improvements to the tidal flow of Swan Cove Pool (F Pool) resulting from modification and replacement of water control structures within Beach Road causeway would have a positive impact on aquatic invertebrates and fish species. Increased water flow and tidal rhythm would allow fish and aquatic invertebrates such as crabs and mollusks passage into this restored salt marsh. Control of mosquitoes may have adverse impacts on birds, fish, amphibians, bats, and other wildlife since they are a known food source for these species. This impact would not be significant because it only occurs in a small area.	Impacts under alternative C would be the same as under alternative B, except that the negative impacts from removal of Bidens at the new recreational beach parking would be reduced to only 4.5 acres.
Socioeconomics	Assuming that visitation would not change as a result of the beach relocation, as the same number of spaces would be preserved, and the short-term transition between the locations would be carefully managed outside the peak visitation period, there would not be any negative economic impact per year resulting from alternative B compared to the base year of 2009. The expansion of several visitor services, such as hunting, may result in increased visitation but is not expected to be significant.	The reduction in beach parking to 480 spaces, would result in a loss of $36.3 million, or 32 percent of current annual baseline expenditures in Accomack and Worcester Counties. Parking loss is the only action for which an economic impact estimate is available, but other actions (e.g., closing the Beach Road causeway and the Service Road and discontinuing OSV use and horseback riding) could have negative impacts on the number of visitors coming to the refuge, although institution of a shuttle and expansion of hunting opportunities could mitigate these decreases.

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
Hunting	The expansion of hunting opportunities due to increase in permits, additional hunting days and hunting of new species would benefit hunters. The expansion of hunting for new species and introduction of fur-bearer trapping would benefit hunters and trappers by providing new and expanded opportunities for these activities.	In addition to those listed below, impacts and benefits would be the same as for alternative B. The increase in sika hunting to achieve the removal of species would be a short-term benefit to hunters as it could increase the number of hunters able to experience the hunt, but the eventual elimination of the sika population would mean over the long term, hunters would not be able to hunt sika and there would be fewer hunting permits available, an adverse impact. While OSV use would be discontinued, use of 4x4 vehicles would be permitted to access the Toms Cove Hook area for sika hunting.
Fishing	OSV use would be allowed to access surf fishing areas but would be limited in the Overwash area from March 15 to September 15 or whenever the last shorebird chick fledges. This would be a slight decrease over present opportunities, creating an adverse impact to anglers. A benefit of the designated ½-mile OSV parking area for fishing is that visitors would have more convenient access to surf fishing when other portions of the OSV zone are closed and an extended time period for fishing using OSV access. Visitors would benefit from improved communication and coordination of the permit process throughout the region under this alternative by saved time, reduced confusion, and raised awareness of rules and opportunities. The relocated beach and change in Beach Road causeway access would result in improved experience for visitors interested in crabbing, clamming, and oyster harvest in Swan Cove (F Pool) and Toms Cove.	OSV use would be discontinued and there would an adverse impact to visitors who come to the refuge to surf fish. Visitors who want to surf fish would experience greater inconvenience in taking their gear to surf fishing locations and surf fishing activities would be concentrated at points along the beach closer to the recreational beach so visitors would experience increased crowding. As a result, some visitors would continue to fish and carry gear by foot, some visitors would not choose to walk with gear down the beach and others would choose not to visit the refuge.

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
	A new crabbing dock at the terminus of Beach Road would create a new facility that would substitute for current inconvenient sites and be more accessible to visitors with disabilities and family groups, resulting in a net benefit.	
Environmental Education and Interpretation	Students and others not able to travel to the refuge would be able to experience and learn about the refuge through the virtual exhibits. Enhanced opportunities would provide for a more informed public and increase stewardship. With the relocation of the recreational beach and change in access, beachgoing visitors would no longer pass by the Herbert H. Bateman Educational and Administrative Center en route to the beach and therefore, may be less inclined to visit, resulting in an adverse impact. However, the new visitor contact station at the recreational beach would have information on both NPS and USFWS and would result in USFWS information being more directly accessible by beachgoing visitors, which would result in a net benefit to beachgoers. Despite the relocation of the recreational beach and the seasonal closure of Beach Road causeway, visitors would continue to benefit from NPS and CBFS canoe/kayak programs, which would have access to Toms Cove at the terminus of Beach Road.	Some beachgoing visitors who previously had not learned about the refuge would benefit from interpretation provided on the beach shuttle.
Wildlife Observation and Photography	Relocation of the beach would be an adverse impact because it would reduce opportunities for wildlife observation and photography in Swan Cove (F Pool), Toms Cove, and the southern end of the island, as parking and foot access to these sites would be more difficult and inconvenient. A relocated recreational beach would change the beach viewshed such that water would not be visible on both sides; however, the viewshed at the relocated beach would also have reduced views of parking. Continuation of Swan Cove Trail to the beach would provide visitors with a benefit in the form of access to an area for wildlife observation and photography and continue to facilitate such access to the beach. The expansion of hunting opportunities for new species and opening	Same adverse and beneficial impacts of removing invasive plant species and of increased hunting as alternative B, except that the elimination of sika would likely increase the abundance of other plant and animal species. Same adverse impacts as alternative B as a result of the relocation of the beach and closure of beach causeway. Closure of the Service Road north of the new recreational beach to public access would reduce opportunities to view the northern

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
	of additional hunting days would mean that other visitors would be more likely to see or hear signs of hunting from adjacent areas, which could adversely affect their wildlife observation and photography. However, this impact would be minimized because hunting would occur during off-peak visitation times. Hunting of new species would reduce the number of those species that visitors could see; however, these species are being identified because of their overabundance and impacts on other species. Thus, in the long term, increased hunting could enhance the opportunity for wildlife observation and photography. The relocated recreational beach would make it inconvenient to drive by the viewing area for the Chincoteague ponies; however, the planned relocation of some of the ponies would ensure continued convenient visual access, mitigating this impact. A benefit of the new observation tower at or in the vicinity of Wallops Island NWR is that it would provide new photography/wildlife observation opportunities in a new location, which would reduce crowding elsewhere and increase awareness of the refuge. Other improvements, such as the pursuit of photography blinds, could attract more visitors, which would increase crowding and disturbance, but would also provide new experiences for existing visitors and bring new visitors to the refuge.	Pony Herd and access to that landscape for photography. Sika would no longer be available to observe and photograph as a result of the planned elimination through hunting, an adverse impact. Views of parking from the recreational beach would be reduced due to the reduction in parking, which would be a benefit. The loss of Swan Cove Trail and no replacement from Wildlife Loop to the new beach would result in an overall loss of wildlife observation and photography opportunities along a trail. The limit on the Chincoteague pony population to 125 could reduce viewing opportunities; however, the current population is between 125 and 135 so no significant impact would be anticipated.
Recreational Beach Use	Beachgoers would benefit from the ongoing provision of the same number of parking spots as there are currently at the existing beach without disruption. However, they would also experience the adverse impacts of traffic and waiting for parking as they currently do. Beachgoers would benefit from the new bicycle lane connection to the recreational beach which would provide a safer transportation option and could result in lower demand on beach parking. The relocation of the beach would have significant adverse impacts,	The reduction in beach parking and introduction of a shuttle would have significant adverse impacts on beach going visitors. Some beachgoers would choose not to visit and instead go elsewhere. The relocation of the beach would have significant adverse impacts, as well as some beneficial impacts, on beachgoing visitors. Beachgoers would be able to continue the

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
	as well as some beneficial impacts, on beachgoing visitors. Beachgoers would be able to continue the same type and level of beach activities on the oceanside. Visitors would not have access to the bayside and thus would not be able to pursue bayside activities, such as clamming, crabbing, and swimming with young children. Due to the reduced points of access to the beach, visitors would experience the adverse impact of more crowding at access points, as some people would not want to carry recreational beach gear further up or down the beach. Visitors could experience increased exposure to mosquitoes in the relocated parking areas; however, the refuge would take measures to reduce the mosquito population, avoiding or minimizing this impact. Facilities would be constructed such that visitors would have continuous access to the refuge and recreational beach throughout the transition from the current to the new location of the recreational beach, and would receive communication on the timeline for relocation, reducing any significant disruption in visitor use. The seasonal closure of Beach Road causeway would eliminate access to the current recreation beach and its particular characteristics, such as water on both sides and easy access to clamming, crabbing, oyster harvest, and other bayside activities.	same type and level of beach activities on the ocean-side. Visitors would not have access to the bayside and thus would not be able to pursue bayside activities, such as clamming, crabbing, and swimming with young children. Due to the reduced points of access to the beach, visitors would experience the adverse impact of more crowding at access points, as some people would not want to carry recreational beach gear further up or down the beach. Visitors could experience increased exposure to mosquitoes in the relocated parking areas; however, the refuge would take measures to reduce the mosquito population, avoiding or minimizing this impact. Facilities would be constructed such that visitors would have continuous access to the refuge and recreational beach throughout the transition from the current to the new location of the recreational beach, and would receive communication on the timeline for relocation, reducing any significant disruption in visitor use. The closure of Beach Road causeway would eliminate access to the current recreation beach and its particular characteristics, such as water on both sides and easy access to clamming, crabbing, oyster harvest, and other bayside activities.

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
Other Uses	Relocation of the beach would change the use of part of the Wildlife Loop such that non-motorized traffic would need to share the right of way with beach traffic, resulting in adverse impacts in the form of increased crowding, discomfort, and safety incidents. In addition, relocation of the recreational beach would benefit bicyclists' access and beach access via bicycle, with introduction of new on-road bicycle lanes that would provide improved, safer, and more direct access and could result in an increase in overall beach visitation, and reduced beach parking demand. However, this may be offset by more visitors choosing to bike to the beach, resulting in more crowded bicycle trails.	Same impacts and benefits as alternative B with regard to impacts of rocket launches and impact to Wildlife Loop. There would be adverse impacts to users who horseback ride, which would be discontinued and to those who smoke, which would be banned on the beach. The relocation of the beach and lack of access at the terminus at Beach Road would result in reduced access to Toms Cove. Bicyclists would benefit from on-road bicycle lanes but bicyclists and visitors generally would be adversely impacted by the loss of Swan Cove Trail and no replacement from Wildlife Loop to the new beach.
Cultural and Historic Properties	A comparison of findings in the report, "Archaeological Reconnaissance of the Chincoteague National Wildlife Refuge, Accomack County, Virginia and Worcester County, Maryland" (Goodwin & Associates, Inc. 1989) with the potential development in alternatives B and C concluded that nothing in the Goodwin report indicated we would be impacting cultural resources based on the previous findings. Since the proposed actions associated with the relocated beach parking and road expansion are conceptual and not finalized, specific details for these actions are currently unknown. Further environmental assessments and analysis for impacts on cultural resources would need to be completed prior to construction.	
Refuge Administration	New activities and programs would require expanded staffing and infrastructure investment. A focus on use of social media/technology would require some infrastructure investments (i.e., fiber optics). The expansion of hunting and trapping opportunities would require a follow-up hunt management plan, with a short-term impact on staff time. Subsequent increase in hunting permits and need for new materials and maps would require additional staff and funding to administer	Impacts related to hunting, the relocation of the recreational beach and Wallops Island would be the same as for alternative B. The removal of the OSV and horseback riding zone would reduce the administrative and enforcement burden on NPS and refuge staff which is a benefit because the time could be dedicated to other management needs.

Resources	Alternative B Balanced Approach	Alternative C Reduced Disturbance
	permits, patrol hunting zones, and provide orientation for new hunters. This would be a long-term impact, as such administration is year-round. The relocation of the recreational beach and related facilities would require staff to develop a transition and communication plan, as well as participate in design, further environmental assessment, and other planning efforts. New staffing would better address Wallops Island NWR needs and the needs created by strategies for resource management (biology), visitor services, maintenance, law enforcement, and coordination with NASA.	

Chapter 5

USFWS

Lighthouse

Consultation and Coordination with the Public and Others

5.1 Pre-Planning Meetings
5.2 Federal Register Notice of Intent
5.3 Public Meetings and Comments
5.4 Planning Team Meetings
5.5 Other Meetings of Note
5.6 Public Outreach
5.7 Draft CCP/EIS Public Comment Period

Chapter 5: Consultation and Coordination with the Public and Others

Effective conservation planning begins with effective consultation with the public and conservation partners, including: other Federal and State agencies, county and town officials, civic groups, non-government conservation and education organizations, and user groups. To ensure that future management of the refuge considers the issues, concerns, and opportunities expressed by the public, USFWS used a variety of public involvement techniques to inform this CCP/EIS.

Public interest in the future management of Chincoteague NWR is widespread. The concerns and situations of the interested members of the public are diverse. The refuge has heard from businesses and full-time and part-time residents from the town of Chincoteague and neighboring communities; hunters and harvesters of waterfowl, fish, shellfish, and upland species; visitors who come to observe birds, the Chincoteague ponies, monarch butterflies, and other wildlife or who seek solitude and respite in the natural world; beachgoers, OSV drivers, horseback riders, and other non-wildlife-dependent recreation users; and State agencies and other programs and organizations concerned about the role and contributions the refuge can play in a larger network of natural areas across the State, the mid-Atlantic, and the Atlantic coast migratory bird flyway.

What follows is the chronology of public outreach activities USFWS conducted while preparing this document. It does not detail activities associated with studies that informed the document, such as the Chincoteague National Wildlife Refuge Alternative Transportation Study (2010), or the hundreds of informal discussions the refuge manager and his staff had. Those involved a wide range of audiences, including congressional representatives or their staffs, local community leaders and other residents, refuge neighbors, refuge visitors, and other interested individuals. During those discussions, the refuge manager and his staff often would provide an update on the CCP/EIS progress and encourage comments and other participation. Since 2009, the refuge manager has held regularly monthly meetings with community leaders and held Town Hall Meetings for the public each May with NPS. The refuge also continued regular communication with NPS throughout the process.

5.1 Pre-Planning Meetings

Refuge pre-planning for the CCP began in 2007. In December, we held an initial joint planning meeting between refuge and NPS Assateague Island National Seashore staff regarding overlaps between the agencies' respective long-range planning processes. The NPS document is known as the General Management Plan (GMP) and similar to the CCP, establishes a vision and provides broad guidance for park management over the next 15 to 20 years. Other pre-planning meetings included local outreach, participation in state events, and working meetings between the CCP consultant at the time, the Tennessee Valley Authority, and USFWS staff. Specific meetings of note were as follows:

- *May 15-16, 2007*: USFWS staff meeting to discuss the development of a draft HMP, to be incorporated into the CCP.
- *July 16, 2007*: Meeting with Town Council and Ron Wolff, Supervisor, Accomack County.
- *December 17-19, 2007*: Meeting with Seashore to identify common goals, issues of concern, and opportunities for coordination as each agency begins long-range planning processes for their respective units.

- *September 2-5, 2008*: First core planning team meeting to develop work plan, discuss key issues, identify data needs, and meet with NPS for the Seashore's GMP kickoff meeting (September 3-4).
- *October 30, 2008*: Commonwealth of Virginia event, "Conserving Virginia's Fish and Wildlife for the Future: Preparing for a Changing Climate," with references to Chincoteague NWR.
- *February 26, 2009*: Technical experts meeting to discuss the overall CCP process, to discuss sea level rise, to review/rank top issues of concern, to define the study area, and to identify conservation areas and critical habitat in the study area.
- *March 10, 2009*: The Commonwealth of Virginia wildlife and climate change workshop.
- *May 11, 2009*: Town Hall Meeting in Chincoteague held by the refuge manager and Assateague Island National Seashore superintendent, with the ongoing GMP and upcoming CCP as major discussion topics.
- *February 25, 2010*: Technical experts meeting to continue discussion of the development of a draft HMP, to be incorporated into the CCP.

5.2 *Federal Register* Notice of Intent

USFWS published the original Notice of Intent (NOI) in the *Federal Register* on September 17, 2010, stating that USFWS intended to prepare "a Comprehensive Conservation Plan (CCP) and associated Environmental Impact Statement (EIS) document for Chincoteague National Wildlife Refuge (NWR) and Wallops Island NWR."

5.3 Public Meetings and Comments

USFWS received public comments from a wide range of user groups and interested parties during two formal periods prior to release of the draft CCP/EIS: the initial scoping period and the presentation of the preliminary draft alternatives. Both of these are described further in this section. Public meetings and comments that came after release of the draft CCP/EIS are addressed further in section 5.7, and appendix R.

5.3.1 Scoping

USFWS conducted a public scoping period from September 17, 2010, through January 18, 2011, to gather public input and identify key issues and concerns to consider during the CCP process. During this timeframe, USFWS invited the public to submit comments and communicated information through news releases, the refuge Web site, and flyers made available at the refuge.

As part of this initial scoping process, USFWS held four events across 3 separate days:

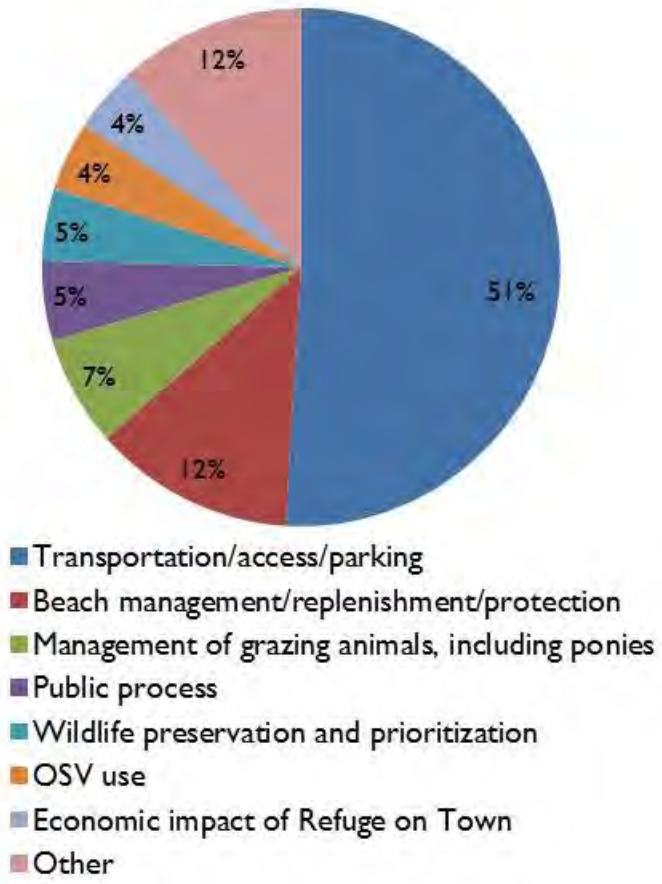
- *August 25, 2010*: Open house event from 9 a.m. to 2 p.m. at the parking area by the public recreational beach.

- *September 21, 2010*: Two public meetings and open houses at the Chincoteague Community Center in the Town of Chincoteague; one from 3 p.m. to 5 p.m. and one from 6 p.m. to 8 p.m.

- *January 13, 2011*: Public meeting from 6 p.m. to 8 p.m. at the Old Train Station in Snow Hill, Maryland.

Over 150 participants attended these meetings and wrote down over 200 discrete comments. In addition, 134 written comments were received by mail, including official comments from the town of Chincoteague's Chincoteague to Assateague Beach Access Committee, the Chincoteague Chamber of Commerce, the County of Accomack, the Citizens Beach Committee, TNC, Ducks Unlimited, and Defenders of Wildlife. Figure 5-1 provides a general categorization of scoping comments by topic.

Figure 5-1: General Categorization of Scoping Comments



5.3.2 Preliminary Alternatives

Preliminary draft alternatives were developed in summer 2011, after 10 months of initial scoping and public involvement. On August 15, 2011, the USFWS published a newsletter with descriptions of four preliminary draft alternatives, which initiated the public comment period on the draft alternatives for further alternative development in this CCP/EIS.

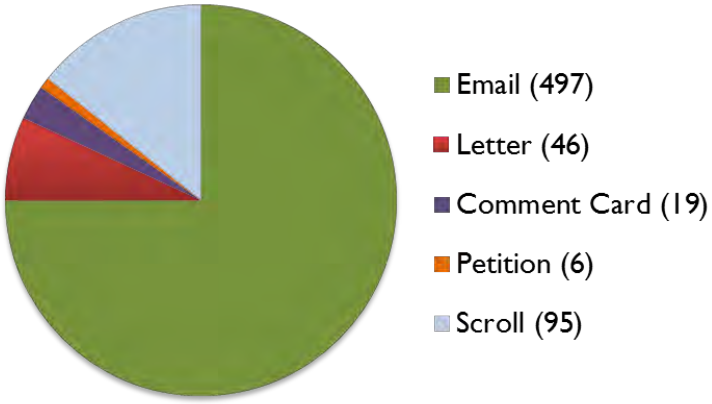
The alternatives comment period began on August 15, 2011, and was set to end on October 1, 2011, but was extended to October 31, 2011 at the request of the public. Four public meetings were held to present the draft CCP alternatives on 3 separate days in August:

- *August 22, 2011*: Two public meetings, one from 9 a.m. to noon at the recreational beach on the refuge and one from 5 p.m. to 7 p.m. at the Chincoteague Center.

- *August 30, 2011*: One public meeting from 4 p.m. to 7 p.m. at the Eastern Shore Community College in Melfa, Virginia.
- *August 31, 2011*: One public meeting from 4 p.m. to 7 p.m. at the Delmarva Discovery Center in Pocomoke City, Maryland.

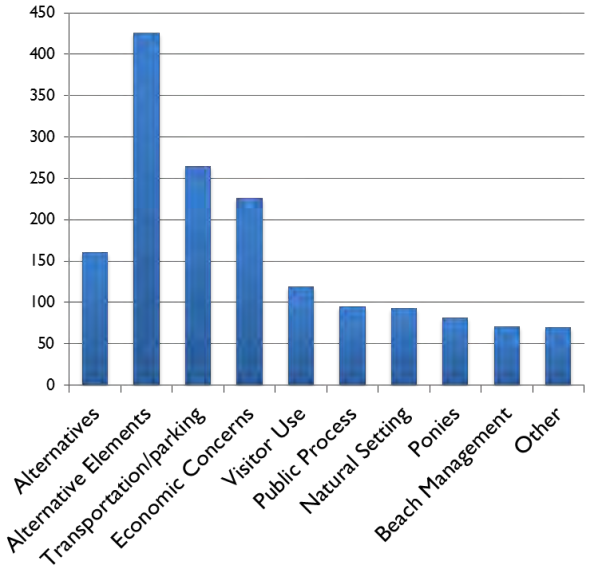
In all, 663 comments were received. Approximately 17 percent (113) of commenters self-identified as property owners and 29 percent (189) of commenters self-identified as visitors. The format of written comments included the use of the public meeting comment form, personalized emails or letters, and petitions (see Figure 5-2). Written comments on draft alternatives were submitted directly to the Refuge Manager, the USFWS regional office, or to the refuge staff. The email address northeastplanning@fws.gov was provided as the designated email address for the project. Comments were also made by participants at the four public meetings held in late August 2011 on comment forms and scrolls provided at exhibits showing the draft alternatives. Some participants submitted comments via more than one format but such comments were only counted once.

Figure 5-2: Format of Comments Received



Comments focused on the four draft alternatives presented in the newsletter as well as other suggested alternatives and alternative elements. Some of the responses were related to only one subject, while others addressed multiple subjects. Most stakeholders commented on transportation/parking, economic concerns, visitor use, the public process itself, the natural setting of the refuge, the Chincoteague ponies, beach management, and other general comments. Figure 5-3 provides the distribution of comments received by topic.

Figure 5-3: Topics Raised in Comments



5.4 Planning Team Meetings

USFWS assembled a CCP/EIS Planning Team of public stakeholders who met throughout the planning process for this CCP/EIS and included representatives from the following public agencies: USFWS, NPS Assateague Island National Seashore, town of Chincoteague, Accomack County, Accomack County Board of Supervisors, Accomack-Northampton Planning District Commission, VMRC, VDGIF, and NASA. Participants were added over time as they were identified, and although all agencies were invited to each meeting, not all were able to attend each meeting. The Volpe National Transportation Systems Center served as facilitator.

Three CCP Planning Team meetings were held:

- *April 6, 2011*: Participants discussed the qualities and attributes of the refuge, reviewed and revised management issues and goals, and drafted a preliminary refuge vision statement.
- *June 21-22, 2011*: Refuge solicited feedback on preliminary draft alternatives to be presented to the public in August for comment. Participants reviewed draft, preliminary management objectives and strategies for key issues across four alternatives and provided feedback on specific content, both in terms of what range of objectives should be considered for each issue but also how specific objectives can be accomplished. On one day, visitor service issues were discussed, and on the other day, resource management issues were discussed. Each day also covered cross-cutting issues.
- *December 21, 2011*: Participants discussed comments received and proposed changes to the CCP draft alternatives. The discussion and subsequent follow-up resulted in clarifications and additional changes to the alternatives.

5.5 Other Meetings of Note

Throughout the development of the draft CCP/EIS, from 2010 to 2012, the refuge conducted a series of meetings with local, Federal, and State agencies and representatives to inform them of the status of the CCP/EIS and solicit input on different considerations. These included meetings

specific to the economic analysis for the CCP and to the feasibility of relocating the recreational beach. Some of these meetings included the following:

- *August 10, 2010*: Meeting with Town Beach Access Committee.
- *September 9, 2010*: Coordination meeting with the VDGIF and the Wildlife Services (WS) Division of USDA-APHIS to discuss CCP issues.
- *February 4, 2011*: Coordination meeting with VDGIF and USDA-APHIS WS to discuss CCP issues.
- *March 7, 2011*: Meeting with Marine Science Consortium and NASA to discuss coastal zone research.
- *March 8, 2011*: Meeting with NPS and the VMRC to discuss CCP/GMP issues.
- *March 10, 2011*: Meeting by conference call with NPS to discuss CCP and GMP.
- *March 22, 2011*: Kick-off for SDM process for recreational beach.
- *April 28, 2011*: Webinar on sea level rise and coastal impoundment management to inform SDM process.
- *May 4, 2011*: Town Hall Meeting with NPS.
- *June 20, 2011*: Meeting with Congressman Scott Rigell (Virginia District 2) to discuss draft alternatives and tour proposed relocated recreational beach.
- *August 12, 2011*: Meeting with NPS to discuss CCP preliminary draft alternatives.
- *August 17, 2011*: Briefing by conference call of congressional staff on the CCP.
- *August 23, 2011*: Meeting with Town and USFWS Economics Division to discuss CCP economic analysis.
- *August 29, 2011*: Meeting with Mayor and Town staff to assess beach damage from Hurricane Irene.
- *September 19, 2011*: Tour of proposed beach relocation area by Town Beach Access Committee by hay wagon.
- *September 19, 2011*: Meeting with Ron Wolff, Supervisor, Accomack County and constituents in Atlantic, Virginia about CCP.
- *September 20, 2011*: Meeting with Beach Access Committee to discuss preliminary draft alternatives.
- *November 17, 2011*: Update by conference call of congressional staff on the CCP.
- *January 19, 2012*: Meeting with the Town to review the draft baseline economic analysis for the CCP.
- *February 17, 2012*: Oversight Hearing for the U.S. House of Representatives Natural Resources Committee's Subcommittee on Fisheries, Wildlife, Oceans, and Insular Affairs on "Fish and Wildlife Service's Proposed Comprehensive Conservation Plan and its Potential Devastating Impact on the Economy of the Town of Chincoteague, Virginia."
- *February 22, 2012*: Meeting with USACE in Norfolk, Virginia on CCP issues.
- *February 23-24, 2012*: Presentation on the CCP at the Virginia State and Federal Partners Meeting, attended by various State and Federal agencies.
- *March 22, 2012*: Meeting with Virginia U.S. Senator Mark Warner's staff to provide overview of refuge CCP issues.
- *April 11, 2012*: Visit by representatives from the Cooperative Alliance for Refuge Enhancement to tour the refuge and discuss CCP issues.
- *May 8, 2012*: Site visit by USACE to identify issues with relocated beach and parking sites.
- *May 15, 2012*: On-site visit and meeting with USGS and Virginia Tech to discuss sea level rise and the piping plover.

- *May 16, 2012*: Meeting between USFWS Region 5 staff and U.S. Congressman Scott Rigell (Virginia District 2).
- *June 4-5, 2012*: Site visit by consultant conducting external review of the CCP/EIS process, in particular the range of alternatives and their viability.
- *June 15-16, 2012*: Presentation and beach walk on climate change and sea level rise with Orrin Pilkey, Professor Emeritus of Earth and Ocean Sciences, Nicholas School of the Environment, at Duke University, and Founder and Director Emeritus of the Program for the Study of Developed Shorelines, which is currently based at Western Carolina University.
- *July 18, 2012*: Site visit and meeting with USACE, NPS, and local government officials to discuss impacts of beach and parking relocation.
- *July 31, 2012*: Kick-off for Wilderness Review (NPS and USFWS collaboration for Assateague Island).
- *August 8, 2012*: Informal consultation with USFWS staff on Delmarva fox squirrel status.
- *August 23, 2012*: Meeting between Joe McCauley, USFWS Region 5 Realty Chief, Division of Realty, and CCP regional lead, and the Town Council and the Beach Access Committee to discuss CCP.
- *September 13, 2012*: Presentation by USFWS Economics Division to Town Council and Beach Access Committee on results of baseline economic analysis for CCP.
- *October 17, 2012:* Presentation by USFWS Economics Division to Accomack County Board of Supervisors on results of baseline economic analysis for CCP.
- *October 17, 2012:* Meeting and site visit with U.S. Congressman Scott Rigell (Virginia District 2) and staff, as well as the Mayor of Chincoteague and representative from the Accomack County Board of Supervisors.
- *January 30, 2013*: Briefing on status of CCP by Joe McCauley for the Town of Chincoteague's Beach Access Committee via phone.
- *April 5, 2013:* Visit and meeting with Virginia U.S. Senator Tim Kaine, as well as the Mayor of Chincoteague and a representative of the Beach Access Committee, to discuss the CCP.

5.6 Public Outreach

USFWS employed a number of outreach strategies, including newsletters, a Web site, radio interviews, and traditional media coverage.

5.6.1 Newsletters

USFWS developed and distributed six "CCP Update" newsletters dated February 2011, May 2011, August 2011, August 2012, November 2012, and April 2013. The newsletters described the USFWS and the Refuge System, the planning process, proposed and updated Draft CCP/EIS schedule, summaries of public comments, potential issues to be addressed in the Draft EIS/CCP, draft Refuge vision and goals, and times and locations of upcoming public meetings. Additional details on each newsletter are provided below:

- *February 2011*: This newsletter described the NOI in the *Federal Register* to prepare the EIS/CCP and the initial public scoping process. In addition to background information on Chincoteague NWR, the newsletter provided a summary of comments from the completed public scoping process, including a categorization of all comments by topic area.
- *May 2011*: This newsletter outlined the members of the CCP/EIS Planning Team and introduced the structured decision-making processes for determining potential alternative

locations for the public recreational beach as well as other parallel efforts. In addition, the newsletter presented the draft vision statement and goals for the refuge.

- *August 2011*: This newsletter provided detail on the four preliminary draft alternatives under consideration to initiate a public comment period. In addition to providing the draft preliminary alternatives and requesting comments, the newsletter announced meeting purpose, dates, locations, and times; provided USFWS contact information; provided background summary information on the CCP; provided instructions on submitting comments; and listed locations where additional information on the process was available.
- *August 2012*: This newsletter provided information on the draft alternatives, refined from public feedback. Three alternatives are presented and, in light of public concerns expressed since the release of the preliminary draft alternatives, clarification as to how the different alternatives and the larger CCP effort will impact recreational beach access and parking.
- *November 2012:* This newspaper summarized the impact of Hurricane Sandy on the refuge and addressed how Hurricane Sandy would and would not impact the CCP/EIS. Overall, Hurricane Sandy resulted in a delay in schedule but no changes to alternatives.
- *April 2013:* This newsletter provided an update on the schedule for the CCP/EIS, a review of the alternatives, and information on post-Sandy restoration and the effects of the Federal budget sequestration on the refuge.
- *May 2014:* This newsletter announced the release of the draft CCP/EIS for public review and comment. In the newsletter, we briefly summarized the three management alternatives that we evaluated, plus we explained where to get a copy of the draft plan and how to submit comments.

The first three newsletters were made available online and in hard copy at several locations and public meetings. The August 2011 newsletter, in which the preliminary draft alternatives were first made public, was made available at the following locations and events:

- Refuge's Herbert H. Bateman Educational and Administrative Center,
- NPS Toms Cove Visitor Center,
- The public library and Sundial Book Store in the town of Chincoteague,
- Public meetings for scoping and draft preliminary alternatives,
- Seashore's GMP meeting at the Marine Science Consortium on Wallops Island,
- Refuge's monthly Community Leaders Meetings, and
- A Kiwanis Club meeting featuring Refuge Manager Louis Hinds.

Hard copies of the August 2011 newsletter were also distributed by TNC and a refuge volunteer. Finally, hard copies were mailed to individuals upon request.

The other newsletters (August 2012, November 2012, and April 2013) were made available online, including through several forms of social media such as Twitter and Facebook. An additional newsletter summarizing the draft CCP/EIS was released and made available in May 2014 with release of the draft plan, and was mailed to those who requested to be on the mailing list.

5.6.2 Web

In addition to the newsletters, all meeting dates, updates to alternatives, and background information were made available on the refuge's CCP planning Web site throughout the process: *http://www.fws.gov/northeast/planning/Chincoteague/ccphome.html*.

5.6.3 Radio

Throughout the CCP process, from August 2010 to March 2013, the refuge manager and others, including representatives from USFWS Region 5, have made periodic appearances on air on local radio stations WCTG 96.5 FM and Delmarva Public Radio's WSDL National Public Radio (NPR) News 90.7 to discuss the CCP. Such appearances have occurred to announce newsletters, public meetings, and address specific concerns around the CCP.

5.6.4 Media

There has been extensive media coverage of the CCP, from local newspapers such as the *Chincoteague Beacon* and *Eastern Shore News* to national newspapers such as the *Washington Post*, as well as on-line blogs and social media. USFWS has issued public releases to the media on newsletters and meetings. In addition, USFWS submitted a letter to the *Washington Poster* in response to Timothy Saasta's opinion article, "A misguided approach to preserving Chincoteague's refuge," published in the *Post* on December 9, 2011. The USFWS letter was published December 23, 2011.

5.7 Draft CCP/EIS Public Comment Period

We initially released the draft CCP/EIS for 60 days of public review and comment from May 15, 2014 to July 14, 2014. In response to public requests, we extended that period another 30 days, to August 15, 2014. We held two public open house meetings in Chincoteague, and additional meetings in Melfa, Virginia and Pocomoke City, Maryland. As part of this public involvement process, USFWS also held a public hearing on June 26, 2014, from 6 p.m. to 9 p.m. at the Chincoteague Center with 28 people formally raising a variety of issues and concerns. We evaluated all the letters and e-mails sent to us during that comment period, along with comments recorded at our public hearing. Please see Appendix R for a summary of all comments, and our responses to them.

Chapter 6

Gary Kramer/USFWS

Black Skimmer

List of Preparers

Chapter 6: List of Preparers

6.1 U.S. Fish & Wildlife Service

6.1.1 Region 5

Thomas Bonetti, Senior Refuge Planner, B.S. Biology, M.S. Recreation Administration
Scott Kahan, Regional Chief, National Wildlife Refuge System (NWRS), B.S. Wildlife Biology
Tylar Greene, Public Affairs Officer, B.A. Geography/Geographic Information Systems and Journalism
Timothy Binzen, Archaeologist, B.A. & M.A. Anthropology
Meredith Bixby, Outreach Assistant, B.S. Arts and Letters, M.S. Wildlife Conservation
Margaret Engesser, Outreach Assistant, B.A. Environmental Studies, Anthropology, M.R.P. Regional Planning
Kathryn Fox, Assistant Planner, B.A. Environmental Studies and Sociology
Sharon Marino, Deputy Regional Chief, NWRS, B.S. Wildlife Biology, M.S. Wildlife Ecology
Joseph McCauley, Wildlife Administrator, B.S. Wildlife Management
Andrew Milliken, North Atlantic Landscape Conservation Cooperative Coordinator, B.A. Northern Studies/Biology, M.S. Biological Oceanography
Janith Taylor, Division of Natural Resource Chief, B.S. Wildlife Biology
Les Vilchek, Biologist (GIS), B.S. Conservation and Resource Development (retired)
John S. Wilson, Regional Historic Preservation Officer/Archaeologist, B.A. & M.A. Anthropology (retired)
Amy B. Wood, Regional Historic Preservation Officer/Archaeologist, B.A. Anthropology, M.A. Archaeology and Heritage

6.1.2 Chincoteague & Wallops Island National Wildlife Refuge

Amanda Daisey, Deputy Refuge Manager, B.S. Wildlife Science, M.S. Natural Resources
Michael S. Dixon, Supervisory Park Ranger, B.S. Park Administration, M.A. Corporate and Organizational Communication
Kim Halpin, Deputy Refuge Manager, B.S. Biology (retired)
Louis Hinds, Refuge Manager, B.S. Wildlife Biology (retired)
Kevin Holcomb, Supervisory Wildlife Biologist, B.S. Environmental Studies/Biology
Brian Richardson, Supervisory Federal Wildlife Officer, B.S. Natural Resource Management
Kevin Sloan, Refuge Manager, B.S. Wildlife Biology

6.1.3 Virginia Ecological Services Field Office

Cindy Schulz, Field Supervisor, B.S. Forestry, Fisheries, and Wildlife, M.S. Wildlife Ecology

6.1.4 USFWS Economics Division

James Caudill, Division Chief, B.A. Geography, M.A. Agricultural Economics, M.A. Architecture and Urban Planning, Ph.D. Agricultural Economics
Edward Maillett, Senior Economist, B.A. and M.A. Economics

6.2 Department of Interior

6.2.1 Office of the Regional Solicitor, Northeast Region

6.3 U.S. Department of Transportation Volpe National Transportation Systems Center

Becky Blatnica, AICP, Environmental Protection Specialist, B.A. History and Geography, Master of Community and Regional Planning
Jonathan Cybulski, Environmental Protection Specialist, B.S. Environmental Science
David Daddio, B.S. Environmental Policy, Master of City and Regional Planning
Marla Engel, AICP, Environmental Protection Specialist, B.A. Urban Planning/Political Science, Master of Regional Planning
Lindsey Morse, AICP, Community Planner, A.B. Social Studies with a Certificate in Health Policy, Master of Urban Planning
George Noel, Civil Engineer, B.S. Civil Engineering
Rosalie Ray, Economist, B.A. Economics
Frank Smigelski, Environmental Protection Specialist/NEPA Team Leader (until August 2011), B.S. Biology, M.S. Engineering

6.4 Tennessee Valley Authority

Anne Aiken, Program Manager
Winifred Nannette Brodie, Senior Environmental Scientist
Patricia Ann Hamlett, Geographic Information and Engineering
Shawn Markus, Geographic Information and Engineering
Chevales Williams, Environmental Engineer

6.5 Planning Team

Jack Tarr, Mayor, Town of Chincoteague
Rob Ritter, Town Manager, Town of Chincoteague
Bill Neville, Town Planner, Town of Chincoteague
John Jester, Town Councilman, Town of Chincoteague
Trish Kicklighter, Superintendent, Assateague Island National Seashore
Carl Zimmerman, Management Assistant, Assateague Island National Seashore (retired)
Todd Engelmeyer, District Wildlife Biologist, Virginia Division of Game and Inland Fisheries
Hank Badger, Chief Engineer – Eastern Area, Virginia Marine Resources Commission
Caroline Massey, Assistant Director, National Aeronautics and Space Administration (NASA) /Wallops Island
Elaine Meil, Executive Director, Accomack-Northampton Planning District Commission
Curt Smith, Director of Planning, Accomack-Northampton Planning District Commission
Rob Testerman, Accomack County Planning Department
Steve Miner, Accomack County Administrator
Robert Crockett, Supervisor, Accomack County Board of Supervisors
Wanda Thornton, Supervisor, Accomack County Board of Supervisors

6.6 Technical Experts

Participants and invitees to the February 2009 Technical Experts Meeting; titles and affiliations listed are as of February 2009.

6.6.1 U.S. Fish and Wildlife Service

Richard Roberts, Volunteer Biologist, Chincoteague NWR
Hal Laskowski, Biologist, Region 5 (retired)
Delissa Padilla Nieves, Coastal Biologist, NWRS
Brian Czech, NWRS, Conservation Biologist
Tom Penn, Wildlife Refuge Biologist, Blackwater NWR/Chesapeake Marshlands NWR Complex
Suzanne Baird, Refuge Manager (Project Leader), Chesapeake Marshlands NWR Complex

6.6.2 Other Federal Agencies

David Allaben, Southeast District Supervisor, Wildlife Services, USDA
Steve Kendrot, Biologist, Animal and Plant Health Inspection Service, USDA
Brian Scharle, Biologist, Animal and Plant Health Inspection Service, USDA
Sam Droege, Biologist, Patuxent Wildlife Research Center, USGS
Adrianna Ortiz, Student Ecologist, U.S. Navy Surface Combat Systems Center (Wallops Island)
Marilyn Ailes, Ecologist, U.S. Navy Surface Combat Systems Center (Wallops Island)
Carolyn Turner, Group Lead/Environmental Program Manager, NASA
Joshua Bundick, Lead, NEPA and Water Programs, NASA
Joel Mitchell, Lead, Hazardous Waste & Natural Resources Program, NASA

6.6.3 Local Government

Katherine Munson, Planner (Land Preservation), Worcester County, Maryland
Ray Rosenberger, Member, Eastern Shore Resource Conservation and Development Council and Chincoteague Planning Commission

6.6.4 Commonwealth of Virginia

Ruth Boettcher, Biologist, VDGIF
Dot Field, Eastern Shore Steward, VDCR
Robbie Lewis, Area Forester, VDF
Tony Watkinson, Deputy Chief Habitat Management Division, VMRC

6.6.5 The Nature Conservancy

Joe Fehrer, Nassawango Land Manager, Maryland/DC Field Office
Alexandra Wilke, Bird Conservation Specialist, Virginia Field Office
Joe Scalf, Habitat Restoration Specialist, Virginia Field Office
Steve Parker, Director, Virginia Coast Reserve
Barry Truitt, Chief Conservation Scientist, Virginia Coast Reserve

6.6.6 Academic Institutions

Dr. Michael Fenster, Professor, Environmental Studies Program, Randolph-Macon College
Dr. George Oertel, Professor, Associate Director for the Program for Spatial Analysis of Coastal Environments Program and Director of the Barrier Island Program, Department of Ocean, Earth and Atmospheric Sciences, Old Dominion University

Amanda Boyd/USFWS

Willet

Acronyms and Glossary

Acronyms

ACJV	Atlantic Coast Joint Venture
AGO	America's Great Outdoors
AHWP	Annual Habitat Work Plans
ANEC	A&N Electric Cooperative
APHIS	Animal and Plant Health Inspection Service
AQI	Air Quality Index
BCC	Birds of Conservation Concern
BCR	Bird Conservation Regions
BIDEH	Biological integrity, diversity, and environmental health
BBS	North American Breeding Bird Survey
CAA	Clean Air Act
CBFS	Chincoteague Bay Field Station
CCB	Center for Conservation Biology
CCP	Comprehensive Conservation Plan
CD	Compatibility Determination
CEQ	Council on Environmental Quality
CFI	Continuous Forest Inventory
CFR	Code of Federal Regulations
CNHA	Chincoteague Natural History Association
DNR	Department of Natural Resources
DOI	Department of the Interior
DOT	Department of Transportation
DRPT	Virginia Department of Rail and Public Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EDA	Economic Development Administration
EFL	Eastern Federal Lands
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERFO	Emergency Relief of Federally Owned Roads Program
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
HMP	Habitat Management Plan
HUD	Housing and Urban Development Administration
IBA	Important Bird Area
IPCC	Intergovernmental Panel on Climate Change
LPP	Land Protection Plan
USFWS	U.S. Fish and Wildlife Service
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSC	Marine Science Consortium
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NACA	National Advisory Committee for Aeronautics
NADP	National Atmospheric Deposition Program
NASA	National Aeronautics and Space Administration
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act

NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWF	North Wash Flats
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
NWPS	National Wilderness Preservation System
OSV	Oversand vehicle
PIF	Partners In Flight
PIT	Passive Integrated Transponder
PPP	Preliminary Plan Proposal
ROD	Record of Decision
SDM	Structured Decision Making
SHPO	State Historic Preservation Office
SLAMM	Sea Level Affecting Marshes Model
SSWG	State Wildlife Grant Program
STAR	Shore Transit and Rideshare
SUP	Special Use Permit
SWF	South Wash Flats
T&E	Threatened and Endangered
TNC	The Nature Conservancy
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USC	United States Code
USACE	U.S. Army Corps of Engineers
USSCP	U.S. Shorebird Conservation Plan
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VDCR	Virginia Department of Conservation and Recreation
VCAP	Virginia Coastal Avian Partnership
VDF	Virginia Department of Forestry
VDGIF	Virginia Department of Game and Inland Fisheries
VMRC	Virginia Marine Resources Commission
VMS	Variable Message Sign
VOP	Virginia Outdoors Plan
WCS	Water Control Structure
WFF	Wallops Flight Facility

Glossary

Adaptive management: Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in a management plan. Analysis of results helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Alternative: Alternatives are different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (Service Manual 602 FW 1).

Biological diversity: The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (Service Manual 052 FW 1). The Refuge System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as biodiversity.

Climate change: Refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer.

Comprehensive Conservation Plan: A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the NWPS; and meets other mandates (Service Manual 602 FW 1).

Concern: See Issue

Designated Wilderness Area: An area designated by the U.S. Congress to be managed as part of the NWPS (Service Manual 610 FW 1).

Disturbance: Significant alteration of habitat structure or composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).

Ecosystem: A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

Endangered species (Federal): A plant or animal species listed under the ESA that is in danger of extinction throughout all or a significant portion of its range.

Endangered species (State): A plant or animal species in danger of becoming extinct or extirpated in the state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

Environmental Assessment (EA): A concise public document, prepared in compliance with NEPA, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Impact Statement (EIS): A detailed written statement required by section 102(2)(C) of NEPA, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

Estuary: The wide lower course of a river into which the tides flow. The area where the tide meets a river current.

Focal species: Focal species are those that received special management considerations due to their status (threatened or endangered), economic importance, declining population status, high degree of public interest, or similar attributes.

Global sea level rise: Average increase in the level of the world's oceans that occurs due to a variety of factors, the most significant being thermal expansion of the oceans and the addition of water by melting of land-based ice sheets, ice caps, and glaciers.

Goal: Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Service Manual 620 FW 1.6J).

Habitat: Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat type: A land classification system based upon the concept of distinct plant associations.

Invasive species: An alien species whose introduction causes or is likely to cause environmental harm or economic losses or harm human health. An invasive species is usually an aggressive plant or animal that colonizes a habitat and displaces native and beneficial species.

Invertebrates: Any animal lacking a backbone or bony segment that encloses the central nerve cord.

Impoundment:	An area of tidal marsh that has been cut off from tidal inundation through the construction of dikes, dams, or water control structures.
Issue:	Any unsettled matter that requires a management decision [e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or other presence of an undesirable resource condition (Service Manual 602 FW 1.6K)].
Management Alternative:	See Alternative
Migration:	The seasonal movement from one area to another and back.
Migratory Birds	Birds that follow a seasonal movement from their breeding grounds to their wintering grounds. Waterfowl, shorebirds, raptors, and songbirds are all migratory birds
Moist Soil Management:	A technique that targets wetlands and their unique cycles of flooding and draining to support wildlife.
Monitoring:	The process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act of 1969 (NEPA):	Requires all agencies, including the USFWS, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (40 CFR 1500).
National Wildlife Refuge System Improvement Act of 1997:	Under the Refuge Improvement Act, the USFWS is required to develop 15-year comprehensive conservation plans for all national wildlife refuges outside Alaska. The Act also describes the six public uses given priority status within the Refuge System (i.e., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) (Public Law 105-57).
National Wildlife Refuge System Mission:	The mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

National Wildlife Refuge System: Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management areas; or waterfowl production areas.

National Wildlife Refuge: A designated area of land, water, or an interest in land or water within the Refuge System.

Native species: Species that normally live and thrive in a particular ecosystem.

Nor'easter: Winter coastal storm characterized by strong winds from the northeast quadrant over long reaches of coast. These winds are part of a counter clockwise cyclonic atmospheric circulation about a center of atmospheric low pressure at sea. The proximity of warm Gulf Stream water to the colder continent during winter and spring favors the development of such storms.

Objective: A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Making objectives attainable, time-specific, and measurable (Service Manual 602 FW 1.6N).

Overwash The process that causes the transportation and deposition of water and sediment over the beach crest.

Preferred Alternative: This is the alternative determined (by the decision-maker) to best achieve the refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.

Priority species: Fish and wildlife species that require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) State-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.

Public: Individuals, organizations, and groups; officials of Federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in service issues and those who do or do not realize that USFWS decisions may affect them.

Recreational beach: The swimming beach zone operated on the refuge by NPS that includes seasonal lifeguards, facilities and infrastructure (such as corresponding adjacent parking spaces, visitor contact station, restrooms, pedestrian trails, seasonal bathhouses, and showers). It is currently located at the end of Beach Road, and totals 1 mile of beachfront in length, based on carrying capacity levels evaluated in development with the 1993 Master Plan.

Refuge Goal: See Goal.

Relative sea level rise: The change in sea level relative to the elevation of the adjacent land, which can also subside or rise due to natural or human-induced factors. Relative sea level changes include both global sea level rise and changes in the vertical elevation of the land surface.

Representative species: A representative species is a species whose habitat needs, ecosystem function, or management responses are similar to a group of other species. It is assumed that conservation planning and actions for a representative species will also address the needs of other species.

Resiliency: As in EO 13653: "the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions."

Strategy: A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6 U).

Storm surge: The abnormal rise of water generated by a storm, over and above the predicted astronomical tide. It is caused primarily by the winds from a storm and is linked to both tropical and extratropical storms.

Study Area: The area reviewed in detail for wildlife, habitat, and public use potential. For purposes of this CCP, the study area includes the lands within the currently approved refuge boundary and potential refuge expansion areas.

Subsidence: The downward settling of the earth's crust relative to its surrounding. One of the geomorphic drivers of sea level rise.

Sustainability: A dynamic process that guarantees the persistence of natural and human systems in an equitable manner.

Threatened species (Federal): Species listed under the ESA that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Threatened species (State): A plant or animal species likely to become endangered in the state within the near future if factors contributing to population decline or habitat degradation or loss continue.

U.S. Fish and Wildlife Service Mission: The mission of the USFWS is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.

Vegetation type, Habitat type, Forest cover type: A land classification system based upon the concept of distinct plant associations.

Vision Statement: A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates (Service Manual 602 FW 1.6 Z).

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Wetlands 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. These areas are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted to life in saturated soil conditions.

Wilderness Study Areas: Lands and waters identified through inventory as meeting the definition of wilderness and undergoing evaluation for recommendation for inclusion in the Wilderness System. A study area must meet the following criteria: 1. Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2. Has outstanding opportunities for solitude or a primitive and unconfined type of recreation; and 3. Has at least 5,000 contiguous roadless acres or is sufficient in size as to make practicable its preservation and use in an unimpaired condition (Service Manual 610 FW 1.5).

Wilderness: See Designated Wilderness Area

Wildfire: A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Kirk Rodgers/USFWS

Common Tern

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